

# EVOENERGY MICRO EMBEDDED GENERATION TECHNICAL REQUIREMENTS

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Technical requirements for connection of small-scale micro embedded generating units to the Evoenergy network

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**Disclaimer**

Whilst this document contains material relevant to the electricity industry legislation, codes of practice and standards, it is not intended to provide legal advice on how electrical contractors can meet their own statutory obligations or comply with legislation, codes of practice or industry standards such as AS/NZS 3000 (Wiring Rules). Whilst care has been taken in the preparation of this document, Evoenergy does not guarantee that the information contained in this document is accurate, complete or up to date at time of publication. To the extent permitted by the relevant legislation Evoenergy will not be responsible for any loss, damage, cost or expense incurred as a result of any error, omission or misrepresentation in relation to the information contained in this document.

**Note**

Printed versions of this document are “uncontrolled copies” - the latest version is available on the Evoenergy [website](#).

# 1. INTRODUCTION

## 1.1 About Evoenergy

Evoenergy own and operate the electricity and gas distribution networks in the ACT, providing electrical power to over 200,000 residential and business customers. The electricity network delivers this power through 2,394 km of overhead lines, 2,694 km of underground cables, over 50,000 poles and over 5000 distribution substations across a geographical area of 2,358 square kilometres.

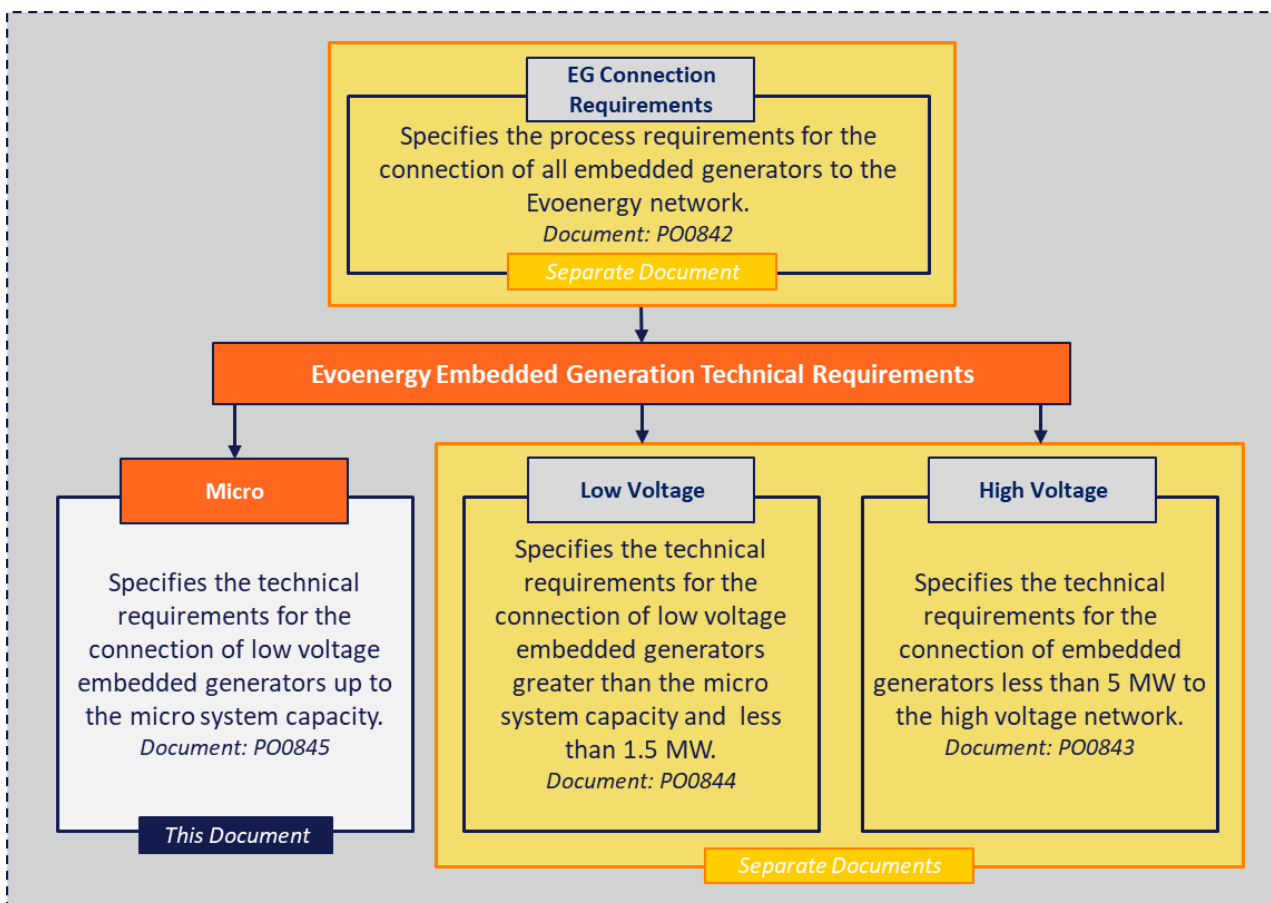
The Evoenergy network currently connects to more than 25,000 embedded generation systems, the majority of which are solar photovoltaic (PV) systems.

Evoenergy maintain and operate the network in compliance with relevant regulatory, technical and safety requirements. These requirements are adhered to in the long term interests of consumers particularly with respect to the price, quality, safety, reliability and security of the electricity supply system.

## 1.2 Scope and Purpose

Evoenergy has developed these technical requirements to provide proponents of Micro Embedded Generator connections information about their obligations for connection to, and interfacing with, Evoenergy's low voltage distribution network. As outlined in Figure 1, this document is one of three documents defining the technical requirements for the connection of embedded generators to the Evoenergy network. These documents supersede the existing *Evoenergy Requirements for Connection of Embedded Generators up to 5MW to the Evoenergy Network (SM3201)* for the defined system capacities.

FIGURE 1. EVOENERGY EMBEDDED GENERATION DOCUMENT ARCHITECTURE



For the purposes of this document, a Micro Embedded Generator is defined as:

*a micro embedded generation system with a total system capacity less than or equal to 10 kVA for a single-phase IES (excluding ESS) network connection, and a total system capacity less than or equal to 30 kVA for a three-phase IES (excluding ESS) network connection that is:*

- a. intended to be connected to, and capable of operating, in parallel with any part of the LV distribution network*
- b. involving minimal or no augmentation of the distribution network*
- c. meeting all other technical requirements set out in this document*

All Micro Embedded Generators are subject to the requirements outlined in this document unless formally advised in writing by Evoenergy. These requirements are applicable to all new connections and modifications of existing systems where the system consists of an Inverter Energy System (IES), Energy Storage System (ESS) or combination of both.

Embedded Generators that are outside the scope of these requirements include:

- 📁 Systems covered by Evoenergy's Low Voltage Embedded Generation Connection Technical Requirements
- 📁 Systems covered by Evoenergy's Medium and High Voltage Embedded Generation Connection Technical Requirements
- 📁 Electric vehicles, unless the on-board battery storage system is capable of exporting to the LV network (in which case the requirements shall apply)
- 📁 Distributed energy resource systems that do not generate electricity, including demand response / demand management systems, unless they impact on the ability of the micro EG system to meet the technical requirements
- 📁 Systems that are off-grid or operate in a non-parallel configuration

This document does not administer the eligibility for any feed-in-tariff or any other tariff. The requirements set out in this document shall be read in conjunction with the Evoenergy Service and Installation Rules which are located on the Evoenergy [website](#).

This document contains technical requirements for the connection of micro embedded generators to the Evoenergy network. Additional information regarding the connection process and associated timelines is available on the Evoenergy [website](#).

### 1.3 Obligations

Embedded Generation Proponents and Evoenergy have certain obligations to ensure the purpose of these requirements is met. Proponents are required to:

- 📁 Comply with the technical requirements as well as relevant national standards, industry codes, legislation and regulations. In the event of inconsistency legislation and regulations, followed by the technical requirements, followed by national standards and industry codes shall prevail
- 📁 Withhold from connecting additional inverters, undertaking system modifications or installing additional micro embedded generation units, including ESS, without prior written agreement from Evoenergy
- 📁 Maintain compliance with the Evoenergy Model Standing offer as detailed on the Evoenergy [website](#)
- 📁 Ensure the requirements are met with regard to the design, installation and operation of Micro Embedded Generating systems

Evoenergy has an obligation to ensure the safe and reliable operation of the distribution system for operating personnel, customers and the general public.

## 1.4 Statement of Compliance

This document complies with the National DER Connection Guidelines for Micro EG Connections, with the exception of the deviations presented in Appendix A: Deviations from the National DER Connection Guidelines.

