Battery Energy Storage System Connection Technical Specification - Basic Installation (≤30kVA)

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PowerWater

Contents

1. Introduction and scope

1.1 Purpose

This technical requirement document provides proponents of battery energy storage system (BESS) connections, with an aggregate inverter rating of less than or equal to 30 kW, information about their obligations for connection to and interfacing with the Power and Water Corporation (Power and Water) electricity network.

1.2 Scope

This document applies to new BESS connections to Power and Water's low voltage (LV) electricity network, or modifications to existing BESS connected to Power and Water's electricity network. This document must be read in conjunction with Power and Water's embedded generation specifications.

Power and Water has developed a suite of technical specifications for BESS installations.

	BESS technical specification document
1	Battery Energy Storage System Technical Specification - Basic Installation (≤30kVA)
2	Battery Energy Storage System Technical Specification – Negotiated Installation (>30kVA to ≤2MW)

Table 1: BESS technical specification suite

The scope of this BESS requirements specification includes:

Micro sized BESS with total site embedded generation (i.e. inverter nameplate) capacity of less than or equal to 30kW connected to the LV network.

The scope of this technical specification does not include:

a. photovoltaic, wind, or other generation sources connected via inverter energy system (IES) (see Power and Water's Embedded Generation Technical Specifications)

b. electric vehicles supply equipment, excluding electric vehicle supply and discharge equipment (EVSDE), refer to the Electric Vehicle Supply Equipment Technical Specification available on Power and Water's website

c. portable equipment

d. BESS installations >30kVA to ≤2MW (see Power and Water's Battery Energy Storage System Technical Specification – Negotiated Installation (>30kVA to ≤2MW))

e. BESS installations >2MW (see Power and Water's Network Technical Code and Networks Planning Criteria, section 3.3).

1.3 Obligations of proponents

Proponents shall comply with all the applicable requirements of this document.

The general obligations of proponents include:

a. the obligation to comply with the technical requirements as well as relevant national standards, industry codes, legislation, and regulations. In the event of inconsistency, an indication of which instrument shall prevail is legislation and regulations, followed by the technical requirements, followed by national standards and industry codes

b. the obligation to not connect additional BESS units, make modifications or install additional BESS units without prior written agreement from Power and Water

c. the obligation to comply with Power and Water's connection agreement

d. the obligation to meet Power and Water's requirements in the design, installation, and operation of the BESS

e. the obligation to meet the connection and commissioning requirements to the distribution network.

Power and Water's obligations are to ensure the safe and reliable operation of the distribution system for operating personnel, customers, and the public.

1.4 Connection enquiry and application

1.4.1 Connection types

Power and Water provides 3 processes for connection to the Northern Territory electrical distribution network: basic, negotiated, and major connections (Figure 1). Additional details are available on Power and Water's Power Connection webpage.

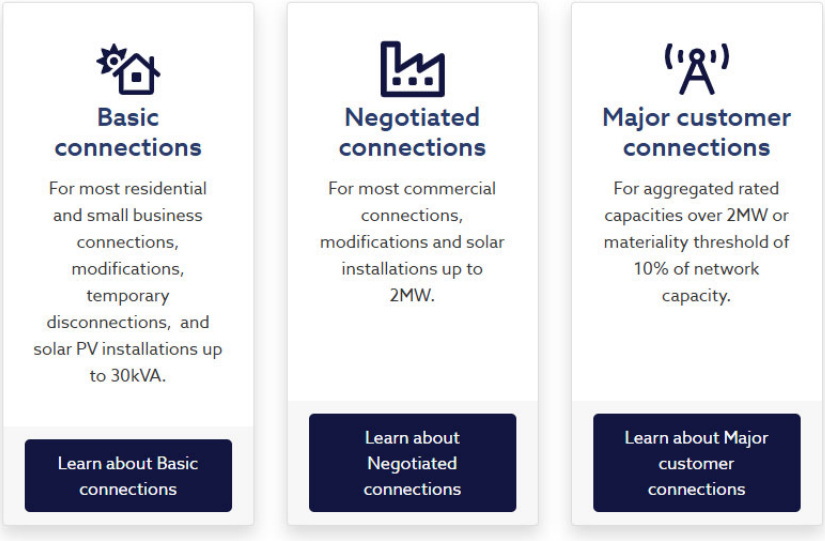

Figure 1: Three connection processes; basic, negotiated and major– refer to the Power and Water power connection webpage

