Electricity Engineers' Association

CONSULTATION DOCUMENT

JULY 2026

DISTRIBUTED GENERATION (Residential up to 10kW) CONNECTED AT LV NETWORK - TECHNICAL GUIDELINE

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Distributed Generation (Residential up to 10kW) Connected at LV Network - Technical Guideline

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Disclaimer

This guide has been prepared by representatives of the electricity supply industry to provide guidance on the connection of residential distributed energy resources (DER) to low-voltage electricity distribution networks.

This guide is recommended as good practice by electricity supply industry representatives, but it is not a substitute for legislative or other regulatory requirements. If there is uncertainty on what guidelines or legislative requirements should apply in any particular situation, specialist advice, including legal advice, should be sought.

The Electricity Engineers' Association of New Zealand (Inc.) and the electricity supply industry representatives involved in preparing this guide, accept no liability or responsibility for an error or omission contained in this guide, or any injury, loss, damage (including indirect or consequential loss or damage), or any other claim from any reliance on, or failure to rely on, the contents of this guide.

This guide has been prepared on the basis that the user will be appropriately trained, qualified, authorised, and competent.

Status of Examples and Case Studies

Examples in this guide are included to assist in how to apply various aspects of this document. The examples are not a comprehensive statement of all matters to be considered, nor steps to be taken, to comply with any statutory obligations pertaining to the subject matter of this guide, but they do illustrate how the guide may be applied.

Acknowledgements

The Electricity Engineers' Association (EEA) acknowledges the significant contribution of industry participants who supported the development of this guideline.

This work has been undertaken in collaboration with the Electricity Authority (EA) and Electricity Networks Aotearoa (ENA), with input from electricity distribution businesses, installers, equipment suppliers, consultants, and other sector stakeholders.

The EEA also recognises the contributions of members of the EEA Technical Connections Steering Group and EEA Asset Management Group (AMG), whose technical expertise, practical insights, and ongoing engagement have helped shape a consistent and implementable national approach.

Preface

Aotearoa New Zealand's electricity system is undergoing rapid change, driven by the increasing uptake of Distributed Energy Resources (DER) such as rooftop solar, battery storage, and electric vehicles. These technologies are transforming how electricity is generated, consumed, and managed, particularly at the Low-Voltage (LV) level.

This transition presents both opportunity and challenge. While DER can support a more efficient, resilient, and low-emissions electricity system, it also requires greater consistency in how connections are assessed, installed, and operated across the country.

This guideline has been developed by the EEA, in collaboration with the EA and ENA, as part of the Streamlining Connections Programme. This document is designed to support consistent practice across the industry when co**nnecting** residential inverter-based DER systems (≤10 kW) to LV networks.

While not a regulatory instrument, this guideline reflects industry-agreed minimum expectations and electricity distribution businesses (EDBs) are expected to align with this guideline as the default basis for their connection requirements. The guide does not override the *Electricity Industry Participation Code Part 6,* but it complements existing legislation and current standards. The guide recognises that EDBs retain discretion over connection requirements, but where they deviate from the guidance, they should clearly justify the reasons for doing so.

The guide also provides practical tools such as installer guidance and commissioning checklists. It will continue to evolve as technologies, standards, and system needs develop.

How to Use This Guide

Appendices provide practical tools and templates to support consistent application of this guideline and should be used alongside the main document.

This guideline is structured to support the work of different users involved in residential DER connections:

INSTALLERS

Refer to:

- Sections 6: Application and Pre-Approval Process
- Section 9.8: Installation, Testing and Commissioning
- Appendix F: Quick Guide for Installers Connecting Residential DER
- Appendix H: Residential Solar PV Commissioning Guide

ELECTRICAL DISTRIBUTION BUSINESS

Refer to:

- Part 2: Technical Requirements
- Section 8: Governance, Versioning and Updates

MANUFACTURERS AND SUPPLIERS

Refer to:

- Part 2: Technical Requirements, particularly inverter performance and interoperability requirements.

CUSTOMERS / DER OWNERS

Refer to:

- Appendix F: Quick Guide for Installers Connecting Residential DER (≤10 kW) to LV Networks
- Appendix H: Residential Solar PV Commissioning Guide, for simplified guidance.

FOR CLARITY

Mandatory Requirements **(MUST)**	Required to meet regulatory or safety obligations
Recommended Good Practice **(SHOULD)**	Strongly encouraged for consistency
Transitional Positions **(INTERIM)**	Temporary settings pending standards updates

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PART 1 General Information

1 Introduction

Aotearoa New Zealand is experiencing rapid growth in distributed energy resources (DER) and other low-carbon technologies (LCTs) such as rooftop solar photovoltaic (PV) systems, battery energy storage systems (BESS), electric vehicles (EVs), EV charging equipment, and flexible electric appliances. These technologies are increasingly installed behind the meter at low voltage (LV) and are fundamentally reshaping how electricity is generated, distributed, and consumed. More residential customers are seeking to connect DER systems to local electricity distribution networks, both to meet their own energy needs and to export surplus electricity.

This growth has been driven by falling technology costs, rising electricity prices, increasing interest in household resilience, and greater consumer awareness of the benefits of smart energy technologies. Only around 3–4% of NZ's approximately two million homes currently have DER installed, indicating significant headroom for future uptake as technologies continue to evolve.

It took more than seven years for NZ to reach its first 30,000 residential solar connections, but only three years to add the next 30,000. As of August 2025, total installed solar PV capacity reached approximately 665 MW, more than double the capacity recorded just two years earlier and a substantial share of this growth has occurred on residential low-voltage (LV) networks.

Growth brings both opportunities and challenges and Government and regulatory agencies are preparing for this. To support customer uptake and reduce unnecessary barriers, work is underway to streamline, simplify, and better enable the consent and connection processes for residential DER installation. As part of this, the Electricity Authority has proposed amendments to the *Electricity Industry Participation Code 2010 (EIPC): Part 6*, including a default 10 kW export limit for new small-scale distributed generation connected at low voltage.

Traditional distribution planning assumptions, including long-held diversity factors and after-diversity maximum demand (ADMD) profiles, no longer reliably describe customer behaviour. Load and generation patterns are becoming more dynamic, less predictable, and increasingly influenced by tariffs, retail products, technology type, and consumer preferences. As DER penetration increases, distribution networks face new and more complex requirements for voltage management, power quality, protection coordination, and hosting capacity. However, when appropriately coordinated and orchestrated through telemetry, control, and communications, DER can also provide valuable flexibility services that support efficient network utilisation, defer investment, and advance NZ's transition to a low-emissions future.

In 2025, the Review of *Distributor Connection Technical Standards* assessed the publicly available *Connection and Operation Standards* (COPS) and *Network Connection Standards* (NCS) of NZ's electricity distribution businesses (EDBs). The review identified that inconsistent technical requirements, documentation, terminology, and processes across EDBs were creating friction for installers and customers, constraining opportunities for automation, and increasing connection costs and timeframes. It highlighted strong opportunities to improve the customer connection experience through nationally consistent templates, standardised processes, and aligned technical and safety expectations.

These recommendations are being progressed by the EEA, in collaboration with the EA and ENA, through the Streamlining Connections Programme. This programme will deliver a suite of national technical connection guidelines covering:

- LV residential DER
- LV non-residential DER (including systems above 10 kW and large customer loads)
- MV and HV DER and load connections (future phases)

This guideline focuses on the fastest-growing DER segment, low-voltage residential DER. For the purposes of this guideline, residential DER refers to systems with a total inverter capacity of 10 kW or less connected at low voltage.

Recent regulatory and standards changes reinforce the need for nationally consistent technical guidance:

The statutory LV voltage limits of 230 V ±10%, provided for in regulation 28 of the *Electricity (Safety) Regulations 2010*, will materially affect inverter behaviour, hosting capacity, and distribution operational practices.

From 23 February 2025, all inverters connected at LV must comply with *AS/NZS 4777.2:2020* and be installed in accordance with *AS/NZS 4777.1:2024.* These standards underpin the voltage and frequency response modes, protection requirements, interoperability features, and commissioning settings referenced throughout this guideline.

This guideline provides residential customers, installers, equipment suppliers, and EDBs with technical guidance on the efficient, consistent, and safe planning, installation, and operation of residential DER.

It establishes a nationally consistent framework for:

- connection pathways and approval processes
- technical and safety requirements
- documentation and commissioning expectations
- DER operational settings and responsibilities.

By supporting a streamlined, predictable, and technically robust customer journey, the guideline helps ensure the ongoing reliability, security, and safety of the electricity system, while also enabling greater uptake of DER across NZ.

This guideline is supported by practical implementation tools provided in:

– **Appendix F:** Quick Guide for Installers Connecting Residential DER (≤10 kW) to LV Networks

– **Appendix G:** DER Connection Flowchart

These appendices are intended to support consistent application of the requirements set out in this document.

2 Purpose and Scope

The purpose of this guideline is to provide a nationally consistent, technically robust, and customer-centred framework for connecting residential inverter-based distributed energy resources (DER) to low-voltage (LV) electricity distribution networks in NZ.

The objectives of this guideline are to:

- Provide clear, comprehensive, and accessible information for all parties involved in LV residential DER connections
- Support a nationally consistent DER connection process, technical requirements, and safety expectations across EDBs
- Enhance the ability of EDB and industry to automate, monitor, and continually improve DER connection processes
- Establish a national platform for stakeholder engagement, review, and ongoing refinement of DER technical and safety standards

The scope of this guideline covers the technical connection of residential inverter-based DER systems up to and including 10 kW (total inverter nameplate generating capacity) that are intended to operate in parallel with, and export electricity to, an EDB network. This includes:

- Solar photovoltaic (PV) systems
- Battery energy storage systems (BESS)
- Hybrid inverters and systems incorporating integrated energy storage (IES)
- Smart inverters using *AS/NZS 4777.2* compliant functions

For clarity, the 10kW limit refers to the total rated AC output capacity of the inverter system connected at the point of supply.

This guideline does not cover non-inverter-based generation technologies (e.g., small wind turbines, micro-hydro) unless the EDB separately assesses and approves such installations under their own processes.

Users of this guideline include:

- Electricity distribution businesses
- Residential customers
- DER installers, electricians, and electrical inspectors
- DER/inverter manufacturers, importers, and suppliers
- Consultants, designers, and compliance auditors
- Businesses maintaining DER systems
- Training providers and occupational licensing bodies

This guideline should be read in conjunction with:

– Appendix F, which provides a plain-English installer pathway aligned with this guideline; and

– Appendix G, which provides a commissioning checklist and verification process for ensuring compliance with technical requirements.

As part of the ongoing Streamlining Connections Programme, the EEA is also looking to publish complementary national guidelines for:

– LV non-residential DER connections (systems above 10 kW and large customer loads), and

– MV and HV DER and load connections, where additional technical and safety considerations apply.

3 Applicability and Connection Types

For the purposes of this guideline, DER refers to inverter-based distributed generation systems that:

- are installed at residential premises
- operate in parallel with an EDB's low-voltage network
- are connected and capable of exporting electricity to the distribution network
- have a maximum total generation capacity of 10 kW or less, and
- are using either single-phase or three-phase inverter-based systems.

The guideline also applies to hybrid inverter systems, including those incorporating IES, and systems capable of both import and export depending on operating mode.

Alignment with Electricity Industry Participation Code 2010: Part 6

The guide does not override the *Electricity Industry Participation Code Part 6.*

Consistent with Part 6 of the Code:

- A system that exports electricity to a distribution network is a distributed generation system and requires the written approval of the distributor before connection
- Customers/DER owners and installers must provide sufficient technical information for the distributor to assess network impacts, safety, and compliance with relevant standards

Distributors may apply reasonable technical and safety requirements, including setting lower export limits, to maintain network stability, safety, and power quality.

Export thresholds and network-specific variations

This guideline sets out national minimum threshold and export categories to promote consistency across distributors. However, where justified:

- Available export capacity and applicable connection categories may vary by EDB, depending on LV network design, DER penetration, and local hosting capacity
- EDBs may apply lower export limits or require additional assessments where needed to ensure safety, power quality, or reliability
- Customers/DER owners and installers must always confirm the applicable requirements with the relevant EDB prior to installation or application submission

In the future, distribution network investment, voltage management changes, and DER orchestration capabilities may enable additional DER hosting capacity and increased export limits.

Systems not connected to an EDB network

Where a DER system:

– Operates for onsite consumption only, and

– Is not connected in parallel with an EDB'S network.

– Part 6 obligations may not apply, and this guideline may not be relevant.

– Customers/DER owners and installers must ensure that:

– The installation complies with Electricity (Safety) Regulations, and

– The DER system remains isolated from the EDB network unless formally approved.

The connection pathways described in this section are reflected in the step-by-step process outlined in Appendix F.

4 Roles and Responsibilities

The safety and quality of DER connections to EDB low-voltage networks are critical to:

– the safety of the DER owner's installation

– the safety of other network users and people working on the network, and

– the overall stability, safety, reliability, and power quality of the electricity distribution system.

Electrical safety and connection obligations are governed by the *Electricity (Safety) Regulations 2010* and *Part 6 of the Electricity Industry Participation Code 2010*, which place responsibilities on multiple parties involved in the design, installation, testing, connection, and operation of DER.

These obligations include, but are not limited to:

– Compliance with the *Electricity (Safety) Regulations 2010* including with cited standards

– Use of DER equipment that conforms to applicable safety, operating and performance requirements

– Application and use of industry best-practice guidelines, and

– Compliance with reasonable distributor-specific technical and safety requirements.

Responsibilities across key parties are outlined below.

Electricity Distribution Businesses (EDBs)

An EDB is responsible for managing and operating its network in accordance with the *Electricity (Safety) Regulations 2010* and in a manner that is safe, secure, reliable, and stable, while facilitating connections in accordance with *Electricity Industry Participation Code Part 6*.

EDB responsibilities include:

– Publishing publicly available information on connection processes, application requirements, and technical standards (including *Connection and Operation Standards and Network Connection Standards*),

– Assessing applications for distributed generation, specifying connection conditions and advising where a Record of Inspection is required,

– Maintain and provide DG connection information in accordance with the *Part 6 of the Electricity Industry Participation Code 2010*, including populating the central registry maintained by the EA with DG information at the ICP level.

The central registry is accessible to *Electricity Industry Participation Code 2010* Participants, with limited publicly available information (e.g. generation capacity and fuel type) reflected through downstream datasets.

– Informing customers of potential export limitations, curtailment, or disconnection requirements, and

– Managing network constraints to maintain safety, power quality, and system integrity.

An EDB may apply export limits to residential DER connections to manage local network constraints. A proposed default export limit of up to 10 kW may apply for small-scale residential DER connected at low voltage.

Where an EDB determines that lower export limits are required due to network constraints, these must be based on transparent, standardised, and industry-developed assessment methodologies, consistent with Part 6 principles.

EDBs must also maintain accessible dispute resolution processes, with unresolved matters able to be escalated through Utilities Disputes Limited (UDL) where appropriate.