## 2. DEFINITIONS AND ABBREVIATIONS

### 2.1 Definitions

TABLE 1. DEFINITIONS

<b>ACT Government – Electrical Inspectorate</b>	The ACT Government Electrical Inspectorate is the inspecting authority in the ACT and is responsible for inspecting and approving the consumer’s electrical installation <i>Contact number is (02) 6207 7775</i> <i>Email: electrical.inspections@act.gov.au</i>
<b>Active power limiting</b>	Where the electricity exported from an IES at the AC output terminals of the inverter(s) is limited below a defined threshold
<b>Amp (A)</b>	A unit of electrical current
<b>Anti-islanding protection (Loss of mains)</b>	A protection system to detect islanded conditions and disconnect the IES from the distribution network
<b>Asynchronous generator</b>	Asynchronous generators draw their magnetising current from the distribution network during operation and are generally not capable of isolated operation
<b>Micro embedded generation connection</b>	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
<b>Bi-directional metering</b>	A meter capable of registering energy supplied to the premises and energy exported from the premises as separate data streams
<b>Central protection</b>	Central protection is the protection defined by AS/NZS 4777.1 (grid connection of energy systems via inverters) installed to perform the functions of; coordinating multiple inverter energy system installations at one site, providing protection for the inverter energy system installation and islanding protection to the connected grid as well as preserving safety of grid personnel and the general public
<b>Connection point</b>	The point where the IES is connected to the rest of the electricity network. This is generally at the consumer’s main or distribution switchboard
<b>Demand response</b>	The alteration of an inverter’s normal mode of operation in response to an initiating signal originating from or defined by a remote agent
<b>Distributed energy resource</b>	Power generation or storage units that are connected directly to the distribution network

<b>DRED (Demand response enabling device)</b>	A device, integral or external to the inverter, which provides the functionalities and capabilities to achieve demand response and meets the requirements of AS/NZS 4755.1
<b>Embedded generating system</b>	A system comprising of multiple embedded generating units. The system rating is defined based off the combined AC output nameplate rating of each generating unit
<b>Embedded generating unit</b>	A generating unit connected within a distribution network and not having direct access to the transmission network
<b>Energy storage system</b>	A system comprising one or more batteries that store electricity generated by distributed energy resources or directly from the grid, and that can discharge the electricity to loads. The Energy Storage System rating is defined based off the AC output nameplate rating of IES connected to the batteries.
<b>Evoenergy</b>	Evoenergy is the ACT's principal Distribution Network Service Provider (DNSP) and is responsible for the distribution of electricity to all customers within the ACT under a regulatory framework. Evoenergy designs, installs, upgrades, repairs and maintains the infrastructure which makes up the distribution network carrying electrical energy to ACT homes and businesses
<b>Export capacity</b>	Combined power that all embedded generator units installed at the consumer's premises are capable of exporting to the network
<b>Export limitation</b>	Where the electricity exported from an IES to the distribution network is controlled so as to not exceed a specified limit. AS/NZS 4777.1 defines two types of export limitation function, namely (i) Hard limit: A limit that will require the IES to disconnect and (ii) Soft limit: A limit that will cause the IES to reduce its output, preventing ongoing export greater than the limit
<b>Export limiting device</b>	Additional hardware installed to perform export limitation  This involves monitoring the utility connection point, for clarification regarding export limiting devices please contact Evoenergy on <a href="mailto:embeddedgeneration@evoenergy.com.au">embeddedgeneration@evoenergy.com.au</a>
<b>Generating unit</b>	The plant used in the production of electricity and all related equipment essential to its functioning as a single entity
<b>Generation</b>	The production of electrical power by converting another form of energy in a generating unit
<b>Generator</b>	A person who owns, operates or controls a generating unit
<b>High voltage</b>	Any voltage greater than 1 kV AC
<b>Hybrid inverter</b>	An inverter which can simultaneously manage inputs from both solar panels and a battery bank, charging batteries with either solar panels or the electricity grid
<b>Installed capacity</b>	Combined nameplate rating of all IES installed at the consumer's premises. This may be equal to or greater than the export capacity
<b>Installer</b>	For <b>IES</b> systems; a person who holds an unrestricted electricians licence and CEC accreditation. For <b>non-IES</b> systems; an engineering consultant body or licensed electrical contractor with relevant knowledge, expertise or experience.

<b>Inverter</b>	A device that uses semiconductor devices to transfer power between a DC source(s) or load and an AC source(s) or load
<b>Inverter energy system (IES)</b>	A system comprising one or more inverters together with one or more energy sources (which may include batteries for energy storage) including controls and one or more grid protection devices and where the inverter(s) satisfies the requirements of AS/NZS 4777.2 connected at a single point in an electrical installation
<b>Islanding (Customer islanded mode)</b>	Any situation where the electrical supply from the distribution network is disrupted and one or more IES maintains any form of electrical supply, be it stable or not, to any section of that distribution network
<b>kVA</b>	kilo-Volt Amp, product of voltage and current; a measure of apparent power (combined real and reactive power)
<b>kVAr (Reactive power)</b>	kilo-Volt Amp Reactive; the rate at which reactive energy is transferred. Reactive energy is integral in an alternating current system with inductive or capacitive components. Although it is not useful energy it assists in regulating the local system voltage
<b>kW</b>	kilo-Watt or 1000 Watts; the rate at which active or real (useful) energy is transferred
<b>Low Voltage (LV)</b>	The mains voltages as most commonly used in any given network by domestic and light industrial and commercial consumers (typically 230 V)
<b>Market generating unit</b>	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)
<b>Meter Protection Device (MPD)</b>	A fuse or other protection and isolation device located on the unmetered side of the installation, intended for the isolation and protection of the meter and its associated customer installation
<b>Micro embedded generation connection</b>	Means a connection between an embedded generating unit and a distribution network of the kind contemplated by Australian Standard AS 4777 (Grid connection of energy systems via inverters) currently up to 200kVA
<b>Micro IES</b>	Small inverter energy systems (IES) up to 30 kVA of installed capacity (excluding ESS)
<b>Model standing offer</b>	A document approved by the Australian Energy Regulator as a model standing offer to provide micro embedded generation connection services or standard connection services which contains (amongst other things) the 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
<b>Negotiated connection</b>	A connection of an embedded generation unit which is neither a micro EG connection or standard connection for which technical requirements are negotiated between the DNSP and proponent
<b>Network</b>	Evoenergy's distribution network
<b>Point of supply</b>	The junction of the installation's consumer mains with Evoenergy's low voltage distribution network, normally at a connection device (see Evoenergy service and installation rules)
<b>Proponent</b>	A person proposing to become a generator (the relevant owner, operator or controller of the generating unit (or their agent))



<b>Registered generator</b>	A person who owns, operates or controls a generating unit that is connected to, or who otherwise supplies electricity to, a transmission or distribution system and who is registered by the Australian Energy Market Operator as a Generator under Chapter 2 of the National Electricity Rules
<b>Retailer</b>	The holder of a retailer authorisation issued under the National Energy Retail Law in respect of the sale of electricity
<b>Service Protection Device (SPD)</b>	The first protection device located on the network side or forming part of the connection point.
<b>Single phase</b>	Connected between the active of a phase and neutral
<b>Single wire earth return</b>	Parts of the electrical distribution network that use a single live conductor to supply single-phase or split-phase electric power with higher network impedances, and with distribution supplying low voltages to premises
<b>Site generation limit</b>	The generation threshold that the embedded generation system cannot exceed, measured downstream of the connection point
<b>Small generation aggregator</b>	A person who has classified one or more small generating units as a market generating unit
<b>Small registered generator</b>	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
<b>Standard connection</b>	A connection service (other than a micro embedded generation connection service) for a particular class (or sub-class) of connection applicant and for which an Australian Energy Regulator approved model standing offer is in place or for which an equivalent model offer is in place in jurisdictions not subject to Chapter 5A of the National Electricity Rules
<b>Supervisory Control and Data Acquisition (SCADA)</b>	A control system that remotely monitors and is capable of switching the embedded generating unit connected to the distribution network
<b>Synchronous Generator</b>	Synchronous generators can operate either in isolation from or connected to the distribution network. When connected to the distribution network, a synchronous generator is “locked into” the distribution network, i.e. operating at the same frequency.
<b>System Capacity</b>	The combined AC output nameplate rating of all embedded generating units installed at the generator’s premises
<b>Three phase</b>	Connected to all phases and neutral (star) or connected between phases (delta)
<b>Utilities Technical Regulation Team</b>	The ACT Government team responsible for the technical administration of utility requirements and administration of the <i>Utilities (Technical Regulation) Act 2014</i>
<b>Volt (V)</b>	Volt; the measure of electrical potential

## 2.2 Abbreviations

**TABLE 2.** ABBREVIATIONS

AC	Alternating Current
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AS	Australian Standard
AS/NZS	A jointly developed Australian and New Zealand Standard
CBD	Central Business District
CEC	Clean Energy Council
CPEng	Chartered Professional Engineer of Engineers Australia
DC	Direct Current
DER	Distributed Energy Resource
DNSP	Distribution Network Service Provider
EG	Embedded Generation or Embedded Generating
ENA	Energy Networks Australia
ESS	Energy Storage System
FAT	Factory Acceptance Testing
GDL	Generation Dispatch Limiter
HV	High Voltage
IEC	International Electrotechnical Commission
IES	Inverter Energy System
LV	Low Voltage
MW	Megawatt
NBN	National Broadband Network
NEM	National Electricity Market
NER	National Electricity Rules
NMI	National Metering Identifier

PV	Photovoltaic
ROCOF	Rate of Change of Frequency
RPEng	Registered Professional Engineer of Professionals Australia
RPEQ	Registered Professional Engineer of Queensland
SCADA	Supervisory Control and Data Acquisition
SCR	Short Circuit Ratio
SWER	Single Wire Earth Return
UTR	Utilities Technical Regulation Team
xDSL	X Digital Subscriber Line

## 2.3 Terminology

To assist with the interpretation and application of the requirements specified in this document, the following instructional terms have been used:

- 👉 The word 'shall' indicates a mandatory requirement
- 👉 The word 'may' indicates a requirement that may be mandatorily imposed on the proponent
- 👉 The word 'should' indicates a recommendation that will not be mandatorily imposed on the proponent

### 2.3.1 Subcategories

To assist proponents in the clear identification of that technical requirements that are applicable to a specific system, Evoenergy have defined several sub-categories. The definitions for each subcategory are outlined in Table 3.

