

# EVOENERGY LOW VOLTAGE EMBEDDED GENERATION TECHNICAL REQUIREMENTS

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**Technical requirements for connection of low voltage 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**

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# 1. INTRODUCTION

## 1.1 About Evoenergy

Evoenergy own and operate the electricity and gas distribution networks in the ACT, providing electrical power to over 220,000 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.

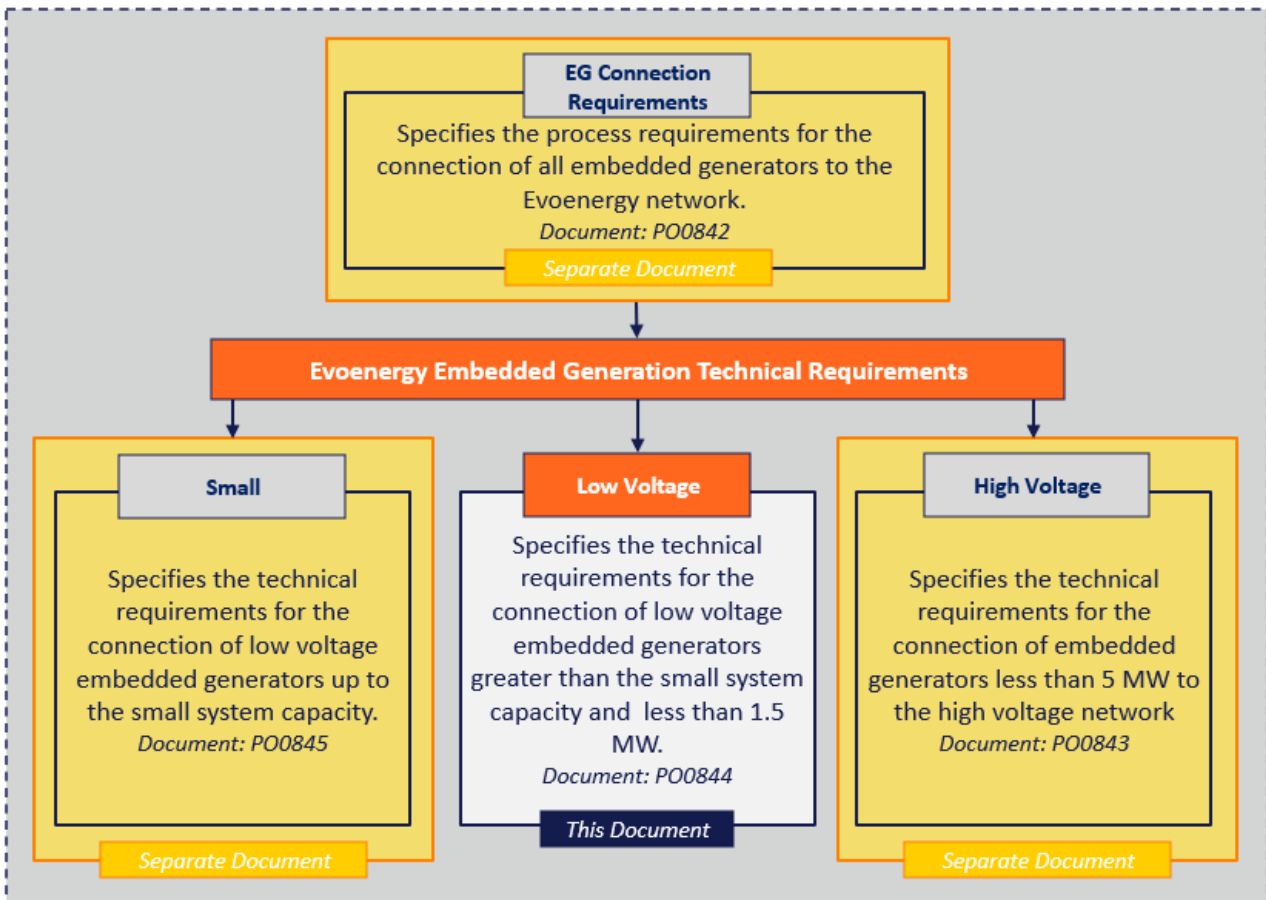
The Evoenergy network currently connects to more than 55,000 embedded generation systems, the majority of which are solar photovoltaic (PV) systems.

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 Low Voltage Embedded Generation 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 previous *Evoenergy Requirements for Connection of Embedded Generators up to 5MW to the Evoenergy Network* for the defined system capacities.

FIGURE 1. EVOENERGY EMBEDDED GENERATION DOCUMENT ARCHITECTURE



For the purposes of this document, a Low Voltage Embedded Generation Connection is defined as:

*an LV EG system with a total system capacity typically less than or equal to 1.5 MVA 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, or connected to, and capable of operating, in parallel with an LV section within the customer's installation.*
- b. meeting all other technical requirements set out in this document.*

OR

*an LV EG system with a total system capacity of greater than 0 kVA and less than or equal to 50 kVA for a single-phase or less than or equal to 1.5 MVA for a three-phase non-IES (synchronous or asynchronous) network connection that is:*

- a. intended to be connected to, and capable of operating, in parallel with any part of the LV distribution network, or connected to, and capable of operating, in parallel with an LV section within the customer's installation.*
- b. meeting all other technical requirements set out in this document.*

All Low Voltage Embedded Generation Connections 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), synchronous generators, asynchronous generators or any combination of these categories.

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

- Systems covered by the Evoenergy Micro EG Connection Technical Requirements
- Systems covered by the Evoenergy HV EG Connection Technical Requirements. If a HV customer wishes to connect an EG system to a LV section of their installation, please contact Evoenergy to confirm which technical requirements will apply.
- 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 LV 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 LV 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 these technical requirements as well as relevant national standards, industry codes, legislation and regulations. In the event of inconsistency legislation and regulations, followed by these 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 connection agreement
- Ensure the requirements are met with regard to the design, installation and operation of Low Voltage Embedded Generating systems
- Meet the connection and commissioning requirements to the LV distribution network

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 LV EG Connections developed by ENA, 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 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. See generation limit.
<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>Backup load</b>	Any load to be supplied by an embedded generating unit during customer islanded mode
<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>Connection point</b>	The junction where the Distribution System is connected (by means of a Connection Device) to the Customers Installation. (see Evoenergy service and installation rules)

<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 (DER)</b>	Power generation or storage units that are connected directly to the distribution network.
<b>DRED (Demand response enabling device)</b>	A device applying demand response signals to the inverter as documented in AS/NZS 4755.1
<b>Embedded generation system</b>	A system comprising of one or 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>Embedded Generation Point of common coupling</b>	The point where embedded generation is connected to the customer's electrical installation. The point of common coupling shall have no upstream loads apart from those related to the embedded generation, such as batteries or power supplies for embedded generation control systems.
<b>Embedded Network</b>	Where an Embedded Network Manager manages the electrical connection of multiple child meters located behind a parent/gate meter.
<b>Energy Source</b>	Voltage or current source requiring conversion from one kind of electrical power to another kind suitable for connection to the electrical installation. E.g. battery energy storage, fuel cell, hydro turbine, photovoltaic or wind turbine.
<b>Energy storage system (ESS)</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 total AC output nameplate rating of IES where batteries are the only energy source. Inverters with multiple energy sources (such as batteries and PV) will be counted towards the system capacity.
<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 generation units installed at the consumer's premises are capable of exporting to the network
<b>Export limit</b>	Where the electricity exported from an embedded generation system 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. While AS/NZS 4777.1 only considers IES, similar definitions of hard and soft limits will be applied to other types of embedded generation.
<b>Export Limit Control</b>	Function to limit the active power from an embedded generation system that can flow from an electrical installation towards the grid.

<b>Export limiting device</b>	<p>Additional hardware installed to perform export limit control.</p> <p>This typically involves an export meter to monitor the utility connection point.</p>
<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 source in a generating unit
<b>Generation limit</b>	<p>Where the active power that can flow from an embedded generating unit towards the rest of the electrical installation is limited to not exceed a specified value less than the nameplate rating of the embedded generating unit. AS/NZS 4777.1 defines two types of generation limitation control, 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 generation greater than the limit.</p> <p>While AS/NZS 4777.1 only considers IES, similar definitions of hard and soft limits will be applied to other types of embedded generation.</p>
<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, 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>	<p>For <b>IES</b> systems installed in ACT, a person who holds an unrestricted electrician's licence with Distributed Energy Resources (DER) endorsement.</p> <p>For <b>IES</b> systems installed in NSW; a person who holds an unrestricted electrician's licence and SAA accreditation.</p> <p>For <b>non-IES</b> systems; an engineering consultant body or licensed electrical contractor with relevant knowledge, expertise or experience.</p>
<b>Interface Protection</b>	<p>Interface Protection is the protection defined by AS/NZS 4777.1 (grid connection of energy systems via inverters). Combination of protection relay functions that opens the disconnection device of the inverter energy system (IES) and prevents its closure, whichever is appropriate, in the case of:</p> <ul style="list-style-type: none"> <li>(a) A fault on the grid;</li> <li>(b) An unintentional islanding situations; or</li> <li>(c) Voltage and frequency being outside the continuous operating range</li> </ul> <p>Interface Protection was previously referred to as Central Protection. Any references to Central Protection in other Evoenergy documentation is referring to Interface Protection.</p>
<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>Inverter Power Sharing Device (IPSD)</b>	A device used to share power from one IES between multiple electrical installations. E.g. Solshare.
<b>Islanding</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 a micro IES and a distribution network of the kind contemplated by Australian Standard AS 4777 (Grid connection of energy systems via inverters)
<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>Proponent</b>	A person proposing to become a generator (the relevant owner, operator or controller of the generating unit (or their agent))
<b>Rated apparent power</b>	Output apparent power of the generating unit, which is a product of the rated current and rated voltage.
<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>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>Supply, alternate</b>	A supply system intended to maintain the functioning of an electrical installation or a part or parts thereof, in case of interruption of the normal supply. For example, a multiple-mode inverter which typically operates in grid connected mode, but will swap to stand-alone mode during a network outage.
<b>Supply, grid</b>	Where an electrical installation is supplied with electricity from the electrical distribution network.
<b>Supply, independent</b>	Supply system intended to supply the functioning of an electrical installation or part thereof, as an islanded operation instead of the grid supply, whilst the grid supply remains connected to the electrical installation. For example, a stand-alone inverter with grid input.
<b>Supply, Supplementary</b>	A supply system intended to operate in conjunction with the normal supply. For example, an inverter operating in grid connect mode.
<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 connected to the generator’s electrical installation.
<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>

Volt (V)

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
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
IPSD	Inverter Power Sharing Device
LV	Low Voltage
MW	Megawatt
NEM	National Electricity Market
NER	National Electricity Rules
NMI	National Metering Identifier

<b>PV</b>	Photovoltaic
<b>ROCOF</b>	Rate of Change of Frequency
<b>SAA</b>	Solar Accreditation Australia
<b>SCADA</b>	Supervisory Control and Data Acquisition
<b>SCR</b>	Special Connection Request
<b>UTR</b>	Utilities Technical Regulation Team

## 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 identifying 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. Note all LV EG IES connections require a three phase site supply.