DER Owners

DER owners are responsible for ensuring that their DER system is:

– Designed, constructed, and maintained to be electrically safe and reliable

– Compliant with applicable legislation, standards, and EDB connection requirements, and

– Operated in accordance with approved connection conditions

DER owners must ensure that appropriate records are retained and that required safety functions are maintained for the life of the installation.

DER owners should ensure their electricity retailer is notified of the installation to enable appropriate metering and contractual arrangements.

The use of competent licensed electrical workers, compliant DER equipment, and accredited installers significantly assists DER owners in meeting these responsibilities.

All DER systems must include mechanisms that allow the system to disconnect safely from the distribution network when required. This includes:

– Accessible isolation devices, and

– Automatic disconnection features responding to abnormal network or system conditions, including under-voltage, over-voltage, under-frequency, over-frequency, and anti-islanding protection

DER Installers

DER installers must be licensed electrical workers registered with the *Electrical Workers Registration Board (EWRB)* and are responsible for:

- Carrying out installation work safely and competently,
- Complying with the *Electricity (Safety) Regulations 2010*, applicable standards, and equipment manufacturer instructions, and
- Meeting all relevant EDB connection and approval requirements.
- Installers must provide the DER owner with a *Certificate of Compliance (CoC)* confirming that:
    - the work is electrically safe,
    - the installation complies with applicable legislation and standards, and
    - the work was completed by an appropriately licensed person.

A CoC is a legal declaration and may be required for insurance, sale of a property, or regulatory verification.

Electrical Inspectors

Where required under the *Electricity (Safety) Regulations 2010*, an EWRB licenced Electrical Inspector provides a Record of Inspection (RoI) which is an independent third-party verification that:

- main parallel generation work (DER) complies with the Act and Regulations, and
- the installation will be safe when connected to the EDB network.

Inspection activities should include verification of switchboards, protection devices, earthing, metering interfaces, and overall safety integrity prior to connection.

DER Equipment Manufacturers, Importers, and Suppliers

Manufacturers, importers, and suppliers of DER equipment are responsible for ensuring that:

- products comply with applicable safety and performance requirements under NZ legislation,
- equipment is suitable for connection to NZ electricity networks, and
- inverter and protection settings appropriate to NZ operating requirements are available and correctly specified.

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Electricity Retailers

Electricity retailers are responsible for:

– providing DER owners with appropriate metering arrangements to support import and export measurement, and

– supplying tariff, pricing, and contractual information relevant to DER operation and export.

The responsibilities described in this section are reflected in the practical steps and obligations outlined in Appendix F - Quick Guide for Installers Connecting Residential DER (≤10 kW) to LV Networks and Appendix G - DER Connection Flowchart.

Summary of Responsibilities

Party	Key Responsibilities
Electricity Distribution Business (EDB)	Operate and manage the distribution network in a manner that is safe, secure, reliable, and stable. Publish connection processes, technical standards, and application requirements. Assess DER connection applications, specify connection and export conditions, maintain a register of distributed generation, inform customers of potential curtailment or interruption, and manage network constraints in accordance with Part 6 of the Electricity Industry Participation Code 2010. Maintain dispute resolution processes and engage Utilities Disputes Limited (UDL) where required.
DER Owner	Ensure the DER system is designed, installed, operated, and maintained safely and in compliance with legislation, standards, and EDB connection conditions. Retain required records and ensure ongoing operation of protection and safety functions, including isolation and automatic disconnection from the network.
DER Installer	Be an EWRB licensed electrical worker responsible for installing DER safely and in accordance with the Electricity (Safety) Regulations 2010, applicable standards, manufacturer instructions, and EDB requirements. Issue a Certificate of Compliance (CoC) confirming the installation is electrically safe and compliant.
Electrical Inspector	Be an EWRB competent licensed electrical worker and where required, provide independent verification that DER installation work complies with the Act and Regulations and is safe to connect and operate in parallel with the EDB network.
DER Equipment Manufacturer / Importer / Supplier	Ensure DER equipment complies with NZ safety and performance requirements, is suitable for use on NZ networks, and supports appropriate inverter and protection settings for local operating conditions.
Electricity Retailer	Provide appropriate metering arrangements for import and export, and supply tariff, pricing, and contractual information relevant to DER operation and export.

5 Regulatory Context and Normative References

Residential DER connections in NZ must comply with a combination of legislation, regulations, mandatory standards, and industry guidance. Together, these set the minimum safety, technical, and operational requirements for connecting inverter-based distributed energy resources to an electricity distribution network.

To help users understand how these obligations relate to one another, Table 2 below summarises the hierarchy of regulatory and technical instruments.

Regulatory and Technical Requirement Hierarchy

Level	Instrument Type	Purpose / Application	Enforced By
1	Primary Legislation	Establishes fundamental legal obligations for electrical safety and participation in the electricity industry.	Parliament / Government
2	Regulations (e.g., Electricity (Safety) Regulations)	Specify mandatory safety requirements, technical rules, product compliance obligations, and define what is electrically safe.	WorkSafe NZ
3	Electricity Industry Participation Code (Part 6)	Sets legal requirements for connecting and operating distributed generation, including application processes, timeframes, equipment requirements, and dispute resolution. Also references and requires compliance with specific technical standards (e.g. AS/NZS 4777 series) as part of connection and operation requirements.	Electricity Authority
4	Cited Standards	Provide detailed, enforceable technical requirements referenced in regulations (e.g., AS/NZS 3000, AS/NZS 4777.1).	WorkSafe NZ
5	Non-cited Standards & Industry Guidelines	Represent good practice for safety and performance, complementing but not replacing mandatory requirements.	Industry bodies (e.g., EEA), EDBs
6	Distributor Connection Standards (COPS/NCS)	Specify local technical and safety requirements for connecting DER to a specific EDB's network.	Electricity Distribution Businesses

Electricity Industry Participation Code 2010 – Part 6 (Distributed Generation)

Part 6 of the *Electricity Industry Participation Code 2010* also requires compliance with specified technical standards for inverter-based distributed generation. From 11 September 2026, all low-voltage distributed generation installations must comply with *AS/NZS 4777.2:2020*, incorporating *Amendments 1 and 2*, including the application of the *Australia A* settings profile.

Alternative settings may be applied in limited circumstances, provided they remain within the allowable ranges specified in the standard and are approved by the distributor. It:

– establishes rules and timeframes for application, approval, commissioning, and ongoing operation

– sets equipment requirements, including minimum inverter performance expectations and anti-islanding capability

– defines the content of connection contracts and obligations of both DG owners and distributors

– requires distributors to publish Connection and Operation Standards (COPS) and Network Connection Standards (NCS), and

– provides a default dispute resolution pathway between DG owners and distributors.

Part 6 is administered and enforced by the EA.

Electricity (Safety) Regulations 2010

The *Electricity (Safety) Regulations 2010* are the primary safety regulations governing prescribed electrical work, installations and appliances safety, and conformity of electrical products in NZ. They:

– define what is electrically safe and unsafe

– specify voltage and frequency limits for safe operation

– require installations to comply with cited standards such as *AS/NZS 3000 (Wiring Rules)*

– prescribe requirements for supplier declarations of conformity for electrical equipment

– require prescribed electrical work to be carried out by EWRB - licensed electrical workers and safety management systems

– establish offences and penalties for non-compliance

The *Electricity (Safety) Regulations* are enforced by WorkSafe New Zealand.

Standards (Cited and Non-Cited)

Relevant standards are listed in Appendix D, including those cited under the *Electricity (Safety) Regulation*s and those required under Part 6 of the *Electricity Industry Participation Code 2010* for DER connection and operation. These standards provide detailed technical requirements for safe and compliant installation and operation.

The most relevant standards for residential DER include:

– AS/NZS 4777 (Grid Connection of Energy Systems via Inverters)

  - This series specifies installation, performance, and safety requirements for grid-connected inverter systems.

– AS/NZS 4777.1:2024 – Installation Requirements:

  - Specifies installation design, connection, and safety requirements for inverter energy systems
  - Use of the streamlined Part 1A application process is conditional on compliance with:

    – AS/NZS 4777.1:2016 (until 10 May 2026)

    – AS/NZS 4777.1:2024 (from 11 May 2026)

– AS/NZS 4777.2:2020 – Inverter Requirements:

  - AS/NZS 4777.2:2020 is not cited under the Electricity (Safety) Regulations; however, it is required under Part 6 of the *Electricity Industry Participation Code 2010* for low-voltage distributed generation connections and therefore forms a mandatory requirement for connection approval.
  - Defines inverter performance settings including voltage/frequency response modes, fault ride-through and anti-islanding protection

– AS/NZS 3000:2018 - Wiring Rules

  - Cited in the *Electricity (Safety) Regulations*; sets fundamental requirements for design, construction, and verification of all electrical installations, including those with DG.

– AS/NZS 3010:2017 - Generating Sets

  - Cited in the *Electricity (Safety) Regulations*; applies to standalone or auxiliary generating sets.

– AS/NZS 3760:2022 - In-Service Safety Inspection and Testing

  - Cited in the *Electricity (Safety) Regulations*; covers inspection and testing of electrical equipment and RCDs.

– AS/NZS 5033:2021 - PV Arrays

- Cited in the *Electricity (Safety) Regulations*; sets safety and installation requirements for PV array wiring, protection, mounting, and isolation.

– AS/NZS 5139 - Battery Systems for Use with Power Conversion Equipment

- Not cited in the *Electricity (Safety) Regulations* but recognised as best practice for battery safety (thermal runaway protection, clearances, enclosures, etc.).

– Industry Standards and Distributor Requirements

- Industry-developed guidelines, such as those produced by the EEA and Standards NZ, support safe, consistent DER integration. Each EDB also publishes local technical and safety requirements (e.g., COPS, NCS, inverter settings spreadsheets, export limit policies), which must align with the EIPC Part 6 and the *Electricity (Safety) Regulations*.

6 Application and Pre-Approval Process

Connection of residential distributed generation (DG) up to 10 kW requires written approval from the local DB before the system is connected to the network.

A summary of the process is provided in Appendix H.

Under Part 6 of the *Electricity Industry Participation Code 2010*, EDBs must follow prescribed steps and timeframes for processing applications for small-scale distributed generation.

The connection process typically follows four key stages:

1. Pre-application and planning
2. Application submission and EDB decision
3. Installation and connection
4. Post-connection obligations

Pre-Application and Planning

Customers/DER owners and installers should undertake early planning to ensure the proposed DER system is technically suitable and compliant.

Key steps include:

– Selecting a DER system that meets safety, performance, and inverter compliance requirements

– Contacting the local EDB to advise of the intention to connect DER and confirm the ≤10 kW application pathway

– Review the connection agreement

Many EDBs offer a fast-track (often automated) approval pathway for residential systems ≤10 kW where:

– compliant equipment from the EDB’s approved inverter list is used, and the LV network has sufficient hosting capacity

Systems using non-pre-approved equipment or installed on constrained networks will require manual engineering review, typically taking up to 10 working days, consistent with *EIPC Part 6*. Applicants should contact their electricity retailer early to understand metering requirements and tariff implications and check whether any Building Consent requirements apply.

Application Submission and EDB Decision

Under Part 6 of the *Electricity Industry Participation Code 2010*, application timeframes depend on the application type:

– **Part 1A Applications (typically ≤10 kW, standard connections):**

The distributor must notify the applicant of its decision within 10 working days of receiving a complete application. This timeframe cannot be extended. If the distributor does not notify its decision within this period, the application is deemed to be approved.

– **Part 1 Applications (more complex or non-standard connections):**

The distributor must notify the applicant of its decision within 30 working days of receiving a complete application. This timeframe may be extended by mutual agreement between the applicant and the distributor.

Application forms should generally align with the EEA *Guide for the Connection of Small-Scale Inverter-Based Distributed Generation* and include:

– Customer / ICP information

– Installer and electrical inspector contact details

– DG system details

– Technology type, inverter capacity, whether new / altered / existing

– Site and connection details (including intended point of connection)

– Connection configuration, e.g.:

    - Single-phase inverter
    - Three-phase inverter
    - Multiple single-phase inverters in parallel
    - Other (specify)

– Inverter information, including:

    - Single line diagram
    - Model and ratings

Many EDBs reference inverter approval lists to support streamlined connection processes. In practice, these lists often align with the *Clean Energy Council (CEC)* approved inverter list used in Australia.

The CEC list provides assurance that inverters have been independently assessed as compliant with *AS/NZS 4777.2* requirements, including voltage and frequency response behaviour, anti-islanding protection, and power quality functions.

Use of inverters included on a recognised approval list (e.g. CEC) may enable faster or automated approval pathways. Where equipment is not on such a list, additional information or assessment may be required by the EDB.

Declaration of conformity to *AS/NZS 4777.2:2020 (*or later editions), where the inverter is not included on a recognised approval list (e.g. CEC).

Battery Energy Storage System (BESS) information, including a Single Line Diagram (SLD) showing all major components.

Export capability information, including proposed export limits and inverter settings (or supporting calculations).

Examples of templates outlining a common national framework for LV residential DG approval are provided in **Appendix C**.

Installation, Settings, and Connection

After approval is granted by the EDB:

– The DER system must be installed by an EWRB licensed electrical worker.

– Testing and inspection must be verified by a person authorized under the *Electricity (Safety) Regulations* to inspect high-risk prescribed electrical work.

– The installer must provide a *Certificate of Compliance (CoC)* to the DER owner and retain records as required under the Electricity (Safety) Regulations.

– The electricity retailer must arrange installation of appropriate import/export metering.

The EDB will provide final approval for connection after verifying documentation (CoCs, inspection records, settings, test results) and, if required, completing an on-site inspection.

Information typically required at this stage:

– Compliance with *Electricity (Safety) Regulations* including:

  - An installer's completed Certificate of Compliance (CoC)
  - An inspector's Record of Inspection certificate and associated compliance documentation
  - Confirmation of settings, and test results (where required by the EDB)
  - Evidence of on-site inspection (if required)

Post-Connection Requirements

Once connected:

– Systems ⩽10 kW generally operate under the regulated terms in *Schedule 2.1 of Part 6 of the Electricity Industry Participation Code 2010*, where no specific connection contract has been agreed

The DER owner must continue to comply with:

– *EIPC Part 6* operational obligations

– Applicable EDB connection and operation standards

– Inverter settings and export limit requirements

– Electricity (Safety) Regulations

Any changes to the system configuration (e.g. inverter replacement, additional capacity, or the addition of batteries) must be notified to the EDB and may require re-approval.

Examples of templates outlining a common national framework for LV residential DG approval are provided in Appendix C.

A simplified, step-by-step version of this process is provided in Appendix F, including a flowchart and checklist to support consistent application.

Appendix G provides an example of a residential solar PV commissioning guide.

7 General Requirements (Non-Technical)

This section outlines the general non-technical requirements that apply to residential distributed energy resources (DER) connecting to an electricity distribution business (EDB) low-voltage (LV) network. Technical and safety requirements are addressed in later sections.

DER Owner Obligations

DER owner responsibilities are described in Section 4.

Installer Obligations

Installer responsibilities are described in Section 4.