**TABLE 3.** SUBCATEGORY DEFINITIONS

<b>Single Phase</b>	Any micro EG system with a system capacity less than or equal to 10 kVA for a single-phase IES (excluding ESS) network connection meeting all technical requirements for micro EG connections set out in this document
<b>Two Phase</b>	Any micro EG system with a system capacity less than or equal to 20 kVA for a two-phase IES (excluding ESS) network connection meeting all technical requirements for micro EG connections set out in this document
<b>Three Phase</b>	Any micro EG system with a system capacity less than or equal to 30 kVA for a three-phase IES (excluding ESS) network connection meeting all technical requirements for set out in this document
<b>Non-Standard</b>	Non-standard micro EG connection – Any micro EG system connecting to a non-standard part of the network including (but not limited to) SWER networks, isolated networks, and CBD networks

There are currently no geographical network restrictions on the Evoenergy distribution network that require a non-standard system classification. If future network conditions result in non-standard geographical locations, the information clearly identifying these areas will be provided on the Evoenergy website.

### 3. RELEVANT RULES, REGULATIONS, STANDARDS AND CODES

#### 3.1 Evoenergy Documents

Table 4 lists the relevant Evoenergy documents that shall be considered in the application of the Micro EG technical requirements.

**TABLE 4.** RELATED EVOENERGY DOCUMENTATION

<b>Evoenergy Service and Installation Rules</b>	Sets out the requirements and associated obligations and procedures for the safe, reliable and efficient connection of electrical installations to an electricity network
<b>Evoenergy Connection Policy</b>	Sets out the circumstances in which connection charges are payable and the basis for determining the amount of such charges. The policy has been prepared in accordance with the requirements in Chapter 5A of the National Electricity Rules (Rules) and the Australian Energy Regulator's (AER's) Connection charge guidelines for retail electricity customers, under Chapter 5A of the National Electricity Rules, version 1.0 (AER connection charge guidelines)

#### 3.2 Standards and Codes

There are a number of Australian and International Standards which specify technical requirements for network connections of generating units and performance requirements. These are outlined in Table 5.

**TABLE 5.** RELATED AUSTRALIAN AND INTERNATIONAL STANDARDS

STANDARD NUMBER	STANDARD NAME	STANDARD TYPE
AS 3011	Secondary batteries installed in buildings	Australian Standard
AS 4086	Secondary batteries for use with stand-alone systems	Australian Standard
AS 60034.1	Rotating electrical machines, Part 1: Rating and performance	Australian Standard
AS 60034.22	Rotating electrical machines, Part 22: AC generators for reciprocating internal combustion (RIC) engine driven generating sets	Australian Standard
AS 60038	Standard voltages	Australian Standard
AS 60044	Instrument transformers (multiple parts)	Australian Standard
AS/NZS 3000	Electrical installations (known as the Australian/ New Zealand Wiring Rules)	Australian/ New Zealand Joint Standard
AS/NZS 3008.1.1	Electrical installations - Selection of cables. Part 1.1: Cables for altering voltages up to and	Australian/ New Zealand Joint Standard









	including 0.6/1 kV – Typical Australian installation conditions	
<b>AS/NZS 4755.1</b>	Demand response capabilities and supporting technologies for electrical products –Part 1: Demand response framework and requirements for demand response enabling devices (DREDs)	Australian/ New Zealand Joint Standard
<b>AS/NZS 4777</b>	Grid connection of energy systems via inverters (multiple parts)	Australian/ New Zealand Joint Standard
<b>AS/NZS 5033</b>	Installation and safety requirements for photovoltaic (PV) arrays	Australian/ New Zealand Joint Standard
<b>AS/NZS 61000.4.3</b>	Electromagnetic compatibility testing and measurement techniques – Power quality measurement methods	Australian/ New Zealand Joint Standard
<b>AS/NZS IEC 60947.6-1</b>	Low-voltage switchgear and control gear - Multiple function equipment - Automatic transfer switching equipment	Australian/ New Zealand Joint Standard
<b>IEC 60255-12</b>	Electrical relays - Part 12: Directional relays and power relays with two input energizing quantities	International Standard
<b>IEC 60255-127</b>	Measuring relays and protection equipment - Part 127: Functional requirements for over/under voltage protection	International Standard
<b>IEC 60255-26</b>	Electrical relays - Part 26: Electromagnetic compatibility requirements	International Standard
<b>IEC 60255-27</b>	Electrical relays - Part 27: Product safety requirements	International Standard
<b>IEC 62109</b>	Safety of power converters for use in photovoltaic power systems	International Standard
<b>IEC 62116</b>	Utility-interconnected photovoltaic inverters – Test procedure of islanding prevention measures	International Standard
<b>IEC 62786</b>	Distributed energy resources connection with the grid	International Standard
<b>IEEE standard 1547-2018</b>	IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems	International Standard
<b>SA/SNZ TR IEC 61000.3.14</b>	Electromagnetic compatibility (EMC), Part 3.14: Limits – Assessment of emission limits for harmonics, interharmonics, voltage fluctuations and unbalance for the connection of disturbing installations to LV power systems	AU/NZ Technical Report

<b>SA/SNZ TR IEC 61000.3.15</b>	Electromagnetic compatibility (EMC), Part 3.15: Limits – Assessment of low frequency electromagnetic immunity and emission requirements for dispersed generation systems in LV network	AU/NZ Technical Report
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In the event of an inconsistency between the Evoenergy technical requirements, Australian standards, international standards and industry codes, the Evoenergy technical requirements shall prevail.

### 3.3 Legislation and Regulation

This section provides a list of the relevant legislation and regulations which shall apply to the design, manufacture, installation, testing, commissioning, operations and maintenance of all plant and equipment for Micro EG connections to the Evoenergy distribution network.

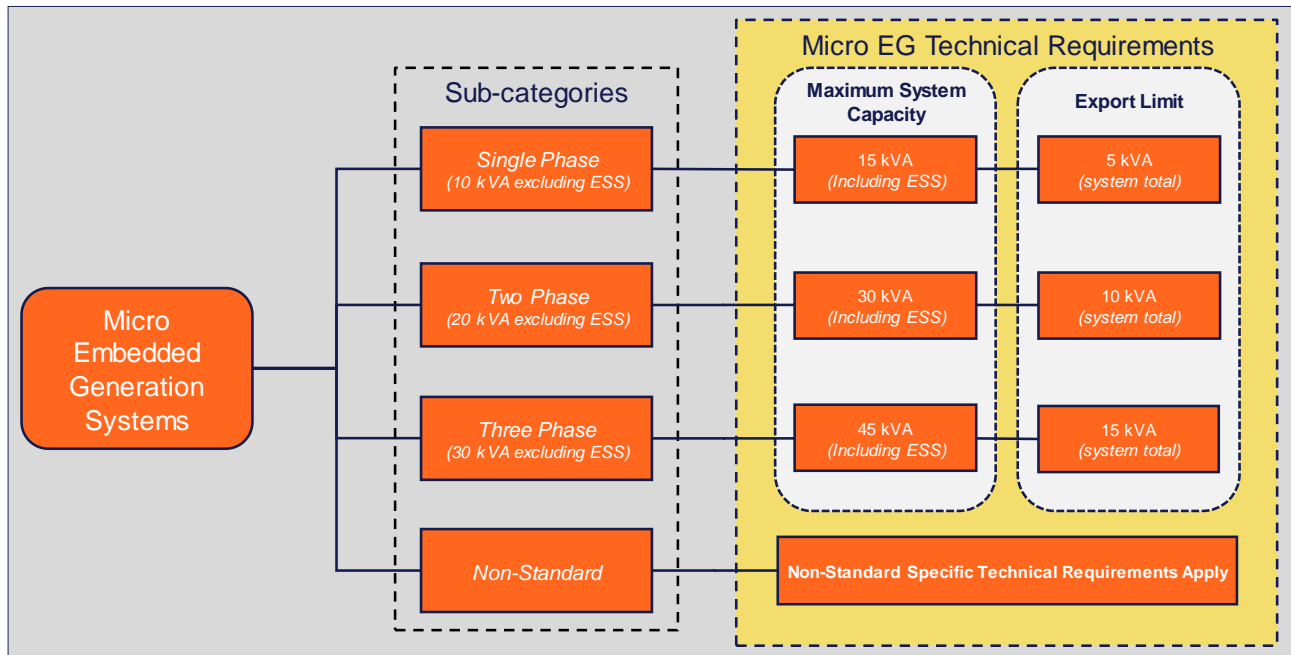
-  Electrical Safety Act 1971
-  Electrical Safety Regulation 2004
-  Utilities Act 2000
-  Utility Networks (Public Safety) Regulations 2001
-  Utilities (Technical Regulation) Act 2014
-  Electricity Feed-in (Renewable Energy Premium) Act 2008
-  Electricity Service and Installation Rules Code Determination 2013
-  Electricity Network Boundary Code Determination 2013
-  Electricity Distribution Supply Standards Code Determination 2013
-  Work Health and Safety Act
-  Work Health and Safety Regulation
-  National Electricity Rules (Chapter 5)