The process for application and assessment of a BESS system is the same as for an embedded generation system. Refer to Power and Water's Embedded Generation Connection Guideline for more information.

The following information provides an overview of the steps involved in connecting a BESS less than or equal to 30kVA to the Power and Water distribution network. These are considered basic connection services.

1.4.2 Process

The diagram below outlines the indicative process for micro-embedded generation systems.

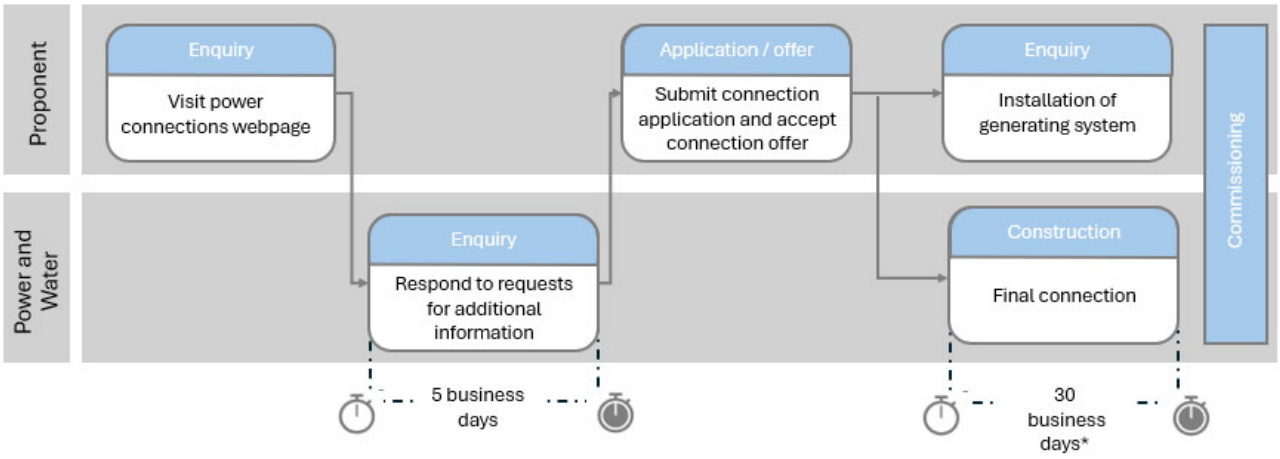

Figure 2: Connections process for micro / basic BESS systems

1.4.3 Enquiry

For general information relating to basic connections, please refer to Power and Water's power connections webpage. If you require additional information to that found on the website, please contact us by calling our Customer Service Centre on 1800 245 092, or by email: connect.me@powerwater.com.au.

1.4.4 Application to connect

To submit an application for a basic connection, download and complete the Basic connections application form and submit it to us via email at connect.me@powerwater.com.au.

1.4.5 Expedited applications

We will assume you want an expedited connection unless you indicate otherwise. This means that you accept the model standing offer as published on our website, and do not need to go through the formal offer and acceptance process. We encourage our customers to choose an expedited connection service as it is the quickest way to get your BESS installation connected to our network. However, if you do not want to enter into an expedited connection application, please contact our Customer Service Centre. Alternatively, you can submit a Negotiated connections application form so we can work together to negotiate your connection needs.

Once we have received your application, we will assess your requirements and be in touch should any additional information be required.