Safety and Access Requirements

General safety and access obligations must ensure that:

– The installation remains electrically safe at all times

– EDB personnel retain safe and reasonable access to metering, isolation devices, and equipment required for network operations.

– Isolation facilities comply with *Electricity (Safety) Regulations* requirements and are clearly identified and accessible for use during emergencies, maintenance, or fault events.

Property Boundary Definitions

The following definitions clarify ownership and demarcation points relevant to residential DER installations.

– Network Connection Point (NCP)

  - The point at which an installation (or group of installations) connects to the EDB network for the purpose of receiving an electricity supply. This is the formal point at which the network and customer installation interface

– Point of Common Coupling (PCC):

  - The nearest point in the EDB network where other customer installations are, or may be, connected. The PCC is typically used for assessing compliance with power quality requirements and determining the potential impact of DER operation on other network users

– Point of Supply (POS):

  - The legal demarcation between the EDB's network and the customer's electrical installation. Ownership, control, and maintenance obligations change at this point. The POS is typically at the property boundary, or meter panel, or service pillar, depending on the network's configuration.

- Point of Connection (PoC)

  - The point at which the electricity network connects to the customer's electrical installation. The Point of Supply is the point for the determination of compliance with the *Electricity (Safety) Regulations*, and therefore for the primary determination of solar hosting capacity. It should be noted that under *AS4777.1*, voltage rise between the Point of Supply and the inverter terminals (typically electrically at or very close to the consumers switchboard) is limited to 2% of nominal voltage or 4.6V.

Installers and DER owners should use Appendix F and Appendix G to ensure all non-technical and documentation requirements are met prior to connection.

8 Governance, Versioning and Updates

While this guideline is not a regulatory instrument, it represents industry-agreed minimum expectations for the connection of residential DER to LV networks in NZ.

Electricity Distribution Businesses (EDBs) are expected to align their documents and processes with this guideline as the minimum default basis for their connection requirements.

Any deviations must be technically justified, documented, and made publicly available to other potential DER applicants.

Adoption and Alignment

To be considered aligned with this national guideline, an EDB should:

- Structure its publicly available DER connection requirements in a manner consistent with the framework, principles, and minimum expectations set out in this guideline
- Apply the technical and safety settings, processes, and documentation standards specified in the guideline, unless a justified deviation is required
- Maintain internal governance processes to ensure updates to local requirements remain consistent with nationally agreed principles and Part 6 of the *Electricity Industry Participation Code 2010* obligations.

Deviations from the Guideline

EDBs may adopt alternative settings or approaches where justified. A deviation from this national guideline is considered justified where:

- The alternative requirement is necessary to comply with jurisdictional legislation, regulatory obligations, safety requirements, or documented network-specific constraints; and/or
- The alternative requirement demonstrably provides improved outcomes for the NZ electricity system, including network reliability, safety, cost-efficiency, customer outcomes, or risk mitigation.

Where a deviation exists, the EDB should:

- Record the deviation in a publicly available deviation table within its DER Connection and Operation Standard (COPS) or Network Connection Standard; and
- Provide sufficient rationale for the deviation, either in the main document or via a hyperlink to supporting information

An example deviation table format is provided in Appendix A.

Evidence Requirements and Auditability

To support consistency, transparency, and audit readiness:

– EDBs should maintain documented evidence supporting any deviations, including relevant network analysis, safety assessments, or regulatory references.

– DER installers and owners should expect to provide standard documentation (e.g., CoCs, inspection records, inverter declarations) that allows an EDB to verify compliance at the time of approval and connection.

– A pre-connection compliance checklist should be used to record any departures from standard requirements and the reasoning for acceptance (Appendix G).

Governance and Updating of the National Guideline

The EEA, in consultation with EA, ENA, and industry stakeholders, will:

– Maintain and periodically reviewing the national guideline.

– Manage version control, including publication of updated editions, transition periods, and change summaries.

– Establish a national process for seeking feedback and proposing changes- including industry consultation and technical review.

– Updated guideline versions will be published on the EEA website, with version histories and effective dates clearly specified.

Monitoring, Compliance and Assurance

The EEA, in collaboration with the EA and industry stakeholders, may periodically review the guide's adoption and alignment across EDBs and looking at such matters as:

– alignment with this guideline within an EDBs connection requirements (e.g COPS or NCS).

– feedback from this guide/EDB connection guide users

– deviations from the guideline being recorded and publicly available

– DER connection audit information

Regulatory Interface

This guideline does not override obligations under the *Part 6* of the *Electricity Industry Participation Code 2010*.

The EA or any other regulator may have regard to this guideline when assessing good industry practice.

Installer and Customer/DER Owner Compliance

– Installers and customers/DER owners should use Appendix G (DER Connection Flowchart) to demonstrate compliance

– Documentation should align with Appendix F (Quick Guide for Installers Connecting Residential DER (≤10 kW) to LV Networks)

Escalation and Dispute Resolution

Where an applicant believes an EDB has misapplied or incorrectly interpreted the guideline:

1. The applicant should first raise the matter with the EDB through its standard connection inquiry or complaints process (as required under *Part 6 of the Electricity Industry Participation Code 2010*).
2. If unresolved, the matter may be escalated through the EDB's formal dispute resolution pathway, which includes referral to *Utilities Disputes Ltd (UDL)* under the approved scheme.

PART 2 – Technical Requirements

9 Technical Requirements

Part 2 of this Guide outlines the key technical requirements that electricity distribution businesses (EDBs), installers, and equipment suppliers should consider when developing, interpreting, or applying network connection and operation standards for low-voltage distributed energy resources (DER).

Technical requirements covered below include:

- Voltage Management
- Alignment with *AS/NZS 4777.2:2020*
- Frequency Response
- Protection and Control
- Export Limits
- Power Quality
- Interoperability and Communication
- Installation, Testing and Commissioning

Part 2 does not replace individual distributor technical requirements. Rather, it provides a nationally consistent reference framework to support safe, reliable, and efficient integration of residential DER into LV networks across NZ.

The requirements presented in this technical section draw on:

- requirements under the *Electricity Industry Participation Code 2010: Part 6*
- safety requirements under the *Electricity (Safety) Regulations 2010*
- cited and supporting standards
- industry good practice and emerging international experience

The following technical requirements are intended to help:

- promote national consistency
- reduce connection timeframes and administrative burden
- support automated or semi-automated approval pathways
- provide clarity for installers and customers
- enable increased levels of DER hosting capacity while maintaining safety, quality, and reliability

Transitional positions are included where relevant to reflect current industry alignment and ongoing regulatory or standards development. These positions are subject to change following EA decisions, updates to the *Electricity Industry Participation Code*, or other safety and technical regulatory changes.

EDBs should apply these requirements in a manner appropriate to their networks, documenting any justified deviations in accordance with the governance principles outlined in Part 1 of this Guide.

FOR CLARITY

Mandatory Requirements **(MUST)**	Required to meet regulatory or safety obligations
Recommended Good Practice **(SHOULD)**	Strongly encouraged for consistency
Transitional Positions **(INTERIM)**	Temporary settings pending standards updates

9.1 Voltage Management (±10 %)

9.1.1 Mandatory Requirements

In June 2025, the Government amended regulation 28 of the *Electricity (Safety) Regulations 2010*, widening the allowable low-voltage (LV) supply limits from 230 V ±6% to 230 V ±10%, reflecting modern inverter behaviour, customer expectations, and increasing DER penetration.

These statutory limits apply to all LV installations except for brief, momentary excursions.

The widened limits:

– Reduce unnecessary curtailment of consumer generation

– Defer or avoid expensive LV augmentation

– Increase hosting capacity across urban and rural feeders

– Maintain safe operation while enabling more flexible, dynamic LV management

In addition to the statutory limits:

– Voltage drop (load) must comply with *AS/NZS 3000:2018* (maximum 5%)

– Voltage rise (from generation) must comply with *AS/NZS 4777.1:2024* clause 3.3.3 (maximum 2%), using one of the three permitted calculation methods

These limits form the regulatory and engineering basis for inverter behaviour and connection requirements under *AS/NZS 4777.2:2020.*

Verification of voltage settings and compliance should be recorded using the commissioning checklist in Appendix G.

9.1.2 Recommended good practice

While wider voltage tolerance enables more efficient DER integration, distributors should consider:

- the potential for increased reactive power exchange (particularly under volt-var / volt-watt modes)
- compatibility of legacy appliances at lower voltages when installation voltage drop is applied
- ensuring customers at feeder extremities are not adversely affected during transformer tap changes or voltage band adjustments
- the increased importance of LV visibility through monitoring, sampling, or model-based estimation for validation

A structured change-management plan should be used when adjusting LV voltage control equipment (e.g., transformer tap settings, line regulators, DER orchestration tools), including customer impact assessment and staged implementation.

9.1.3 Global Context (for information only)

NZ's updated voltage limits and DER connection settings are broadly aligned with international practice, including Europe (230 V ±10%) and emerging global standards for inverter performance and interoperability.

This alignment supports:

- Equipment interoperability and availability
- Supply chain consistency
- Harmonisation with Australian inverter settings and profiles
- Consistency with international standards and evolving der integration practices

Further detail on international standards and approaches is provided in Appendix I.

9.2 Alignment with AS/NZS 4777.2:2020 Amd2

9.2.1 Mandatory Requirements

Regulation 28 of the *Electricity (Safety) Regulations* requires voltage remain 230 V ±10%, excluding momentary fluctuations

However, some inverter setpoint ranges in *AS/NZS 4777.2:2020* Amd2 (NZ region) were developed for the former ±6% environment and may not align with the new statutory range. Until the Standard is amended, a transitional alignment is required.[1].

9.2.2 Recommended interim national approach

It is recommended that, as an interim national position, inverters connected to LV networks in NZ adopt the Australia 'A' profile, including voltage response mode settings, frequency response settings, and protection settings, until AS/NZS 4777.2 is updated to reflect the recent change to 230 V ±10%.

9.2.3 Transitional Positions

To ensure consistent implementation across manufacturers and installers, it is recommended that NZ adopt the Australia A voltage setpoint profile as an interim approach.

This approach will:

– Provide alignment with *Australian DNSP*s while Standards are being updated

– Avoid bespoke NZ only profiles that increase cost and complexity

– Support early adoption of the new statutory voltage range

– Keep settings within the "Allowed Range" applicable to all regions under the Standard

Australia A is widely deployed by the *NEM's DNSPs*2 across dense urban and long rural feeders with very high DER penetration and is operationally proven. Australia's penetration of DER/CER, especially solar PV, has been very rapid, and application of these settings are widely deployed in high DER penetration environments and are considered operationally robust.[3].

---

[1] *It is assumed that current industry standards (allowable limits and calculation methodology) will remain unchanged – for example, 5% allowable voltage drop as per the Wiring Rules – AS/NZS3000:2018 or b) overall voltage rise from the point of supply to the inverter AC terminal to be 2% or less of the nominal voltage as per the AS/NZS 4777.1:2024.*

[2] *Ausgrid, AusNet Services, Endeavour Energy, Essential Energy, Ergon Energy & Energex, Evoenergy, Jemena, CitiPower, Powercor, United Energy, SA Power Networks, and Power & Water (NT).*

[3] *Except the need for the configurable settings so that it can be changed when required to manage the network and market requirements.*

In summary:

– *Australia A* is a pragmatic transitional approach

– It may not be the final NZ settings profile

– We may need a NZ-specific settings profile once the Standards catch up

– EDBs may apply alternative settings where justified.

9.2.4 Implementation plan for voltage transition - updated inverter settings (Interim Australia A Profile)

The following tables compare current *AS/NZS 4777.2:2020 Amd2 NZ* region settings with the proposed Australia A values (recommended values shown in bold). All values remain within the Standard's allowable ranges.

9.2.5 Volt-watt response mode

The volt-watt response mode varies the maximum active power output level of the inverter in response to the voltage at its grid-interactive port.

Volt-watt response default set point values

Current Default Set Point Values		
	Vw1	**Vw2**
Voltage	242	250
Inverter maximum active power output level (P) % of Srated	100%	20%

→

New Default Set Point Values		
	Vw1	Vw2
Voltage	**253**	**260**
Inverter maximum active power output level (P) % of Srated	100%	20%

Source: Table 3.6: Australia/New Zealand Standard-AS/NZS 4777.2:2020. Reproduced with permission from Standards Australia and Standards New Zealand under licence.

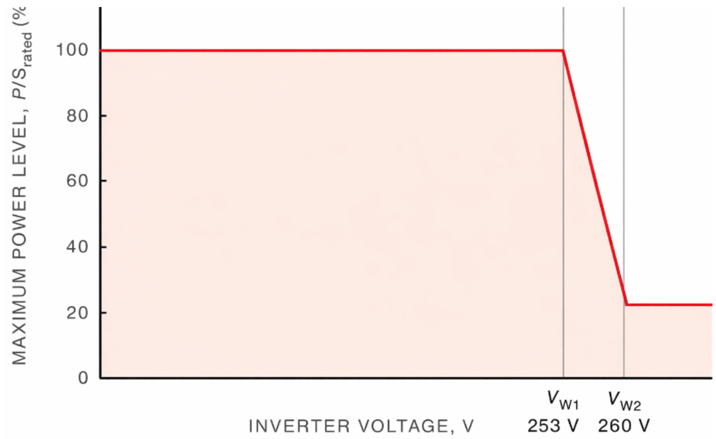

Figure 3.1 — Example curve for the volt-watt response mode

Figure 1 Example curve for the volt-watt response mode

Source: Figure 3.1: Australia/New Zealand Standard-AS/NZS 4777.2:2020. Reproduced with permission from Standards Australia and Standards New Zealand under licence.

9.2.6 Volt-watt set point values for multiple mode inverters with energy storage when charging

An inverter with energy storage that can be charged through the grid-interactive port shall have the following volt-watt response mode:

Table: 1 Volt-watt response set point values for multiple mode inverters with energy storage when charging

Current Default Set Point Values		
	Vw1-ch	Vw2-ch
Voltage	216V	224V
Pcharge/Prated-ch	20%	100%

→

New Default Set Point Values		
	Vw1-ch	Vw2-ch
Voltage	207V	215V
Pcharge/Prated-ch	20%	100%

Source: Table 3.8: Australia/New Zealand Standard-AS/NZS 4777.2:2020. Reproduced with permission from Standards Australia and Standards New Zealand under licence.

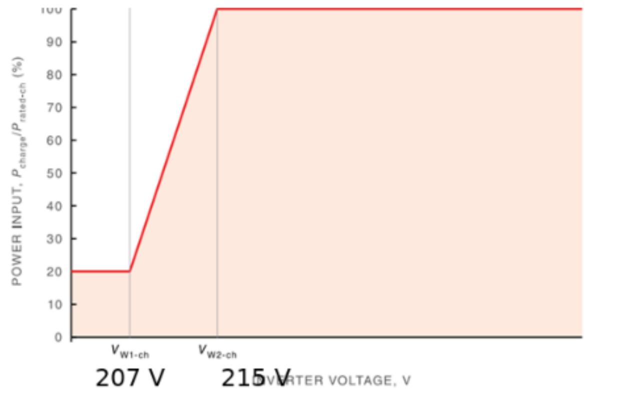

Figure 3.4 — Example curve for the volt-watt response mode for multiple mode inverters with energy storage when charging

Figure 2 Example curve for the volt-watt response mode for multiple mode inverters with energy storage when charging

Source: Table 3.4: Australia/New Zealand Standard-AS/NZS 4777.2:2020. Reproduced with permission from Standards Australia and Standards New Zealand under licence.