**TABLE 3.** SUBCATEGORY DEFINITIONS

<b>LV EG IES (IPSD)</b>	<b>Exporting</b>	Any LV IES EG system that uses an Inverter Power Sharing Device (IPSD), that is not a small EG system.
	<b>Non-Exporting</b>	These systems are further subcategorised as exporting or non-exporting
<b>LV EG IES (≤ 200kVA)</b>	<b>Exporting</b>	Any LV EG system, that is not a small EG system, and does not use an IPSD, with a total system capacity less than or equal to 200 kVA, meeting all relevant technical requirements for LV EG connections set out in the Evoenergy technical requirements document.
	<b>Non-Exporting</b>	These systems are further subcategorised as exporting or non-exporting
<b>LV EG IES (&gt; 200kVA)</b>	<b>Exporting</b>	Any LV EG system that does not use an IPSD, with a total system capacity greater than 200 kVA and typically less than or equal to 1.5 MVA, meeting all relevant technical requirements for LV EG connections set out in the Evoenergy technical requirements document. These systems are further subcategorised as exporting or non-exporting
	<b>Non-Exporting</b>	Any LV EG system that does not use an IPSD, with a total system capacity greater than 200 kVA and typically less than or equal to 1.5 MVA, meeting all relevant technical requirements for LV EG connections set out in the Evoenergy technical requirements document. These systems are further subcategorised as exporting or non-exporting
<b>LV EG Non- IES</b>	<b>Exporting</b>	LV EG non-IES connection – Any LV EG system, that is synchronous or asynchronous, with a total system capacity greater than 0 kVA and less than or equal to 50 kVA for a single phase network connection or 1.5 MVA for a three-phase network connection, meeting all relevant technical requirements for LV EG connections set out in the Evoenergy technical requirements document. These systems are further subcategorised as exporting or non-exporting
	<b>Non-Exporting</b>	

The maximum LV system capacity of 1.5 MVA is the indicative limit for proponents being required to implement a HV connection. Proponents applying to connect near or above this capacity should contact Evoenergy to determine if an LV connection is appropriate.

Exporting systems shall be considered as LV EG systems operating in parallel with the distribution network and capable of exporting electricity via partial or full export into the network, where:

- Partial-export LV EG systems limit the amount of export into the LV distribution network to an agreed export limit defined in the connection agreement. This may be either:
  - Static limit: a fixed limit that applies at all times
  - Dynamic limit: a limit that changes, such as lower export being permitted between certain hours, or days of the week.
- Full-export LV EG systems can export into the LV distribution network to the full nameplate capacity (full AC rating) as defined in the connection agreement

Non-exporting systems shall be considered as LV EG systems operating in parallel with the LV distribution network that are export limited to ensure they cannot export electricity into the LV distribution network as defined in the connection agreement.

Evoenergy can be contacted via the contact details on the Evoenergy [website](#) for any clarification regarding the definitions and application of subcategories.

### 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 LV 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)
<b>Evoenergy embedded generation connection requirements</b>	Sets out the requirements of the connection application process for embedded generation.

#### 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 including 0.6/1 kV – Typical Australian installation conditions	Australian/ New Zealand Joint Standard
AS/NZS 4755.1	Demand response capabilities and supporting technologies for electrical products –Part 1: Demand response framework and requirements for demand response enabling devices (DREDs)	Australian/ New Zealand Joint Standard
AS/NZS 4777	Grid connection of energy systems via inverters (multiple parts)	Australian/ New Zealand Joint Standard
AS/NZS 5033	Installation and safety requirements for photovoltaic (PV) arrays	Australian/ New Zealand Joint Standard
AS/NZS 61000.4.3	Electromagnetic compatibility testing and measurement techniques – Power quality measurement methods	Australian/ New Zealand Joint Standard
AS/NZS IEC 60947.6-1	Low-voltage switchgear and control gear - Multiple function equipment - Automatic transfer switching equipment	Australian/ New Zealand Joint Standard
IEC 60255-12	Electrical relays - Part 12: Directional relays and power relays with two input energizing quantities	International Standard
IEC 60255-127	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

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 LV EG connections to the Evoenergy distribution network.

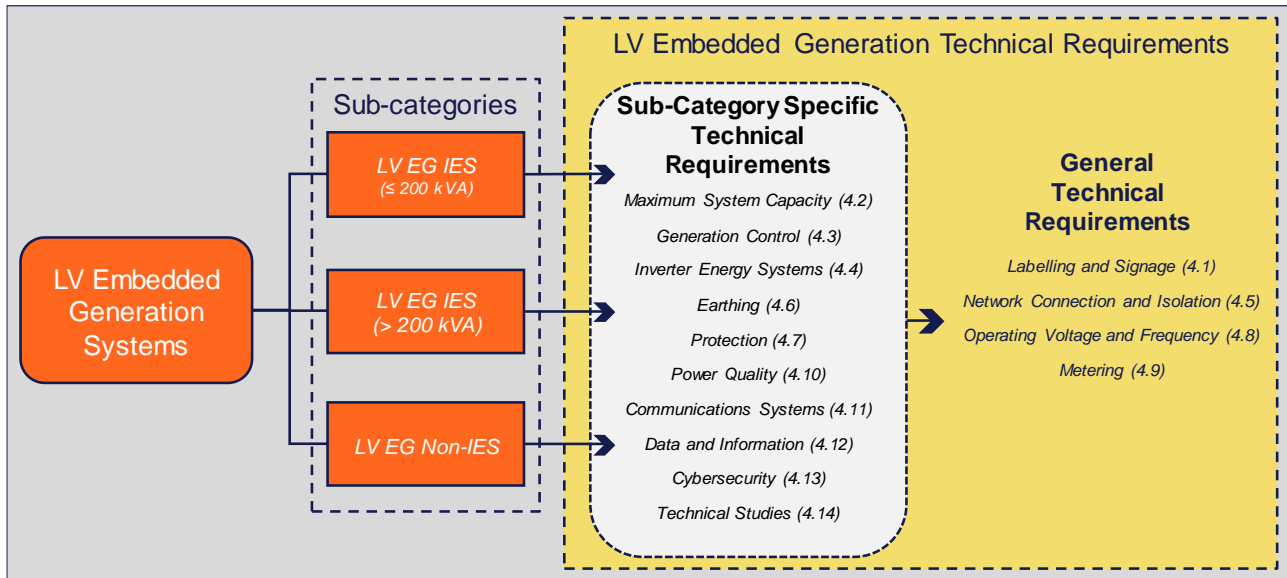
- Electrical Safety Act 1971
- Electrical Safety Regulation 2004
- Utilities Act 2000
- Utility Networks (Public Safety) Regulations 2001
- Utilities (Technical Regulation) Act 2014
- Electricity Feed-in (Renewable Energy Premium) Act 2008
- Electricity Feed-in Code 2020
- Electricity Service and Installation 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 5A)

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 LV Embedded Generation Connections. The technical requirements specified in this section should be interpreted as applying to all subcategories of LV 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. If the external isolation switch is not located adjacent the MSB or metering location, signage shall be placed at the metering and/or MSB location indicating the location of EG remote isolation switch.

If there are multiple external isolation switches, they shall be labelled with the total number of switches and locations of the other external isolation switches.

If inverter serial numbers are not visible without exposing of live parts, a label indicating the serial number will be attached to the outside of the inverter where it can be easily read.

### 4.2 Maximum System Capacity

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

TABLE 6. MAXIMUM SYSTEM CAPACITY FOR EACH SUBCATEGORY

SUBCATEGORY	MAXIMUM SYSTEM CAPACITY (INCLUDING ESS)
LV EG IES (IPSD)	For LV EG IES (including ESS) using IPSD, the maximum system capacity across all connection points shall be determined at the time of application but shall typically be less than or equal to 1.5 MVA



<b>LV EG IES (≤ 200kVA)</b>	For LV EG connections of IES (including ESS) not using an IPSD, the maximum system capacity at the same connection point shall be set to less than or equal to 200 kVA
<b>LV EG IES (&gt; 200kVA)</b>	For LV EG connections of IES (including ESS) not using an IPSD, the maximum system capacity at the same connection point shall be determined at the time of application but shall be greater than 200 kVA and typically less than or equal to 1.5 MVA
<b>LV EG Non-IES</b>	For LV EG connections of non-IES, the maximum system capacity shall be determined at the time of application but shall typically be less than or equal to 50 kVA for single phase or less than or equal to 1.5 MVA for three phase

The difference between the aggregate single phase inverter(s) capacity (including ESS) on each phase shall not differ by more than 10% for IES. The difference between the aggregate single phase PV inverter(s) capacity on each phase shall not differ by more than 5% for IES.

## 4.3 Generation Control

### 4.3.1 Export Limits at Connection Point

Export limitation may be required for LV EG connections, this will be determined by Evoenergy upon performing an internal review. The factors that will be considered in determining an export limit include, but are not limited to;

- Existing Asset Ratings
- Power Quality at the relevant network location
- Existing and forecast DER penetration at the relevant network location
- Existing demand at peak generation

Export limits may be static, one set export limit that applies at all times, or dynamic. Dynamic export limits may have different export schedules based on the time of day, daily changes, or seasonal changes. For example; in industrial areas with low loads during weekends and public holidays, we may allow no or minimal export at those times. In residential areas with high penetration of residential solar, we may allow no or minimal export during the middle of the day. For complex sites, an hourly or seasonal schedule may be provided. Please note an export limit exceeding 200kVA will not be agreed without communication requirements as per section 4.11.2.

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. For static export limits, the export limiting functionality shall be of the “soft” and “hard” limitation type as defined in AS/NZS 4777.1. For dynamic export limits, the hard limit is only required if the total inverter rating exceeds the maximum allowed export of the system.

Where an existing PV system is being added to, the site export limit will be reassessed based on the new proposal and current network condition. The new export limit may be lower than the previously agreed limit.

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 is dependent upon network characteristics which change over time. Several factors can result in the need for the limit to be constrained, for example, the operation of power quality response modes.

### 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.

Proponents may use a generation limit as per section 3.4.8 of AS/NZS AS4777.2 in order to meet the limits for communication requirements as per section 4.11.2.. If doing so, both a “soft” and “hard” limit shall be set.

Generation limits will not change the subcategory definition, as this is determined by the nameplate rating. For example, interface protection will be required for a 220kVA IES with a generation limit of 200kVA.