1.4.6 Assessment

There are a number of factors considered in assessing your application, such as size of your system, where it connects to our network, and the location within the Northern Territory. If during our assessment of the application we deem there is risk to our network security, safety or reliability, we maintain the right to offer a negotiated agreement instead to preserve the network and ensure your connection arrangement is suitable.

A copy of the current connection agreements and supply agreement is available on our power connections webpage.

1.4.7 Construction and commissioning

Once your BESS has been installed, you or your electrical contractor will need to provide us with a copy of the Certificate of Compliance (CoC) and commissioning sheet to confirm your system is compliant with the technical and operating conditions specified in your application and connection contract. Once we have received these documents, we will complete the final connection (including upgrade or replacement to the metering at the premises) and any inspections or testing required to ensure your connection is safe.

1.4.8 Energisation

Before your connection is energised you need to ensure you have necessary arrangements in place for the sale and purchase of electricity. Please contact your authorised electricity retailer.

A list of electricity retailers can be found on our website.

2. Relevant standards and regulations

2.1 Standards and codes

There are a range of applicable standards and industry codes which define connection types and requirements, and network standards as set out below.

In the event of any inconsistency between an applicable Australian/international standard or industry code (except for legislated industry codes) and these technical requirements, these technical requirements will prevail.

2.1.1 Australian and international standards and industry codes

The Australian and international standards and industry codes listed in Table 2 shall apply to the design, manufacture, installation, testing and commissioning, and operation and maintenance of all plant and equipment for BESS connections to the electrical distribution network.

Document number	Document name	Document type
AS/NZS 3000	Electrical Installations - Wiring Rules	AU/NZ Joint Standard
AS/NZS 5139	Electrical Installations - Safety of battery systems for use with power conversion equipment	AU/NZ Joint Standard
AS/NZS 61000	Electromagnetic compatibility (EMC) (multiple parts)	AU/NZ Joint Standard
AS/NZS 4755.1	Demand response capabilities and supporting technologies for electrical products Part 1: Demand response framework and requirements for demand response enabling devices (DREDs)	AU/NZ Joint Standard
AS/NZS 4755.3.5	Demand response capabilities and supporting technologies for electrical products Part 3.5: Interaction of demand response enabling devices and electrical products – Operational instructions and connections for grid connected electrical energy storage (EES) systems	AU/NZ Joint Standard
AS/NZS 4777.1:2024	Grid connection of energy systems via inverters Part 1: Installation requirements	AU/NZ Joint Standard
AS/NZS 4777.2:2020	Grid connection of energy systems via inverters Part 2: Inverter requirements	AU/NZ Joint Standard
AS 5374:2023	Energy storage system performance	AU Standard
	Best Practice Guide: battery storage equipment – Electrical Safety Requirements, V1.0 (2018)	AU guide

Table 2: Applicable standards

2.1.2 Related Power and Water documents

For more information on Power and Water's network requirements, see Table 3 below. These shall apply to all connections to the Power and Water electricity network.

Document title	Record number
Service and Installation Rules	NP018
Meter Manual	NP010
Network Technical Code	N/A
Remote Area Network Technical Code	N/A
Basic Micro Embedded Generation Technical Requirements Specification – less than or equal to 30kVA	N/A
Negotiated Embedded Generation Technical Requirements Specification – greater than 30kVA, less than or equal to 2000kVA	N/A
Safe Work Method	
HV approach restrictions	

Table 3: Power and Water references and documents

2.2 Legislation and regulation

The relevant legislation and regulations listed in Table 4 shall apply to the design, manufacture, installation, testing and commissioning, and operations and maintenance of all BESS connections to the network.

In the event of any inconsistency between legislation and regulations and these technical requirements, the legislation and regulations shall prevail.