This volt-watt response mode is only active when energy storage charges through the grid-interactive port. The volt-watt response mode for charging of energy storage shall be enabled by default.

9.2.7 Volt-var response mode

The volt-var response mode varies the reactive power absorbed or supplied by the inverter in response to the voltage at its grid-interactive port[4].

Where the inverter apparent power rating is reached, active power level shall be reduced to stay within the inverter apparent power rating while meeting the volt-var mode reactive power requirements. This behaviour is intended to provide reactive power priority.

[4] Alternatively, a fixed power factor mode and/or volt-var response modes specified in AS/NZS 4777.2:2020 can be enabled (the minimum range of settings should be 0.8 leading to 0.8 lagging in accordance with the standard).

Table: 2 Volt-var response set point values

Current Default Set Point Values				
	Vv1	Vv2	Vv3	Vv4
Voltage	207V	220V	235V	244V
Inverter reactive power level (Q) % of Srated	60% supplying	0%	0%	60% absorbing

New Default Set Point Values				
	Vv1	Vv2	Vv3	Vv4
Voltage	207V	220V	240V	258V
Inverter reactive power level (Q) % of Srated	44% supplying	0%	0%	60% absorbing

Source: Table 3.7: Australia/New Zealand Standard-AS/NZS 4777.2:2020. Reproduced with permission from Standards Australia and Standards New Zealand under licence.

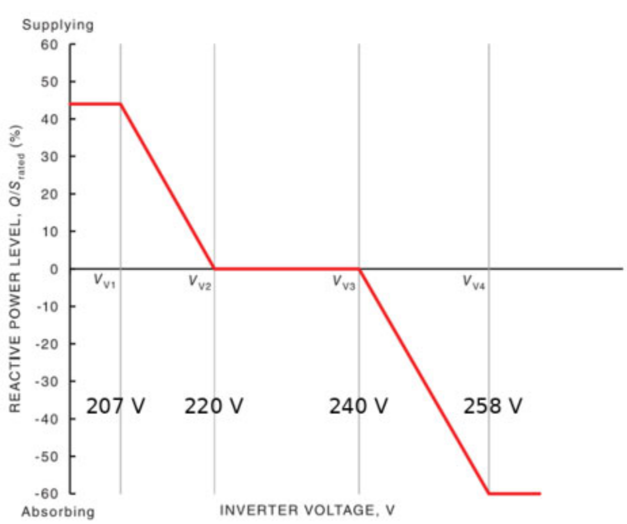

Figure 3.2 — Example curve for the volt-var control mode

Figure 3 Example curve for the volt-var control mode for multiple mode

Source: Figure 3: Australia/New Zealand Standard-AS/NZS 4777.2:2020. Reproduced with permission from Standards Australia and Standards New Zealand under licence.

9.2.8 Sustained operation for voltage variation:

The inverter must operate the automatic disconnection device within 3s when the average voltage for a 10 min period exceeds the Vnom-max as specified.

Table: 3 Settings for Vnom-max

Current Default Set Point Values	
Vnom-max	249V

New Default Set Point Values	
Vnom-max	**258V**

Source: Table 6: Australia/New Zealand Standard-AS/NZS 4777.2:2020. Reproduced with permission from Standards Australia and Standards New Zealand under licence.

9.2.9 Key Issues on Notice

Further investigation is required at an industry and regulatory level to determine the appropriate long-term NZ inverter profile and ensure alignment with the new statutory voltage limits. Areas for assessment include:

- Inverter behaviour at voltages between 253 V and 258 V, especially for volt-watt and volt-var functions
- Differences between Australia's lower limit (–6%, or 216 V) and NZ's –10% limit (207 V)
- Optimised volt-watt charging setpoints for multi-mode inverters
- Characteristics of NZ LV networks, including feeder lengths, impedance variation, and voltage-regulation granularity
- Current and future DER penetration across different network types
- Ability to monitor LV power quality in real time or at periodic intervals
- Potential revision of four-quadrant reactive power capability for NZ conditions.

This analysis will inform the development of a dedicated NZ profile for a future amendment to AS/NZS 4777.2.

9.3 Frequency Response

9.3.1 Mandatory Requirements (ESR and AS/NZS 4777.2)

Inverters connected to LV networks must comply with the frequency operating requirements specified in *AS/NZS 4777.2:2020 (Amendment 2)*, including defined continuous operating ranges and response characteristics for under-frequency and over-frequency conditions.

Regulation 29 of the *Electricity (Safety) Regulations 2010* require operation at a nominal system frequency of 50 Hz, except for allowable variations consistent with power system operation.

In the NZ context, inverter frequency response must also support the broader power system security framework operated by Transpower. Inverters must:

– maintain continuous operation within the defined continuous operating frequency range

– automatically adjust power output in response to under-frequency and over-frequency events (e.g. frequency-watt response)

– disconnect where frequency exceeds applicable statutory or standards-based limits

– align with broader power system security requirements, including under-frequency load shedding (UFLS) and emerging fast frequency response (FFR) frameworks.

9.3.2 Transitional Settings (Interim): Frequency Response Settings

The System Operator has advised the *Electricity Authority* that it is comfortable with the existing NZ frequency response settings defined in *AS/NZS 4777.2:2020.*

As a result, no change to the current frequency response settings is proposed at this time, and inverters should be configured in accordance with the NZ region settings specified in *AS/NZS 4777.2:2020.*

This position will be reviewed over time as the power system evolves, particularly in the context of increasing DER penetration, reduced system inertia, and the potential development of new frequency response capabilities (e.g. fast frequency response).

Frequency response settings should be verified during commissioning using Appendix G.

9.3.3 Frequency Variation Withstand Limits

Under the transitional settings:

Table: 4 Frequency variation withstand limits

Current Default Set Point Values				
Inverter Response	Decrease in frequency response Lower limit Hz	Lower limit of continuous operation range (fLLCO) Hz	Upper limit of continuous operation range (fULCO) Hz	Increase in frequency response Upper limit Hz
	45	49.8	50.2	55

New Default Set Point Values				
Inverter Response	Decrease in frequency response Lower limit Hz	Lower limit of continuous operation range (fLLCO) Hz	Upper limit of continuous operation range (fULCO) Hz	Increase in frequency response Upper limit Hz
	47	**49.75**	**50.25**	**52**

Source: Table4.4: Australia/New Zealand Standard-AS/NZS 4777.2:2020. Reproduced with permission from Standards Australia and Standards New Zealand under licence.

These revised thresholds introduce a marginally wider continuous operating range and closer alignment with *Australian DNSPs*, improving inverter ride-through performance during system events.

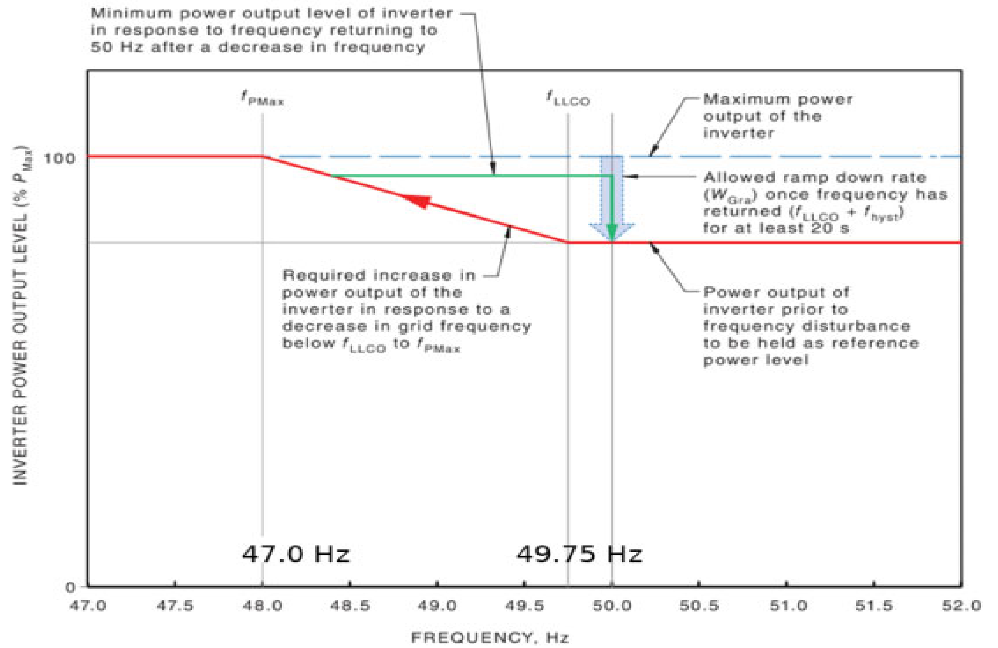

Figure 4.1 — Example frequency response for a decrease in frequency for an inverter that has a reduced output

Figure 4 Example frequency response for a decrease in frequency for an inverter that has a reduced output

Source: Figure 4.1: Australia/New Zealand Standard-AS/NZS 4777.2:2020. Reproduced with permission from Standards Australia and Standards New Zealand under licence.

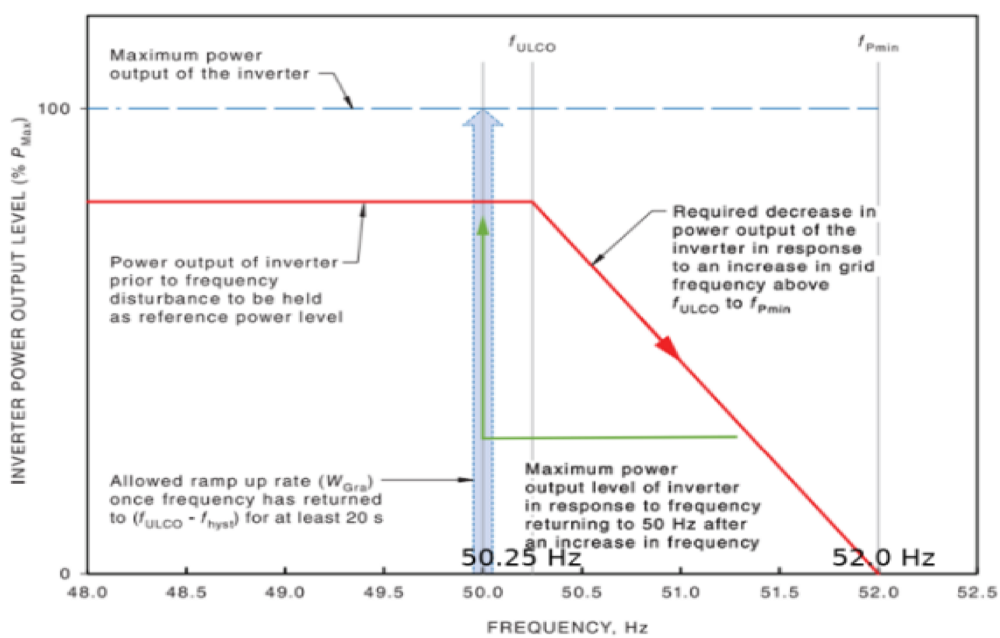

Figure 4.3 — Example frequency response for an increase in frequency for f_{Pmin} of 52 Hz

Figure 5 Example frequency response for an increase in frequency for fpmin of 52Hz

Source: Figure 4.3: Australia/New Zealand Standard-AS/NZS 4777.2:2020. Reproduced with permission from Standards Australia and Standards New Zealand under licence.

9.3.4 Frequency – Power Response

Table: 5 Frequency response limits (decrease in frequency)

Source: Table 8: Australia/New Zealand Standard-AS/NZS 4777.2:2020. Reproduced with permission from Standards Australia and Standards New Zealand under licence.

Current Default Set Point Values		
Inverter Response	Frequency where power output level is maximum (fPmax) Hz	Frequency where charging power level is zero (fstop-ch) Hz
	48	49

New Default Set Point Values		
Inverter Response	Frequency where power output level is maximum (fPmax) Hz	Frequency where charging power level is zero (fstop-ch) Hz
	48	**49**

Under-frequency response:

– Maximum power output must be maintained until 48 Hz (fPmax).

– Charging power must reduce to zero by 49 Hz (fstop-ch).

Over-frequency response:

– Discharging must reduce to zero by 50.75 Hz (ftransition).

– Minimum power output must be maintained at 52 Hz (fPmin).

Table: 6 ***Frequency response limits (increase in frequency)***

Current Default Set Point Values		
Inverter Response	Frequency where discharging power level is zero (ftransition) Hz	Frequency where power level is minimum (fPmin) Hz
	51	52

New Default Set Point Values		
Inverter Response	Frequency where discharging power level is zero (ftransition) Hz	Frequency where power level is minimum (fPmin) Hz
	50.75	**52**

Source: Table 9: Australia/New Zealand Standard-AS/NZS 4777.2:2020. Reproduced with permission from Standards Australia and Standards New Zealand under licence.

9.3.5 Hysteresis Margin

The hysteresis margin (fhyst) remains unchanged at ±0.1 Hz, preventing chattering behaviour around trip thresholds.

Frequency response – Maximum response times and values for hysteresis margin (fhyst):[5]

Table: 7 ***Frequency response – values for hysteresis margin (fhyst)***

Response commencement time	Response completion time	f_{hyst}
1 s	10 s	0.1 Hz

Source: Table 10: Australia/New Zealand Standard-AS/NZS 4777.2:2020. Reproduced with permission from Standards Australia and Standards New Zealand under licence.

[5] *Source: jemena.com.au*

9.3.6 Recommended Good Practice

EDBs should consider:

– the interaction between inverter frequency response and UFLS schemes

– the cumulative effect of high DER penetration on system inertia and event recovery

– aligning settings with emerging Transpower guidance on low-inertia operation.

Future Considerations:

– NZ may require a dedicated frequency response profile as the power system transitions toward i.e., higher DER penetration, lower synchronous inertia, and more frequent frequency variability. The long-term profile will need to consider:

- FFR (Fast Frequency Response) capabilities
- four-quadrant operation
- aggregated DER fleet response
- coordination with market-based ancillary service arrangements.

9.4 Protection and Control

This section sets out the minimum protection requirements for LV-connected inverter energy systems. Protection requirements ensure safe operation during network disturbances, faults, and islanding conditions. EDBs may apply additional protection requirements as required.

Protection settings must comply with *AS/NZS 4777.1:2024, AS/NZS 4777.2:2020 Amd2*, and all relevant regulatory requirements.

General Requirements

All protection settings must be configurable, secured against unauthorised changes, and adjustable only by authorised persons.

Inverters must not connect to the network unless the correct regional settings (e.g. *Australia A* during the transition period) have been selected and activated.

Protection systems must operate reliably under both grid-supplied and DER-supplied conditions.