Evoenergy does allow soft generation limits to be used for replacement systems to be considered like-for-like, such as with the replacements of fixed feed in tariff systems, or when a specific inverter size is not currently available. For example, if the existing system has a 100kVA inverter, a 110kVA inverter could be used as a replacement as long as it is programmed with an 100kVA generation limit. However, if this causes a change in the system subcategory, then it will need to meet the requirements of the new subcategory. For example, if a 200kVA inverter is replaced with 220kVA inverter(s) programmed with a generation limit of 200kVA, interface protection will be required as per the requirements of a 220kVA system.

## 4.4 Inverter Energy System

For inverter energy systems, 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 or multiple mode 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 power quality response modes enabled.

## 4.5 Network Connection and Isolation

There shall be a visible method of ensuring the LV 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, unless an access gate is provided and secured by an Evoenergy padlock to grant access, and the access path is documented on the site plan. The location shall always be kept clear. If access is obstructed, the embedded generator shall remove the obstruction or relocate the method of isolation. The isolation switch may be stand alone or part of a distribution board, and shall not disconnect any loads not associated with the generation plant. Tripping of interface protection is an acceptable form of isolation. The isolation point shall be clearly identified with permanent labelling, and location documented on the site plan.

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.

Any additional requirements for network connection and isolation for Non-IES connections will be determined by Evoenergy and communicated to the proponent in the connection application stage.

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 Embedded Networks

Embedded networks are where an Embedded Network Manager is engaged to manage the network connection of multiple child meters. In this instance the network connection point is considered to be the parent connection point, regardless of whether the child meter has gone on market to engage a separate retailer. The Embedded Network Manager is responsible for ensuring all embedded generation physically connected to their network meets relevant Evoenergy technical requirements.

Generally technical requirements for embedded generation connected to an embedded network will be based on total aggregate system size, however in cases where a small IES is connected behind a child meter, and that IES meets all the requirements outlined in PO0845 – Evoenergy Small Embedded

Generation Technical Requirements, Evoenergy may choose to apply PO0845 – Evoenergy Small Embedded Generation Technical Requirements rather than PO0844 – Evoenergy LV Embedded Generation Technical Requirements. This will be determined once the SCR has been submitted and will be listed in the connection proposal or approval letter.

The Embedded Network Manager shall be responsible for ensuring the site maintains phase balance, and shall coordinate the installations of single phase systems to be evenly distributed among the three phases. Phase connection information shall be provided to Evoenergy during the commissioning phase.

## 4.6 Earthing

The LV EG system earthing shall be in compliance with the Evoenergy Service and Installation Rules in addition to the requirements specified in Table 7.

**TABLE 7.** EARTHING REQUIREMENTS

SUBCATEGORY	EARTHING REQUIREMENTS
LV EG IES (IPSD)	Earthing requirements shall be as per AS/NZS 3000 and AS/NZS 4777.1
<b>LV EG IES (≤ 200kVA)</b>	Earthing requirements shall be as per AS/NZS 3000 and AS/NZS 4777.1
<b>LV EG IES (&gt; 200kVA)</b>	Earthing requirements shall be as per AS/NZS 3000 and AS/NZS 4777.1
<b>LV EG Non-IES</b>	Earthing requirements shall be as per AS/NZS 3000 and AS/NZS 3010

All systems with ESS shall adhere to the earthing requirements specified in AS 3011.

## 4.7 Protection

This section specifies the protection requirements for the subcategories of LV embedded generators connected to the Evoenergy network. Protection systems for LV embedded generators shall be designed in accordance with the relevant Acts, Regulations and Evoenergy requirements.

### 4.7.1 Inverter Integrated Protection

For LV EG IES systems, inverter integrated protection shall be as per AS/NZS 4777.1 and AS/NZS 4777.2.

In the case of additions to the system, or replacement of any inverter, all new, replacement and existing inverters must be programmed as close as possible to the inverter integrated protection settings listed below, and have power quality response modes programmed as close as possible to those listed in section 4.10.2. This may require firmware updates, or other reprogramming of existing inverters. The proponent must advise Evoenergy if the required settings are unable to be configured.

At any time, inverter integrated protection settings may be changed to our currently listed requirements. It is the responsibility of installers to ensure If one setting is changed, all settings for all inverters connected at the same NMI are brought as close as possible to the current settings listed below, including power quality response modes. Evoenergy shall be notified of any changes to inverter integrated protection settings or power quality response modes so records can be updated including those in the AEMO DER register.

Where LV embedded generating units can be remotely accessed by the manufacturer to adjust the inverter settings, we may direct the manufacturer to remotely adjust inverter settings to comply with these technical requirements. Inverter integrated protection shall be as per AS/NZS 4777.1 and AS/NZS 4777.2 for LV embedded generators. Passive anti-islanding protection set points are defined in Table 8.

## Anti-Islanding Protection

The passive anti-islanding protection set points and limits for sustained operation are defined in Table 8.

**TABLE 8.** PASSIVE ANTI-ISLANDING INVERTER PROTECTION SET-POINT VALUES (AS PER AS/NZS 4777.2 SECTION 4.4 AUSTRALIA A)

PROTECTIVE FUNCTION	PROTECTIVE FUNCTION LIMIT	TRIP DELAY TIME	MAXIMUM DISCONNECTION TIME
Undervoltage (V<<)	70 V	1 s	2 s
Undervoltage (V<)	180	10s	11s
Overvoltage (V>)	265 V	1 s	2 s
Overvoltage (V>>)	275 V	-	0.2 s
Under-frequency (F<)	47 Hz	1 s	2 s
Over-frequency (F>)	52 Hz	-	0.2 s

Active anti-islanding protection shall be implemented as per section 4.3 of AS/NZS 4777.2 and shall operate the automatic disconnection device within two (2) seconds of disruption to the power supply from the grid.

### Sustained Operation Limits

Limits for sustained operation shall be enabled as per section 4.5 of AS/NZS 4777.2 using Australia A set points.

### Interlocking

IES systems with single phase inverters installed in a three phase arrangement shall be interlocked and configured to behave as an integrated multiphase inverter providing balanced output to all connected phases. This should be set to grade with interface protection phase balance requirements as outlined in section 4.7.2.2.

Three phase inverters shall have integrated phase balance protection as per AS/NZS 4777.2.

### 4.7.2 Interface Protection

For new installations, Interface protection is required for all non-IES LV embedded generation systems and IES embedded generation systems using IPSD or that are greater than 200kVA.

For existing systems commissioned to earlier versions of Evoenergy embedded generation technical requirements, Interface protection is required for any IES greater than 30kVA that contains inverters not compliant to AS/NZS 4777.2:2020 or later.

Interface protection shall be implemented in the form of a protection relay that complies with the relevant Australian and International Standards.

Interface protection settings shall be secured against inadvertent or unauthorised tampering. Changes to settings shall require the use of a tool and special instructions not provided to unauthorised personnel. (Special interface devices and passwords are regarded as tools). After commissioning of the interface protection is complete, settings shall not be altered without approval from Evoenergy. Any change to interface protection settings will require secondary injection testing to be repeated and witnessed by Evoenergy at the customer's expense.

Where interface protection is existing, the proponent shall provide a list of currently programmed settings and may be asked to provide a copy of the latest injection test report if Evoenergy does not have this on

record. Where any addition (Increase to total AC rating) is being made, interface protection shall be brought up to our current requirements.

At any time, a proponent may choose to update the interface protection settings to be in line with our current requirements. If this involves the addition of a new protection element, or editing of existing protection elements, the entire interface protection must be retested and witnessed by Evoenergy (fees may apply). If one setting is updated to our current requirements, all settings shall be updated.

The application of interface protection parameters for systems in each sub category is specified in Table 9. The detailed protection parameters as are specified in the following subsections.

**TABLE 9.** INTERFACE PROTECTION REQUIREMENTS BY SUBCATEGORY

PROTECTIVE FUNCTION	LV EG IES					LV EG Non-IES		
	IPSD	≤ 200 KVA		> 200 KVA				
	Export	Non-Export	AS/NZS 4777.2 :2020	Non-AS/NZS 4777.2 :2020	Export	Non-Export	Export	Non-Export
Grid reverse power (32R)	*	✓	✗	✗	*	✓	*	✓
Generator circuit Phase balance protection (46/47)	*	*	✗	*	*	*	✓	✓
Overcurrent facility fault, grid fault and earth fault protection (50/51)	*	*	✗	✗	✓	✓	✓	✓
Passive anti-islanding protection (27, 59, 81U/O, 81R)	✓	✓	✗	✓	✓	✓	✓	✓
Vector Shift (78)	*	*	✗	✗	*	*	*	*
Inter-tripping	*	*	✗	✗	*	*	*	*
Power Factor Control (55)	*	*	✗	*	*	*	*	*

The symbols used to denote the above requirements have the following meanings:

- ✓ Shall be required
- \* May be required
- ✗ Shall not be required

### Grid Reverse Power Protection

Grid reverse power protection shall be implemented on all non-exporting and partial export systems with a static export limit that are not in the LV EG IES  $\leq 200\text{kVA}$  subcategory. Where a dynamic limit allows the IES to be fully exporting at some times, a reverse power element will not be required. When the maximum export limit as part of a dynamic export limit is less than the total inverter rating, a reverse power element will be required and set to this maximum export value. This protection shall be measured at the connection point. The parameters for reverse power are specified in Table 10.

**TABLE 10.** GRID REVERSE POWER PROTECTION REQUIREMENTS

SYSTEM SUBCATEGORY	PROTECTION ELEMENT	SETTING LIMIT	DISCONNECTION TIME
Non-Exporting	Grid Reverse Power (32R)	5% of EG Rating	2 seconds
Partial Export	Grid Reverse Power (32R)	Export Limit Value + 5%	2 seconds

For non-exporting systems grid reverse power flow shall be set as low as practicable with the consideration of the protection relay, CT accuracy and generating system characteristics. The design of control systems shall minimise reverse power flow immediately following synchronisation.

For partial export systems, the design of control systems shall minimise export values above the agreed export limit.

### Phase Balance Protection

LV EG connections with single phase generating units shall have phase balance protection that consists of both current and voltage unbalance elements as outlined in the following subsections. Phase balance protection shall operate for unbalance caused by LV embedded generating units. Typically phase balance protection shall be measured at the embedded generation point of common coupling.

IES systems made up of Three-phase IES generating units compliant to AS/NZS 4777.2 with inverter-integrated phase balance protection are exempt from this requirement. Three phase non-IES systems are exempt from this requirement. Systems in the LV EG IES  $\leq 200\text{kVA}$  subcategory are exempt from this requirement.

IES systems made up of single phase IES generating units shall meet the interlocking requirements outlined in section 4.7.1.3 and also meet the requirements of this section.

### Current Unbalance Protection

Current unbalance requirements, if required, shall be implemented in interface protection as specified in Table 11.