Document name	Documents type
National Electricity (NT) Rules	Regulation
Electricity Safety Act 2022 and Regulations 2024	Legislation
Electricity Reform (Safety and Technical) Regulations 2000	Regulation
Network Technical Code	Code produced under Electricity Reform (Administration) Regulations
System Control Code	Code produced under Electricity Reform (Administration) Regulations
Critical Infrastructure Act 2021	Regulation
Australian Energy Sector Cyber Security Framework (AESCSF)	Code procedure under Critical Infrastructure Act

Table 4: Regulations and legislation

3. Functional requirements

3.1 Remote control

A BESS may need some level of remote control for integrating distributed energy resources (DER) or consumer energy resources (CER) such as solar PV, and electric vehicles (EV). The following control schemes may be required as a result:

- peak demand control.
- voltage control.
- operating limits such as dynamic operating envelope (DOE) control.
- DER management system (DERMS) control.

Remote control requirements shall be advised by Power and Water at the time of connection application and may include control via systems such as DNP3, Modbus TCP, 61870-5-104, API, or IEEE1555/CSIP-AUS.

3.2 Data and information

3.2.1 Static data and information

Dynamic data and information that may be required to be provided by the proponent to Power and Water is set out within **Appendix A:** Static data and information. These requirements depend on the capacity of the BESS.

3.2.2 Dynamic data and information

Dynamic data and information that may be required to be provided by the proponent to Power and Water is set out within **Appendix B**: Dynamic data and information. These requirements depend on the capacity of the BESS.

3.3 Communications systems

For IES including BESS, the following communication interface requirements shall be adopted:

- physical communications interface including an ethernet port capable of being used for communications with the system by authorised parties
- remote control capability via application programming interface (API) to remote services (e.g. retailer, equipment manufacturer, aggregator)
- internet accessibility through at least one method for forming a reliable internet connection accessible by authorised parties
- remote monitoring communication function that is capable of reporting data
- remote control capability to respond to remotely provided commands from authorised parties to charge or discharge the battery and change the export limit
- remote configuration capability to respond to remotely provided commands from authorised parties to alter firmware or operational settings.

3.4 Documentation and compliance

Operators shall be required to submit comprehensive documentation, including system design reports, testing and commissioning records, and ongoing monitoring plans. These requirements ensure that BESS installations operate within the specified parameters and contribute to the overall stability and reliability of the NT electricity network.

4. Technical requirements

4.1 Power quality and operating protocol

New BESS connections, including grid forming BESS, shall be compliant with the relevant Power and Water Network Technical Code (NTC) requirements.

4.1.1 IES power quality response modes

The volt–var and volt–watt response modes shall both be initially enabled and shall respond as per the appropriate embedded generation technical specifications settings. For grid forming BESS with diesel off operation capacity, the final values for these parameters will be determined during commissioning.

4.1.2 Ramping requirements

For ramping requirements refer to the appropriate embedded generation technical specifications. Inverters capable of use with energy storage systems shall be configured to operate in 'changes to energy source operation' mode. Additional ramping requirements may be given after analysis by Power and Water.

The voltage changes from various loading/unloading rates and its resulting impact on the network voltage control systems form a part of Power and Water connection assessments. Battery systems are especially unique in the sense that they are capable of ramping extremely fast in response to control signals and their operation cannot be readily forecast. To ensure that there is no adverse impact on the network voltage control systems, the proponent shall ensure voltage fluctuations are maintained within acceptable limits.

5. Standalone operations

Some battery systems can provide supply to site loads during grid supply outages. When these systems are operating in standalone mode, they shall comply with the requirements of AS/NZS 4777.2 section 3.4. The following key points shall be ensured:

- continuity between the neutral conductor shall be maintained
- active conductors on the standalone port shall be isolated from the grid interactive port
- during transitions between standalone and grid tied modes of operation, the system shall minimise surge or inrush currents and minimise voltage disturbances
- while connected to the grid, all IES shall have Australia Region A settings as per AS/NZS 4777.2 active
- installation shall be as per AS/NZS 3000 and AS/NZS 4777.1.

6. Fire and safety protocols

The fire and safety requirements of constructing a BESS, particularly for community/neighbourhood batteries located in suburban areas are as follows.

