

EVOENERGY HIGH VOLTAGE EMBEDDED GENERATION TECHNICAL REQUIREMENTS

Technical requirements for connection of high 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 200,000 residential and business customers. The electricity network delivers this power through 2,394 km of overhead lines, 2,694 km of underground cables, over 50,000 poles and over 5000 distribution substations across a geographical area of 2,358 square kilometres.

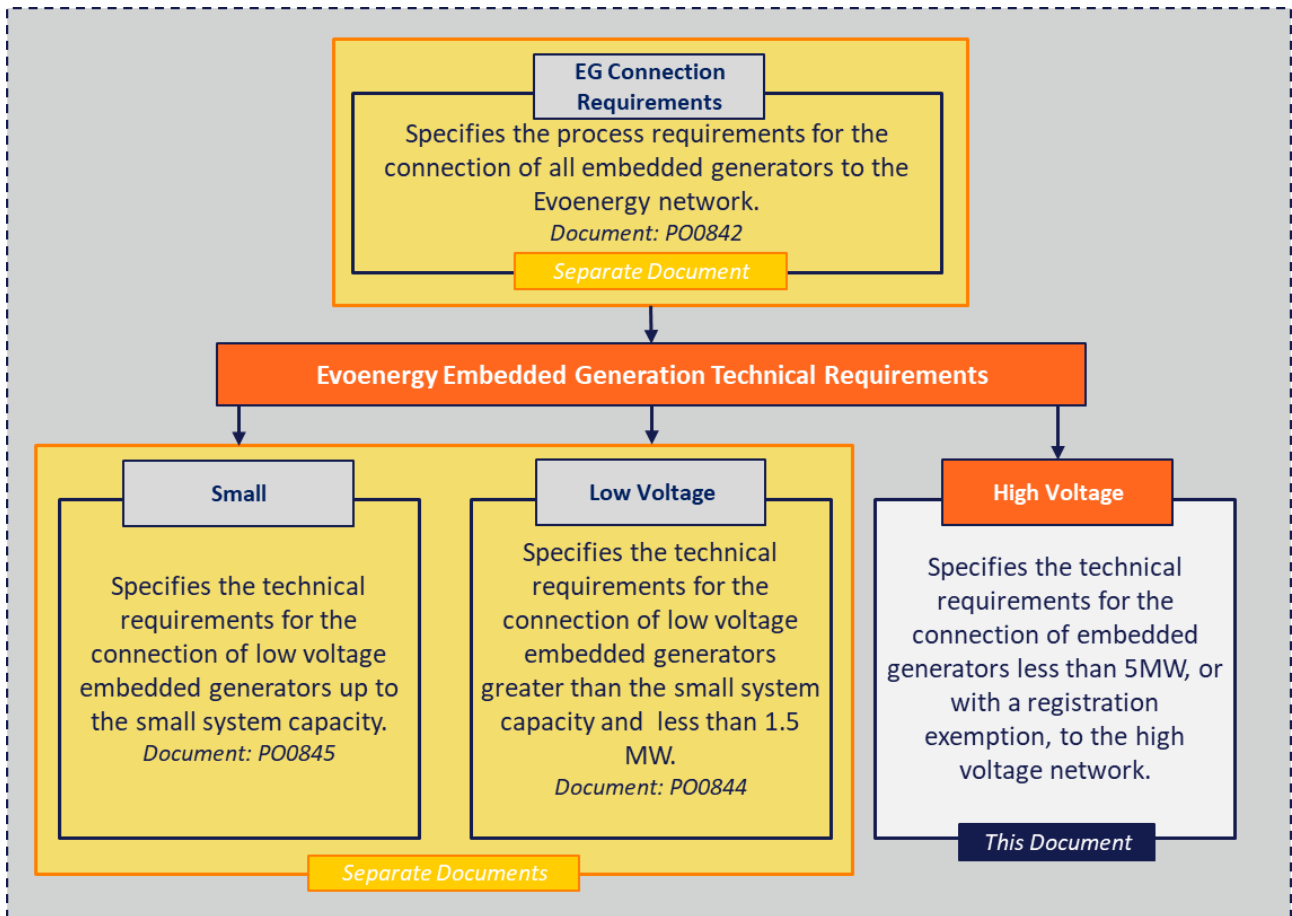
The Evoenergy network currently connects to more than 55,000 embedded generation systems, the majority of which are solar photovoltaic (PV) systems.