**TABLE 11.** CURRENT UNBALANCE PROTECTION REQUIREMENTS

SYSTEM CAPACITY	PROTECTION ELEMENT	SETTING THRESHOLD	ELEMENT DELAY
$\leq 200\text{kVA}$	Current Unbalance (46)	21.7A	5 seconds
$> 200\text{kVA}$	Current Unbalance (46)	5% of Full Load Current	15 seconds

Current unbalance protection does not apply to single phase connected non-IES. However, Evoenergy may determine from a connection specific technical study that a three-phase embedded generator shall be utilised.

### Voltage Unbalance Protection

Voltage unbalance requirements shall be implemented in interface protection as specified in Table 12.

**TABLE 12.** VOLTAGE UNBALANCE PROTECTION REQUIREMENTS

PROTECTION ELEMENT	NEGATIVE SEQUENCE LIMIT	ELEMENT DELAY
Voltage Unbalance (47)	10% of Nominal Voltage	5 seconds

### Overcurrent Facility Fault, Overcurrent Grid Fault and Earth Fault Protection

Overcurrent and earth fault protection is not required as part of central protection for LV IES with a system capacity  $\leq 200\text{KV}$ .

For Non-IES and IES with a system capacity  $> 200\text{kVA}$  bi-directional overcurrent and earth fault protection shall be enabled in interface protection. This protection shall be measured at the embedded generation point of common coupling. This protection shall be set to detect faults within the proponent's installation and the Evoenergy network, these settings shall be determined by the proponent during the system design phase and shall grade with existing protection systems. These settings shall be provided to Evoenergy as part of the SCR application for approval.

### Passive Anti-islanding Protection

Passive anti-islanding protection shall be implemented for all LV IES systems as per Table 13.

**TABLE 13.** CENTRAL VOLTAGE AND FREQUENCY PROTECTION SET POINTS FOR IES SYSTEMS

SETTING PARAMETER	MAXIMUM DISCONNECTION TIME	TRIP DELAY TIME	SETTING LIMIT
Stage 1 Over voltage (V $>$ ) (59)	3 seconds	2.5 seconds	267 V
Stage 1 Under voltage (V $<$ ) (27)	12 seconds	11.5 seconds	179 V
Stage 2 Under voltage (V $<<$ ) (27)	3 seconds	2.5 seconds	69 V
Over frequency (F $>$ ) (81O)	1.5 seconds	1 second	52 Hz
Under frequency (F $<$ ) (81U)	3 seconds	2.5 seconds	47 Hz
Rate of Change of Frequency (ROCOF) (81R)	1 second	0.5 seconds	4.0 Hz / 1 second
Vector Shift* (78)	instantaneous		10 deg

\*Vector shift is only required for non-IES systems. Vector shift may be required for IES with a system capacity  $>200\text{kVA}$  but shall not be set lower than 20 deg for IES.

Passive anti-islanding protection shall be implemented for all Non-IES systems, the settings shall be determined by the proponent on a case-by-case basis and provided to Evoenergy for approval.

### **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 (backup loads), which have also been electrically disconnected from the distribution network
- The disconnection point and backup loads must be clearly identified on the SLD

### **Inter-tripping**

Inter-tripping refers to an inter-trip set up between Evoenergy asset(s) and the customer's interface protection.

The requirement for implementing inter-trip protection for EG systems will be determined on a case-by-case basis through a network technical study. The indicative threshold where Evoenergy will consider mandating an inter-trip scheme is 200 kVA, if a proponent is installing a system at or near this threshold it is recommended that they contact Evoenergy via the details on the Evoenergy [website](#).

In the event an inter-tripping scheme is required, Evoenergy will work with the proponent to establish the following:

- Design parameters for the communication interface
- The responsibilities and for implementation and monitoring of the communication link
- The philosophy of the inter-trip scheme including the process when the communication link fails or supply to the protection scheme is lost

Evoenergy may grant written approval for the proponent to install Neutral Voltage Displacement (NVD) protection utilising a voltage transformer on Evoenergy's HV distribution network. LV EG connections with NVD protection will not be required to install inter-trip protection.

For non-exporting LV EG connections, inter-tripping may not be required provided grid reverse power protection is installed.

More information regarding the requirements and fees associated with the configuration of inter-trip and NVD protection can be obtained by contacting Evoenergy via the details provided on the Evoenergy [website](#).

### **Power Factor Protection**

Power factor protection may be required as part of interface protection for non-IES systems and IES with a system capacity >200kVA. Refer to section 4.7.3 for more details.

#### **4.7.3 Power Factor Control**

LV EG connections shall maintain the power factor at the embedded generation point of common coupling such that the site maintains the limits specified by the Evoenergy Service and Installation rules.

All LV EG IES shall either have power factor control enabled as per section 4.10.2, or the proponent will propose alternative power factor and reactive power control settings including details of how these will be implemented to Evoenergy for review as part of the network technical study.

For LV EG non-IES the proponent will propose power factor and reactive power control settings including details of how these will be implemented to Evoenergy for review as part of the network technical study.

Power factor or reactive power protection may also be required in interface protection and this will be determined by Evoenergy in the network technical study. Where this is implemented in interface protection, it must be co-ordinated with LV EG power factor control and power quality response modes.



#### **4.7.4 Synchronisation**

Automatic synchronising and synchronisation check closing protection shall be installed at all locations where it is intended that parallel operation of a generating unit will occur, to prevent non-synchronised connection to the distribution network.

Connection of the generating unit in parallel with the distribution network shall be prevented unless all phases of the distribution network at the network connection point are energised.

#### **4.7.5 Additional Requirements for LV EG Non-IES**

There are no additional protection requirements for LV EG Non-IES connections to those specified above.

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

The system shall be designed and installed to limit voltage rise to 2% from the connection point to the LV EG 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 system in accordance with AS/NZS 4777.1 Appendix C3.

The operating voltage and frequency shall be within the limits specified in Section 4.7.

### **4.9 Metering**

LV EG connections shall not be energised without the correct metering arrangement in place. The proponent shall contact the retailer to ensure metering requirements for grid connected IES installations are fulfilled prior to energising the system.

### **4.10 Power Quality**

#### **4.10.1 Quality of Supply & 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 Flicker
- Harmonics
- Voltage Balance

The LV 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.

Where the total inverter rating exceeds 200kVA, Evoenergy may require a permanent power quality meter to be installed at the local distribution substation. In the event this is required, this will be customer funded. This requirement will be advised as part of the connection enquiry response.

#### **4.10.2 LV EG IES Power Quality Response Modes**

All LV IES embedded generating units shall comply with section 3.3 of AS/NZS 4777.2 Inverter power quality response modes.

All LV EG IES generating units shall have volt-watt power quality response enabled as per AS/NZS 4777.2 Clause 3.3.2.2 with the Australia A settings detailed in Table 14.

**TABLE 14. VOLT-WATT RESPONSE**

AS/NZS 4777.2 REFERENCE	VOLTAGE	GENERATION POWER LEVEL (% RATED POWER)
V1	253 V	100%
V2	260 V	20%

In addition, LV EG IES generating units with energy storage shall have volt-watt power quality response enabled as per AS/NZS 4.777.2 Clause 3.4.3 with the Australia A settings detailed in Table 15

**TABLE 15. VOLT-WATT RESPONSE FOR ESS**

AS/NZS 4777.2 REFERENCE	VOLTAGE	CHARGING POWER LEVEL (% RATED POWER)
V1 <sub>ch</sub>	207 V	20%
V2 <sub>ch</sub>	215 V	100%

In addition, LV EG IES generating units shall have volt-var power quality response enabled as per AS/NZS 4777.2 Clause 3.3.2.3 with the Australia A settings detailed in Table 16.

**TABLE 16. VOLT-VAR RESPONSE**

AS/NZS 4777.2 REFERENCE	VOLTAGE	VAR LEVEL (% OF RATED VA)
V1	207 V	44% Leading/Supplying
V2	220 V	0%
V3	240 V	0%
V4	258 V	60% Lagging/Absorbing

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.

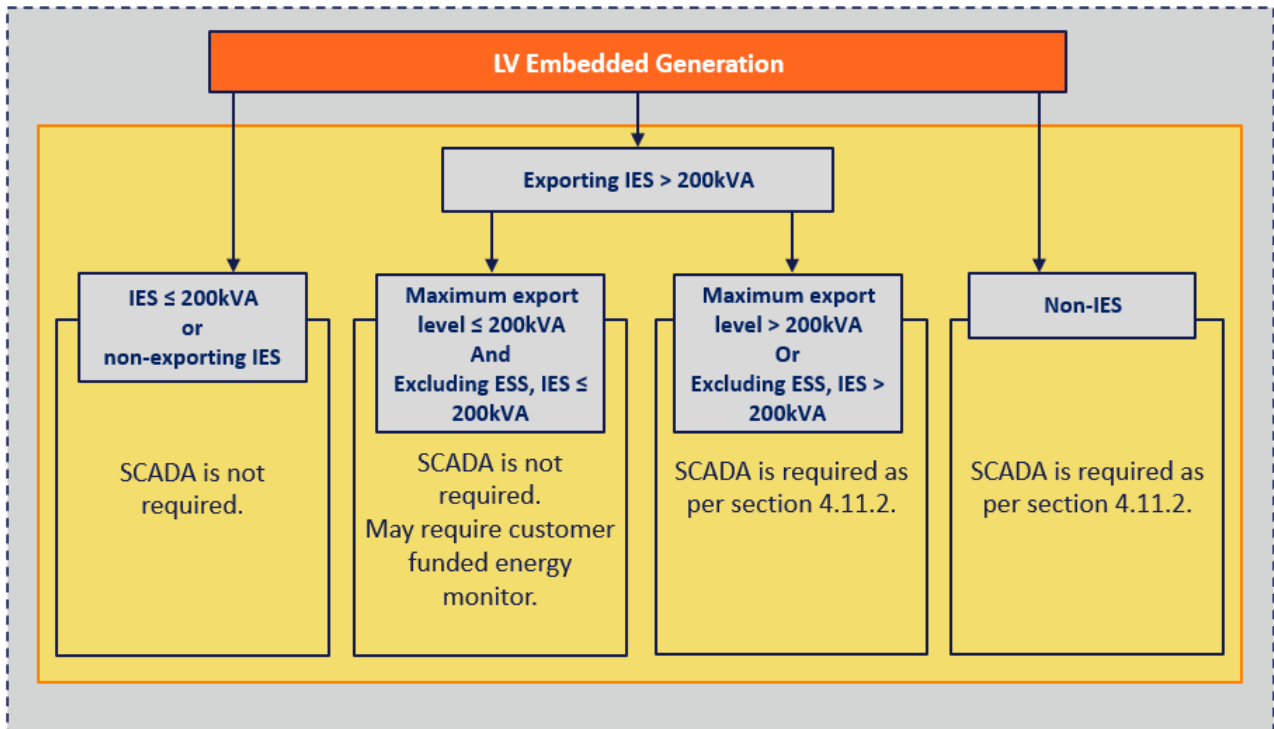
Proponents shall ensure that power quality settings are uniform across systems with multiple inverters. The replacement of inverters, including warranty replacements, shall be configured to have power quality response modes enabled. IES power quality response modes and settings shall not be altered without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

### 4.10.3 LV EG Non-IES Power Quality Response

LV EG Non-IES connections shall be designed and operated to adequately control real and reactive power output through either Voltage control mode or fixed power mode.