9.4.1 Anti-Islanding Protection (Mandatory)

Inverters must implement both active and passive anti-islanding protection as required in the standard *(AS/NZS 4777.2:2020)*. Passive Anti-Islanding Protection Includes:

- Over-voltage
- Under-voltage
- Over-frequency
- Under-frequency

Standard trip thresholds and maximum disconnection times apply, using the transitional voltage and frequency settings. Active Anti-Islanding Protection:

- Inverters must use at least one active method specified in *AS/NZS 4777.2:2020 clause 4.3*, such as:

- Reactive power shift
- Frequency shift
- Impedance injection.

- These techniques ensure that the inverter will cease supplying power when the grid is de-energised, reducing safety risk for field crews and the public.

9.4.2 Multiple Inverters at One Installation

Where multiple inverters are installed:

- Protection settings must be configured to ensure coordinated operation.
- If any inverter trips due to a protection event or DRM0 signal, all inverters must disconnect within 2 seconds.
- Compliance may be demonstrated through manufacturer-certified configurations or commissioning verification.

9.4.3 Automatic Disconnection Requirements

Inverters must automatically disconnect when:

- Voltage exceeds or falls below continuous operating limits
- Frequency is outside allowable operational thresholds
- Any protection function operates (fault, anti-islanding, loss of mains).

Transitional Disconnection Requirements:

- At <180 V or >260 V: Disconnect within 200 ms
- Sustained over-voltage (>258 V for 10-minute average): Disconnect within ≤3 s.

9.4.4 Power Rate Limit (WGra[6])

Applicable for:

- Ramp-up after connect/reconnect
- Changes in AC operational mode
- Changes in energy source or control mode.

9.4.5 Ride through capabilities

Inverter energy systems (IES) must remain connected through defined voltage and frequency disturbances, within the limits of *AS/NZS 4777.2:2020.*

9.4.6 Voltage Disturbance Withstand

For disturbances shorter than the anti-islanding trip delay refer *AS/NZS 4777.2:2020, Table 4.1- Passive anti-islanding voltage limit values*, the inverter must restore output to pre-disturbance levels within 400 ms once voltage returns to normal.

Three-phase inverters must respond correctly to disturbances on any phase.

A “multiple disturbance” event applies when disturbances occur within 15 seconds; after 15 seconds the next disturbance is treated as a separate event.

9.4.7 Frequency Disturbance Withstand

When frequency falls below the continuous range and power output is reduced due to a PQ or DRM mode, output must increase linearly down to the fpmax limit.

While generating, the inverter must maintain at least the same power output until f<stop-ch.

When charging, the inverter must reduce charging power linearly until fstop-ch.

9.4.8 Earth Fault and Residual Current Protection: PV Arrays

Inverters must comply with *IEC 62109-1/-2 and AS/NZS 5033* regarding:

- earth fault detection
- residual current monitoring
- isolation resistance monitoring.

9.4.9 Battery Systems

Where an IES interfaces with a battery:

- Earth fault alarm functionality must comply with *AS/NZS 5139*.

---

[6] *WGra controls how fast the inverter ramps its power up or down, so output changes are smooth rather than abrupt.*

- Where inverter-integrated alarms are insufficient, external devices must be provided.

9.4.10 Out-of-Scope Protection Functions and Prioritisation

Rate of Change of Frequency (ROCOF) and/or Vector Shift /Phase-Angle Shift type protection is not required for the small residential distributed generation unless mandated by an EDB for centralised / back up anti-islanding protection.

Table: 8 Prioritisation of protection and operation modes

Prioritisation level	Description
1	All disturbance withstand limits described in Section 4 of *AS/NZS4777.2:2020* while abnormal conditions prevail and until the duration exceeds the time limits of the passive anti-islanding settings in clause 4.4
2	All requirements to operate the automatic disconnection device
3	Generation control function (Section 6)
4	Sustained operation for frequency disturbances of Clause 4.5.3
5	Inverter demand response mode of Clause 3.2 and power quality modes of Clauses 3.3.2 and 3.3.3
6	Power rate limit of Clause 3.3.4.

9.4.11 Protection requirements Summary

For inverter-based systems up to 30 kW connected to LV networks:

- Central protection: Not required
- Inverter protection: Must be provided within the inverter and configured in accordance with *AS/NZS 4777.2:2020 (including Amendment 2:2024)*

The following indicative protection settings and disconnection times are aligned with *AS/NZS 4777.2* requirements:

Protective Function	Protective Function Limit	Trip delay Time	Maximum disconnection Time
Undervoltage 1 (V<)	180V	10s	11s
Undervoltage 2 (V<<)	70V	1s	2s
Overvoltage 1 (V>)	265V	1s	2s
Overvoltage 2 (V>>)	275V		0.2s
Sustained Overvoltage (10 minutes)	258V		3s
Under-frequency (F<)	47Hz	1s	2s
Over-frequency (F>)	52Hz		0.2s
Active anti-islanding	Note (3)		2s
Voltage phase angle shift withstand	60 ° (Note1) , 20 ° (Note2)		2s
Rate of Change of Frequency (ROCOF)	4.0 Hz/s		0.25s
Reconnection delay	**60s**		

Notes:

(1) 60 °- Single phase disturbance

(2) 20 ° - Three phase disturbance

(3) The method used to provide active anti-islanding protection shall be as per AS/NZS 4777.2:2020 Section 4.3 (preferable is Frequency Shift)

Protection settings and functionality must be verified and recorded as part of commissioning in accordance with Appendix G.

9.5 Export Limits

As residential DER uptake increases, export limits play a key role in maintaining voltage quality, network safety, and equitable access to hosting capacity on LV networks. The EA has consulted on introducing a default export limit of 10 kW per ICP for small-scale distributed generation under a streamlined application process. Final regulatory decisions will inform future updates to this guideline and associated EDB methodologies (e.g. ELAM/BELAM)[7]. Proposed national approach:

– Default export limit (up to 10 kW per ICP): Residential PV and inverter-based DER systems (≤10 kW total inverter capacity) may export up to a default limit of 10 kW per ICP unless a distributor determines that a lower—or higher—limit is necessary to maintain safety, power quality, and network stability.

– Export behaviour must comply with AS/NZS 4777.2 voltage and frequency protection settings.

– Transparent assessment of deviations - Where export limits differ from the default, EDBs are expected to apply a standardised and transparent methodology, such as:

– ELAM for site-specific export-capacity assessment

– BELAM for feeder or LV-cluster-level constraints.

This supports consistency, fairness, and repeatability across the country.

– DER/CER Register - EDBs are expected to maintain an up-to-date register of DER installations to support network planning, modelling, and hosting-capacity analysis.

– Hosting capacity mapping - EDBs should progressively develop LV hosting-capacity maps using:

– Approximation tools (e.g., DG Host)

– Detailed LV modelling

– Smart-meter and LV-monitor voltage data.

– Export limits should be applied in a transparent and non-discriminatory manner, consistent with the principles set out in Part 6 of the Electricity Industry Participation Code 2010

These insights enable proactive network planning, targeted investment, and improved connection timeframes.

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[7] *Maximising benefits from local electricity generation (Export limits) Decision paper published in April 2026-* Maximising benefits from local electricity generation (Export limits)

Future shift to Dynamic Operating Envelopes (DOEs) - To maximise clean-energy utilisation and minimise curtailment, electricity distribution businesses (EDBs) should progressively transition from static export limits to dynamic operating envelopes (DOEs) that vary over time in response to network conditions.

DOEs should be implemented in a staged manner, recognising current system capability and data availability. Initial implementations may use day-ahead or intraday (e.g. five-minute resolution) forecasts, with increasing sophistication over time.

Future DOE methodologies are expected to align with nationally developed ELAM and BELAM frameworks to ensure consistency, transparency, and repeatability across electricity distribution networks.

As a minimum, DOE frameworks should:

– provide time-varying export limits at the connection point (ICP or site level)
– be based on transparent and repeatable methodologies, informed by network modelling, monitoring, or measured data
– be secure, auditable, and enforceable, with clear accountability for issuing and applying limits
– include defined fallback behaviour (e.g. reversion to the last valid limit or a safe static limit) in the event of communication failure

Where DOEs are implemented, DER systems (via inverter or site controller) should be capable of:

– receiving and applying updated export limits
– confirming or logging the applied limit for audit purposes
– responding within timeframes appropriate to the resolution of the DOE signal

EDBs should clearly communicate to installers and customers:

– whether a connection is subject to static export limits or DOEs
– how export limits are determined and updated
– any equipment, configuration, or communication requirements needed to participate

This guideline recognises that DOE implementation in NZ is evolving. Future versions may define a more formalised national framework, including standardised methodologies, communication protocols, and functional requirements.

Export limit configuration and verification should be recorded as part of commissioning documentation in accordance with Appendix G.

9.6 Power Quality Requirements

DER must integrate into LV networks without adversely affecting voltage quality, harmonic levels, or phase balance. Power quality (PQ) behaviour is governed by *AS/NZS 4777.2:2020*, complemented by NZ's *EEA 2024 Power Quality Guidelines* and the *Electricity (Safety) Regulations 2010*.

9.6.1 Inverter Power Quality Modes

Inverters must support the power quality response modes specified in *AS/NZS 4777.2:2020*. These modes should be configured as required for the installation and network conditions, noting that some modes may be enabled by default and not all modes operate simultaneously. Common power quality modes include:

– Volt-watt mode (reducing active power as voltage rises)

– Volt-var mode (providing reactive support for voltage management)

– Fixed power factor mode

– Fixed reactive power mode

– Frequency-watt response for both increasing and decreasing frequency.

These functions improve network stability, hosting capacity, and customer experience.

EDBs may specify required modes and settings to support network performance, consistent with *AS/NZS 4777.2* and this guideline.

9.6.2 Harmonics, Flicker, and Unbalance

Standards applying to residential DER installations include:

– Voltage changes and flicker: Must comply with IEC 61000-3-3 (≤16 A/phase) or IEC 61000-3-11 (>16 A/phase).

Harmonic emission limits:

– AS/NZS 61000.3.2 (<16 A/phase)

– AS/NZS 61000.3.12 (>16 A to ≤75 A/phase)

Phase unbalance: Multi-phase IES must maintain balanced operation; EDBs typically apply a limit of ≤5 kVA difference per phase.

Ramp rate: After the automatic disconnection device operates to connect or reconnect the inverter the output shall rate limit increase in power generation to the set power rate limit (W) for increase in power. The power rate limit (W) shall be adjustable within the range 5 % to 100 % of rated power per minute. It is permitted to have two separate power rate limits for increase and decrease in power levels.

The inverter power rate limit (W) is applicable to operate in the following modes:

a) Soft ramp up after connect, reconnect or soft ramp up/down following a response to frequency disturbance. All Inverters have this mode.

b) Changes in a.c. operation and control (if this mode is available).

c) Changes in energy source operation. This mode only applies to multiple mode inverters with energy storage.

Distributors (EDBs) may specify additional PQ monitoring requirements where historical data indicates voltage/flicker sensitivity or where multiple DER systems are clustered.

Power quality settings and inverter modes should be confirmed during commissioning using Appendix G.

9.7 Interoperability and Communications

As DER becomes more dynamic and interactive, interoperability will ensure safe coordination, enable flexibility services, and will support future market participation. It is, therefore, recommended that the systems should be "VPP-ready" and able to communicate securely with external parties where required to participate in the market.

NZ is expected to adopt a capability-based interoperability approach, enabling multiple protocol pathways rather than mandating a single standard.

9.7.1 Principles

- Open standards ensure longevity and vendor neutrality.
- Communications capability should support both monitoring and control.
- Cybersecurity and authentication are essential for any function that can adjust power flows or export limits.
- Where communication-enabled functionality is implemented, configuration and verification should be recorded in commissioning documentation (Appendix G).

9.7.2 Information Exchange and Visibility

To support safe and efficient network operation, relevant DER operational information should be available to the EDB where required.

The level of information exchange should be proportionate to the level of network impact and control required and may evolve over time.

As a minimum:

For standard residential DER connections with static export limits, routine real-time data exchange with the EDB is not required, provided systems comply with approved settings and limits.

Where enhanced visibility or control is required (e.g. constrained networks, high DER penetration areas, or where dynamic operating envelopes are applied), DER systems should be capable of providing relevant information, which may include:

- export/import power levels
- voltage at the point of connection (where available)
- inverter status and operating mode
- confirmation of applied export limits (static or dynamic)

Where dynamic operating envelopes (DOEs) are implemented, DER systems (via inverter or site controller) should be capable of:

- receiving export limit signals
- and confirming or logging the applied limit for audit and verification purposes.
- Information exchange should:
- use open and interoperable standards where practicable
- be secure and authenticated, particularly where control signals are involved; and
- avoid unnecessary data transfer beyond what is required for network operation or agreed services.

This guideline recognises that data exchange frameworks are evolving. Future iterations may define more detailed requirements, including standardised data sets, communication protocols, and roles for aggregators or third-party service providers.

Commonly used protocols

EDBs and retailers are encouraged to adopt open-standard frameworks such as:

- *IEEE 2030.5*, including CSIP-AUS profile
- OpenADR 2.0
- IEC-based interoperability models (future NZ profiles under development)
- These protocols can support secure exchange of:
- Dynamic export limits (DOEs)
- Demand-response signals
- Device-level commands
- Bidding and scheduling information for future markets
- Telemetry (power, voltage, SOC, alarms)
- Event logs and settlement data

9.7.3 Fallback behaviour

Where dynamic signals fail, IES must revert to either:

- the last valid DOE; or
- a predefined static export limit, in a safe and predictable manner, with appropriate records retained for audit purposes.

Future iterations of this guideline may define a formal NZ Functional Interoperability Profile and DOE implementation framework.

Interoperability capabilities should align with the commissioning and verification processes outlined in Appendix G.

9.8 Installation, Testing and Commissioning

Safe installation and commissioning ensure DER operates as intended, meets regulatory requirements, and maintains network integrity. *AS/NZS 4777.1:2024* introduces clearer supply-type definitions that clarify when inverter systems are grid-interactive and therefore require EDB approval.

Installers should use **Appendix G** (Residential Solar PV Commissioning Guide and Checklist) to verify compliance with the requirements in this section.

Supply types (AS/NZS 4777.1:2024)

The following definitions must be used when documenting system configuration:

- **Supplementary supply** – grid-connected; can operate in parallel with the grid.
- **Alternative supply** – supplies the installation only when isolated from the grid (two variants described in the standard).
- **Substitute supply** – dedicated, electrically separated outlet up to 15 A.
- **Independent supply** – meets AS/NZS 4777.2 Appendix M Clause 3.4.4; cannot export and provides no grid-support functions.

These definitions determine which technical requirements apply and whether distributor approval is required.

Installation requirements

Installers must ensure:

- All equipment is compliant with AS/NZS standards, including correct regional inverter settings (Australia A during transition).
- *AS/NZS 5033:2021*, Installation and safety requirements for photovoltaic (PV) arrays.