6.1 Design considerations

The following items should be considered during the design phase:

- constructed on top of a non-combustible surface such as a concrete plinth or earthen hardstand
- security infrastructure such as fences and cameras should be installed
- appropriate monitoring of the infrastructure should be provided to ensure that any short-circuit faults or equipment failure is able to be rapidly identified and notified to emergency services
- appropriate water ingress protection including floodwater, as well as measures to manage fire water run-off
- if adjacent to a road, mechanical protection should be provided around the BESS to prevent vehicle collisions
- to minimise the risk of fire, battery systems should comply with current international standards for cell and module testing and fire management strategies, including but not limited to:
    - NFPA 855: Standard for the installation of Stationary Energy Storage Systems
    - UL 9540: Energy Storage System Requirements
    - UL 9540A: Standard Test Method for Evaluating Thermal Runway Fire Propagation in Battery Energy Storage Systems
    - FM Global Property Loss Prevention Data Sheet 5-33.

6.2 Fire safety and location restrictions

According to AS/NZS 5139 standard, a residential battery is treated as a potential ignition source. AS/NZS 5139 shall be fully complied with, and the following items are identified for specific attention:

- **prohibited locations:** Not in any hazardous or explosive zone (e.g. gas meter alcoves, cistern ventilation, chemical stores). No installation beneath gas vents, open flames or inside areas with flammable vapours.
- **no egress obstruction:** BESS units shall not be installed in stairways, corridors, foyers, under-floor or roof spaces, or below the main walkway of an escape route. The installation shall be at least 600 mm clear of exits/doorways (900 mm if door >900 mm wide).
- **outdoor restrictions:** Batteries shall be indoors or under cover and recommended not outdoors where vehicles or equipment could damage them (no parking/traffic within 600 mm). Roof-mounting shall not be suitable unless the roof has fixed staircase access, batteries shall not be installed in unventilated ceiling cavities.
- **airflow and clearances:** BESS must have adequate ventilation and clearance from other equipment. Non-BESS appliances such as hot water units, cooktops, air-conditioner compressors, motors, etc. shall not be closer than 600 mm horizontally or 900 mm vertically. Space heaters and gas appliances shall not be within the horizontal plane of a battery.
- **barrier for habitable-room walls**: Fire resistant barrier (e.g. masonry, tile or cement-sheet ≥6 mm) shall be fitted extending at least 600 mm beyond the BESS edges and 900 mm above, if the battery is within

300 mm of a wall that adjoins a habitable room (bedroom, living room, kitchen/dining, office, playroom, etc.). Typical house wall linings (plasterboard, timber panelling) shall not be recommended.

- **smoke alarms:** Smoke alarm installation in the same room as the battery shall be as per AS/NZS 3786.

6.3 Electrical clearances

As per AS/NZS 3000 table 2.3, 1.0m clear in front and 0.3m on side working space shall be maintained around BESS. Under no circumstances, shall BESS be placed under a laundry chute, flue or near open flames.

6.4 Emergency access and egress

The BESS location shall not impede escape routes. No BESS shall be placed on or under any evacuation path as per AS/NZS 5139. All direct current (DC) and alternating current (AC) isolation devices for the BESS shall be readily accessible, clearly marked and shall not be locked behind barriers.

6.5 Enclosures

BESS shall be housed in appropriate enclosures or battery rooms. Outdoor cabinets shall be weatherproof rated to an ingress protection (IP) standard such as IP54 or higher as per IEC 60529. Indoor installation shall protect people and property, walls immediately behind a BESS shall be at least non-combustible with acceptable materials (such as brick, concrete, cement-fibre board or ceramic tiles) as per AS/NZS 1530.1.