The power quality response mode and associated settings for LV EG Non-IES connection shall be proposed by the proponent and reviewed by Evoenergy as part of the network technical study.

## 4.11 Communication Systems



### 4.11.1 LV EG IES less than or equal to 200 kVA Communications Systems

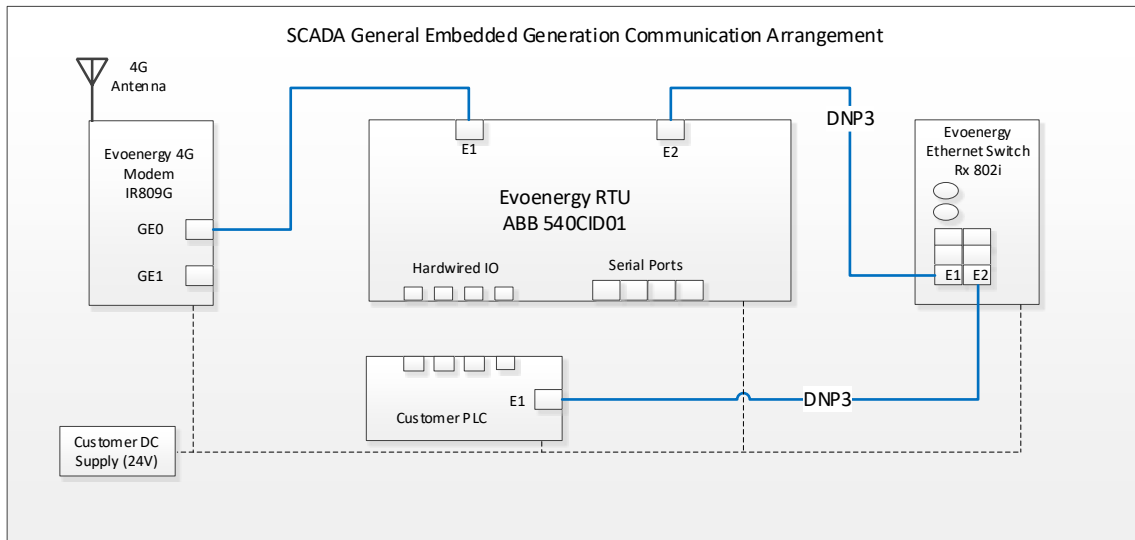
Evoenergy do not currently mandate communication requirements for LV EG IES less than or equal to 200kVA. However, Evoenergy do engage in demand management programs that are implemented through third party aggregators. More information regarding these programs can be found on the Evoenergy [website](#).

### 4.11.2 LV EG IES greater than 200 kVA (excluding ESS) Communications Systems

Exporting LV EG IES connections where total inverter rating excluding ESS is greater than 200 kVA shall adhere to the following communication requirements. Evoenergy do not mandate communication requirements for non-exporting LV EG IES systems.

#### SCADA Architecture Requirements

Evoenergy's general SCADA architecture and interface for embedded generation systems is given below:



This arrangement may vary on a project-specific basis as determined by Evoenergy upon receipt of the application for connection. Direct fibre optic connection into Evoenergy’s SCADA network may be required in the place of the 4G modem for some installations (mandatory where inter-tripping schemes are required). Where the proponent’s installation includes both a PLC and other devices, the PLC only shall be used to interface directly with Evoenergy’s RTU. Any IO required from the protection relay or any other devices (e.g. metering equipment) shall be provided to Evoenergy through the PLC.

The proponent’s installation shall contain provision for the installation and DC supply of Evoenergy communication equipment including, but not limited to; a remote terminal unit (RTU), a switch, a modem and an external 4G antenna. Evoenergy will procure these assets and issue these to the proponent for installation within their system. The DC system is required to support a combined power consumption of 40W for these assets as minimum.

Fibre optic cable is the preferred method for all communications between Evoenergy’s RTU and the proponent’s PLC. Copper Ethernet cabling may be accepted for short connections not greater than 10m within the same or an adjacent enclosure.

All Evoenergy owned communication equipment located within the EG system shall be protected from vermin and weather and must not exceed normal operating temperature range. Evoenergy shall have unrestricted access to the equipment at all times.

**SCADA Protocol Requirements**

DNP3 or Modbus over TCP/IP are the required protocols for all communications between Evoenergy’s RTU and the proponent’s PLC. The requirements for each of these protocols is provided below. Note: digital inputs and outputs may also be accepted as hard-wired voltage-free contacts on a project specific basis.

**DNP3 Requirements**

For DNP3 interfaces the following groups and variations will be used:

- Digital Output Controls: Group 12 Variation 1 (Direct Operate).
- Digital Inputs: Group 1 Variation 2, Object 2 Variation 2.
- Analog Inputs: Object 30 Variation 2, Object 32 Variation 2.

The generator system is also required to support polling by classes and DNP3 time synchronisation. Evoenergy’s RTU will poll the proponent’s PLC for data once every 2 seconds.

**Modbus Requirements**

For Modbus interfaces the following tables will be used:

- Digital Output Controls: Coils.
- Digital Inputs: Discrete Inputs.
- Analog Inputs: Input Registers, 16-bit signed values

Evoenergy's RTU will poll the proponent's PLC for data once every 2 seconds.

**SCADA IO Requirements**

The following SCADA IO are required (Inputs/Outputs are from the perspective of Evoenergy's RTU).

**Digital Outputs**

I/O	DESCRIPTION
<b>Generator CB Trip</b>	<p>This output allows Evoenergy to trip the proponent's generator CB and disconnect the generation from Evoenergy's network during emergency situations.</p> <p>Only trip is required (close not required).</p>
<b>Generator CB Close Enable/Disable</b>	<p>This signal provides Evoenergy with the ability to prevent the generation from connecting to Evoenergy's network during fault or emergency conditions.</p> <p>If the 'Generator CB Close Disable' is sent, the proponent is not permitted to close the generator CB and connect their generation to Evoenergy's network. The proponent needs to implement appropriate logic and interlocking within their system to ensure that the generator CB cannot be closed when the "Generator CB Close Disable" has been sent.</p> <p>To connect the generation to Evoenergy's Network, the proponent must contact Evoenergy's control room to request permission. The 'Generator CB Close Enable' signal will be sent once Evoenergy is satisfied that it is safe for the generation to be connected.</p> <p>Logic will be implemented within Evoenergy's RTU to automatically send the 'Generator CB Close Disable' signal to the proponent's PLC under the following conditions:</p> <ul style="list-style-type: none"> <li>• 'Generator CB Trip' Control is sent by the Evoenergy RTU.</li> <li>• A 'Protection Operated' signal is received from the PLC by Evoenergy's RTU.</li> </ul> <p>Note: If the CB is currently closed and the 'Generator CB Close Disable' control is sent by Evoenergy's RTU, this does not require the CB to trip. The generator may remain connected and continue to generate on receipt of this signal.</p>
<b>Communications Heartbeat</b>	<p>The proponent is responsible for monitoring the integrity of the communications link between Evoenergy's RTU and the proponent's PLC. Evoenergy will provide a 'Communications Heartbeat' signal for this purpose. This signal will provide regular pulses at one-minute intervals with 5 consecutive missed pulses over a 5-minute period indicating a loss of communications. The required action for the generation system following a loss of communications will be one of the following (dependent on the particular installation):</p> <ul style="list-style-type: none"> <li>• Allow the generation to continue operating (if currently running) but prevent the generation from re-connecting if not already connected.</li> <li>• Limit the generation export to a predefined set value.</li> <li>• Initiate an automatic controlled shut down of the generating system.</li> </ul>

Additional Digital Outputs may be required on a project specific basis.

**Digital Inputs**

I/O	DESCRIPTION
<b>Protection Operated</b>	This signal indicates whether the proponent’s generation protection relay has operated and tripped the generator circuit breaker.
<b>CB Close Enabled</b>	This signal indicates whether proponent close control is currently inhibited. This is a back indication from Evoenergy’s ‘Generator CB Close Enable/Disable Close’ Control.
<b>CB Closed</b>	Generator circuit breaker closed status indication.  Where additional circuit breakers exist between the generation source and the connection point to Evoenergy’s network the ‘CB closed’ status will also be required for these additional circuit breakers.
<b>DC Supply Fail</b>	Fail indication for the proponent’s DC system.
<b>PLC Fail</b>	Fail indication from proponent’s PLC or protection relay.

Additional Digital Inputs may be required on a project specific basis.

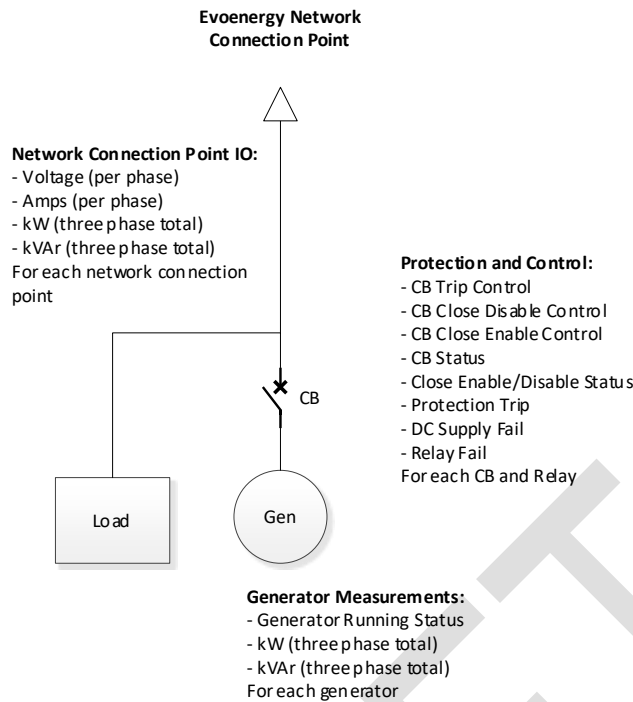
**Analog Inputs**

I/O	DESCRIPTION
<b>Per Phase Current</b>	Measured at the Evoenergy network connection point.
<b>Per Phase Voltage</b>	Measured at the Evoenergy network connection point.
<b>Three Phase Active Power</b>	Measured at both the Evoenergy network connection point and the generation source.
<b>Three Phase Reactive Power</b>	Measured at both the Evoenergy network connection point and the generation source.
<b>Three Phase Power Factor</b>	Measured at both the Evoenergy network connection point and the generation source.

