LV EG Network Access Standard - Capacity up to 200kVA

UE-ST-2008.1

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1. Introduction

This document provides the technical requirements for the equipment and installation of low voltage (LV) embedded generation (EG) connections with total system capacity of less than or equal to 200kVA to United Energy's (UE) distribution network. This document has been prepared based on present network conditions and is subject to change. This document complies with the *ENA National Distributed Energy Resources (DER) Connection Guidelines for Basic Micro EG Connections*, with the exception of UE specific requirement deviations presented in Appendix A:.

This document shall be read in conjunction with UE-PR-2008 EG Customer Connection Procedure which details the EG connection services offered and the application process.

1.1 Purpose of the Document

The purpose of this document is to provide proponents of embedded generation connections with information about their obligations for connecting to and interfacing with the UE distribution network.

An EG connection type is defined in Table 1 and Table 2; provided:

- it is intended to be connected to and capable of operating in parallel with any part of the LV distribution network
- it meets all other technical requirements set out in this document
- a *Certificate of Electrical Safety (CoES)* is issued for the installation and provided to UE
- it consists of only an Inverter Energy System (IES)
- the generator owner complies to the Model Standing Offer (MSO) or the Generation Agreement, as appropriate.

Figure 1 illustrates the requirements set out in Table 1 with a typical EG arrangement.

Any connection that does not comply with the above will need to go through a negotiated assessment process and complete a generation agreement. Refer to UE-PR-2008 to determine the relevant connection process.

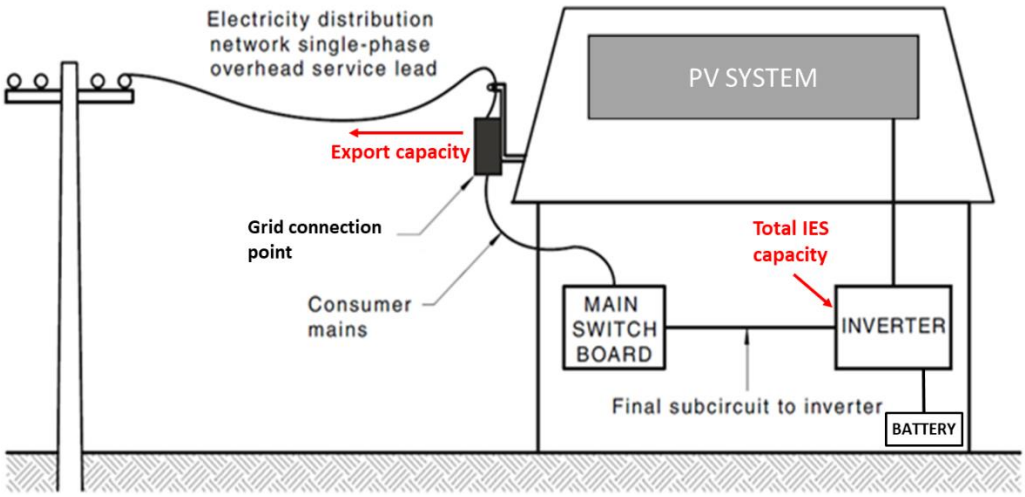

Figure 1: Typical EG arrangement

1.2 Scope

This document applies to embedded generation units connecting to the low voltage electricity distribution network as micro embedded generators. It applies to both new connections of EG systems and modifications to existing EG systems.

Micro embedded generators are generators whose aggregate inverter rating at a point of connection falls within the following categories:

- Total inverter capacity ≤ 30kVA (Generators in this category are typically covered by our Model Standing Offer and are considered a micro embedded generator basic connection)
- Total inverter capacity > 30kVA to ≤ 200kVA (Generation covered by a negotiated generator agreement).

It excludes the following:

- Embedded generation units where the total installed capacity is greater than 200kVA (refer to LV Embedded Generation Network Access Standard – Capacity Greater Than 200kVA. (UE-ST-2008.2))
- Embedded generation units connected to an electrical installation for which the point of connection to the distributor's network is at High Voltage (HV), Sub-transmission, or transmission voltage levels (refer to HV EG Network Access Standard (UE-ST-2008.3))
- Electric vehicles, unless the on-board battery storage system is capable of exporting to the network (in which case the requirements in this document shall apply)
- Electrical installations where any non-inverter-based generation that is capable of being connected to the distribution network is installed (refer to LV Embedded Generation Network Access Standard – Capacity Greater Than 200kVA. (UE-ST-2008.2)).

The MSO provides a description of the embedded generator basic connection services together with the applicable terms and conditions of providing that service.

A generation agreement is signed for a total inverter capacity of 30kVA to ≤200kVA or where the proponent is requesting export values greater than 5kW per phase.

1.2.1 Micro Embedded Generation - Capacity ≤ 30kVA

Generation captured in Table 1 below is the subcategory of generation that is covered by our model standing offer.

Table 1: Micro Embedded Generation Capacity up to 30 kVA

Connection point arrangement	Maximum system capacity[2,3]	Maximum export capacity[4]	Low static export limit
Single-phase	5 - 30 kVA	5 kW	0 W
Two-phase	10 - 30 kVA	5 kW per phase 10 kW in total	0 W
Three-phase	15 - 30 kVA	5 kW per phase 15 kW in total	0 W

Notes:

1. An MSO connection satisfies both the maximum total IES capacity and export capacity requirements shown .
2. Maximum system capacity refers to the aggregate nameplate rating of inverters installed on site.
3. The maximum system capacity installed shall depend on the supply capacity and the coordination of operation (charging or discharging) of bidirectional units that form part of the embedded generation system.
    a. To prevent customer and network issues (i.e. nuisance tripping) the embedded generation shall be sized, set up and operated such the overall generation does not exceed the supply capacity of the site at any time including, but not limited to, the capacity of the main circuit breaker, the supply protection device, and the metering equipment.
    b. Where the maximum system capacity exceeds the site supply capacity, and operation of the system might cause the overall generation to exceed the site capacity at any time, a site generation limit control (as in AS/NZS 4777.2) to, or below, the site supply capacity is required. For the avoidance of doubt, it is the REC's and the generation system owner's responsibility to ensure the entire system adheres to this requirement.
4. Maximum export capability is the maximum allowable export for a connection under the model standing offer. The approved export limit may be equal to or less than the maximum export capability and is determined on a per-site basis. Any site export allowance is subject to the EG system being emergency backstop enabled (i.e. successfully establishing CSIP-AUS communications to enable the remote interruption or curtailment of the IES by completing the commissioning process with UE utility server).
5. Low static limit for <30kVA systems will apply for the following conditions:

a) Where the micro EG system is required to be backstop enabled but cannot practicably be connected with the UE utility server via the internet. In this case the EG systems export limit will need to be set to the low static export limit by the installer at the time of installation.

b) Where the micro EG system is CSIP-AUS emergency back stop enabled, a CSIP-AUS failsafe limit activates upon loss of communication between the EG system and the UE utility server. This will be set via the UE utility server upon establishing the CSIP-AUS communications and completing the commissioning process.