6.6 Appropriate signage

The following signage and warnings shall be applied in clearly visible indelible labels:

- signage in accordance with the relevant requirements of AS/NZS 5139, AS/NZS 3000, and the AS/NZS 4777 series
- warning notices for the electrical and high voltage hazards of any BESS must be located on-site
- capacity
- chemistry
- safety systems
- shut down and isolation details
- contact details of the BESS owners and the specialist response personnel to provide 24/7/365 support to emergency services.

7. Cybersecurity requirements

The BESS owner is responsible for securing it from unauthorised external control and modification.

If Power and Water require a direct connection to the customer assets, then additional cyber security measures may be advised at time of application.

8. Fees and charges

Information regarding fees and charges applicable to proponents is available on our website at https://www.powerwater.com.au/pricing#power_service_charges.

9. Testing and commissioning

Testing and commissioning requirements for BESS are in the appropriate embedded generation technical specification. A summary is provided below in Table 5.

Testing and commissioning requirements	BESS
Protection settings and performance	✓
Power quality settings and performance	✓
Export limits settings and performance	✓
Communications settings and performance	✓
Shutdown Procedures	–
Confirm fallback at loss of comms settings and performance	✓
Confirm system is as per specifications	✓
Confirm approved single-line diagram is located on site	✓
Power and Water on-site attendance	–

Table 5: Testing and commissioning requirements

Symbols are used to denote testing and commissioning requirements, where:

✓ represents that the testing and commissioning shall be required

– represents that the testing and commissioning may be required

× represents that the testing and commissioning shall not be required

Refer to the Power and Water Embedded generation commissioning form, available at the following link:

https://www.powerwater.com.au/customers/power/power-connections

10. Operations and maintenance

Operations and maintenance requirements for BESS include:

a. the BESS shall be operated and maintained to ensure compliance with the battery manufacture's guidelines, connection agreement, and all legislation, codes, and/or other regulatory instruments at all times.
b. Power and Water may inspect and test the proponent's BESS at any time at Power and Water's cost. Should the inspection identify non-compliance with this technical requirement document, the BESS may be disconnected from Power and Water's network. The BESS will not be reconnected to the network until Power and Water is satisfied that the non-compliance has been resolved. Rectification of non-compliance issues shall be at the proponent's cost.

General expectations for operating and maintaining the BESS shall include:

a. maintaining the electrical installation at the supply address in a safe condition.
b. ensuring that any changes to the electrical installation at the supply address are performed by an electrician lawfully permitted to do the work and that the proponent holds a Certificate of Compliance issued in respect of any of the changes.
c. the proponent shall seek Power and Water's approval prior to altering the connection in terms of an addition, upgrade, extension, expansion, augmentation or any other kind of alteration, including changing inverter settings.

11. Definitions and abbreviations

11.1 Definitions

Term	Definition
Arc flash	Electrical explosion or discharge, which occurs between electrified conductors during a fault short-circuit condition.
Arc flash incident energy	Measurement applied to determine the available incident arc flash energy at a specified distance originating from an arc flash.
Authorised person	Person in charge of the premises, or the licensed electrical contractor or electrician or other competent person appointed or selected by the person in charge of the premises to perform certain duties associated with the BESS or battery system installation on the premises.
Battery	Unit consisting of one or more energy storage cells connected in series, parallel or series parallel arrangement.
Battery energy storage system (BESS)	System consists of power conversion efficiency, battery system(s), and isolation and protection devices. May also includes auxiliary equipment, cables, battery management module(s), and battery management system.
Battery management module (BMM)	Distributed battery and battery module devices that feed into the BMS and are generally part of the electronics on an individual cell or module.
Battery management system (BMS)	Electronic system that monitors and manages a battery or battery system's electric and thermal states enabling it to operate within the safe operating region of the battery.
Battery module	One or more cells linked together. It may also have incorporated electronics for monitoring, charge management and/or protection.
Pre-assembled battery system (BS) equipment	A system compromising one or more cells, modules or battery system, and auxiliary supporting equipment such as a battery management system and protective devices and any other required components as determined by the equipment manufacturer.
Electric vehicle (EV)	A road vehicle that obtains some or all its propulsion energy from on-board batteries which may be charged from the AC electricity supply grid. An EV can be a battery electric vehicle (BEV) without a fuel engine, or a plug-in hybrid electric vehicle (PHEV) with a fuel engine.
Explosive gas hazard	Mixture with air, under atmospheric conditions, of flammable substances in the form of gas or vapour which, after ignition, permits self-sustaining flame propagation which may cause harm to people, property, or the environment
Fire hazard	Potential source of physical injury or damage to persons or property resulting from burns due to the ignition and combustion of flammable materials present in the battery or battery system or enclosure.
Hazard	Potential source of harm.
Maximum rate of charge	The maximum current (Amps) or power (W) that the electric vehicle supply equipment (EVSE) is capable of drawing from the AC supply, given the circuit limits and the internal settings made during installation.