In an event where there is any inconsistency between legislation and regulations and these technical requirements, the legislation and regulations shall prevail.

## 4. TECHNICAL REQUIREMENTS

This section specifies the detailed technical requirements for Micro Embedded Generators. The technical requirements specified in this section should be interpreted as applying to all subcategories of micro EG connections unless otherwise specified. The relationship between the sub-categories and the associated technical settings is displayed in Figure 2.

FIGURE 2. SUBCATEGORY HIERARCHY



### 4.1 Labelling and Signage

The labels and signs on the installation, including cables, shall be as per the labelling requirements specified in AS/NZS 4777.1, AS/NZS 3000 and AS/NZS 5033. In the event the installation requires an external isolation switch to enable network isolation (as outlined in Section 4.5) the isolation switch shall be labelled as per the requirements specified in AS/NZS 4777.1

## 4.2 Maximum System Capacity

This section specifies the maximum system capacity of the Micro EG connections for each sub-category. These values are inclusive of all generating sources including ESS.

**TABLE 6.** MAXIMUM SYSTEM CAPACITY FOR EACH SUBCATEGORY

SUB CATEGORY	MAXIMUM SYSTEM CAPACITY (INCLUDING ESS)
<b>Single Phase</b>	Any micro EG system with a system capacity less than or equal to 15 kVA for a single-phase IES (including ESS) network connection meeting all technical requirements for micro EG connections set out in this document
<b>Two Phase</b>	Any micro EG system with a system capacity less than or equal to 30 kVA for a two-phase IES (including ESS) network connection meeting all technical requirements for micro EG connections set out in this document
<b>Three Phase</b>	Any micro EG system with a system capacity less than or equal to 45 kVA for a three-phase IES (including ESS) network connection meeting all technical requirements for set out in this document
<b>Non-Standard</b>	As there are currently no geographical areas requiring non-standard systems for connection to the Evoenergy network this limit shall be specified on a case by case basis

For individual systems sharing a network connection point under different strata titles, the connection type shall be defined by the capacity at the connection point. Evoenergy will assess these applications on a case by case basis, for more information please contact Evoenergy via the details listed on the [website](#).

## 4.3 Generation Control

### 4.3.1 Export Limits at Connection Point

This section specifies the power export limits for micro embedded generator connections against each category. These limits are defined in Table 7.

**TABLE 7.** EXPORT LIMITS

SUB CATEGORY	EXPORT LIMIT (PER PHASE)	EXPORT LIMIT (SYSTEM TOTAL)
<b>Single Phase</b>	5 kVA	5 kVA
<b>Two Phase</b>	5 kVA	10 kVA
<b>Three Phase</b>	5 kVA	15 kVA
<b>Non-Standard</b>	<i>defined on a case by case basis</i>	

Export limitation shall be achieved through the use of a dedicated export limiting device; details of the configuration shall be provided on the single line diagram submitted to Evoenergy. The export limiting functionality shall be of the “soft” limitation type as defined in AS/NZS 4777.1.

Where export limitation settings can be changed via a keypad or switches, adequate security must be employed to prevent any tampering / inadvertent / unauthorised changes. Suitable locks or a password system shall be used.



The export limit is a maximum limit and the ability to export at the defined limit is not guaranteed as it depends upon network characteristics which change over time. Several instances can result in the need for the limit to be constrained, for example, the operation of active power quality response modes.

For micro embedded generator connections undergoing modification, Evoenergy may allow the proponent to maintain the current export limit provided a dedicated export limiting device is installed and configured to prevent the system from exceeding this limit. For more information regarding this process please contact Evoenergy via the contact details on the Evoenergy [website](#).

### **4.3.2 Site Generation Limit Downstream of Connection Point**

Evoenergy site generation limits are as defined for each subcategory in Section 4.2 – Maximum System Capacity.

## **4.4 Inverter Energy System**

The IES shall comply with the following technical requirements:

- 🔌 shall be tested by an authorised testing laboratory and be certified as being compliant with AS/NZS 4777.2 with an accreditation number
- 🔌 shall comprise of inverters that are registered with CEC as approved grid connect inverters
- 🔌 shall comprise of inverters that are tested by an authorised testing laboratory and certified as being compliant with IEC 62116 for active ant islanding protection as per AS/NZS4777.2
- 🔌 shall comprise of inverters installed in compliance with AS/NZS 4777.1
- 🔌 shall comprise of inverters that have both volt-var and volt-watt response modes available.

## **4.5 Network Connection and Isolation**

There shall be a visible method of ensuring the EG system is disconnected from the distribution network for all residential and commercial systems. The method of isolation shall be safely accessible to Evoenergy personnel at all times. The location shall not be located behind fences and shall always be kept clear. If access is obstructed, the embedded generator shall remove the obstruction or relocate the method of isolation. Switches designated as main switches for inverter supply shall be as per AS/NZS 4777.1. As a minimum, mechanical isolation shall be as per AS/NZS 3000 and lockable in the open position.

Where an ESS and IES are physically integrated, the isolation switches and isolation arrangements shall also comply with AS/NZS 5033.

In the case where premises, such as townhouse complexes, are supplied by the same service cable to connect several consumers via dedicated service fuses, links and metering equipment located at the point of common coupling (PCC), the inverter main switch may be installed at the individual consumer's residence. This switch must be located in an accessible location that is external to the residence.

If the requirement for access as specified in this section cannot be achieved, special approval for the connection of the IES shall be sought from Evoenergy via the contact details on the Evoenergy [website](#).

### **4.5.1 Shared Generation**

Shared generation is where an embedded generation unit/s, or system, is electrically connected to, supplying, and shared between, multiple generators.

Evoenergy recommends that proponents utilising a shared generation arrangement engage an Embedded Network Manager to become an embedded network. In such an instance, the network connection point moves from the generator (now child) connection point to a new agreed parent connection point.

### **4.5.2 Phase Connection of IES**

Single phase IES installed in three phase installations must be installed on the phase with the lowest recorded voltage. The installer must take these measurements prior to installing the EG system. The phase of the installed EG system must be documented and provided to Evoenergy as additional information upon submission of the final commissioning RFS form.

If the requirement for access as specified in this section cannot be achieved, special approval for the connection of the IES shall be sought from Evoenergy via the contact details on the Evoenergy [website](#).

## 4.6 Earthing

For IES earthing requirements shall be as per AS/NZS 4777.1 and AS/NZS 3000 and for ESS earthing requirements shall be as per AS 3011.

## 4.7 Protection

Protection systems for Micro embedded generators shall be designed in accordance with the relevant Acts, Regulations and Evoenergy requirements. IES protection shall comply with the requirements of AS/NZS 4777.2.

### 4.7.1 Inverter Integrated Protection

Inverter integrated protection shall be as per AS/NZS 4777.1 and AS/NZS 4777.2 for Micro embedded generators. Passive anti-islanding protection set points and limits for sustained operation are defined in Table 8.

**TABLE 8.** INVERTER PROTECTION SET-POINT VALUES (AS/NZS 4777.2)

PROTECTIVE FUNCTION	PROTECTIVE FUNCTION LIMIT	TRIP DELAY TIME	MAXIMUM DISCONNECTION TIME
Undervoltage (V<)	180 V	1 s	2 s
Overvoltage (V>)	260 V	1 s	2 s
Overvoltage (V>>)	265 V	-	0.2 s
Under-frequency (F<)	47 Hz	1 s	2 s
Over-frequency (F>)	52 Hz	-	0.2 s
Sustained Overvoltage (V <sub>nom_max</sub> 10-minute average)	258 V	-	3 s
Increase in frequency (f <sub>stop</sub> )	52 Hz	<i>Inverter response as outlined in AS/NZS 4777.2 Section 7.5.3.1</i>	
Decrease in frequency (only applicable to inverters with Energy storage)	49.75 Hz	<i>Inverter response as outlined in AS/NZS 4777.2 Section 7.5.3.2</i>	

Active anti-islanding protection shall be implemented as per AS/NZS 4777.2 and shall operate the automatic disconnection device within two (2) seconds of disruption to the power supply from the grid.