6. Where single-phase systems are split across a two-phase or three-phase site, the export meter must summate all phases with generation connected in order to manage the site export.
7. The above table is subject to technical requirements as set out in Section 4, in particular the phase balance requirements in section 4.7.4 for multi-phase connections.
8. Where a three-phase inverter is being installed, the total system capacity may reach 30kVA. Where single-phase inverters are installed on a multi-phase connection, including three-phase connections, the maximum allowable capacity is as per the phase balance requirements of *AS4777.1*. Single-phase inverters with a nameplate rating of up to 10kVA may be installed if they are generation limited to 5kVA via single inverter generation limit control. Larger single-phase capacities may be permitted on multiple-phase installations if inverter current balance protection is implemented with a limit of 21.7A.
9. Generation IES refers to any inverter-based generation system with an energy source other than a standalone BESS.
10. The maximum allowable export capacity shall not exceed the rating of the main circuit breaker or service cable.

1.2.2 Embedded Generation - Capacity > 30kVA to ≤ 200kVA

Generation captured in Table 2 below is covered by our negotiated generator agreement.

Table 2: Generation Capacity > 30 to ≤ 200 kVA

Connection point arrangement	Minimum system capacity	Maximum system capacity	Maximum export capability	Low static export limit
Three-phase	> 30 kVA	≤ 200 kVA	Up to the maximum rating of the main circuit breaker, service cable, and total capacity ≤ 200 kVA.	0 W

Notes:

1. Maximum system capacity refers to the total aggregate nameplate rating of inverters installed on site.
2. Maximum export capability is the approved level of export to the grid. It may be equal to or less than the maximum export capability and is subject to the EG system being emergency backstop enabled (i.e. successfully establishing CSIP-AUS communications to enable the remote interruption or curtailment of the IES by completing the commissioning process with UE utility server).
3. The Low static export limit for >30 to ≤ 200kVA systems will apply for the following condition[1]:
    a. When the system is CSIP-AUS emergency back stop enabled a CSIP-AUS failsafe limit activates upon loss of communication between the EG system and the UE utility server. This will be set via the UE utility server upon establishing the CSIP-AUS communications and completing the commissioning process.
4. Where single-phase systems are split across a three-phase site, the export meter must summate all phases with generation connected in order to manage the site export.
5. Single-phase, split-phase, two-phase, and SWER connected generation shall not exceed the values in Table 1.

1.3 Obligations

UE has developed this standard to meet its obligations to ensure the safe and reliable operation of the distribution system for operating personnel, customers and the general public.

The obligations of proponents are:

[1] Under the emergency backstop order sites >30kVA cannot be exempt for the reason of cannot practicably be connected to the United Energy utility server via the internet.

- Fully comply with UE's technical requirements (this document) as well as all relevant national standards, industry codes, legislation and regulations. In the event of inconsistency, the legislation and regulations shall prevail, followed by UE's technical requirements, followed by national standards and industry codes.
- Not connect additional generation including ESS (Energy Storage Systems), make any modifications, without prior written agreement from UE.
- Fully comply with UE's model standing offer or the generation agreement, whichever is applicable (refer to Appendix C:).
- Fully comply with the requirements in the design, installation, operation and maintenance of the generation system.
- Not connect additional IES, including Battery Energy Storage Systems (BESS), or make modifications without prior written agreement from UE.

2. Definitions and Abbreviations

2.1 Definitions

For purposes of this Procedure, unless otherwise stated, the following Terms and Definitions shall apply:

Table 3: Terms and Definitions

Term	Definition
Aggregate Rating	The summated apparent power nameplate rating of all AC generation connected to a Point of Connection to the Distribution Network.
Bidirectional Unit	A device that is capable of supplying and absorbing energy (typically a BESS or an EV).
Connection Agreement	A legally binding document between the distributor and the proponent stipulating the commercial and technical terms of the LV EG connection.
Distributed Energy Resources	Power generation or storage units that are connected directly to the distribution network.
Distributor	Distributed Network Service Provider: United Energy (UE).
Embedded Generating Unit	A generating unit connected within a distribution network and not having direct access to the transmission network.
Embedded Generating System	A system comprising of multiple embedded generating units.
Emergency backstop enabled unit	A micro embedded generating unit that is able to communicate to the distribution network's utility server via a communication channel that is compliant to *IEEE 2030.5 CSIP-AUS* to enable the remote interruption or curtailment of the generation.
Generating Unit	The plant used in the production of electricity and all related equipment essential to its functioning as a single entity.
Generation	The production of electrical power by converting another form of energy in a generating unit.
High Voltage	Any voltage greater than 1kV AC.
IEEE 2030.5 CSIP-AUS	The Common Smart Inverter Profile Australia (CSIP-AUS) implementation to Standard *IEEE 2030.5-2018*, for Smart Energy Profile Application Protocol, and as amended from time to time.
Interface Protection	Interface protection is the protection contemplated by *AS/NZS 4777* installed to perform the functions of: coordinating multiple inverter energy system installations 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.

Term	Definition
Inverter Energy System (IES)	A system comprising of one or more inverters together with one or more energy sources (which may include batteries for energy storage), and controls, which satisfies the requirements of *AS/NZS 4777.1* and *AS/NZS 4777.2*.
Low Voltage	The mains voltage as most commonly used in any given network by domestic and light industrial and commercial consumers (typically 230V).
Market Generating Unit	A generating unit whose generation is not purchased in its entirety by a retailer (and receives payment for generation through the National Electricity Market or Wholesale Electricity Market).
Micro embedded generation basic connection	A connection between a distribution network and a retail customer's premises for a micro embedded generating unit, for which a model standing offer is in place or an equivalent model offer is in place in jurisdictions not subject to Chapter 5A of the National Electricity Rules.
Micro embedded generation connection	Means a connection between an inverter-based embedded generating unit and a distribution network where the aggregate generation rating is less than or equal to 200kVA and for which a generator agreement is issued.
Model standing offer	A document approved by the Australian Energy Regulator as a model standing offer to provide basic micro embedded generation connection services or standard connection services which contains terms and conditions, safety and technical requirements to be complied with by the proponent. This definition also applies to an equivalent model offer for jurisdictions not subject to Chapter 5A of the National Electricity Rules.
Proponent	A person proposing to become a generator (the relevant owner, operator or controller of the embedded generating unit (or their agent)).
Point of Connection	The point at which the service cable/line connects to the consumer's terminals.
Service Cable/Line	The final span or section of low voltage aerial or underground network that is connected to the consumer's terminals.
Single Wire Earth Return	Parts of the UE electrical distribution network that use a single live high voltage conductor to supply single-phase or split-phase electric power with higher network impedances, and with distribution supplying low voltages to premises.
Site Generation Limit	The generation export threshold that the embedded generation system cannot exceed, measured downstream of the connection point.
Small Generation Aggregator	A person who has classified one or more small generating units as a market generating unit.
Small Registered Generator	A generator who elects to register a generator with the Australian Energy Market Operator as a market generating unit who would otherwise be entitled to an exemption to register based on size.
Standard Connection	A connection service (other than a LV embedded generation connection service) for a particular class (or sub-class) of connection applicant and for which an Australian Energy Regulator approved offer in accordance to Chapter 5A of the National Electricity Rules.
Technical Requirements Document	The document produced by each Distribution Network Service Provider setting out their requirements for proponents to enable a grid connection, to which these guidelines apply (this document).