- Documentation (SLDs, inverter/BESS specifications, CoC, inspection records) is complete and accurate.
- Isolation, labelling, and switching arrangements meet ESR and *AS/NZS 3000* requirements.
- Protection functions—including voltage/frequency response modes—are correctly implemented.

9.8.1 Testing and Commissioning

Before energisation, installers and inspectors must verify:

- Voltage and frequency trip thresholds and timers
- Volt-var, volt-watt, and power-factor modes
- Export-limit enforcement (static or dynamic)
- Phase balance and correct polarity
- Reconnection delays
- BESS-specific protections (earth-fault alarms, isolation resistance).

Testing Requirements:

All DER systems must include mechanisms that allow the system to disconnect safely from the distribution network when required. This includes:

- accessible isolation devices, and
- automatic disconnection features responding to abnormal network or system conditions, including under-voltage, over-voltage, under-frequency, over-frequency, and anti-islanding protection.

Installation & testing reports, as well as the protection settings and verification reports should be recorded in the commissioning documentation provided in Appendix G.

9.8.2 Ongoing compliance

To ensure safe long-term operation:

- Where changes are made to a DER system (e.g. firmware updates, equipment replacement, or configuration changes), the DER owner and installer must ensure the system continues to comply with applicable standards and approved connection settings.
- Some changes may trigger the requirement for a new or updated application under *Part 6 of the Electricity Industry Participation Code 2010*. Installers and DER owners should refer to Part 6 to determine when re-application or re-approval is required, noting that these requirements may be updated over time.

- Event logs should be retained for an appropriate period (e.g. at least 90 days), including alarms, trips, DOE signals, and settings changes, to support troubleshooting, compliance verification, and audit processes.
- Where communication-enabled functionality is implemented, cybersecurity controls should include authenticated and encrypted communication, with appropriate credential management.

Appendix G provides a structured checklist to:

- verify inverter settings
- confirm protection functionality
- record compliance evidence
- support EDB approval and connection.

Compliance shall be checked by inspection of the inverter's markings and manufacturer's documentation, and testing in accordance with *IEC 62109-2.*

Where the additional detection for functionally earthed PV arrays, as required by *AS/NZS 5033*, is present in the inverter, this additional detection shall, before start-up of the system:

(a) open circuit the functional earth connection to the PV array

(b) measure the resistance to the earth of each conductor of the PV array

(c) if the earth resistance is above the resistance limit (Riso Table 2.1, the system shall reconnect the functional earth and shall be allowed to start, and

(d) if the earth resistance is equal to or less than the resistance limit (Riso limit) threshold Table 2.1, the inverter shall shut down and initiate an earth fault alarm in accordance with the requirements of IEC 62109-2.

Table: 9 PV array to earth insulation resistance (Riso) limits for inverter ratings

Table 2.1 — PV array to earth insulation resistance (R_{iso}) limits for inverter ratings

Inverter rating kVA	R_{iso} limit kΩ
≤ 20	30
> 20 to ≤ 30	20
> 30 to ≤ 50	15
> 50 to ≤ 100	10
> 100 to ≤ 200	7
> 200 to ≤ 400	4
> 400 to ≤ 500	2
> 500	1

Appendix A Glossary and Definitions

The following list of definitions and acronyms are used throughout the guide. Note that within legislation or standards other terms are defined.

Automatic Voltage Regulator (AVR)
An electronic device that regulates voltage to a constant level to deliver constant, reliable power supply.

Battery Energy Storage Systems (BESS)
A system that stores electrical energy in batteries for later use.

Consumer Energy Resources (CER)
Energy resources owned or controlled by the consumer, including generation, storage, or flexible loads.

Certificate of Compliance (CoC)
A declaration by a licensed electrical worker that prescribed electrical work complies with applicable legislation and standards.

Certificate of Verification (COV)
Provided by electricians or electrical inspectors to confirm that a property is safe to be connected to our network when work is completed.

Clean Energy Council (CEC) Australia.
The Clean Energy Council (CEC) does not maintain a single, public list of all approved inverters, but provides a database for EDBs to use for their own lists

Code (the Code)
Electricity Industry Participation Code 2010 is the set of rules that governs nearly every aspect of the electricity industry and may be the basis of rules, practices and requirements our network or retailers have e.g. for connections or metering.

Connection
A point at which the electricity network connects to a customer's electrical system.

Distributed Energy Resources (DER)
Any resource on the distribution system that produces or stores electricity or load that can be controlled to use electricity at other times. This can include distributed generation, storage, heat pumps and electric vehicles, as well as other technologies.

Distributed Generation (DG)
Is equipment used, or proposed to be used, for generating electricity that is:

a) Connected, or proposed to be connected, to EDBs managed networks that is directly or indirectly connected to the grid, or to an installation that is connected to distribution networks that an EDB manages.

b) Capable of injecting electricity into distribution networks that an EDB manages.

DG hosting capacity
The maximum export power, per ICP with DG installed, on a network which can be tolerated without causing voltage or current limits to be exceeded, for a given DG penetration level.

DG penetration level	The proportion of ICPs in each network that have export-capable DG installed.
Distributor	Also called lines companies, network companies or distribution companies, distributors own and operate the lower voltage power lines and distribution networks in local areas. These connect to the national grid to deliver electricity to homes and businesses.
Distribution Network Operators (DNO)	Is another name for an EDB.
DNP	Distributed Network Protocol is a set of communications protocols used between components in automated systems such as the systems that monitor and remotely control electricity networks.
Demand Response (DR)	Is customer demand that changes in response to signals from the electricity system to balance supply Government Investment in Decarbonising Industry Fund.
Demand-Side Management (DSM)	Is the process by which EDBs, retailers, customers or service providers may manage their demand through their services and offerings which may include automated control, information, pricing, rewards or other incentives.
Distribution System Operator (DSO)	Operates an active distribution system to optimise outcomes for our network, demand, generation and other DERs.
Electrical inspector	An electrical inspector in NZ is a licenced electrical worker who holds an electrical inspector's licence and inspects mains installations prior to livening to see whether the installations comply with relevant regulations and codes of practice. Some inspectors are authorised by various electricity retailers to install meters and ripple signalling equipment on their behalf. Some inspectors are authorised by EDBs to connect and liven complying installations on their network.
Electricity distribution business	Often shortened to EDB and known as a lines company.
Electricity distribution network	The system of lower voltage power lines, cables and other equipment in a local area that is used to carry electricity from the national grid to homes and businesses.
Electricity retailer	An electricity retailer (sometimes referred to as a 'power company') purchases electricity from the wholesale market to sell to residential and business users. Also referred to as Trader or Participant.
Embedded generator -.	An embedded generator, also known as a 'distributed generator', is a generator located at a home or business which can generate electricity for

	that home or business's own use. It may also be capable of putting surplus generation back into our network
Export	Electricity flowing from a customer's distributed generation or electrical system into an EDB network.
Fault	When your power is out. Also known as an outage or a power cut.
Fuse	A safety device that melts when too much electricity goes through it. It cuts off electricity supply quickly to ensure there is no damage to appliances or internal wiring of a building or appliances.
Hybrid inverter	An inverter that can manage both solar PV generation and battery storage, allowing energy to be used, stored, or exported to the grid depending on what's needed.
Hertz (HZ)	A measure of frequency.
Inverter	A device that converts direct current (DC) electricity — typically from solar panels or batteries — into alternating current (AC) electricity, which is used by homes and businesses or exported to the grid.
Inverter energy system (IES)	A system comprised of inverter(s), energy source(s) which may include electrical energy storage, wiring, control, monitoring, and protection devices connected at a single point in an electrical installation. Multiple IES installations can exist within a single electrical installation.
Inverter operational modes -	Modes of operation of an inverter which will contribute to export congestion management or to maintaining the power quality, in the vicinity of the distributed generation's ICP. These various operating modes, if available, may be enabled or disabled in an inverter and may include, but not be limited to, the following as described by AS/NZS 4777.2: a) Power quality response modes including volt-var and volt-watt, fixed power factor or reactive power mode, power response mode, and power rate limit, b) Demand response modes, and c) Multiple mode inverter operation.
Islanding	A condition where part of the electricity network continues to operate independently while disconnected from the main grid, often used to maintain power supply during outages or faults — intentional or unintentional

kV - Kilovolt being 1,000 volts.	Voltage is a unit of measure that describes the pressure that pushes electricity and is a function of the electric potential between two points.
kW- Kilowatt. 1,000 Watts.	This is a measure of the amount of power flowing and may also be used to indicate the maximum capacity of a device.
Licenced electrical worker	A licenced electrical worker is an individual who is registered with the NZ EWRB and holds a current practising licence. This statutory authorisation allows them to legally carry out or supervise "prescribed electrical work" (PEW), such as installing, maintaining, and testing electrical systems and equipment. Holding a practising licence means they are up-to-date on current safety procedures and standards and must renew it every two years to continue working legally.
Low Voltage LV	Low Voltage is defined in the Electricity (Safety) Regulations 2010 as any voltage exceeding 50 volts AC or 120 volts ripple-free DC, but not exceeding 1,000 volts AC or 1,500 volts ripple-free DC. It also generally refers to the street-level network that delivers power to homes and small businesses.
Mains installation	The cable or line between our electricity distribution network and your premises.
Maximum export power	The maximum active power exported into the local network at the distributed generation's ICP, being equal to the nameplate capacity minus the minimum load at the point of connection, or to the power export limit imposed by an active export control device, specified in Watts.
Multiple mode inverter	An inverter that operates in more than one mode, for example having a grid-interactive functionality when grid voltage is present and strong-alone functionality when the grid is de-energized or disconnected, as defined by AS/NZS 4777.2. Inverters with battery storage ports are also considered multiple mode inverters.
Nameplate capacity	The maximum gross power generator of the DG system, being the lesser of the continuous inverter apparent power rating and the maximum continuous active power output of the energy source, specified in Watts
Network	A network (also called an electricity distribution network) is the lower voltage power lines and other assets that used to carry electricity from the national grid to you.
Network connection point (NCP)	A point at which the local network connects to your electrical installation. This is usually at your property boundary. It is sometimes on the exterior

	of a building. You are responsible for the electrical installation on the premises side of the NCP. We are responsible for equipment on the other side of the NCP.
Network Operations Control (NOC)	The operations centre for a network that controls operational conditions, network configuration, contractor access and outages.
Point of Connection (POC)	being the point at which the electricity network connects to your electrical system.
Point of Supply (POS)-	Generally, means the point or points on the boundary of the property at which exclusive fittings (e.g. power lines or circuits) enter that property. Some networks may define this in other ways e.g. the isolating fuse located either on the boundary of your property or on the pole nearest to your property.
Power Quality	Power quality is a measure of how well the electrical power supplied to equipment matches ideal specifications, considering factors like voltage, frequency, and waveform.
Power quality response modes	Modes of operation of an inverter which will contribute to export congestion management or to maintaining the power quality, in the vicinity of the distributed generation's ICP. These various operating modes, if available, may be enabled or disabled in an inverter and specifically include, but are not limited to, the following as described by AS/NZS 4777.2: volt-var and volt-watt, fixed power factor or reactive power mode, power response mode, and power rate limit.
Pre-application -	The engagement that occurs between us and you before a new connection (Part 6) application is made.
Record of Inspection -.	A Record of Inspection (RoI) is issued after high-risk prescribed electrical work (such as high voltage installations, photovoltaic systems or mains work) has been checked by an authorised inspector and confirmed to be safe. The person providing the RoI must be a licenced electrical worker is not the same person who carried out the work
SEANZ approved installer	A solar or BESS installer who meets the minimum requirements set by SEANZ to install rooftop solar or household BESS to industry standard best practice. (See acronyms in list below for SEANZ explanation). For electrical work this person must be a Licenced Electrical Worker.
Service main	The line or cable that connects your property to our network. Your service main is owned and maintained by you and is not part of our network.

Solar PV
Electricity generation through solar photovoltaics (PV). PV cells convert sunlight into electricity by an energy conversion process. Solar PV is different from solar hot water as it generates electricity that can be fed back into our network requiring an installation to meet required standards.

Utilities Disputes Ltd
Utilities Disputes Ltd provides a free and independent service which can review and further investigate issues. They can make rulings that are binding to settle complaints.

Appendix B Acronyms

AC	Alternating Current
BELAM	Bulk Export Limit Assessment Methodology
BESS	Battery Energy Storage System
CER	Consumer Energy Resources
CoC	Certificate of Compliance
CSIP-AUS	Common Smart Inverter Profile (Australia)
DC	Direct Current
DER	Distributed Energy Resources
DG	Distributed Generation
DOE	Dynamic Operating Envelope
EA	Electricity Authority
EDB	Electricity Distribution Business
EEA	Electricity Engineers' Association
EES	Electrical Energy Storage system
EIPC	Electricity Industry Participation Code 2010
ELAM	Export Limit Assessment Methodology
ENA	Electricity Networks Aotearoa
EV	Electric Vehicle
EWRB	Electrical Workers Registration Board
FFR	Fast Frequency Response
ICP	Installation Control Point
IES	Inverter Energy System
LV	Low Voltage (nominal voltage levels at 230V or 400V)
LPS	Lightning Protection System

OpenADR	Open Automated Demand Response
PCC	Point of Common Coupling
PoC	Point of Connection
PoS	Point of Supply
PV	Photo-voltaic
RoI	Record of Inspection
ROCOF	Rate of Change of Frequency
SEANZ	Sustainable Energy Association of New Zealand
SLD	Single Line Diagram
SPD	Surge Protection Device
UFLS	Under-Frequency Load Shedding
UPS	Uninterruptible Power Supply
VPP	Virtual Power Plant

Appendix C Examples of Application Templates

This guide is citing the *2024 version of AS/NZS 4777.1,* while that is the current version it not the version cited in the *Electricity Participation Code* which still cites the 2016 version.

However, the *Electricity (Safety) Regulations* cite the 2024 version. The question is to comply with the *Electricity (safety) Regulations or the Code*. The only way to comply with both requirement is to process inverter-based DG of less than 10kW under part 1 not part 1A as part 1 does not cite *AS/NZS 4777.1* standard as it covers any type of DG less than 10kW not just inverter-based DG.