### 4.7.2 Central Protection

Central protection shall be required as per Table 1 of AS/NZS 4777.1. An example arrangement of a central protection system is shown in Appendix B.

### 4.7.3 Interlocking

Single phase inverters installed in a three phase arrangement with system capacity above 5 kVA per phase shall be interlocked and configured to behave as an integrated multiphase inverter providing balanced output (maximum unbalance between phases of 5 kVA) to all connected phases.

Alternatively, where inverters cannot be interlocked by internal controls, the installation must be protected by phase balance protection as per Clause 3.4.4.2 of AS/NZS 4777.1.

Three phase inverters shall have integrated phase balance protection. Where this function is not integral to the inverter a separate central protection system shall be implemented as per Clause 3.4.4.2 of AS/NZS 4777.1.

#### **4.7.4 Customer Islanded Mode**

Generators can seek approval from Evoenergy to operate in customer islanded mode. In addition to Evoenergy approval, the following operational conditions must also be satisfied:

- 📌 Embedded generating unit is electrically disconnected from the distribution network, either manually or as the result of automatic disconnection from a loss of supply, prior to becoming a customer island
- 📌 Reconnection of the customer island to the distribution network must not occur until the network supply has been fully restored and stabilised such that synchronisation from within the generator's installation can occur
- 📌 The islanded embedded generating unit must only supply the generator's installation, or a section of the generator's installation, which have also been electrically disconnected from the distribution network

### **4.8 Operating Voltage and Frequency**

The system shall be designed and installed to limit voltage rise to 2% from the point of supply to the inverter terminals. Regardless of the connection method applied, the voltage rise for an embedded generation system shall be calculated based on the maximum current imbalance permitted by the inverter control in accordance with AS/NZS 4777.1 Appendix C3.

The operating voltage and frequency shall be within the limits specified in Section 4.7.1.

### **4.9 Metering**

Micro embedded generators shall not be energised without the correct metering arrangement in place. The consumer shall contact the retailer to ensure metering requirements for grid connected IES installations are fulfilled prior to energising the system.

### **4.10 Quality of Supply and Generation**

The National Electricity Rules place certain responsibilities on Evoenergy for maintaining the quality of supply within the network. Evoenergy are responsible for adhering to relevant jurisdictional based regulations and licence conditions regarding power quality parameters including:

- 📌 Network Voltage Control
- 📌 Voltage Fluctuations and Step Voltage
- 📌 Harmonics
- 📌 Voltage Balance

The Micro EG connection shall not adversely impact Evoenergy's ability to meet these requirements and shall comply with the applicable power quality requirements as well as relevant state based regulations and licence conditions.

### 4.10.1 IES Power Quality Response Modes

All Micro embedded generators shall have volt-watt power quality response enabled as per AS/NZS 4777.2 Clause 6.3.2.2 with the settings detailed in Table 9.

**TABLE 9.** VOLT-WATT RESPONSE

AS/NZS 4777.2 REFERENCE	VOLTAGE	POWER LEVEL (% RATED POWER)
V1	207 V	100%
V2	220 V	100%
V3	250 V	100%
V4	258 V	20%

In addition, Micro embedded generators shall have volt-var power quality response enabled as per AS/NZS 4777.2 Clause 6.3.2.3 with the settings detailed in Table 10.

**TABLE 10.** VOLT-VAR RESPONSE

AS/NZS 4777.2 REFERENCE	VOLTAGE	VAR LEVEL (% OF RATED VA)
V1	207 V	30% Leading
V2	220 V	0%
V3	250 V	0%
V4	258 V	30% Lagging

The ramping requirements for IES power quality response modes shall be the default values specified in AS/NZS 4777.2.

In some cases, Evoenergy may request alternate settings be enabled, including application of fixed power factor, for specific installations and will communicate these to proponents upon receiving a connection application.

Proponents shall ensure that power quality settings are uniform across systems with multiple inverters. The replacement of inverters, including warranty replacements, shall be configured to have power quality response modes enabled. IES power quality response modes and settings shall not be altered without written approval from Evoenergy.

## 4.11 Communication Systems

Evoenergy do not currently mandate communication requirements for Micro embedded generators. However, Evoenergy do engage in demand management programs that are implemented through third party aggregators. More information regarding these programs can be found on the Evoenergy [website](#).

## 4.12 Data and Information

### 4.12.1 Static Data and Information

The static data and information required to be provided by the proponent to Evoenergy is specified in *Appendix D: Static Data and Information*. Additional detail regarding this data can be found on the Evoenergy [website](#).

### 4.12.2 Dynamic Data and Information

As outlined in Section 4.11 Evoenergy do not currently mandate the requirement for dynamic data and information for Micro embedded generators.

## 4.13 Cyber Security

As outlined in Section 4.11 Evoenergy do not currently mandate communications for Micro embedded generators and therefore do not specify cyber security requirements.

## 4.14 Technical Studies

Network technical studies are not required to be carried out by the proponent or at the proponent's expense to enable the connection of a Micro embedded generator to connect to the distribution network.

## 5. FEES AND CHARGES

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All fees and charges relating to network services and tariffs are located on the Evoenergy [website](#).

Micro Embedded Generators compliant with the requirements specified in this document are considered as Class 1 systems for the purposes of fees and charges.

## 6. TESTING AND COMMISSIONING

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Before being placed in service the IES installation shall be tested and commissioned in accordance with the requirements of AS/NZS 3000, AS/NZS 5033 and AS/NZS 4777.1. These tests shall be installation tests, not type tests.

The installation shall also be approved for connection by the ACT Government Electrical Inspectorate and the completed Certificate of Electrical Safety shall be included in the IES manual.

The proponent shall submit notification to Evoenergy upon successful commissioning of the system as outlined on the Evoenergy [website](#).

## 7. OPERATIONS AND MAINTENANCE

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The Micro Embedded Generation system shall be operated and maintained to ensure compliance with the connection agreement and all legislation, codes and / other regulatory instruments at all times.

The generator shall be responsible for the following:

- 🔧 Maintaining the electrical installation at the supply address in a safe condition
- 🔧 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 customer holds a Certificate of Compliance issued in respect of any of the changes
- 🔧 Seeking Evoenergy 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

- ☛ Perform periodic verification of the system every five years as per the periodic test procedure. The test declaration and test records forms can be accessed via the Evoenergy [website](#). The consumer shall maintain records of periodic tests and provide Evoenergy with a copy of the test results

If Evoenergy wish to inspect a system at any time, they may do so at no cost to the generator.

In the event a system is deemed to be non-compliant, Evoenergy will contact the generator in addition to the ACT Electrical Inspectorate and request that the system is rectified within a specified timeframe. If the generator fails to adequately address the non-compliance within the timeframe, Evoenergy will take steps to have the system disconnected from the network to ensure its obligations regarding the safe and reliable operation of the distribution system for operating personnel, customers and the general public are met. This process may vary depending on the severity of the safety risk posed by the system.

## 7.1 Feed in Tariff (FiT) Replacements

In the event of an inverter failure for a system with a fixed feed in tariff the generator shall replace the inverter with a compliant inverter with a generating capacity less than or equal to the failed inverter in accordance with the *Electricity Feed-in (Renewable Energy Premium) Act 2008*.

Where for technical reasons a “like for like” inverter compliant with the *Electricity Feed-in (Renewable Energy Premium) Act 2008* is not available, Evoenergy may consider an appropriately sized replacement inverter with active power limiting enable. The active power limit must be set to the rating of the existing approved inverter capacity for the IES.