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

FIGURE 1. EVOENERGY EMBEDDED GENERATION DOCUMENT ARCHITECTURE



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

- An Inverter Energy System (IES) or non-IES or network connection for which the EG system:*
- Is not required to be, or is exempt from, being registered in the National Electricity Market*
 - Typically has a system capacity of less than 5 MW*
 - Is connected to, and capable of operating, in parallel with any part of the HV distribution network*
 - Meets all other technical requirements set out in this document*

All High Voltage Embedded Generators are subject to the requirements outlined in this document unless formally advised in writing by Evoenergy. These requirements are applicable to all new connections and modifications of existing systems where the system consists of an IES, Energy Storage System (ESS), synchronous generators, asynchronous generators or any combination these categories.

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

- Systems covered by the Evoenergy Small EG Connection Technical Requirements
- Systems covered by the Evoenergy LV EG Connection Technical Requirements
- Systems that are directly connected to the transmission network
- Electric vehicles, unless the on-board battery storage system is capable of exporting to the HV network (in which case these 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 HV system to meet the technical requirements

These technical requirements will form the basis for High Voltage Embedded Generators that are registered within the National Electricity Market, although additional requirements may apply. It is recommended that proponents wishing to connect at or near the registration threshold contact Evoenergy to discuss their application via the contact details on the Evoenergy [website](#).

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

1.3 Obligations

Evoenergy and proponents have certain obligations regarding high voltage embedded generators.

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

Proponents have an obligation to ensure the safe and reliable operation of high voltage embedded generators and are required to:

- Comply with the technical requirements as well as relevant national standards, industry codes, legislation and regulations. In the event of inconsistency, legislation and regulations, followed by the technical requirements, followed by national standards and industry codes shall prevail
- Obtain written approval from Evoenergy prior to connecting HV embedded generating units
- Maintain compliance with the Evoenergy connection agreement
- Ensure the requirements are met with regard to the design and installation, operation and maintenance of HV Embedded Generating systems
- Meet the connection, commissioning, operations and maintenance requirements to the HV distribution network

1.4 Statement of Compliance

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

2. DEFINITIONS AND ABBREVIATIONS

2.1 Definitions

TABLE 1. DEFINITIONS

ACT Government – Electrical Inspectorate	The ACT Government Electrical Inspectorate is the inspecting authority in the ACT and is responsible for inspecting and approving the consumer’s LV electrical installation <i>Contact number is (02) 6207 7775</i> Email: electrical.inspections@act.gov.au
Active power limiting	Where the electricity exported from an IES at the AC output terminals of the inverter(s) is limited below a defined threshold. See also Generation Limit.
Amp (A)	A unit of electrical current

Anti-islanding protection (Loss of mains)	A protection system to detect islanded conditions and disconnect the IES from the distribution network
Asynchronous generator	Asynchronous generators draw their magnetising current from the distribution network during operation and are generally not capable of isolated operation
Backup load	Any load to be supplied by an embedded generating unit during customer islanded mode
Basic Micro embedded generation connection	A connection between a distribution network and a retail customer's premises for an embedded generating unit of the kind contemplated by AS 4777, for which a model standing offer is in place.
Bi-directional metering	A meter capable of registering energy supplied to the premises and energy exported from the premises as separate data streams
Central protection	Central protection is the protection defined by AS/NZS 4777.1 (grid connection of energy systems via inverters) installed to perform the functions of; coordinating multiple inverter energy system installations at one site, providing protection for the inverter energy system installation and islanding protection to the connected grid as well as preserving safety of grid personnel and the general public
Connection point	The point where the IES is connected to the rest of the electricity network. This is generally at the consumer's main or distribution switchboard
Demand response	The alteration of an inverter's normal mode of operation in response to an initiating signal originating from or defined by a remote agent
Distributed energy resource (DER)	Power generation or storage units that are connected directly to the distribution network
DRED (Demand response enabling device)	A device applying demand response signals to the inverter as documented in AS/NZS 4755.1
Embedded generation system	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
Embedded generating unit	A generating unit connected within a distribution network and not having direct access to the transmission network
Embedded Generation Point of common coupling	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.
Embedded Network	Where an Embedded Network Manager manages the electrical connection of multiple child meters located behind a parent/gate meter.