2.2 Acronyms

Table 4: Acronyms

Acronym	Definition
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator

Acronym	Definition
AER	Australian Energy Regulator
AS/NZS	A jointly developed Australian and New Zealand Standard
CBD	Central Business District
CEC	Clean Energy Council
DER	Distributed Energy Resources
DERMS	Distributed Energy Resources Management System
DNSP	Distribution Network Service Provider
EG	Embedded Generation
EN	Embedded Network
ESS	Energy Storage System
GMM	Generator Monitoring Meter
HV	High Voltage
IEC	International Electrotechnical Commission
IES	Inverter Energy System
IPSD	Inverter Power Sharing Device
LV	Low Voltage
MSO	Model Standing Offer
NCC	Network Control Centre
NEM	National Electricity Market
NER	National Electricity Rules
NMI	National Metering Identifier
REC	Registered Electrical Contractor
SCADA	Supervisory Control And Data Acquisition
SWER	Single Wire Earth Return

2.3 Terminology

The following terminology has been used in this document:

- The word “shall” indicates a mandatory requirement to comply with this document.
- The word “may” indicates a recommendation that will not be mandatorily imposed on the proponent.
- The word “should” indicates a requirement that may be mandatorily imposed on the proponent based on connection specific safety or operational requirements.

3. Relevant Rules, Regulations, Standards and Codes

3.1 Standards and Codes

This section lists Australian and international standards and industry codes which shall apply to the design, manufacture, installation, testing and commissioning, and operation and maintenance of all plant and equipment for EG connections to the distribution network. The latest versions of the Australian and international standards and industry codes shall be used.

Table 5: Standards and Codes

Standard	Title
AS/NZS 3000	Electrical installations (known as the Australian/ New Zealand Wiring Rules)
AS/NZS 4777	Grid connection of energy systems via inverters (multiple parts) AS/NZS 4777.1 Grid connection of energy systems via inverters, Part 1: Installation requirements AS/NZS 4777.2 Grid connection of energy systems via inverters, Part 2: Inverter requirements.
AS/NZS 5139	Electrical installations – Safety of battery systems for use with power conversion equipment
AS/NZS 5033	Installation and safety requirements for photovoltaic (PV) arrays
AS/NZS IEC 60947	Low-voltage switchgear and control gear
AS/NZS 60898.1	Electrical accessories – Circuit Breakers for overcurrent protection for household and similar installations, Part 1: Circuit Breakers for a.c. operation
AS/NZS 60947	Low-voltage switchgear and control gear
IEC 62116	Utility-interconnected photovoltaic inverters – Test procedure of islanding prevention measures
IEEE 2030.5, CSIP-AUS	The Common Smart Inverter Profile Australia (CSIP-AUS) implementation to Standard IEEE 2030.5-2018
IEEE Standard 1547	IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems

3.2 Legislation and Regulation

This section lists relevant legislation and regulations which shall apply to the design, manufacture, installation, testing and commissioning, and operations and maintenance of all plant and equipment for EG connections to the distribution network. The latest version of the legislation and regulations shall be applicable.

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

Table 6: Legislation and Regulations

Document Title	Description
National Electricity Rules Chapter 5A	Electricity Connection for Retail Customers
Electricity Distribution Code	Regulates the distribution of electricity, connections to distribution networks, and the transfer of electricity between distribution systems so that they are undertaken in a safe, efficient, and reliable manner
Electricity Industry Act 2000	The main purpose of this Act is to regulate the electricity supply industry
Electricity Industry Guideline 15 - Connection of Embedded Generation	Provides arrangements for connecting embedded generating units to distribution systems
Victorian Service and Installation Rules	Provides industry agreed technical requirements that meet all legislative and code requirements for the supply and metering related aspects of any connection to the Victorian electricity supply network
Electrical Safety (Installation) Regulations	Provides details on regulatory obligations for electricity installation works in Victoria
Emergency Backstop Ministerial Order	Specifies ministerial licence conditions, relating to the connection of embedded generating units to the distribution network and enabling the remote interruption or curtailment of generation

4. Technical Requirements

All EG connections ≤ 200kVA that are capable of operating in parallel with the LV distribution network, whether they are exporting, or non-export systems, shall comply to all technical requirements of this document.

Where there are multiple EG systems connected to a single point of connection, the system capacity will consider the aggregate of the existing and proposed EG systems nameplate rating at the connection point.

Where proponents intend to modify or upgrade existing systems, their entire system will be required to comply with the technical requirements of this document and meet all obligations outlined within. Proponents must submit an application that includes all existing systems that are being retained as well as any new systems to United Energy prior to the modification or upgrade being commenced.

4.1 Labelling and Signage

The labels and signs on the installation, including cables, shall be as per *AS/NZS 4777.1*, *AS/NZS 3000* and *AS/NZS 5033*. Site specific labelling for additional energy sources and operating procedure for the energy sources shall be installed at each isolation point that has a possibility of energy feedback from the IES.

4.2 Maximum System Capacity

Refer to Table 1 and Table 2 for details of maximum system capacity.

4.3 Generation Control

4.3.1 Export Limits at Connection Point

The maximum export limit of micro EG connections is as per Table 1 or Table 2. The export limit imposed may be a "hard" or "soft" limit, consistent with the definitions in *AS/NZS 4777.2*. For connections covered by Table 1 as basic connections, the export limit will be a soft export limit.

Export limits lower than the maximum export limit may be applied to an EG connection for the following reasons:

- As part of the connection application pre-approval process.
- For basic connections, failure to be emergency backstop enabled (establish CSIP-AUS communications and complete commissioning with the UE utility server) in which case the Low Static Export limit shall apply as per Table 1.