## VERSION CONTROL

VERSION	DETAILS	APPROVED
1.0	Initial release version	W. Cleland – Asset Standards Mgr
1.1	Minor adjustment for final release	W. Cleland – Asset Standards Mgr
1.2	Updated connection diagrams	W. Cleland – Asset Standards Mgr
1.3	Template change	W. Cleland – Asset Standards Mgr
1.4	Volt VAR/Watt - V1; 216 to 207	W. Cleland – Asset Standards Mgr
2.0	Changes to Section 4.5 Update document number from SM5061 to PO0845	W. Cleland – Asset Standards Mgr
2.1	Update to figures for change of document numbering	M Lloyd – Customer Technical Services Manager
2.2	Placed phase connection and earthing clauses back into document	M Lloyd – Customer Technical Services Manager

## DOCUMENT CONTROL

DOCUMENT OWNER	PUBLISH DATE	REVIEW DATE
Customer Technical Service Manager	17 November 2020	17 November 2022

## APPENDIX A – DEVIATIONS FROM THE NATIONAL DER CONNECTION GUIDELINES

TABLE 11. DEVIATIONS FROM THE NATIONAL DER CONNECTION GUIDELINES

SECTION	DESCRIPTION OF DEVIATION	TYPE OF DEVIATION	JUSTIFICATION
Introduction	Addition of subsections	Administrative	To improve ease of understanding and clearly state the context, scope, purpose obligations and compliance relevant to this document
Definitions and Abbreviations	Incorporation of System Capacity definition, amendment to Energy Storage System definition and addition of jurisdictional abbreviations and definitions	Administrative	To remove ambiguity in the interpretation and application of definitions throughout the document
Subcategories	Relocation of statement specifying the application of technical requirements to subcategories to Section 4 and inclusion in diagram	Administrative	To improve ease of understanding regarding the technical requirements applicable to each sub-category
Subcategories	Inclusion of two-phase subcategory to flow through the document	Promote improved benefits to Australia's electricity system	Specification of the requirements around two phase installations that often occur on brownfield sites provides clearer direction for proponents and improves efficiency of DNSP internal processes
Subcategories	Geographical reference not provided for non-standard connections	Jurisdictional	There are currently no geographical areas on the Evoenergy network requiring a non-standard connection
Relevant Rules, Regulations, Standards and Codes	Addition of Evoenergy Documents subsection	Jurisdictional	Identification of jurisdictional documentation that is applicable to the Evoenergy network
Maximum System Capacity	Alteration of Maximum System Capacity to include ESS	Promote improved benefits to Australia's electricity system	Enables proponents to AC couple existing systems when adding ESS without breaching identified limits through export limitation
Maximum System Capacity	Inclusion of assessment process for strata connections sharing a common connection point	Promote improved benefits to Australia's electricity system	Assessment of these connections will enable customers sharing a connection point to access the maximum system capacity rather than applying a reduced limit
Connection and Isolation	Inclusion to mandate and record phase connection of	Promote improved benefits to	Recording and balancing of phases is important for system security and

	single phase IES in three phase installations	Australia's electricity system	will provide greater benefits from VPP export in the future
Connection and Isolation	Inclusion to mandate the use of embedded networks for shared systems	Promote improved benefits to Australia's electricity system	Including this change will allow generators in shared complexes to uptake embedded generation
Protection	Inclusion of sustained operating parameters in Table 8	Administrative	To improve ease of understanding regarding the protection settings through displaying the required internal inverter parameters in a single table
Islanding Protection	Permitted customer islanding operation	Promotes improved benefit to electricity system	Inclusion of customer islanded mode to specify requirements allowing customers to safely retain supply during network outages
Technical Studies	Removal of statement that technical studies will not result in any changes to the technical requirements for connections	Promote improved benefits to Australia's electricity system	Technical studies will inform the application of fixed power factor settings in addition to dynamic export limits and strata connection assessments
Operation and Maintenance	Inclusion of five yearly testing regime	Jurisdictional	This is an Evoenergy jurisdictional requirement
Operation and Maintenance	Inclusion of Feed in Tariff subsection	Jurisdictional	The rate of failures within the ACT for inverter replacements on jurisdictional FiT tariffs requires clear direction on how the technical replacement of these systems shall be achieved
General	Removal of New Zealand settings from protection tables	Administrative	New Zealand values removed for ease of interpretation

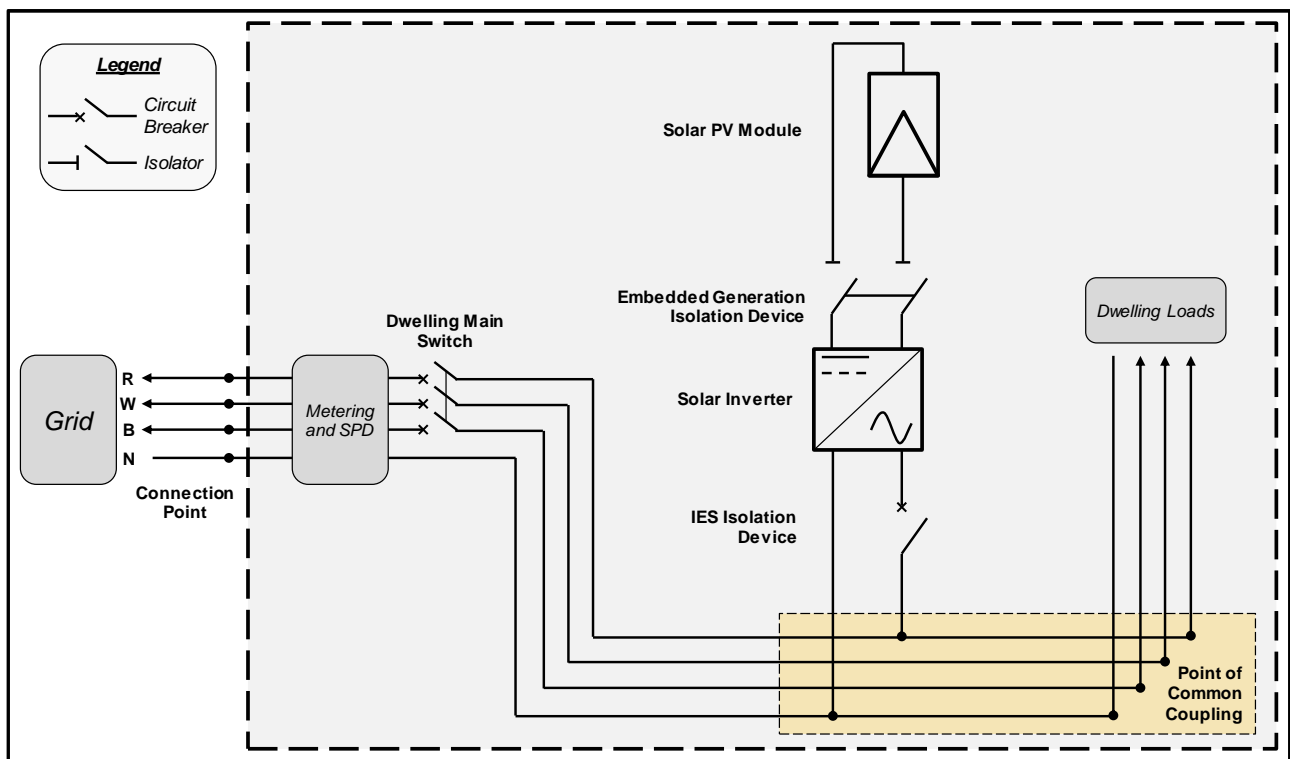


## APPENDIX B – CONNECTION ARRANGEMENT REQUIREMENTS

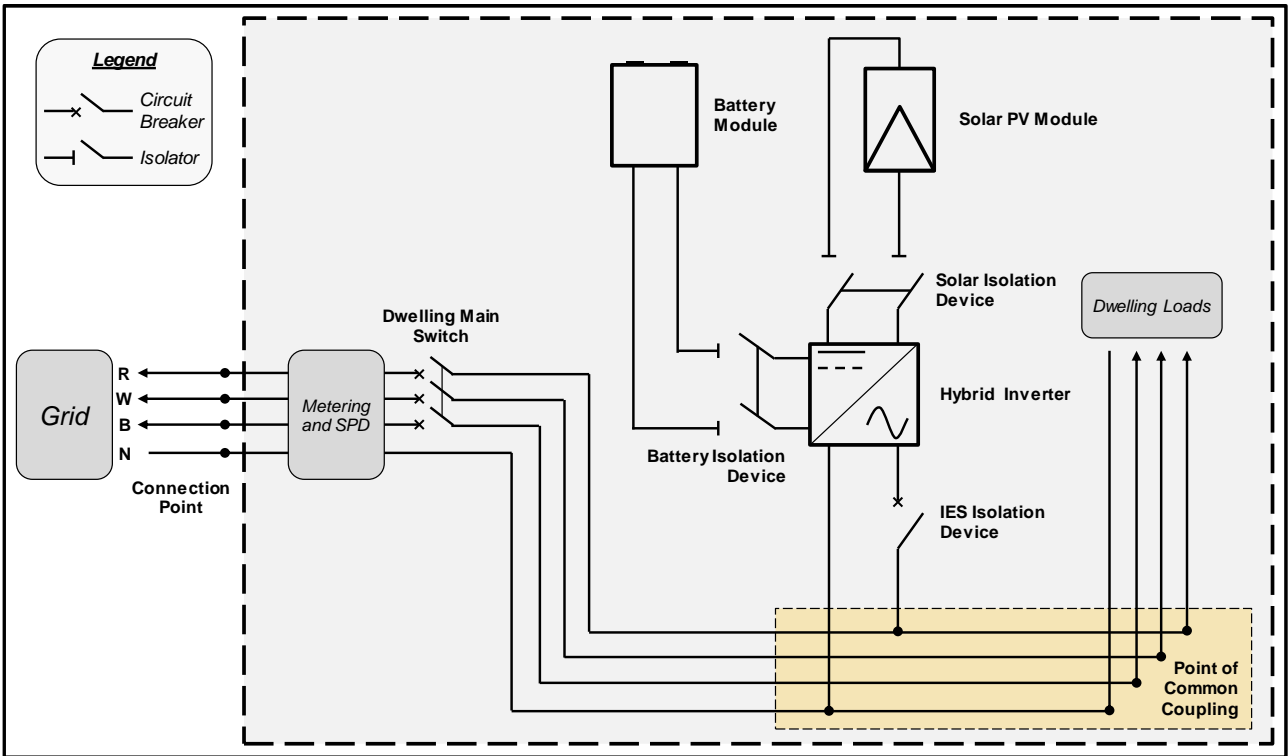
The figures in this Appendix display the common connections for Micro Low Voltage Embedded Generators. Meters are not shown and the connections shall comply with retailers metering requirements. For additional information regarding connection arrangements please contact Evoenergy via the contact details listed on the [website](#).