- Confirmation of details provided in application for connection
- Electrical Certificate(s) of Compliance (CoC)
- Demonstrated compliance with EDBs technical requirements including:
  - AS/NZS 4777.1: 2024: Grid connection of energy systems via inverters, Part 1: Installation requirements
  - AS/NZS 4777.2: 2020: Grid connection of energy systems via inverters — Part 2: inverter requirements
  - AS/NZS 3000:2018: Electrical installations (known as the Australian/New Zealand Wiring Rules)
  - AS/NZS 3010:2017: Electrical installations - Generating sets
  - AS/NZS 3760:2022: In-service safety inspection and testing of electrical equipment and RCDs
  - AS/NZS 5033:2021: Installation and safety requirements for photovoltaic (PV) arrays
  - Other technical requirements as specified in the application
    - Demonstrated compliance with safety and protection requirements including:
      - Disconnection/isolation switch
      - Generation circuit breaker
      - Over/under voltage protection
      - Over/under frequency protection
      - Earth fault protection
      - Mains loss protection and protection for auto recloser operation
      - Synchronization of system with distribution protection
      - Neutral voltage displacement protection
      - Automatically and fully isolate itself from the network in the event of an outage
      - Not reconnect to the network until the network is fully returned to normal function
      - Other safety and protection requirements as specified in the application

DISTRIBUTED GENERATION UPTO 10KW CONNECTION STANDARD GENERATE - AEN

Connection of Distributed Generation of 10kW or less in total

APPLICATION FORM FOR DISTRLBUTED GENERATION UNDER 10KW		
CUSTOMERS CONTACT DETAILS: OWNER AND OPERATOR OF THE DG		
Name		
Address		
Telephone No.		
Email		
INSTALLERS CONTACT DETAILS		
Name		
Address		
Telephone No.		
Email		
APPLICATION FEE INVOICE ADDRESS		
Is this a new installation or capacity increase to existing?	New: ☐	Capacity increase ☐
This application is under Part 1 or Part 1A of Schedule 6.1 of the EIPC (refer to clause 1.1) *	Part 1: ☐	Part 2: ☐
Energy Retailer at OG site:		
Proposed connection date:		
TYPE OF 0G (PHOTOVOLTAIC, WIND ETC.)		
Maximum AC generation:	Number of phases:	Amps per phase:
Inverter make and model		
Inverter complies with AS/NZS 4777.1 and 2?	Yes: ☐	No: ☐
Any Battery Storage?	Yes: ☐	No: ☐
DG connection point:		
ICP number:		
Site Address		

TYPICAL LOAD AT THE PROPOSED POINT OF CONNECTION:		
Will Voll / Watt response mode be enabled? (this is recommended)	Yes: ☐	No: ☐
Will Voll / VAR response mode be enabled? (this is recommended)	Yes: ☐	No: ☐
Does the installation comply with what are the minimum requirements detailed in 393S089 Clause 2.2?	Yes: ☐	No: ☐
Does the installation comply with the EDB's over voltage protection requirements detailed in 393S089 Clause 2.3?	Yes ☐	No: ☐
Phase to neutral and phase to phase loop Impedance (including inverter wiring)	R-N Ω	R-W Ω
	W-N… Ω	R-B Ω
	B-N Ω	W-B Ω
Voltage at switchboard:	V __________________	

** Part 1 and Part 1A of Schedule 6.1 in the Electricity Industry Participation Code (EIPC) 2010 outline procedures for connecting small-scale distributed generation (up to 10 kW) to a network.*

Appendix D Reference Materials

This appendix lists standards relevant to residential DER connections. These include standards cited under the Electricity (Safety) Regulations, as well as standards required under Part 6 of the Electricity Industry Participation Code for connection and operation. Other standards are included as industry good practice.

Table: 10 Standards and Guidance for Residential DER Connections

CATEGORY	DOCUMENT	TITLE / DESCRIPTION	STATUS / APPLICABILITY
Regulatory Standards (Electricity (Safety) Regulations -cited)	AS/NZS 3000:2018	Electrical Installations (Wiring Rules)	Cited under the Electricity (Safety) Regulations; mandatory for all electrical installations
	AS/NZS 5033:2021	Installation and Safety Requirements for Photovoltaic (PV) Arrays	Cited under Electricity (Safety) Regulations; mandatory for PV installations
	AS/NZS 3010:2017	Electrical Installations – Generating Sets	Cited under Electricity (Safety) Regulations; applies to generation systems
	AS/NZS 3760:2022	In-service Safety Inspection and Testing of Electrical Equipment	Cited under Electricity (Safety) Regulations; applies to inspection and testing
Code-Required Standards (Part 6)	AS/NZS 4777.1:2016 / 2024	Grid Connection of Energy Systems via Inverters – Installation Requirements	Required for inverter installations. Use of the Part 1A application process is conditional on compliance with AS/NZS 4777.1:2016 (until 10 May 2026) and AS/NZS 4777.1:2024 (from 11 May 2026)
	AS/NZS 4777.2:2020 (Amd 1 & 2)	Grid Connection of Energy Systems via Inverters – Inverter Requirements	Required under Part 6 of the Codefor LV DER connections. From 11 September 2026, compliance (including Amendments 1 & 2) is required,

CATEGORY	DOCUMENT	TITLE / DESCRIPTION	STATUS / APPLICABILITY
			including application of the Australia A settings profile (subject to approved variations within allowable limits)
International / Supporting Standards	IEC 61000-3-2 / 3-12	Harmonic current emission limits	Applicable for harmonic performance
	IEC 61000-3-3 / 3-11	Voltage fluctuation and flicker limits	Applicable for voltage quality
	IEC 62109-1 / 62109-2	Safety of power converters for PV systems	Referenced for inverter safety
	EN 50160	Voltage characteristics of electricity supply	Informative international reference
Industry Good Practice Standards	AS/NZS 5139:2019	Safety of Battery Systems	Industry good practice; not currently cited under Electricity (Safety) Regulations
Publicly Available Specifications (PAS)	PAS 6014:2025	Residential solar PV and battery storage systems guideline	Informative; guidance on design and integration
	PAS 6011:2023	Residential electric vehicle (EV) charging	Informative; EV charging installation guidance
	PAS 6012:2022	Smart home guidelines	Informative; smart home and interoperability guidance
EEA and Industry Guidance	EEA Guide for the Connection of Small-Scale Inverter-Based DG (2018)	Previous national DG connection guidance	Superseded / supporting reference
	EEA Power Quality Guide (2024)	Power quality and network performance guidance	Industry guidance

CATEGORY	DOCUMENT	TITLE / DESCRIPTION	STATUS / APPLICABILITY
	EEA Power System Earthing Guide (2019)	Earthing design and safety guidance	Industry guidance
	EEA Guide for the Connection of Generating Plant (2007)	Legacy generation connection guidance	Superseded / supporting reference
	Safety Manual – Electricity Industry (SM-EI)	Industry safety framework for work on electrical networks	Industry code of practice (widely adopted)
	EDB Connection and Operation Standards (COPS / NCS)	Network-specific connection requirements	Mandatory at distributor level
New Zealand Electrical Codes of Practice (NZECP)	NZECP 34:2001	Electrical Safe Distances	Recognised code of practice; relevant for clearances
	NZECP 35:1993	Power Systems Earthing	Historical reference; largely superseded
	NZECP 51:2001 (SM-EI)	Electricity Supply Industry Safety Manual	Industry safety framework

Appendix E Example of Smart inverter settings[8]

Correct configuration of the inverter improves grid reliability and solar grid capacity, while also improving safety.

To correctly configure solar PV and/or battery inverter settings, follow the steps below.

Configuring your smart inverter

- Make sure the inverter has the latest firmware installed.
- Select your country/region. Some manufacturers may have this pre-selected.
- Select the 'AS/NZS 4777.2:2020 Australia A' setting through the relevant section in the inverter app or display screen.
- Confirm that the correct low static export limit has been set as default (1kW for systems ≤30kW).
- Turn on the device.

Once the system has been installed, use the inverter manufacturer's app or portal to commission the system (in-band registration) or generate an LFDI (out-of-band registration).

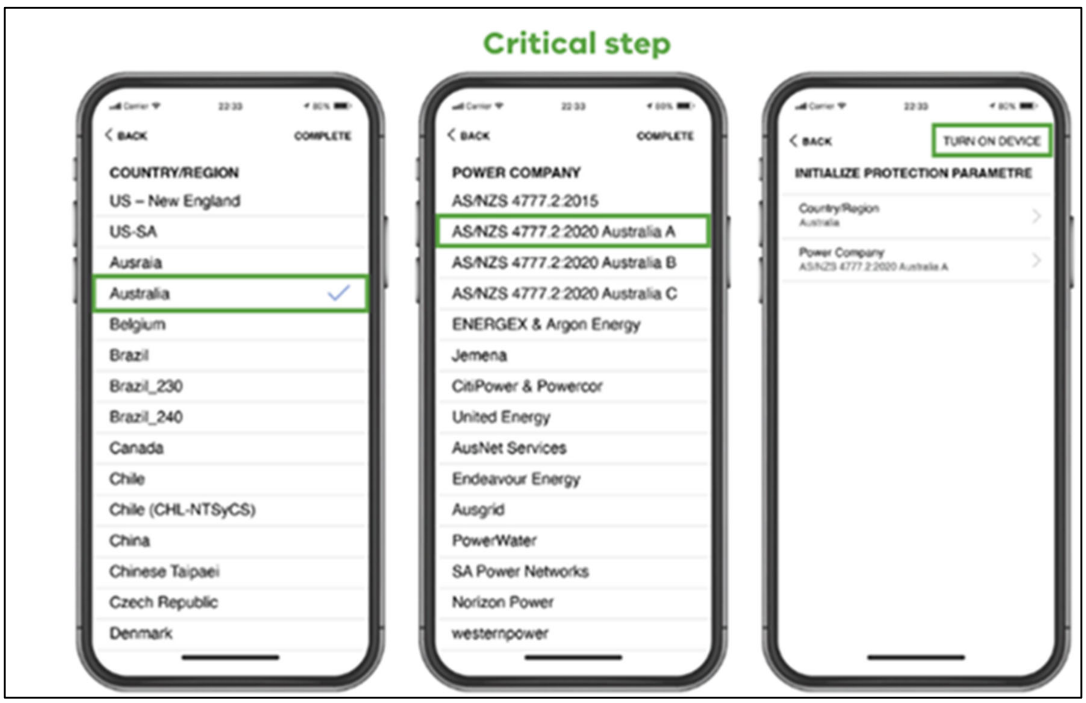


Figure 6 Example of Critical Steps

The images above show an example of this process; however, this may differ depending on the inverter manufacturer.

[8] Smart inverter settings - AusNet

Sometimes inverter manufacturers may need to remotely adjust inverter settings. This is to comply with technical and safety obligations. To allow this, activate the remote access on your inverter to ensure your connection is not interrupted and the grid continues to operate safely.

Why inverter compliance is important

Inverter settings manage the way the inverter behaves in response to voltage and system frequency changes. These settings are developed to:

– best balance the amount of power used or exported

– protect the equipment and our network

– keep you safe.

Appendix F Quick Guide for Installers Connecting Residential DER (≤10 kW) to LV Networks

This appendix provides a simple, step-by-step overview of how to connect a residential distributed energy resource (DER) system (≤10 kW) to a low-voltage (LV) network in NZ.

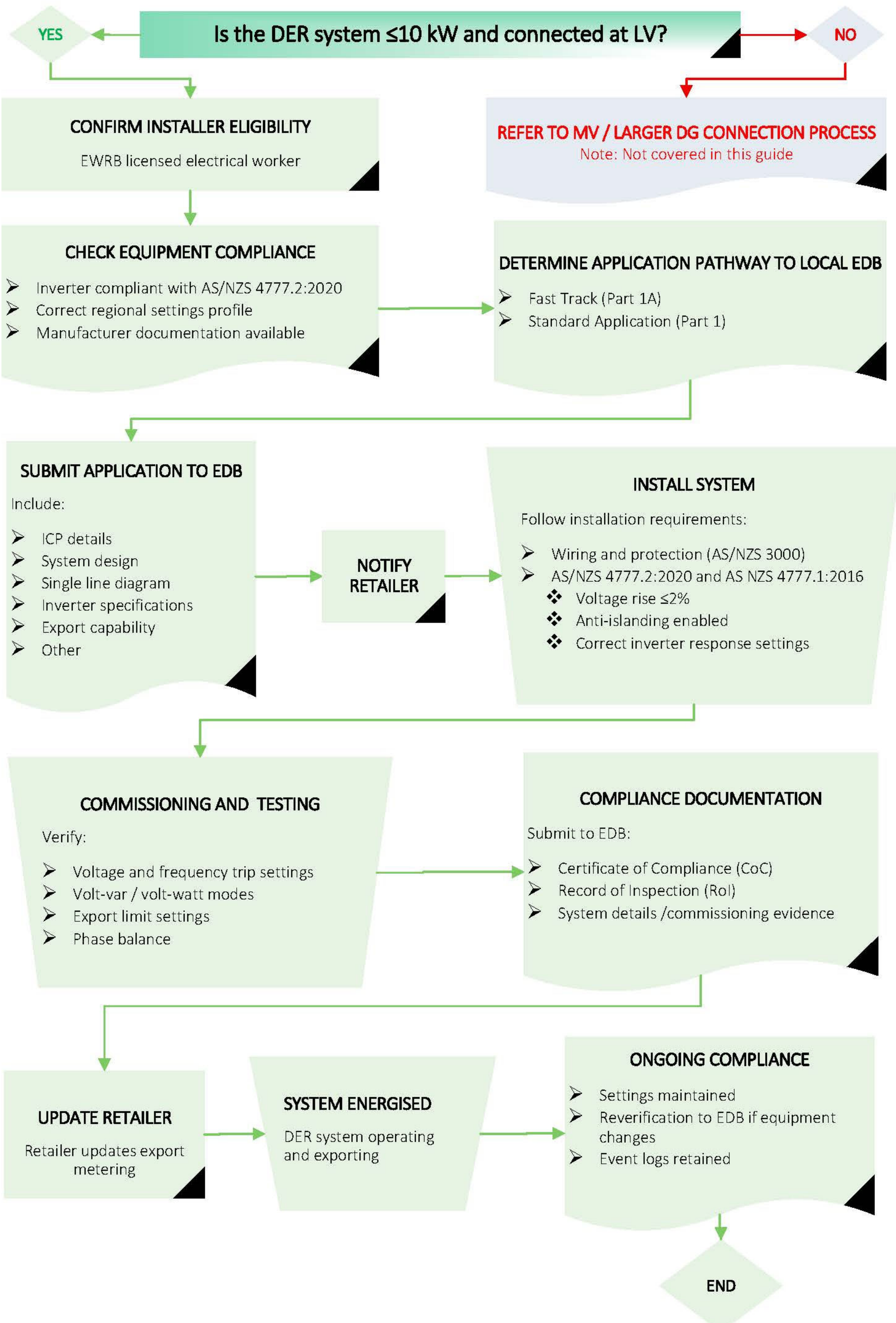
The DER Connection flow diagram (Appendix G) is intended to be used alongside the main guideline.