Additional Analog Inputs may be required on a project specific basis

**SCADA Single Line Diagram**

The following simplified single line diagram summarises Evoenergy’ embedded generation SCADA IO requirements.



## SCADA Design Requirements

The following details are required as part of the proponent's SCADA design submission:

- Overall communications architecture including details of the physical and protocol level interfaces to Evoenergy's SCADA equipment.
- Generator control system panel/cubicle layout including proposed location for Evoenergy's SCADA equipment.
- Generator system single line diagram and proposed connection point to Evoenergy's network.
- Details on the proposed PLC used to interface with Evoenergy's SCADA equipment.
- SCADA IO schedule with nominated addresses for each IO point (Evoenergy will nominate Server/Client Protocol and IP addresses for the Evoenergy's RTU and the proponent's PLC).

## Inter-tripping Interface

Where an inter-tripping interface is required, Evoenergy will provide the required inter-tripping signals using SEL mirrored bits over fibre optic cable. These signals will be determined on a project specific basis.

### 4.11.3 LV EG Non-IES Communication Systems

Exporting LV EG Non-IES connections shall adhere to the same requirements for IES systems stated above in section 4.11.2.

Non-exporting LV EG Non-IES connections may have some or all of the requirements as stated above in section 4.11.2. This will be determined on a case by case basis.

## 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*.

### 4.12.2 Dynamic Data and Information

Dynamic Data requirements are specified in 4.11 above.

### 4.13 Cyber Security

All systems with communications requirements as outlined in Section 4.11 shall adhere to the following cyber security requirements:

- All monitoring and communications devices shall be in lockable enclosures accessible to Evoenergy and designated personnel
- All devices and settings shall have password protection implemented
- Access to the generating unit shall be restricted for required monitoring only
- Evoenergy’s SCADA communications network must be physically isolated from proponent’s business networks and external networks

Evoenergy can provide additional information to proponents regarding cyber security requirements for specific systems via the contact details on the Evoenergy [website](#).

### 4.14 Technical Studies

Technical studies for LV EG connections shall be performed as outlined in Table 17.

**TABLE 17. TECHNICAL STUDY REQUIREMENTS FOR LV EG CONNECTIONS**

TECHNICAL STUDIES	LV EG IES				LV EG Non-IES	
	≤ 200 KVA		> 200 KVA		Exporting	Non-Exporting
	Exporting	Non-Exporting	Exporting	Non-Exporting		
Voltage Level (including power factor)	*	*	✓	*	✓	✓
Load Flow	*	*	✓	*	✓	✓
Fault Level	*	*	✓	*	✓	✓
Protection Grading including islanding risk evaluation	*	*	✓	*	✓	✓

The symbols used to denote the above requirements have the following meanings:

- ✓ Shall be required
- \* May be required
- ✗ Shall not be required

Evoenergy shall undertake technical studies where required for most systems with a capacity of less than or equal to 1.5 MVA. Systems above this capacity, or of a complex nature, may require the proponent to engage a suitably qualified engineer to perform the study for Evoenergy review prior to installation. Evoenergy will contact the proponent and specify the DNSP inputs, scope of the study and criteria for assessment upon receiving an initial enquiry.



For technical studies undertaken by Evoenergy, the inputs required by the proponent are located in *Appendix E: Network Technical Study Information*. The fees and charges associated with the technical study are addressed in Section 6.

Technical studies will be assessed against the following criteria:

- Load flow parameters including power quality considerations and thermal loading
- Fault levels
- Protection coordination
- Connected generation type and capacity, load type and capacity and inverter specification to evaluate risk of islanded operation

The outputs of technical studies will include, but are not limited to the following:

- Assessment outcome specifying the approval or rejection of the application
- Export limitations where applicable
- Permitted maximum system capacity
- Additional network connection and Isolation points
- Site specific protection settings
- Inter-tripping requirements
- Power quality response requirements
- Detailed communications requirements
- Site specific operational requirements where applicable

Where the technical study results in the rejection of the application due to the assessment criteria, Evoenergy shall provide the proponent with justification and an alternative option which may include:

- Alternative configurations of the generating system (e.g. lower generation control limits)
- Network augmentation (and associated costs of network augmentation)

Depending on the complexity of studies required for a specific application, Evoenergy may choose to apply a network technical study charge for a lower fee class. Fees for any network technical studies will be advised to the proponent, and agreed upon, prior to the studies commencing.

## 5. TESTING AND COMMISSIONING

All LV EG connections shall be subject to testing and commissioning prior to being placed in service. Table 19 specifies the required commissioning tests for each subcategory.

**TABLE 18. TESTING AND COMMISSIONING REQUIREMENTS FOR LV EG CONNECTIONS**

TESTING AND COMMISSIONING REQUIREMENTS	LV EG IES						LV EG Non-IES	
	IPSD		≤ 200 KVA		> 200 KVA		Export	Non-Export
	Export	Non-Export	Export	Non-Export	Export	Non-Export		
Protection Settings and Performance	✓	✓	✓	✓	✓	✓	✓	✓
Power Quality Settings and Performance	✓	✓	✓	✓	✓	✓	✓	✓
Export Limits Settings and Performance	*	✓	*	✓	*	✓	*	✓
Communications Settings and Performance	*	*	✗	✗	✓	✗	*	*
Shutdown Procedures	✓	✓	✓	✓	✓	✓	✓	✓
Confirm System is as per specifications (Including Isolation Point)	✓	✓	✓	✓	✓	✓	✓	✓
Confirm System Documentation	✓	✓	✓	✓	✓	✓	✓	✓

The symbols used to denote the above requirements have the following meanings:

---

✓ Shall be required

---

\* May be required

---

✗ Shall not be required

The following requirements shall be met when performing testing and commissioning on LV EG connections:

- Testing and commissioning plans shall be produced by the proponent and submitted to Evoenergy prior to finalising the connection. This shall include secondary injection testing of interface protection if present.

- Prior to performing testing and commissioning, the installation shall also be approved for connection by the ACT Government Electrical Inspectorate. A Certificate of Electrical Safety shall be completed with a copy provided to Evoenergy. Any additional requirements, including those specified by the Utilities Technical Regulation team, shall be addressed prior to connection.
- Evoenergy shall witness the testing and commissioning and provide approval prior to the connection of the LV EG to the network
- Testing and commissioning acceptance shall be performed and authorised by an Evoenergy-approved suitably qualified person
- For IES, commissioning requirements shall be in accordance with AS/NZS 4777.1, AS/NZS 3000 and AS/NZS 5033 (where applicable), the equipment manufacturer’s specifications and the Evoenergy technical requirements to demonstrate that the LV EG IES system meets the requirements of the connection agreement. Secondary settings shall be tested and proven through secondary injection
- For Non-IES, testing and commissioning requirements shall be in accordance with the equipment manufacturer’s specifications and the Evoenergy technical requirements to demonstrate that the LV EG non-IES system meets the requirements of the connection agreement. Secondary settings shall be tested and proven through secondary injection
- All tests shall be installation tests, not type tests
- A copy of injection test report shall be provided to Evoenergy where interface protection is present

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

## 6. FEES AND CHARGES

The following fees and charges for a LV EG connection are specified in the Evoenergy schedule of charges available on the Evoenergy [website](#):

- Connection Enquiry Processing Charges
- Contract Administration and Testing

All fees are specified by system class, where the class of EG systems are outlined in Table 19.

**TABLE 19.** CHARGING CLASS TABLE

SYSTEM FEE CLASS	SYSTEM CAPACITY
<b>Class 2</b>	Up to 60 kVA
<b>Class 3</b>	Exceeding 60 kVA and up to 120 kVA
<b>Class 4</b>	Exceeding 120 kVA and up to 200 kVA
<b>Class 5</b>	Exceeding 200 kVA and up to 1500 kVA
<b>Class 6</b>	From 1500 kVA up to 5000 kVA

In addition to the application charges, the system may be subject to Network Connection Charges will typically consist of the following items (where applicable):

- Network Technical Studies
- Network augmentation and design work
- Project management
- Communication Installation
- Inter-trip or Neutral Voltage Displacement installation

These will be calculated on a case-by-case basis and a quotation will be provided to the proponent.

In addition to the above, an ongoing operational fee is applicable for export-only LV EG connections as outlined in the Evoenergy schedule of charges located on the Evoenergy [website](#).

## 7. OPERATIONS AND MAINTENANCE

The LV EG 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:

- Development of an operation and maintenance plan that will be provided to Evoenergy
- Maintaining the electrical installation at the supply address in a safe condition
- Providing operation and maintenance reports to Evoenergy on an annual basis
- Ensuring that any changes to the electrical installation at the supply address are performed by an electrician lawfully permitted to do the work and that the proponent holds a Certificate of Compliance issued in respect of any of the changes
- 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. These changes shall be tested, and the testing be witnessed by Evoenergy.
- For LV EG IES connections, perform periodic verification of the system every five years as per the inverter 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.

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*.

## VERSION CONTROL

VERSION	DETAILS	APPROVED
1.0	Initial release version	W. Cleland – Asset Standards Mgr
1.1	Minor adjustments for final release	W. Cleland – Asset Standards Mgr
1.2	Minor adjustments and 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	SCADA Requirements added and change to Section 4.5  Update document number from SM5062 to PO0844	W. Cleland – Asset Standards Mgr
2.1	Update of figures to have reference to new document number	M Lloyd – Customer Technical Services Manager
2.2	Updated definitions for consistency and removal of unused definitions.  Updated inverter settings to align with AS/NZS 4777.2:2020 including power quality response modes  Central protection settings modified  Embedded Network section added  Various minor adjustments	B Harvey – Market Transactions Manager
2.3	Minor updates including clarifications for replacements and additions and information regarding dynamic export limits.  Shifting of boundaries for fee classes.	B Harvey – Market Transactions Manager
2.4	Updated communication requirements for ESS systems exceeding 200kVA.	B Harvey – Market Transactions Manager
3.0	Major update to meet AS/NZS 4777.1:2024 Definitions updated New subcategory for IPSD IES systems New phase balance requirements Interface protection removed for most IES systems ≤200kVA, and settings updated to meet AS/NZS 477.1:2024  Added clause about remote update of inverter settings	

## DOCUMENT CONTROL

DOCUMENT OWNER	DOCUMENT CUSTODIAN	PUBLISH DATE	REVIEW DATE
Group Manager Customer Delivery	Embedded Generation Team Lead		