Where an export limit is required to be implemented by the proponent, the proponent shall:

- Ensure that all equipment is installed and configured to ensure that the export limit can be applied. This includes, but is not limited to, installation of a dedicated export metering, inverter settings and configuration.
- Verify that the export limiting capability is functioning correctly and, for non CSIP-AUS enabled connections, the low static export limit is set and being adhered to.
- The export limit shall apply to the net active power level at the point of supply from the grid across all phases. The export limit shall be applied to all connected generation, regardless of type, to ensure that the summated export of all generation does not exceed the allowable site export limit.

The export limit of the proponent's EG system is not guaranteed, and the distributor reserves the right to revise the export limit of the proponent's EG system at any time, without notice. Export limits are dependent upon distribution network characteristics which may change over time. Any augmentation cost to revise the export limit of the proponent's EG system will be borne by the proponent.

4.4 Inverter Energy System

The IES shall comply with the following requirements:

- IES shall be tested by an authorised testing laboratory and be certified as being compliant with *AS/NZS 4777.2* with an accreditation number
- IES shall comprise of inverters that are registered with the Clean Energy Council as approved network connected inverters
- BESS units shall be registered with the Clean Energy Council as approved batteries. It is not sufficient for the inverter to be listed on the Clean Energy Council inverter register.
- IES shall be tested and certified with a software communication client that is CSIP-AUS compliant and listed with a certified software client on the Clean Energy Council approved inverter list
- IES shall comprise of inverters installed in compliance with *AS/NZS 4777.1*.

Please refer to our website for a list of approved inverters that comply with the above requirements.

4.4.1 Electric Vehicle Reverse Power Transfer

Electric vehicle (EV) supply equipment (EVSE) that is capable of enabling reverse power transfer shall be *AS/NZS 4777.2* Australia A compliant and shall adhere to the requirements of this document. This shall be achieved via settings within the EVSE where the inverter is located within the EVSE, or by communications where the EVSE can communicate protection and control settings to an inverter located within the EV. If an inverter within the EV is not capable of meeting the requirements communicated by the EVSE, reverse power transfer shall be blocked. EVs shall not be connected for reverse power transfer using Mode 1 or Mode 2 EV supply equipment.

4.5 Network Connection and Isolation

Network connection and isolation requirements shall be as per *AS/NZS 4777.1* and *AS/NZS 3000*. The main switch (inverter) shall be able to be secured in the open position only.

The maximum rating of the customer owned main circuit breaker and associated wiring shall be appropriately sized to not exceed the maximum thermal rating of upstream distribution assets (e.g. service cable/line and transformer).

4.5.1 LV EG IES Shared with Multiple NMIs

Multiple occupancy buildings may connect an Inverter Power Sharing Device (IPSD) to facilitate a shared IES connection. If the aggregate inverter rating at the multiple electrical installation exceeds 30 kVA, an interface protection device shall be installed. The voltage and current inputs to the interface protection device shall be measured at a point between the main switch (grid) and the point of common coupling of the multiple electrical installation as shown in Figure 2. This shall be in accordance with the *Electricity Safety Act*, *Electricity Safety (Installations) Regulations*, *Victorian Service and Installation Rules* and the Inverter Power Sharing Device (IPSD) requirements in *AS/NZS 4777.1*. Interface protection requirements are detailed in LV EG Network Access Standard - Capacity Greater Than 200kVA (UE-ST-2008.2).

All photovoltaic IPSD connections must be backstop enabled with export monitoring capability located at a point between the main switch (grid) and the point of common coupling.

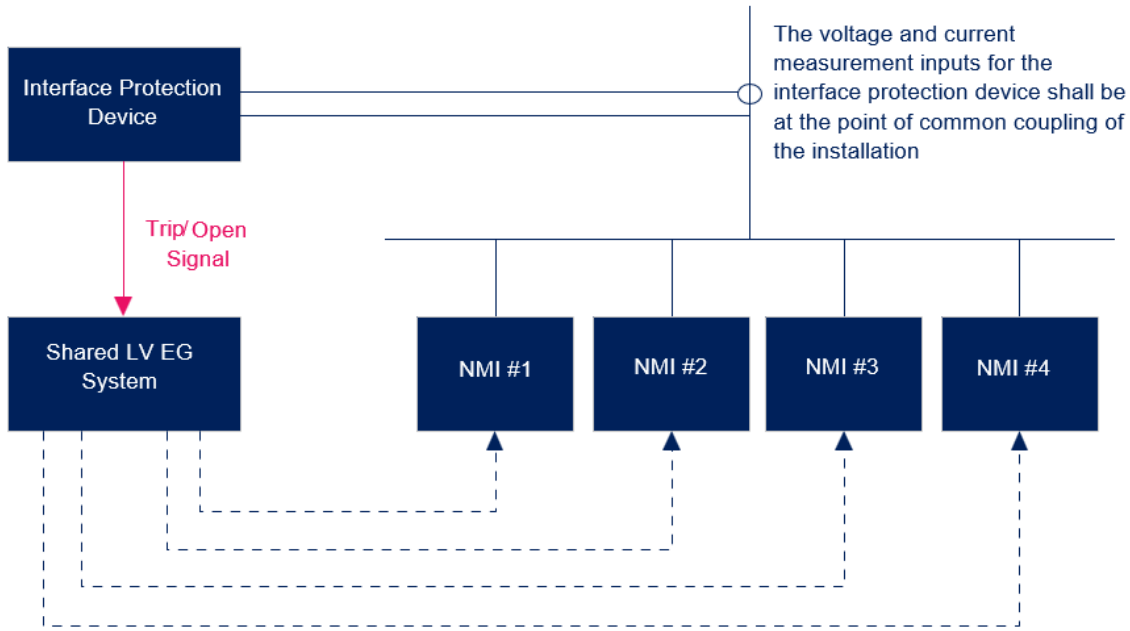

Figure 2: Shared LV EG System

4.5.2 LV EG IES Located on a Different Land Title

A safety risk may be present in the event the owner of multiple land titles sells one of the land titles to another owner and retains the PV system connection as shown in Figure 3. A PV system located on another land title may reasonably be assumed to be NOT connected to the point of supply of the neighbouring land title. This may result in a safety incident due to unintentional incorrect isolation of the PV system while electrical works are carried out in the neighbouring land title. Hence, if the owner of the multiple land title sells one of the land titles, the owner of the land title with the PV system shall apply for a unique National Meter Identifier (NMI).