Term	Definition
Power conversion equipment (PCE)	Electrical device converting and/or manipulating one kind of electrical power from a voltage or current source into another kind of electrical power with respect to voltage, current and/or frequency. Examples include but are not limited to DC/AC inverters, DC/DC converters and charge controllers.
Remote agent	A person, organisation, or entity, other than the user or owner, who is: a) authorised to initiate demand response (DR) by transmitting commands and operational instructions; and b) responsible for secure communications with the electrical product.
Technical specifications document	This document, which sets out specifications for proponents to enable a grid connection.
Thermal runway	Unstable condition arising during constant voltage charge in which the rate of heat dissipation capability, causing a continuous temperature to increase with resulting further charge current increase, which can lead to the destruction of the battery.
Islanding	Any situation where the electricity supply from a grid is disrupted or fails and one or more inverters maintains any form of electricity supply, be it stable or not, to any section of that grid or within the electrical installation.
Interface protection	The protection installed to perform the functions of coordinating multiple inverter energy systems installed at one site, providing protection for the entire inverter energy system installation and islanding protection to the connected grid as well as preserving safety of grid personnel and the general public.

Table 6: Definitions

11.2 Abbreviations

Abbreviation	Definition
AC	Alternating current
API	Application programming interface
AS/NZS	A jointly developed Australian and New Zealand Standard
BESS	Battery energy storage system
CEC	Clean Energy Council
CER	Consumer energy resources
CoC	Certificate of compliance
DC	Direct current
DER	Distributed energy resources
DERMS	Distributed energy resources management system
DNSP	Distribution network service provider
DRC	Demand response controller
ESS	Energy storage system
EV	Electric vehicle
EVSE	Electric vehicle supply equipment
EVSDE	Electric vehicle supply and discharge equipment
HV	High voltage
IEC	International Electrotechnical Commission
IES	Inverter energy system
IP	Ingress protection
LV	Low voltage
NEM	National Electricity Market
NER	National Electricity Rules
NMI	National metering identifier
NT	Northern Territory
NTC	Power and Water's Network Technical Code
PCS	Power conversion system
POS	Point of supply

Table 7: Abbreviations

11.3 Terminology

Instructional terms are to be interpreted in the following way:

- The words ‘shall’ or ‘must’ indicate a mandatory requirement.
- The word ‘may’ indicates a requirement that could be mandatorily imposed on the proponent.
- The word ‘should’ indicates a recommendation that will not be mandatorily imposed on the proponent.

Appendix A: Static data and information

The static data and information that is required to be provided by the proponent to Power and Water is to be provided via the Power and Water Embedded generation commissioning form, available on our website at https://www.powerwater.com.au/customers/power/power-connections.

Appendix B: Dynamic data and information

The dynamic data and information that is required to be provided by the proponent to Power and Water is available on our website at https://www.powerwater.com.au/customers/power/power-connections.

12. Further information

If more information is required, please contact:

Power and Water Corporation

GPO Box 1921

Darwin NT 0801

Email: EGApplications.PWC@powerwater.com.au

Phone 1800 245 092

Contact

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