DRAFT

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

TABLE 20. 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	<ul style="list-style-type: none"> <li>Various changes to definitions and removal of unused definitions.</li> </ul>	Administrative	To remove ambiguity in the interpretation and application of definitions throughout the document
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	Administrative	Alignment with the Small EG connection system sizing capacity to promote improved benefits for proponents adding batteries to existing systems
Connection and Isolation	Inclusion of requirements for embedded networks	Promote improved benefits to Australia's electricity system	Including this change will allow generators in embedded networks to uptake embedded generation
Anti-Islanding Protection	Active Anti-islanding	Administrative	Statement regarding Active Anti-islanding incorporated over table of set points to promote greater choice for proponents selecting compliant inverters
Inverter Integrated Protection	Sustained operation limits	Promotes improved benefit to electricity system	Inclusion of sustained operation limits to align with AS/NZS 4777.2
Interlocking	Relocated to be inside inverter integrated protection section.	Administrative	Interlocking is a form of inverter integrated phase balance protection.
Islanding Protection	Permitted customer islanding operation	Promotes improved benefit to electricity system	Inclusion of customer islanded mode to specify requirements allowing proponents to safely retain supply during network outages
Central Protection	Alteration of table	Administrative	Correction of table to specify that reverse power protection, vector shift, and power factor protection is required for specified

			systems to promote increased level of clarity for proponents
Central Protection	Voltage and frequency set-points for Central protection relocated to Passive Anti-islanding protection table	Administrative	Values consolidated to a single table to provide an increased level of clarity for proponents
Grid Reverse Power Protection	Inclusion of setting limit	Administrative	Providing a setting limit enables an increased level of clarity for proponents
Overcurrent Facility Fault, Overcurrent Grid Fault and Earth Fault Protection	Removal of requirement for IES $\leq 200\text{kVA}$ . Proponent to propose settings as part of application.	Promotes improved benefit to electricity system	Clarity for proponents regarding requirement and enabling the proponent to determine these values promotes an increased degree of flexibility
Passive Anti-islanding Protection	Set point values not provided for Non-IES systems	Jurisdictional	Passive set points for Non-IES systems will be specific to the type of generator used. Enabling the proponent to determine these values promotes an increased degree of flexibility
Passive Anti-islanding Protection	Inclusion of vector shift for $>200\text{kVA}$ systems	Promotes improved benefit to electricity system	Additional requirement due to system size for improved safety.
Inter-tripping	Inclusion of Neutral Voltage Displacement protection	Jurisdictional	Allowing the application of NVD or conventional inter-trip promotes additional flexibility for proponents
Operating Voltage and Frequency	$V_{\text{nom\_max}}$ value relocated to the passive anti-islanding table	Administrative	Values consolidated to a single table to provide an increased level of clarity for proponents
Fees and Charges	Payment process not specified in this section	Administrative	The Evoenergy payment process is managed separately to the governance of LV EG PV connections. Proponents are able to seek clarity around this process during the application stage
Testing and Commissioning	Alteration of table	Administrative	Communications not required for some systems and is not able to be tested. Updated to enable increased clarity for proponents. Shutdown procedures are a requirement for all IES systems as per AS/NZS 4777.1
Operation and Maintenance	Inclusion of five yearly testing regime	Jurisdictional	This is an Evoenergy jurisdictional requirement
Operation and Maintenance	Inclusion of Feed in Tariff statement	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



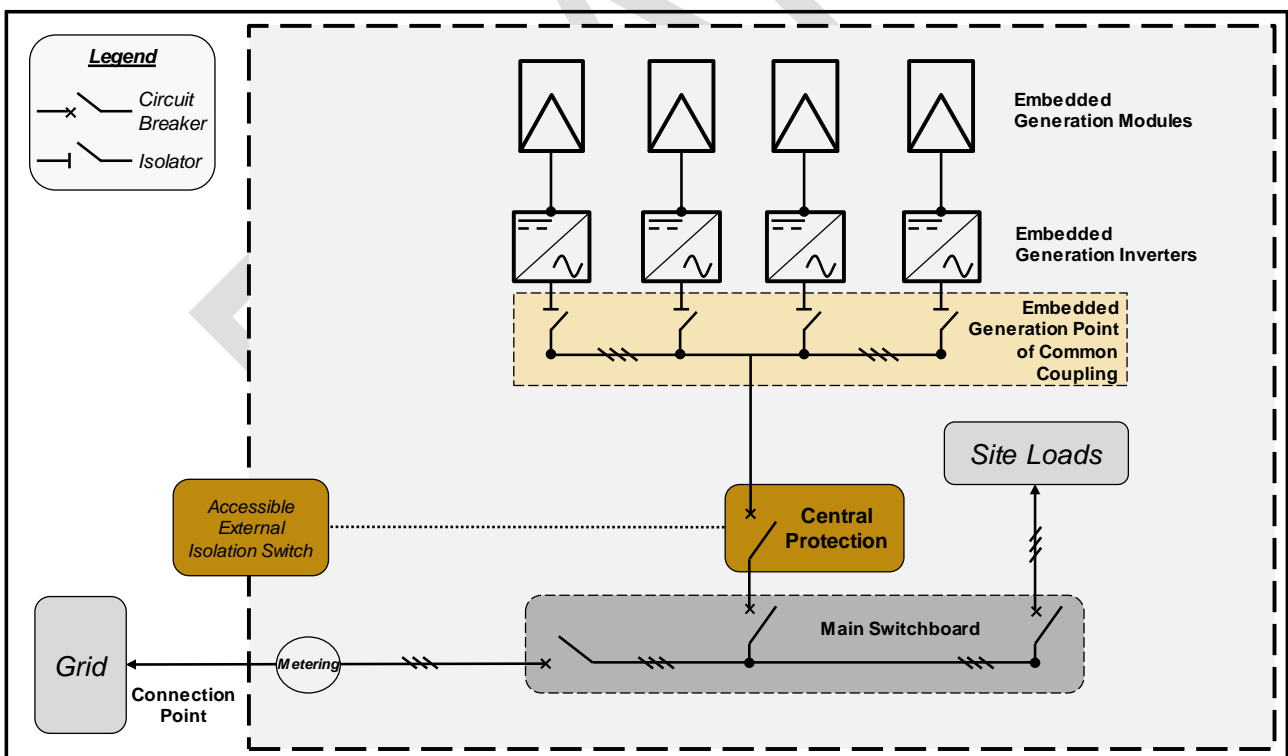
Appendix D	Appendix links to Evoenergy website to specify static data requirements	Administrative	Link to the online portal specifying the data will enable independent update of the requirements with the establishment of the AEMO DER register
Appendix E	Inclusion of Appendix for NTS data	Administrative	Separate appendix specifying the information required to perform an NTS promotes an increased level of clarity for proponents
General	Removal of New Zealand settings from protection tables	Administrative	New Zealand values removed for ease of interpretation

## APPENDIX B – CONNECTION ARRANGEMENT REQUIREMENTS

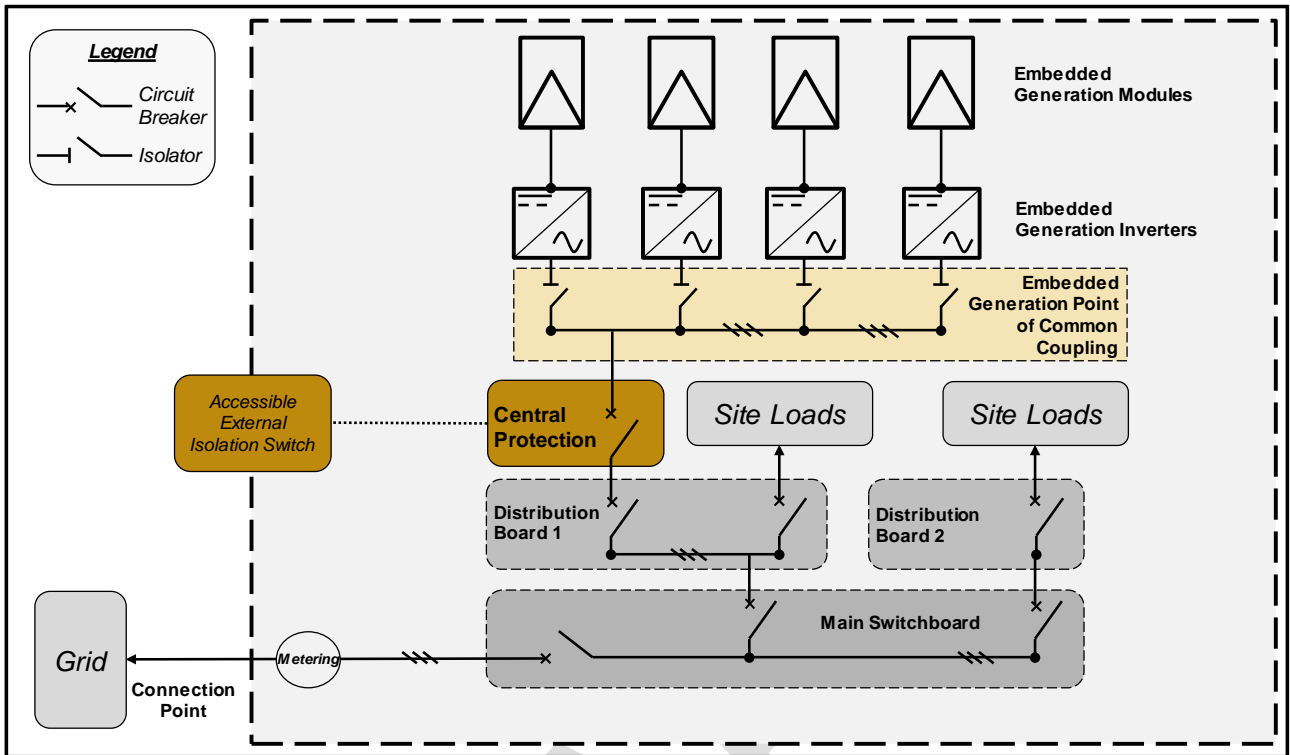
The figures in this Appendix display the common connections for Low Voltage Embedded Generators. Meters are not shown and the connections shall comply with retailers metering requirements. For additional information regarding connection arrangements please contact Evoenergy via the contact details listed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