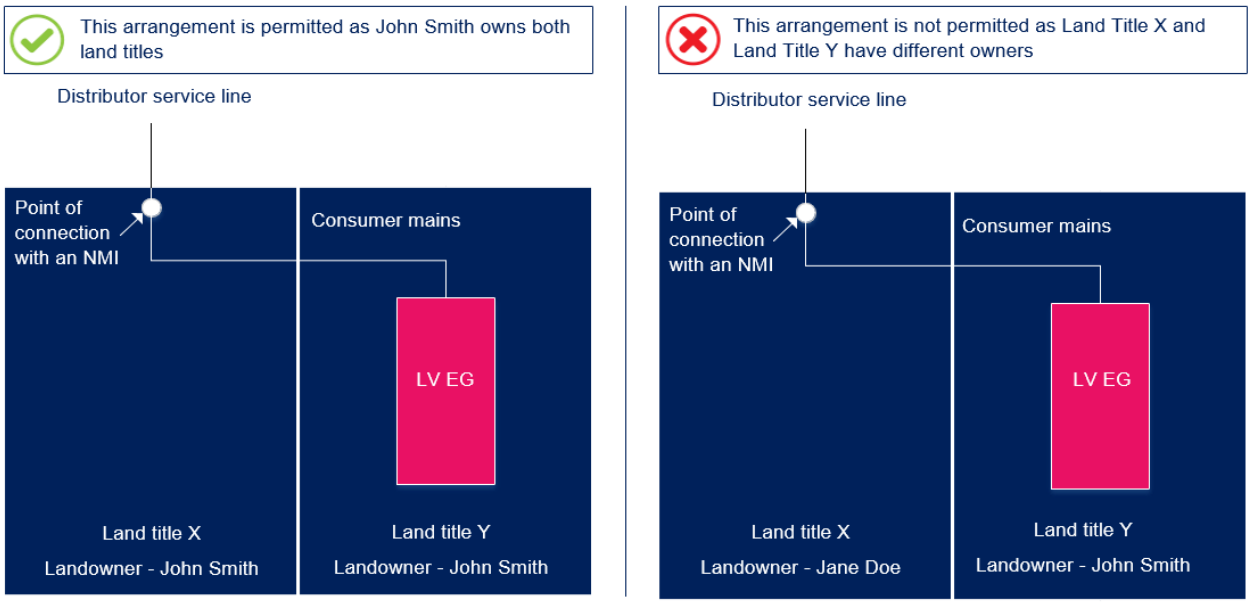

Figure 3: Multiple land titles under the same landowner

4.6 Earthing

The earthing requirements shall be:

- For IES, as per *AS/NZS 4777.1* and *AS/NZS 3000.*
- For ESS, as per *AS/NZS 5139* and *AS/NZS 3000*.

4.7 Protection

The intention of this section is to ensure the safe and reliable operation of the distribution system for operating personnel, proponents, customer (i.e. electricity consumers) and the general public. The IES intending to connect to the network shall not adversely affect the operation and safety of other existing network users. UE may impose limitations and/or conditions of operation on the new IES connection in order to mitigate these issues.

Inverters shall comply to *AS/NZS 4777.2* Australia A protection/control settings and performance requirements.

Interface protection shall be required as per Table 7 below.

Table 7: Protection Relay Requirements

IES Protection	Single or multi-phase EG system ≤ 30kVA	Three-phase ≤ 200kVA non-IPSD EG system	Three-phase > 30kVA IPSD EG system
Inverter integrated protection as per *AS/NZS 4777.2*	Yes	Yes	Yes
Interface protection	No	No	Yes

Note:

1. Where phase current balance protection is not incorporated as part of the inverter protection, a separate phase current balance protection device shall be installed.
2. Interface protection shall be installed for IPSD(s) with a connected aggregated inverter rated apparent power greater than 30kVA. The interface protection shall reference a single point that is located on the multiple electrical installation between the main switch (grid) for the multiple electrical installation and each electrical installation as part of that multiple electrical installation.
3. EG system is the total aggregate nameplate rating of generation connected in parallel to the LV distribution network.

4.7.1 Overcurrent and earth Fault Protection

The overcurrent and earth fault protection settings shall be site specific. Examples of site specific factors include circuit rating, loading, fault level, device grading etc. Operation of overcurrent/earth fault protection shall immediately trip a suitably fault rated circuit breaker.

4.7.2 Inverter Integrated Protection

AS/NZS 4777.2 Australia A settings shall be implemented.

Activation of protection settings will need to comply with Clause 4.9 of *AS/NZS 4777.2*.

Inverters shall comply to the cease power generation characteristics in clause 4.5.4.1 of *AS/NZS 4777.2*.

Active anti-islanding protection shall be as per *AS/NZS 4777.2*.

4.7.3 Interface Protection

For electrical installations requiring interface protection, such as those utilising IPSD, refer to the interface protection requirements detailed in section 5.8.3 of LV EG Network Access Standard - Capacity Greater Than 200kVA (UE-ST-2008.2).

4.7.4 Phase Balance

The nominal rating of an EG system connected to a multiple-phase installation shall be balanced across all phases.

The consumer mains active and neutral conductors current-carrying capacity shall be not less than the current-carrying capacity of the largest associated active conductor.

Where a multiple-phase installation comprises of multiple single-phase IES with an energy source other than a battery system, the maximum per-phase capacity is 5kVA. An additional 5kVA per-phase of may be connected when the only energy source is a battery system (e.g. a BESS or EV supply equipment capable of reverse power transfer). Larger single-phase battery systems may be installed provided that single inverter generation limit control is used as specified in *AS/NZS 4777.2* and is set to 5kW. The maximum permissible current unbalance between phases is 21.7A.

Where phase balance protection is not incorporated as part of the inverter integrated protection in a multiple-phase inverter, or where the installation comprises of multiple single-phase inverters with a per phase capacity of greater than 5kVA, a separate phase balance protection device shall be installed to disconnect all IES by automatic operation of a disconnection device.

Where a single-phase inverter connected to an energy storage device (such as a BESS) and a single-phase inverter with an energy source (such as solar) is connected to a multiple-phase electrical installation, they shall be connected to the same phase. Charging off one phase while generating into a different phase is not permitted.

The maximum current imbalance in a multiple-phase IES comprised of either individual single-phase inverters connected on separate phases or a combination of single-phase inverters and multiple-phase inverters shall be in accordance with clause C3.2 and C3.3 of *AS/NZS 4777.1*.

4.7.5 Interlocking

The interaction, interlocking and safe operation of different types of generation downstream of the point of connection shall be the responsibility of the Proponent.

4.8 Operating Voltage and Frequency

The operating voltage and frequency range requirements shall be in accordance to *AS/NZS 4777.2*. Voltage rise requirements are as per of *AS/NZS 4777.1* and shall be calculated at the point of supply.