Quick Guide for Installers Connecting Residential DER (≤10 kW) to LV Networks	
Step 1 – Confirm the System is in Scope	Before starting, confirm that: – The system is ≤10 kw inverter capacity, **and** – It is connected at low voltage (LV), **and** – It will export electricity to the network If not, this guide does not apply — refer to the MV or larger DG process.
Step 2 – Confirm You Are Eligible to Install	You must: – Be an EWRB-licensed electrical worker, and – Carry out all work in accordance with: – Electricity (Safety) Regulations – AS/NZS standards – Manufacturer instructions.
Step 3 – Check Equipment Compliance	Before applying, confirm: – Inverter complies with AS/NZS 4777.2:2020 – Correct New Zealand inverter settings profile is available – Manufacturer documentation is complete. – If using non-standard or non-approved equipment, expect a longer approval process – Discuss with retailer
Step 4 – Determine the Application Pathway	Contact the local EDB and confirm the application type: – Fast Track (Part 1A) Typically applies where: – System ≤10 kw – Approved inverter used – Network has available capacity
	Standard Application (Part 1)
	Required where: – equipment is not pre-approved, or – network constraints exist.
	Provide all required information:

Step 5 – Submit Application to the EDB	– ICP and customer details – Installer and inspector details – System design and configuration – Single line diagram (sld) – Inverter specifications – Battery details (if applicable) – Export capability and proposed limits
	Incomplete applications will delay approval.
Step 6 – Install the System	Install in accordance with: – AS/NZS 3000 (Wiring Rules) – AS/NZS 4777.1 and 4777.2 – Electricity (Safety) Regulations. Key requirements: – Voltage rise ≤ 2% – Anti-islanding protection enabled – Correct inverter response modes configured – Protection settings applied correctly.
Step 7 – Configure Inverter Settings	Ensure inverter is set correctly: – Correct regional profile (Australia A during transition) – Voltage and frequency protection settings – Volt-Watt and Volt-VAR enabled – Export limits configured (if required).
	Incorrect settings are one of the most common reasons for rejection.
Step 8 – Commission and Test	Before energisation, verify: – Voltage and frequency trip settings – Inverter response modes (volt-var / volt-watt) – Export limit operation – Phase balance and polarity – Reconnection timing – Battery protections (if installed).
Step 9 – Complete Compliance Documentation	Provide: – Certificate of Compliance (coc) – Record of Inspection (roi) – Commissioning evidence (settings + test results). – Submit required documents to the EDB.
Step 10 – Notify Retailer	**You must notify the electricity retailer so they can:** – Install or update import/export metering – Enable export billing

Step 11 – Final Approval and Energisation	**The system must not be energised for export until:** – EDB approval is confirmed, and – Metering is in place. **Once approved:** ✓ System can be energised ✓ Export to network can begin
Step 12 – Ongoing Compliance	**After connection:** – Maintain correct inverter settings – Retain event logs (typically ⩾90 days) – Notify edb of any changes, including: • inverter replacement • added capacity • battery installation • firmware changes. **Reverification may be required**
KEY THINGS TO GET RIGHT	**Most commissioning problems come from:** ✗ Incorrect inverter settings ✗ Missing documentation ✗ Poor slds ✗ Unapproved equipment ✗ Not confirming EDB requirements early.
INSTALLER CHECKLIST (QUICK VIEW)	**Before energising:** – Approved by EDB – System installed to AS/NZS standards – Inverter settings correct – Export limit configured – CoC + RoI completed – Retailer notified – Metering installed
FINAL NOTE	**This process ensures:** – Safe installation – Compliant connection – Reliable network operation – Efficient approval **Following these steps will minimise delays and avoid rework.**

Appendix G DER Connection Flowchart



Appendix H Residential Solar PV Commissioning Guide

This appendix supports compliance with the technical requirements in Part 2 of this guideline and should be used for commissioning and verification prior to connection.

How to Use the Commissioning Checklist

This guide explains how to use the Residential Solar PV Commissioning and Inverter Settings Checklist.

The checklist is the minimum expected commissioning standard for residential DER systems (≤10 kW) connected to low-voltage networks.

It helps ensure that:

- The system is safe and compliant
- Inverter settings are correct and consistent
- The installation will operate properly on the network
- Required information is available for EDBS, inspectors, and audits.

What Commissioning Means

Commissioning is the final step before a system is energised and allowed to export.

It is where you confirm:

- The system has been installed correctly
- The inverter settings are correct
- Protection and safety functions work as intended
- Export limits (if required) are working
- All required documentation is complete

A system should not be connected or left exporting until commissioning is complete.

How to Use the Checklist

Work through the checklist in order, from pre-commissioning through to final sign-off.

For each item:

- Tick when completed
- Attach evidence where required (photos or screenshots)
- Record key information (e.g. firmware version, settings)

The checklist becomes part of the installation evidence pack.

Key Stages of Commissioning

Residential Solar PV Commissioning Guide	
WHAT	**HOW**
1. Pre-Commissioning (Before Energisation)	**Before turning the system on, confirm:** – EDB approval has been received – The system matches what was approved – Inverter firmware is up to date – Isolators, labelling, and safety access are complete CTs and sensors (if used) are installed correctly Most commissioning issues come from incorrect setup before energisation.
2. Set the Correct Inverter Profile (Critical Step)	**You must:** – Set the inverter to AS/NZS 4777.2 Australia A profile – Confirm the correct profile is active Record evidence (screenshot or photo) This is one of the most important steps. Incorrect settings can result in rejection or unsafe operation.
3. Check Protection Functions	**Confirm the inverter will disconnect safely when required:** – Anti-islanding enabled – Over/under voltage protection – Over/under frequency protection Reconnection delay working These are mandatory safety functions.
4. Enable Grid Support Functions	**Modern inverters support the network through automatic responses.** Confirm: – Volt-Watt is enabled – Volt-VAR is enabled – Frequency response is enabled Ramp rate / soft start is configured These functions help manage voltage and improve hosting capacity.
5. Set and Test Export Limits (If required)	**If the EDB has specified an export limit:** – Confirm the required limit – Configure it correctly – Test it (e.g. Step test or monitoring) Confirm fail-safe behaviour Export limits must apply to the whole system, not just individual inverters.

6. Carry Out Site Tests	**Before connection, check:** – Polarity and earthing – PV string voltage and polarity – Inverter startup (no alarms) – Anti-islanding operation Shutdown and restart procedures
	These are standard commissioning checks under AS/NZS requirements.
7. Prepare the Evidence Pack	**You must provide:** – Certificate of Compliance (coc) – Record of Inspection (roi) – Inverter settings evidence (screenshots/photos) – Commissioning test results System documentation (SLD, manuals)
	This is what the EDB uses to approve connection.
8. Handover to Customer	**Provide the customer with:** – System manuals – Shutdown procedure – Monitoring access Warranty information
	Explain: – How the system operates – What to do in an emergency
9. Final Sign-Off	Before energising/exporting: ✓ All checklist items complete ✓ Documentation submitted ✓ Settings verified Approvals confirmed
COMMON ISSUE TO AVOID	Most commissioning problems come from: ✕ Wrong inverter profile selected ✕ Missing screenshots or evidence ✕ Export limits not tested ✕ Cts installed incorrectly ✕ Settings changed after commissioning ✕ Incomplete documentation

ONGOING RESPONSIBILITIES	After commissioning: – Settings must be maintained – Changes must be notified to the EDB – Event logs should be retained – Systems may need re-verification after: • Firmware updates • Equipment replacement – System upgrades
KEY TAKEAWAY	The checklist is not just paperwork — it is: ✓ Proof the system is safe ✓ Proof it will operate correctly ✓ Proof it meets EDB requirements Following it properly will: – Reduce rework – Avoid connection delays – Ensure consistent installations across New Zealand

Appendix H - Residential Solar PV Commissioning and Inverter Settings Checklist

SITE ADDRESS		**Date of completion**	
INSTALLER (COMPANY)		**Installer license / reg.**	

Introduction

This checklist is the minimum expected commissioning evidence for LV ≤10 kW connections. There may be further requirements as specified by the EDBs, OEM, or regulatory authorities from time to time. Also, this is not a comprehensive installer guide to provide step-by-step field support instructions.

There will be further clarity on export limits as EA has recently circulated a consultation paper on “Maximising benefits from local generation" and will need to be reflected in this guide at an appropriate time.

Note that 230 V ±10% applies at the Point of Supply.

This checklist will be mainly used by the installer during commissioning. However, there are items which will be verified by the inspectors or EDBs as specified.

Tick each item and attach evidence (photos/screenshots) where requested.

A. Pre-commissioning (before energisation)

☐ Connection approval received (EDB approval / connection agreement / pre-approval).

☐ Inverter model is approved/certified for AS/NZS 4777.2:2020 Amd2:2024.

☐ Latest inverter firmware installed (record firmware version).

☐ System design matches approval: PV capacity (kW), inverter rating (kVA), phases, export limit (if any).

☐ CTs/sensors installed correctly (if export limiting or monitoring is used); orientation/placement verified.

☐ AC/DC isolation and labelling complete; safe access and shutdown procedure confirmed.

☐ Inverter installed with required clearances.

☐ Inverter protected from rain/sun.

☐ Wi-Fi configuration checked (to ensure remote access is available).

☐ Installation complies to the requirements of AS/NZS3000:2018 Amd 3:2023 (Wiring Regulations).

B. Inverter grid profile selection (critical)

☐ Set grid profile to AS/NZS 4777.2:2020 Australia A.

☐ Record evidence: screenshot/photo of active grid profile (include inverter serial/model in same evidence pack if possible).

☐ Confirm settings are locked/protected against inadvertent change (where available).

C. Interface protection functions (EDB to verify via commissioning reports)

☐ Anti-islanding / loss-of-mains enabled (active method as per inverter certification).

☐ Over/under voltage protection enabled (OV/UV).

☐ Over/under frequency protection enabled (OF/UF).

☐ Reconnection delay enabled and compliant with profile.

☐ Record evidence: settings summary export or screenshots showing key protection page(s) (where available).

D. Grid-support functions (smart inverter modes)

☐ Volt-Watt enabled (with Australia A points).

☐ Volt-VAR enabled (with Australia A).

☐ Frequency-Watt / frequency response enabled.

☐ Ramp rate / soft-start configured as per profile.

☐ Power factor / reactive power mode set to profile default unless otherwise approved.

☐ Record evidence: screenshots of Volt-Watt / Volt-VAR / Frequency response pages (or settings export).

E. Export control (only if required by EDB approval)

☐ Export limit requirement confirmed (kW or kVA, per phase and/or total; either default 10kW limit or lower as per the EDB using ELAM tool).

☐ Export limiting method documented: inverter setting / external controller / retailer gateway / battery system control.

☐ Export limit commissioned and tested (step test or monitored ramp to confirm cap).

☐ Record evidence: screenshot of export limit value and test result (e.g., monitoring trace, meter reading, or inverter log).

☐ Fail-safe behaviour confirmed (what happens if CT comms fail / sensor fails / controller offline).

F. Commissioning tests (site)

☐ AC polarity and earthing checks completed; insulation resistance (where applicable) recorded.

☐ PV array open-circuit voltage and string polarity verified (where applicable).

☐ Inverter starts normally; no persistent alarms; communications/monitoring configured.

☐ Anti-islanding functional check performed (as per standard commissioning practice).

☐ Loss of Network Supply Auto Isolation Test completed (record auto isolation disconnection speed)

☐ Earth resistance test completed (record each phase to neutral values in ohms).

☐ Shutdown and restart procedure demonstrated and documented).

☐ As-built photos taken: inverter, switchboard, isolators, labels, CT installation (if used).

☐ Voltage and Frequency ride through capabilities tested (delay time recorded).

G. Evidence pack and handover

☐ Customer documentation provided: manuals, shutdown procedure, warranty info, monitoring access.

☐ The copy of the commissioning sheet from the inverter manufacturer provided (includes the grid settings and inverter serial number).

☐ A photo of the inverter screen showing both the inverter serial number and the grid settings provided.

☐ A screenshot of the commissioning process that shows both the inverter serial number and grid settings provided.

☐ Certificate of Compliance (CoC) and Record of Inspection (RoI) from a licensed electrician/licensed electrical inspector supplied confirming compliance to the Electricity Safety regulations 2010.

☐ Final copy of circuit diagram and Schedule of protection settings provided.

☐ Network-required documentation completed and submitted (as applicable).

☐ Evidence pack uploaded/attached: profile screenshot, settings pages, export limit proof, serial/model photo.

☐ Installer declaration signed; customer sign-off obtained (optional).

H. Sign-off

Installer name		**Signature**	
Date		**Company**	

Appendix I International Context and Benchmarking

INFORMATIVE

This appendix provides a high-level overview of relevant international standards and practices to support comparison with the approach adopted in this Guide. It is provided for information only and does not introduce additional requirements.

1. Voltage Standards

NZ's updated low voltage limits (230 V ±10%) are broadly aligned with international norms.

– Europe / United Kingdom (EN 50160):

Nominal voltage is 230 V. Under EN 50160, voltage is typically required to remain within ±10% for 95% of 10-minute average values over a one-week period.

In the United Kingdom, distribution network operators have historically operated closer to +10% / –6%, although there is ongoing consideration of wider operating ranges in response to increasing distributed energy resource (DER) penetration.:

– Australia (National Electricity Market):

Nominal voltage is 230 V. Distribution network service providers (DNSPs) commonly operate within a range of approximately +10% / –6% under standard conditions.

However, some DNSPs are able to operate across a wider range (up to ±10%) where permitted, particularly as networks adapt to increasing DER penetration and evolving voltage management practices.

– IEC 61000-3-100:

- Normal operating band: ±10% for 95% of the time
- Rare excursion band: approximately 195–265 V for up to 5% of the time

This alignment supports equipment interoperability, supply chain consistency, and harmonisation with international inverter performance standards.

2. DER Connection and Inverter Standards

International standards and connection frameworks are increasingly focused on enabling DER integration while maintaining system stability and interoperability.

– IEEE Std 1547-2018 (United States):

A key standard defining technical requirements for DER interconnection, including:

- voltage and frequency ride-through capabilities
- voltage and reactive power control (e.g. Volt-VAR, Volt-Watt)
- interoperability and communications (e.g. IEEE 2030.5, SunSpec, Modbus, DNP3)

CONSULTATION DOCUMENT

  - increasing alignment with cybersecurity frameworks (e.g. IEC 62443)

– California Rule 21 (e.g. PG&E, SCE, SDG&E):

  - Enables advanced inverter functions, including configurable real and reactive power priority
  - Supports grid services through smart inverter behaviour and remote configuration

– United Kingdom (Engineering Recommendation G98):

  - Defines streamlined connection requirements for small-scale, type-tested microgeneration (≤16 A per phase)
  - Supports simplified approval pathways for standardised systems

3. Advanced and Emerging Practices

Leading jurisdictions are increasingly adopting more dynamic and flexible approaches to DER integration.

– Dynamic Export Limits / Operating Envelopes:

  - Used in Australia, the UK, and parts of the United States
  - Enable higher DER penetration by dynamically adjusting export limits based on network conditions

– Emergency Backstop Mechanisms (Australia):

  - Provides a last-resort capability to remotely curtail or disconnect distributed solar generation during system security events (e.g. minimum demand conditions)
  - Typically implemented via standardised communication protocols (e.g. CSIP-AUS)

– Utility-Specific Practices (e.g. LADWP):

  - Include functions such as momentary cessation, where inverter output is temporarily reduced during voltage disturbances and rapidly restored once normal conditions resume

4. Key Observations

Across jurisdictions, several consistent themes are emerging:

– increasing use of standardised inverter capabilities to support grid stability

– growing emphasis on interoperability and communications

– movement toward dynamic and flexible export management

– alignment of voltage limits and performance standards to support global equipment markets

These trends reinforce the direction taken in this Guide, including alignment with international standards, support for interoperability, and progression toward more dynamic approaches to DER integration.