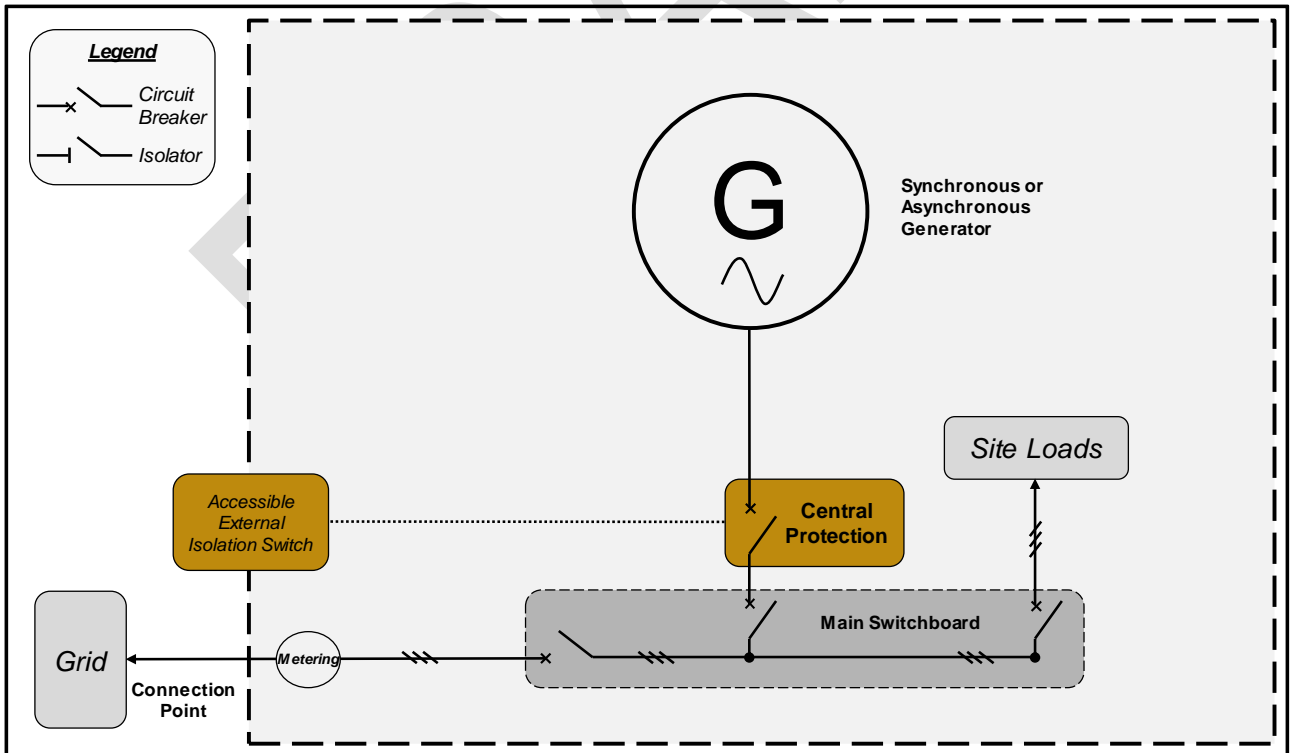
**FIGURE 3.** LV EG IES CONNECTION TO MAIN SWITCHBOARD



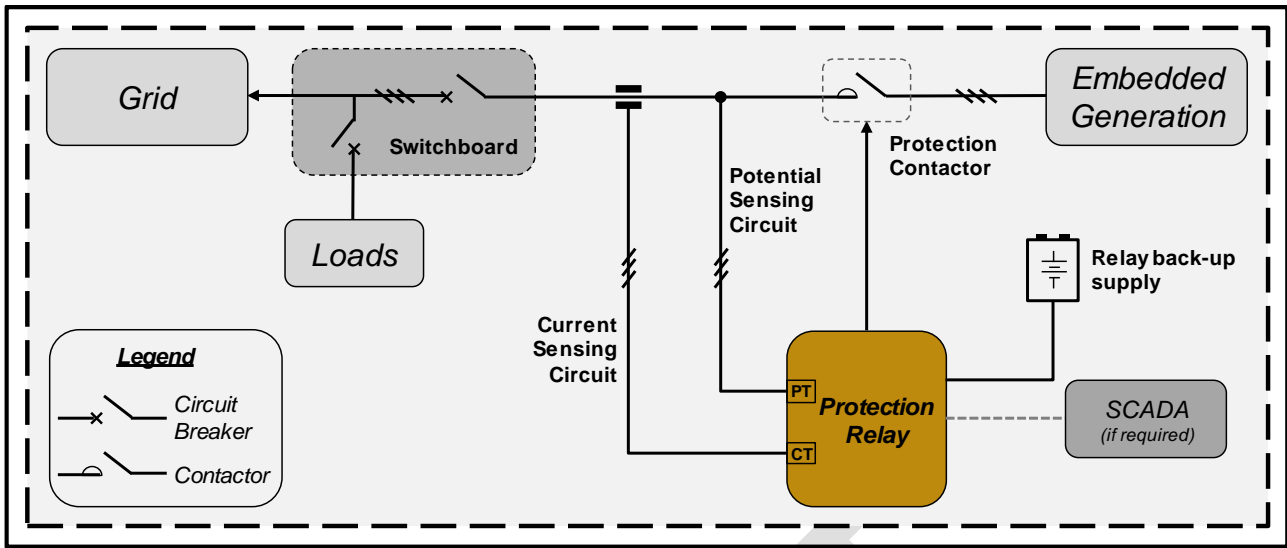
**FIGURE 4.** LV EG IES CONNECTION TO DISTRIBUTION BOARD



**FIGURE 5.** LV EG NON-IES CONNECTION TO MAIN SWITCHBOARD



**FIGURE 6.** EXAMPLE ARRANGEMENT OF INTERFACE PROTECTION



Interface protection settings can be found in Section 4.7.

## APPENDIX C – MODEL STANDING OFFER

LV EG connections are administered through non-standard connection agreements. More information regarding connection agreements can be obtained by contacting Evoenergy through the contact details listed on the Evoenergy [website](#).

## APPENDIX D – STATIC DATA AND INFORMATION

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

The information to be provided on the Evoenergy DER portal includes, but is not limited to:

- NMI meter number (10 digit)
- Fuel source
- Make, model and manufacturer of all DER devices
- Equipment ratings (kW/kVA) and storage capacity (kWh) as applicable
- Installer details

The proponent shall inform Evoenergy as part of their application if any of the below are true for any DER device connected at the application NMI:

- registered for ancillary service provision
- part of an aggregated control
- remotely controllable
- Islanded operation
- Inverter or protection settings different to those specified in this document

Photos of all existing inverters greater than 1kVA shall be provided. These photos shall clearly show:

- Full inverter name plate
- Inverter model number
- Inverter serial number

Photos or other proof of existing to remain panel model numbers and ratings may be requested on a case by case basis, such as when panel quantities are not matching Evoenergy records, or for validation of gross metered systems.

Photos or information relating to existing non-IES equipment may also be requested.

For all LV EG applications a site plan shall be provided to Evoenergy as part of the SCR application. These shall:

- Identify locations of panels, inverter(s), non-IES generating units, and any relevant switchboards
- Identify a lockable AC isolation point in 24-hour accessible location
- Show access path from street to AC isolation point, and detail access arrangements through any obstructions such as gates.

The proponent shall provide at least one single line diagram (SLD) to Evoenergy as part of the SCR application. These single line diagram(s) shall:

- Be site specific and display the site address
- Match what is submitted in the connection application
- Be in an electronic format (i.e. not hand drawn/ written)

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

- Quantity, manufacturer, and model number (as shown on relevant Clean Energy Council Approved List if applicable) for all new embedded generation equipment including inverters, panels, batteries and other equipment.
- As much information as is known about existing embedded generation equipment. Quantity of existing panels and inverter model number(s) at a minimum must be provided.
- Clearly show how panels are distributed between multiple inverters if present.
- Identify phases involved in proposed system and all phases at each switchboard. It should be clear if the site has a single or three phase supply, and if single phase equipment are connected to the same or different phases. SLDs shall use a consistent method of identifying phases throughout.
- Location of site loads.
- Location of interface protection including where disconnection will occur, where current and voltage is being monitored, and any communication to/from the interface protection unit. Model numbers of protection relays shall be provided.
- All current transformers (CTs) used for export monitoring or limiting devices and where they are taking readings from. It should be clear which generating unit(s) each device controls. All export limits and/or generation limits shall be clearly stated.
- Clearly show metering arrangement as gross, net or both as applicable.
- Include the wiring from the embedded generation to the connection point or retail meter. All points where the customer's embedded generating unit and the Evoenergy distribution network can be connected/disconnected (such as circuit breakers and isolators / load break switches) must be clearly shown.

After the installation is complete, the following commissioning information shall be provided to Evoenergy within 20 business days via the Evoenergy DER portal.

- Date of installation
- Serial numbers of new inverters and non-IES generating units
- Voltage readings of all phases (with inverters and other generating units switched off)
- Phase connection of new inverters and non-IES generating units
- Certificate of electrical safety
- Interface protection injection test report

## APPENDIX E – NETWORK TECHNICAL STUDY INFORMATION

The information required from the proponent for Evoenergy to perform a network technical study is outlined in the following table:

NETWORK TECHNICAL STUDY REQUIREMENT	DETAIL
<b>Embedded Generation Application (SCR)</b>	A completed embedded generation application via the Evoenergy DER portal is required for all generator connections as outlined in <i>Appendix D</i> .
<b>Generator Description</b>	<p>A description of the proposed embedded generating unit(s) using the list below shall be provided by the proponent (where applicable):</p> <ul style="list-style-type: none"> <li>Proposed operating mode(s) for systems, for example, peak lopping control regime, demand response regime, any storage strategies</li> <li>Proposed interaction with the Evoenergy distribution network under abnormal network conditions for example, network support operation and or customer islanded mode operation</li> <li>Details of any voltage control or power factor control strategies proposed</li> <li>Details of any energy storage capability</li> <li>Proposed local proponent loads to be supplied from the embedded generating unit where applicable</li> <li>Known future staging / development of the embedded generating system and / or local proponent loads</li> </ul>
<b>Generator Data</b>	For Non-IES systems, the proponent shall provide a comprehensive list of technical generator data. For IES systems, Evoenergy may request information to confirm that the inverter is CEC accredited and / or meets Evoenergy requirements
<b>Generation and Load Profiles</b>	The proponent shall provide a generation and load profiles for the embedded generator, detailing the estimated load and generation behaviour on weekdays and weekends during summer and winter
<b>Single Line Diagram</b>	The proponent shall provide detailed electrical single line diagram(s) which shall meet the requirements as outlined in Appendix D –
<b>Protection Information</b>	<p>The proponent shall provide a functional block / schematic diagram of the protection and control systems relevant to the embedded generating unit's connection to the Evoenergy distribution network which includes an in-depth technical philosophy of the protection and control systems including:</p> <ul style="list-style-type: none"> <li>All relevant relay current circuits</li> <li>Relay potential circuits</li> <li>Alarm and monitoring circuits</li> <li>Back-up systems</li> <li>Auxiliary power supply systems and</li> <li>Proposed parameters / settings of all protection and control system elements</li> </ul>
<b>Site Plan</b>	The proponent shall provide a detailed site plan in accordance with Appendix D.
<b>Communications Information</b>	<p>For systems requiring communications, the proponent shall provide the following:</p> <ul style="list-style-type: none"> <li>A drawing indicating all SCADA connections including provision for Evoenergy communications equipment</li> <li>A proposed index of I/O points</li> <li>Anticipated commissioning date</li> </ul>