4.9 Metering

Revenue Metering shall be installed as per *Victorian Service and Installation Rules*.

4.10 Power Quality Settings

AS/NZS 4777.2 compliant inverters have inbuilt power quality response capability to either maintain the power quality at the point of connection or provide support to the distribution network. All inverters connected to the distribution network shall have the volt response (both Volt-Watt and Volt-VAr response modes) enabled. Fixed power factor response mode shall not be enabled. By enabling volt response modes, the inverter is able to dynamically respond to voltage changes at the inverter terminals without adversely affecting the voltage within an electrical installation.

4.10.1 Volt-Watt Response Mode

The Volt-Watt response mode varies the active power output of the inverter in response to the voltage at its terminals. It shall be enabled and set to the Australia A region default values as per *AS/NSZ 4777.2*.

4.10.2 Volt-Var Response Mode

The Volt-VAr response mode varies the reactive power output of the inverter in response to the voltage at its network side terminals. It shall be enabled and set to the Australia A region default values as per *AS/NSZ 4777.2*.

4.10.3 Energy Storage Charging Response Mode

Where an inverter is connected to an ESS, the inverter shall vary the power imported from the network to charge the energy storage device based on the voltage at its network side terminals. It shall be enabled and set to the Australia A region default values as per *AS/NSZ 4777.2*.

4.11 Emergency Backstop Controls

To address network risks associated with network minimum demand events, the Victorian Government has legislated the requirement for all new, upgraded, altered, and replacement solar systems to be capable of being remotely curtailed or switched off during an emergency minimum system load event. For more information, refer to: *Victoria's Emergency Backstop Mechanism for rooftop solar | Engage Victoria*. To comply to the government mandate and to future proof the network, United Energy requires all new, upgraded, altered, and replaced solar Inverter Energy Systems be capable of receiving and adhering to backstop control signals.

United Energy has the obligation to ensure that connected solar photovoltaic generating units are capable of being remotely curtailed or interrupted under direction from AEMO. The emergency backstop control capability is provided by CSIP-AUS internet-based communication (refer to section 4.11.1).

Alternative methods of remote disconnection of the embedded generator shall be negotiated with UE if the EG connection cannot practically be connected with the UE utility server via the internet. Note that export zero is not an acceptable alternative for >30kVA systems under the emergency backstop mechanism. Only one remote backstop method may be used per site. For details on the Generator Monitoring Meter (GMM) alternative backstop solution, refer to LV EG Network Access Standard - Capacity Greater Than 200kVA (UE-ST-2008.2).

Legacy solar generation installed prior to the 1st of October 2024 does not need to be backstop enabled unless it is being altered.

If a legacy system is replaced with a new system, the system must comply with remote backstop requirements unless it is replaced under a warranty replacement. If new solar generation is installed in addition to legacy solar generation without altering the legacy solar generation, then only the new installation is required to be backstop enabled.

For the avoidance of doubt, hybrid inverters are required to be backstop enabled when connected to photovoltaic panels. Inverters that only have a battery system or electric vehicle port are not required to be backstop enabled.

Additional backstop requirements for embedded networks are detailed in section 4.12.2 below.

4.11.1 CSIP-AUS Communication Requirements

The following communications requirements apply for solar photovoltaic connections that are emergency backstop enabled via the CSIP-AUS protocol. The Distributor requires the EG connection to establish communication and undertake commissioning with the Distributor's utility server. Communication between the IES and the Distributor shall be established using the CSIP-AUS standard.

The CSIP-AUS commands utilised under the emergency backstop control are:

- Export limit – the inverter is required to ensure that the amount of energy exported to the grid, measured at the connection point, is constrained.
- Generation Limit – the inverter is required to ensure that the amount of energy generated by the inverter, measured at the inverter output, is constrained.
- De-energise – the inverter is required to turn off and not produce any energy.

The Distributor's server shall be in constant communication with the IES providing the generation or export limits. A low static export limit (as per Table 1) shall be automatically applied upon expiry of the most recently received export or generation limit command.

The IES shall respond to and operate with control signals sent from UE as part of the minimum demand backstop function.

This may be achieved by:

- Installing *IEEE 2030.5 CSIP-AUS* compliant inverters with a client which can directly communicate back to the utility server via the internet;
- Installing *IEEE 2030.5 CSIP-AUS* compliant inverters via a gateway device that can directly communicate between UE utility server and the inverters; or
- Installing *IEEE 2030.5 CSIP-AUS* compliant inverters and/or gateway device and establishing an aggregator communication connection that can interface between UE utility server and the gateway device and/or inverters.

Refer to our website for details of equipment that complies with the above requirements.

4.11.2 Installation Requirements

To support the Communications and control functionality, the IES installation shall:

- Be connected to the internet and able to communicate to the UE utility server – this process will be described in the manufacturer(s) documentation
- Have export metering installed to monitor the power flow at the connection point. The export metering shall connect to the inverter and/or gateway device providing it with the ability to accurately manage export limits
- The device must be tested and commissioned including capability test in line with section 5.1.

4.12 LV Embedded Networks with Embedded LV EG

An LV embedded network operator is exclusively responsible for the management of the embedded network including any LV EG within the embedded network. The distributor does not have a direct relationship with the LV EG and/or the proponent in this case. Hence, the LV embedded network operator shall make available all necessary documentation to demonstrate compliance to this document and other applicable standards and regulations. If the aggregate apparent power rating of generation connected to the embedded network point of connection exceeds 200kVA, LV EG Network Access Standard - Capacity Greater Than 200kVA (UE-ST-2008.2) shall apply to all generation connected to the embedded network.

4.12.1 Interface Protection for Embedded Networks

Interface protection requirements for embedded networks shall be as per section 4.7.

4.12.2 Remote Backstop for Embedded Networks

Embedded networks have additional remote backstop requirements that differ from normal installations due to the additional complexities of managing distributed generation against a single point of connection. Backstop may be achieved through either CSIP-AUS or GMM solutions. However, only one solution may be used per embedded network. The technical solution for each shall be discussed with the Distributor prior to commissioning.

4.12.2.1 Greenfield Sites

For new sites, the preferred solution is for the embedded network operator (ENO) to manage a CSIP-AUS enabled site generation control system that is capable of communicating with all solar photovoltaic systems within the embedded network. Site export monitoring shall be installed at the point of connection to enable the site generation to be ramped down to 0kW.

If distributed solar cannot practically connect to a generation control system, the ENO may elect for solar systems less than or equal to 30kVA to be export limited to 0kW at the child NMI, building or structure to which they are connected. All solar systems greater than 30kVA, must be backstop enabled.