Connection arrangements are shown for indication only with all loads shown as three phase for consistency. Actual connection arrangements are dependent on specific installation configurations.

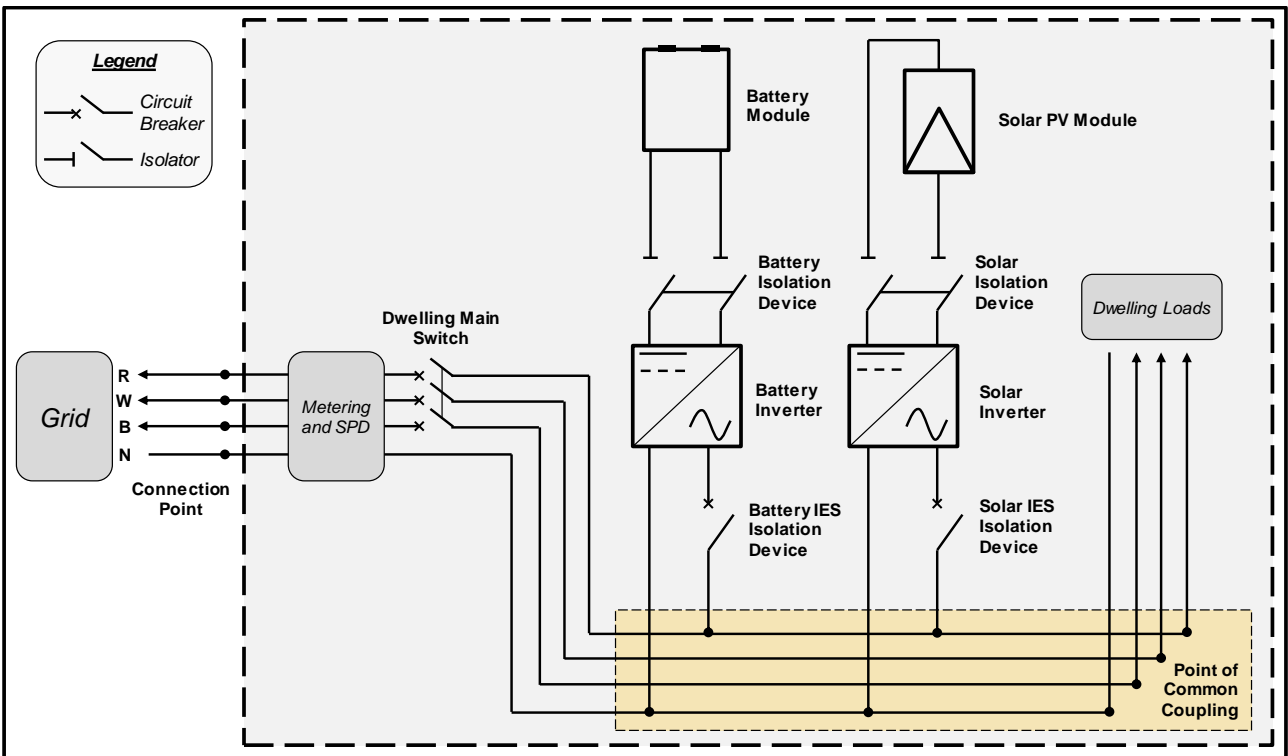
FIGURE 3. SINGLE PHASE PV CONNECTION



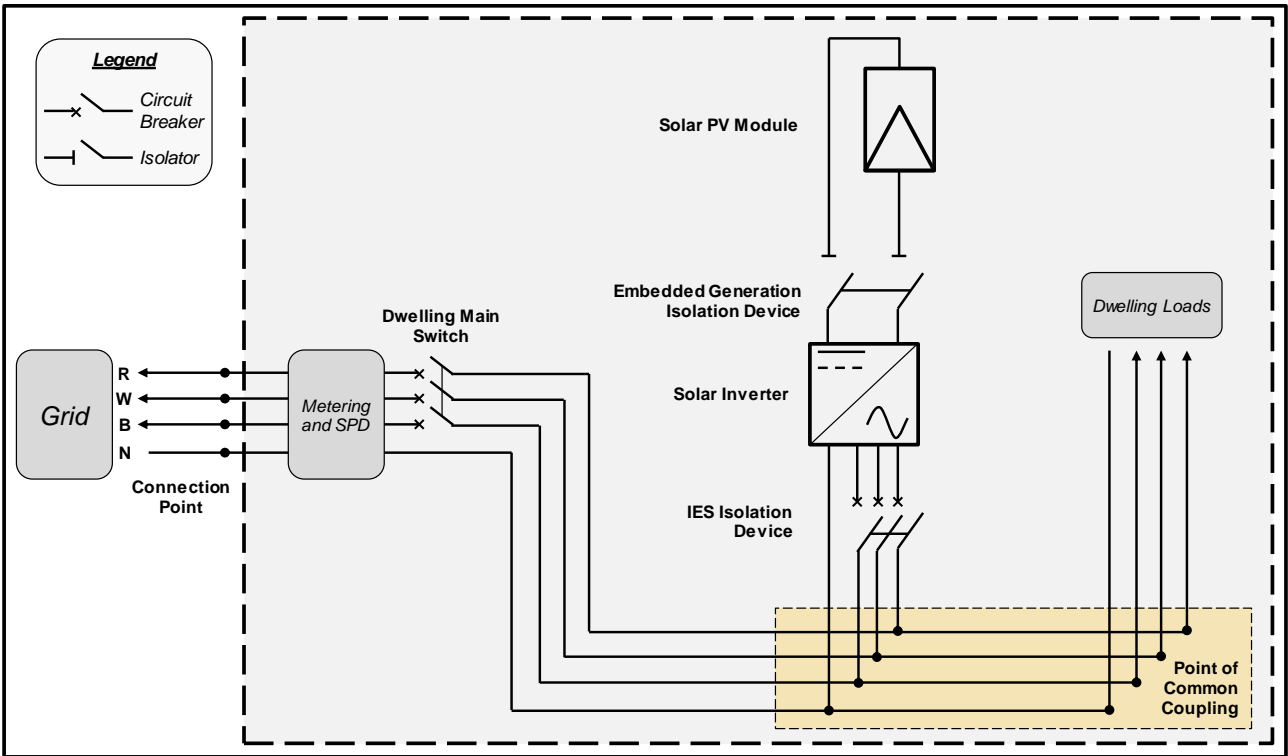
**FIGURE 4.** SINGLE PHASE ESS AND PV CONNECTION WITH A SINGLE INVERTER



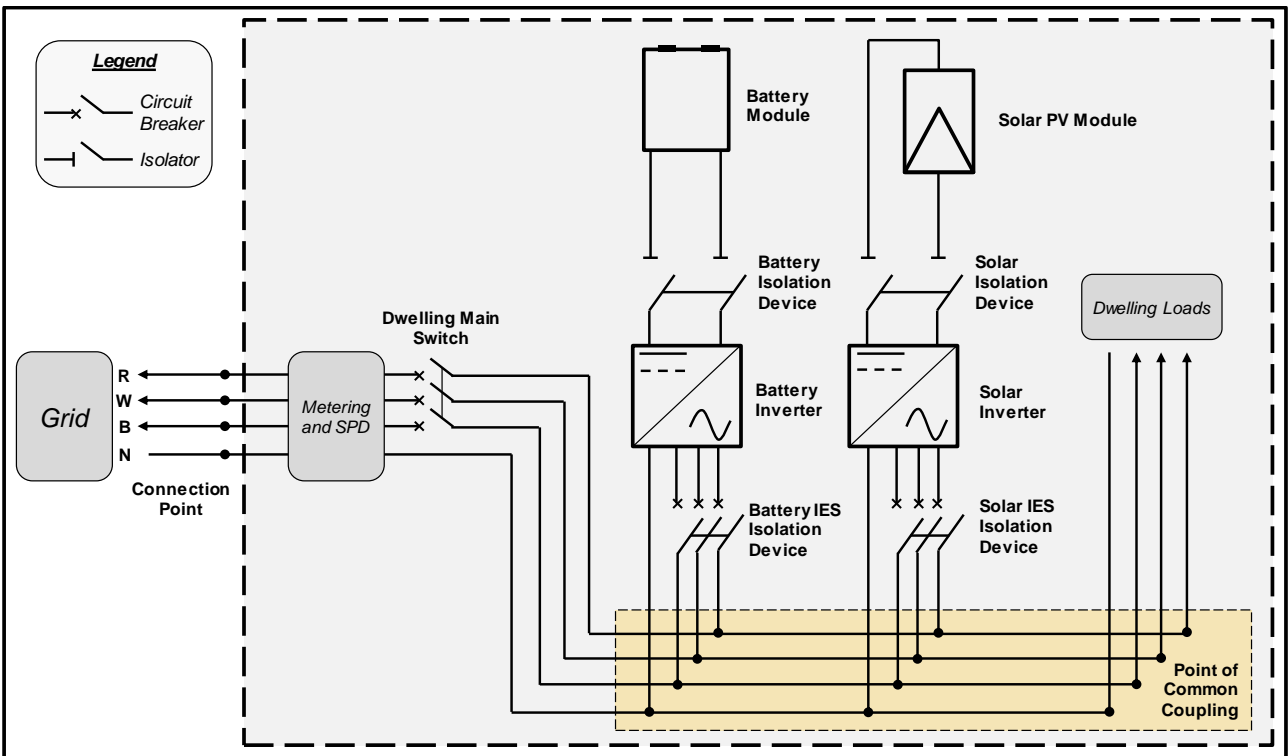
**FIGURE 5.** SINGLE PHASE ESS AND PV CONNECTION WITH DUAL INVERTERS



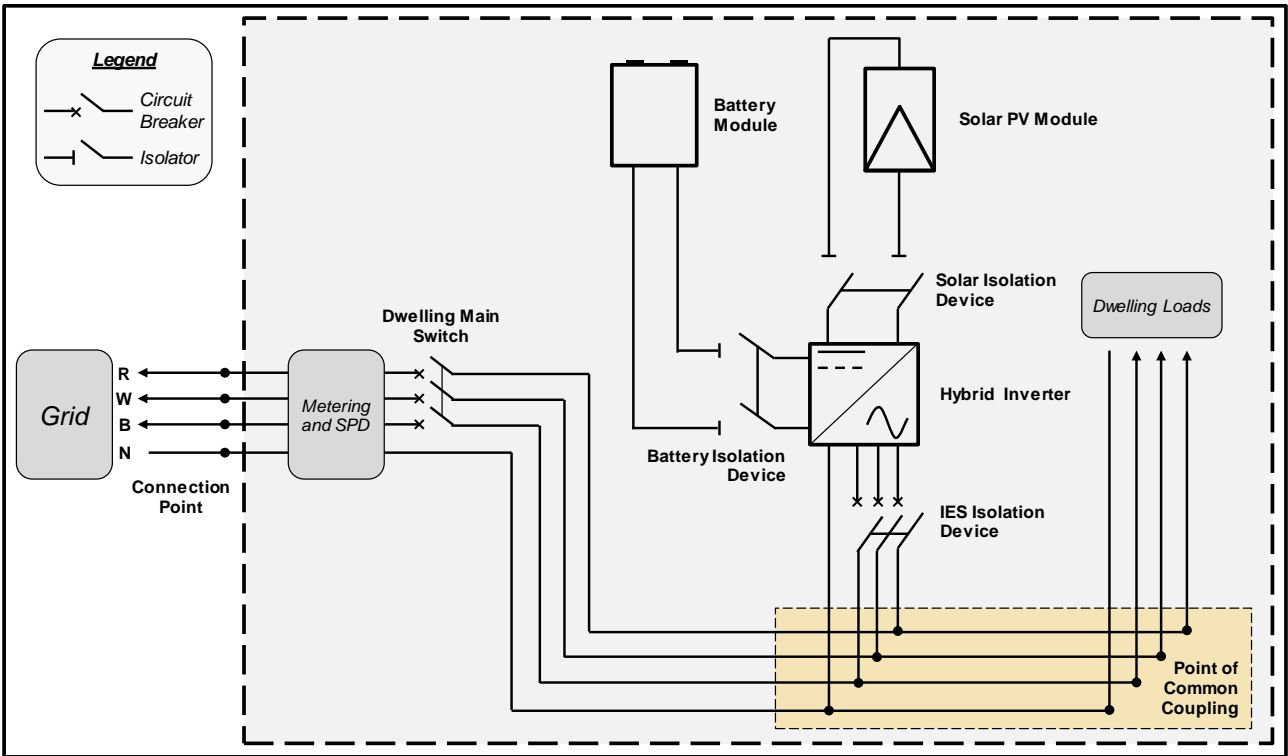
**FIGURE 6. THREE PHASE PV CONNECTION**



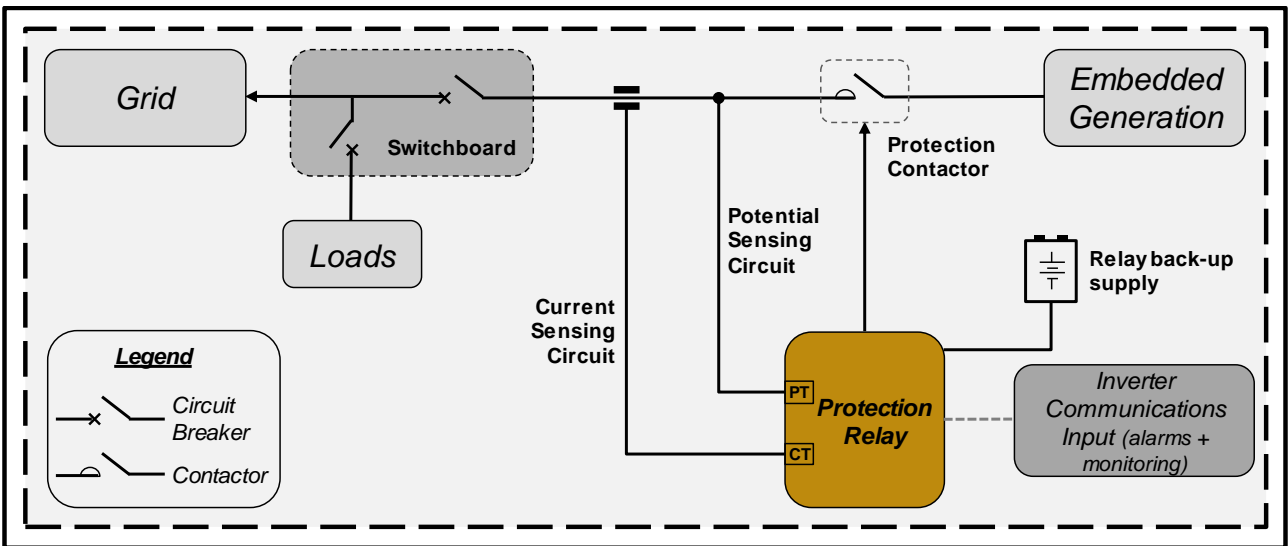
**FIGURE 7. THREE PHASE ESS AND PV CONNECTION WITH DUAL INVERTERS**



**FIGURE 8.** THREE PHASE ESS AND PV CONNECTION WITH A SINGLE INVERTER



**FIGURE 9.** EXAMPLE ARRANGEMENT OF CENTRAL PROTECTION



Central protection settings can be found in Section 4.7.2.

## APPENDIX C – MODEL STANDING OFFER

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The model standing offer for the connection of Micro Low Voltage Embedded Generator connections to the Evoenergy network can be found on the Evoenergy [website](#).

## APPENDIX D – STATIC DATA AND INFORMATION

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The static data requirements are defined as per the application form available on the Evoenergy [website](#).

The single line diagram(s) provided to Evoenergy with the connection application shall:

- 📁 Be site specific
- 📁 Match what is submitted in the connection application

The contents of the single line diagram(s) shall contain the following information:

- 📁 The configuration and manufacturer / model of all embedded generating units and customer equipment with circuits between the generating unit(s) and the network connection point
- 📁 All primary circuit equipment such as main switchboards, other switchboards, circuit breakers and isolators / load break switches. In particular, all points where the customer embedded generating unit and the Evoenergy distribution network can be connected / disconnected must be clearly identified from end-to-end. It must be shown which phases the system will connect to
- 📁 All secondary protection and control equipment associated with the embedded generating unit's connection and parallel operation with the Evoenergy distribution network including, current transformers, voltage transformers, protection and control elements (using ANSI codes), SCADA and sensing points
- 📁 Local customer load connections including any interconnections with other parts of the customer's installation. In particular, where interconnection with other parts of the customer's installation is proposed the means to prevent paralleling of Evoenergy substations / transformers and / or unsynchronised connection to the distribution network shall be clearly identified