4.12.2.2 Brownfield Sites

Where one or more new solar generation systems are being installed, the preferred solution is for the ENO to manage a CSIP-AUS enabled site generation control system that is capable of communicating with all new solar photovoltaic systems within the embedded network. A site export meter shall be installed at the point of connection to enable the newly connected generation to be ramped down to 0kW.

If distributed solar cannot practically connect to a generation control system, the ENO may elect for solar systems less than or equal to 30kVA to be export limited to 0kW at the child NMI, building or structure to which they are connected. All non-legacy solar systems greater than 30kVA, must be backstop enabled.

Legacy solar systems will be backstop exempt until the point at which they are replaced, altered, or augmented.

4.13 Data and Information

4.13.1 Static Data and Information

The static data and information shall be provided by the proponent as listed in Appendix D:. The distributor will provide this data to AEMO's Distributed Energy Resource Register (DERR) on behalf of the proponent.

The proponent shall provide confirmation of the application of "Australia A" settings for each IES and confirmation of the application of the Low Static Export Limit.

4.13.2 Dynamic Data and Information

The IES shall provide dynamic data and system information as prescribed in *IEEE 2030.5 CSIP-AUS*.

4.14 Cybersecurity

All devices and equipment settings associated with the IES system shall be secured against inadvertent or unauthorised tampering. Changes to the IES settings shall require the use of tools (e.g. special interface devices and passwords) and special instructions which shall not be provided to unauthorised personnel.

4.15 Technical Studies

No technical studies are required to be submitted by the proponent to distributor.

5. Testing and Commissioning

Testing and commissioning of the EG installation shall be undertaken in accordance with *AS/NZS 4777.1*, *AS/NZS 3000*, *AS/NZS 5033*, the CEC approved checklist, the equipment manufacturer's specifications and to the technical requirements stipulated in this document, in order to demonstrate that the installed EG system meets all requirements of the connection agreement or MSO.

Where a static export limit is implemented, the proponent shall provide UE written confirmation that the export limit is functioning correctly.

Note these tests shall be installation tests and not type tests of the equipment.

5.1 Emergency Backstop CSIP-AUS Registration, Commissioning and Capability Test

CSIP-AUS capability testing shall be completed as part of IES installation and commissioning. To facilitate the emergency backstop capability testing, the proponent shall ensure that the IES is connected to the internet and configured in the IES manufacture's systems ready for registration with UE. Refer to the relevant manufacturer information for details on configuring IES in their systems.

The device registration, commissioning and capability testing process is performed through the myEnergy application portal as part of the connection process.

Once the commissioning and capability testing has been completed, and a COES has been obtained, the installer will need to complete the alteration request in the myEnergy application portal.

6. Operations and Maintenance

EG systems shall be operated and maintained by the proponent to ensure compliance with the MSO or connection agreement and all legislation, codes, and/or other regulatory instruments at all times. In addition, the proponent shall:

- Maintain the electrical installation at the supply address in a safe condition
- Ensure that any changes to the IES installation are performed by an electrician lawfully permitted to do the work and that the proponent holds a Certificate of Electrical Safety (CoES) issued in respect of any of the changes
- Seek distributor approval prior to altering the connection in terms of an addition, upgrade, extension, expansion, augmentation or any other kind of alteration, including any changes to firmware and protection functions or settings
- Ensure as far as reasonably practicable, that the IES remains connected to the internet at all times

If any breach of this technical standard is suspected, UE may undertake an investigation. If the investigation reveals a breach, the proponent shall be required to rectify this breach and pay UE for the costs associated with the investigation and associated works undertaken.

7. Fees and Charges

Refer to UE's connection policy for type of connection fees applicable to EG connections and how these fees are determined.

Refer to UE website: https://www.unitedenergy.com.au/your-electricity/tariffs-charges/ for details of connection charges.

Appendix A: Deviations from the National DER Connection Guidelines

Table 8: Table of Deviations from National DER Connection Guidelines

Section	Description of deviation	Type of deviation	Justification
1.1	The system capacity for single-phase basic micro EG system is 30kVA instead of less than or equal to 5kVA as per the National DER Basic Micro EG Connection Guideline.	Promote improved benefits to Australia's electricity system	To promote clarity on IES capacity and facilitate EG basic connections by allowing higher IES capacity under basic connection.
1.2	Combined two categories of generation capacities. Total inverter capacity ≤ 30kVA Total inverter capacity > 30kVA to ≤ 200kVA	To meet DNSP technical requirements	Technical requirements are similar for both categories
2.1	Definition of IES is different from the National DER Basic Micro EG Connection Guideline.	To meet jurisdictional requirement	The definition was amended to align with AS/NZS 4777.1.
2.3	Definition of the word 'may' and 'should' were swapped as described in the National DER Basic Micro EG Connection Guideline	Promote improved benefits to Australia's electricity system	Clarifies requirements for proponents
4.11	Added emergency backstop technical requirements	To meet regulatory requirements	Align with the Gazette S31, 31/01/2024

Appendix B: Connection Arrangement Requirements

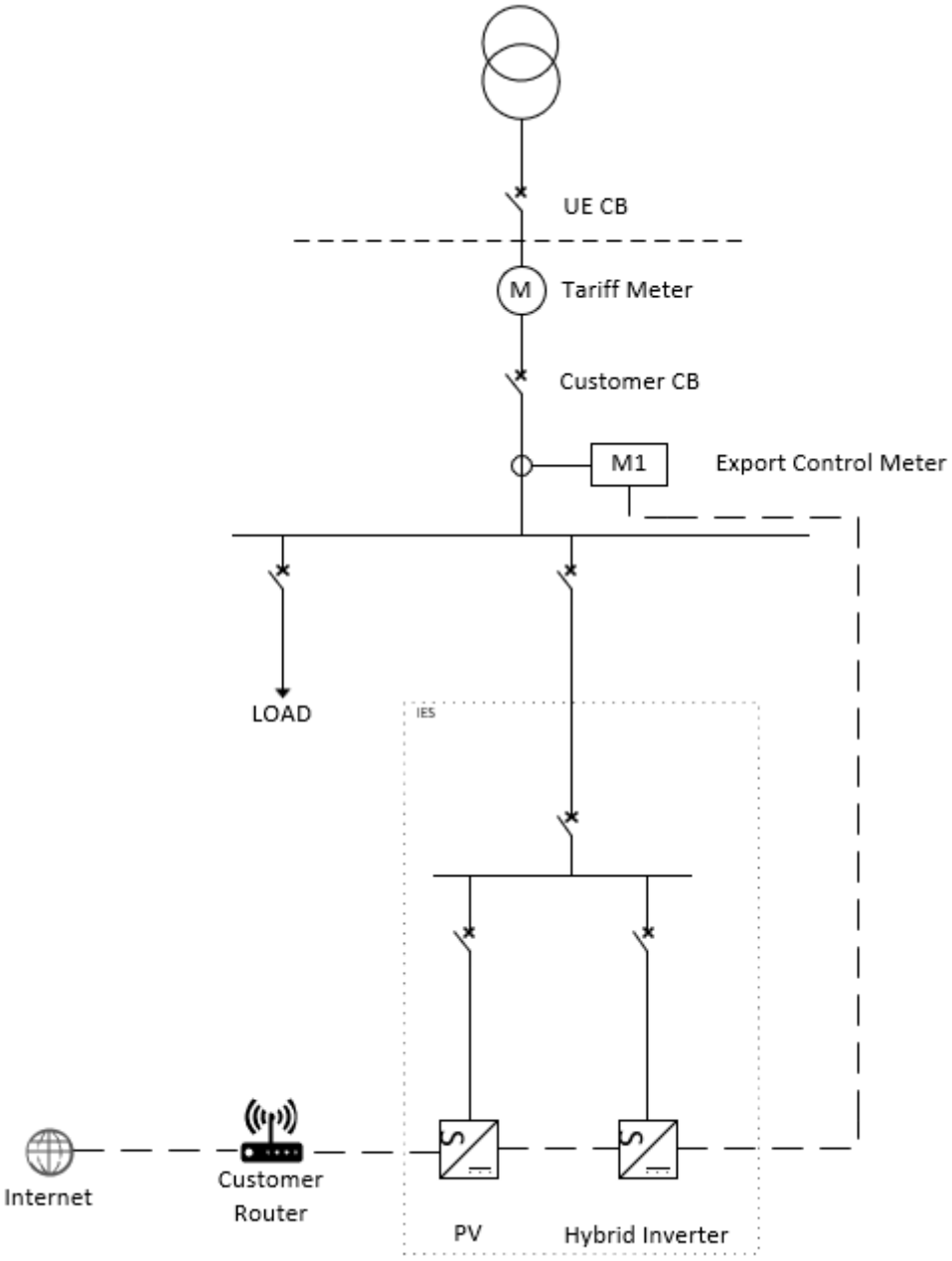

Figure 4: Typical single line diagram for IES system with compliant inverters

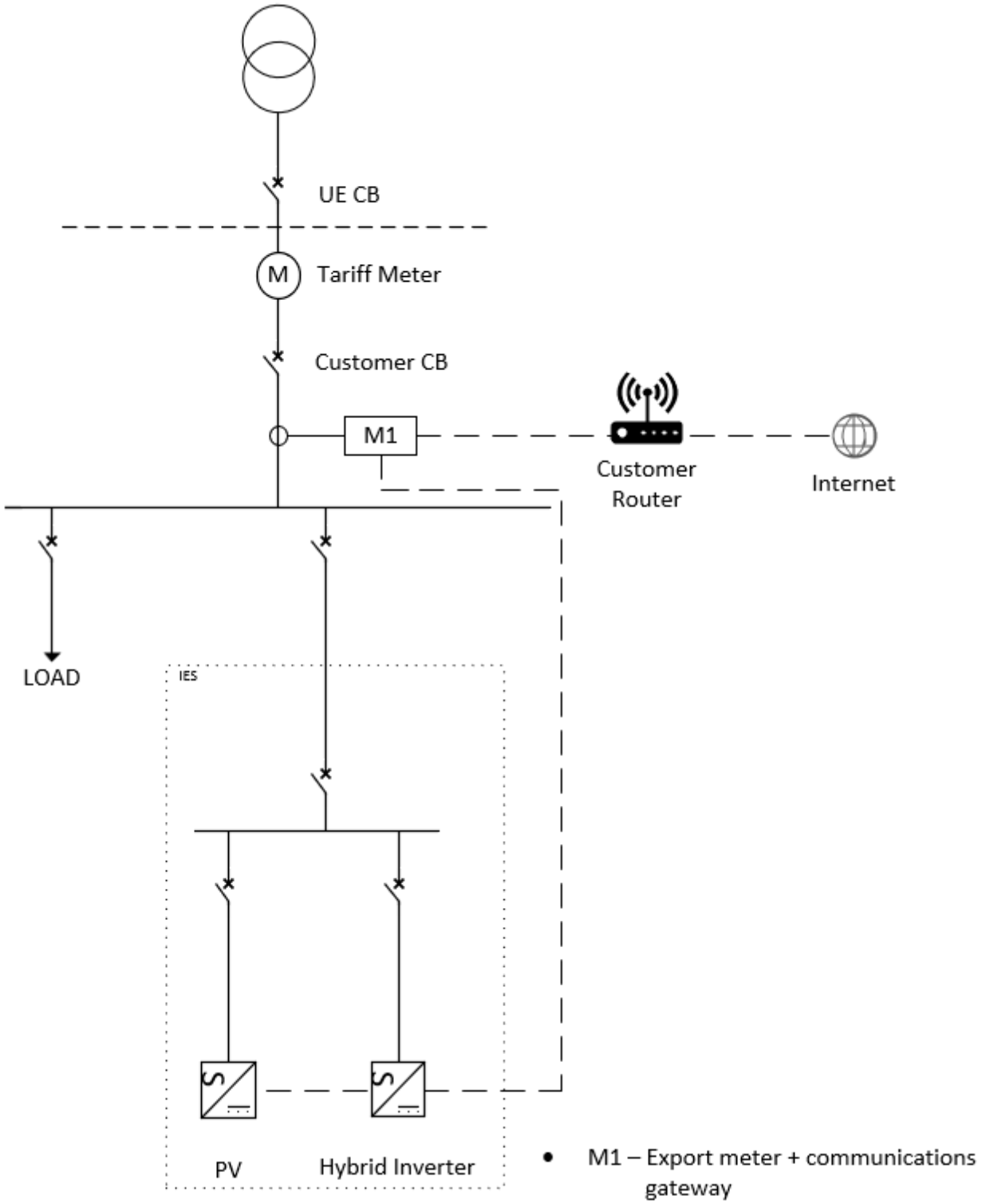

Figure 5: Typical single line diagram for IES system with Gateway device

Appendix C: Model Standing Offer and Generation Agreement

The Model Standing Offer Basic Connection Service for Retail Customers (For Micro Embedded Generation) can be found on UE's website.

https://www.unitedenergy.com.au/partners/solar-installers/model-standing-offer/

Generation agreement for retail Customers:

https://media.unitedenergy.com.au/factsheets/Generator-Agreement-Retail-Customers.pdf

Appendix D: Static Data and Information

Static data and information to be provided by the proponent can be found on our website.