Energy Source	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.
Energy storage system (ESS)	A system comprising one or more batteries that store electricity generated by distributed energy resources or directly from the grid, and that can discharge the electricity to loads. The Energy Storage System rating is defined based off the AC output nameplate rating of IES connected to the batteries.
Evoenergy	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
Export capacity	Combined power that all embedded generator units installed at the consumer's premises are capable of exporting to the network
Export limit	Where the electricity exported from an IES to the distribution network is controlled so as to not exceed a specified limit. AS/NZS 4777.1 defines two types of export limitation function, namely (i) Hard limit: A limit that will require the IES to disconnect and (ii) Soft limit: A limit that will cause the IES to reduce its output, preventing ongoing export greater than the limit. While AS/NZS 4777.1 only considers IES connected at LV, the same definitions will be applied to other types of embedded generation considered by this document.
Export limiting device	Additional hardware installed to perform export limitation This typically involves an export meter to monitor the utility connection point.
Generating unit	The plant used in the production of electricity and all related equipment essential to its functioning as a single entity
Generation	The production of electrical power by converting another form of energy in a generating unit
Generation limit	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 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 generation greater than the limit. While AS/NZS 4777.1 only considers IES connected at LV, the same definitions will be applied to other types of embedded generation considered by this document.
Generator	A person who owns, operates or controls a generating unit
High voltage (HV)	Any voltage greater than 1 kV AC
Hybrid inverter	An inverter which can simultaneously manage inputs from both solar panels and a battery bank, charging batteries with either solar panels or the electricity grid

Installed capacity	Combined nameplate rating of all IES installed at the consumer's premises. This may be equal to or greater than the export capacity
Installer	For IES systems installed in ACT; a person who holds an unrestricted electrician's licence with Distributed Energy Resources (DER) endorsement. For IES systems installed in NSW; a person who holds an unrestricted electrician's licence and SAA accreditation. For non-IES systems; an engineering consultant body or licensed electrical contractor with relevant knowledge, expertise or experience.
Interface Protection	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: <ul style="list-style-type: none"> (a) A fault on the grid; (b) An unintentional islanding situations; or (c) Voltage and frequency being outside the continuous operating range Interface Protection was previously referred to as Central Protection. Any references to Central Protection in other Evoenergy documentation is referring to Interface Protection.
Inverter	A device that uses semiconductor devices to transfer power between a DC source(s) or load and an AC source(s) or load
Inverter energy system (IES)	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) either: <ul style="list-style-type: none"> • satisfies the requirements of AS/NZS 4777.2 • or are designed for connection at High Voltage
Islanding	Any situation where the electrical supply from the distribution network is disrupted and one or more embedded generating unit maintains any form of electrical supply, be it stable or not, to any section of that distribution network
kVA	kilo-Volt Amp, product of voltage and current; a measure of apparent power (combined real and reactive power)
kVAr (Reactive power)	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
kW	kilo-Watt or 1000 Watts; the rate at which active or real (useful) energy is transferred
Low Voltage (LV)	The mains voltages as most commonly used in any given network by domestic and light industrial and commercial consumers (typically 230 V)
Market generating unit	A generating unit whose generation is not purchased in its entirety by a retailer (and receives payment for generation through the National Electricity Market or Wholesale Electricity Market)
Meter Protection Device (MPD)	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 proponent installation

Micro embedded generation connection	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)
Small IES	Small inverter energy systems (IES) up to 30 kVA of installed capacity (excluding ESS)
Model standing offer	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
Negotiated connection	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
Network	Evoenergy's distribution network
Point of supply	The junction of the installation's consumer mains with Evoenergy's low voltage distribution network, normally at a connection device (see Evoenergy service and installation rules)
Proponent	A person proposing to become a generator (the relevant owner, operator or controller of the generating unit (or their agent))
Registered generator	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
Retailer	The holder of a retailer authorisation issued under the National Energy Retail Law in respect of the sale of electricity
Service Protection Device (SPD)	The first protection device located on the network side or forming part of the connection point.
Single phase	Connected between the active of a phase and neutral
Single wire earth return	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
Site generation limit	The generation threshold that the embedded generation system cannot exceed, measured downstream of the connection point
Small IES	Small inverter energy systems (IES) up to size limits as specified in PO0845 Evoenergy Small Embedded Generation Technical Requirements.
Small generation aggregator	A person who has classified one or more small generating units as a market generating unit

Small registered generator	A generator who elects to register a generator with the Australian Energy Market Operator as a market generating unit who would otherwise be entitled to an exemption to register based on size
Standard connection	A connection service (other than a 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
Stand-alone mode	A generating unit capable of stand-alone mode will have the ability to supply electricity to a section of the customer's installation when disconnected from the Evoenergy network.
Supervisory Control and Data Acquisition (SCADA)	A control system that remotely monitors and is capable of switching the embedded generating unit connected to the distribution network
Supply, alternate	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.
Supply, grid	Where an electrical installation is supplied with electricity from the electrical distribution network.
Supply, independent	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.
Supply, Supplementary	A supply system intended to operate in conjunction with the normal supply. For example, an inverter operating in grid connect mode.
Synchronous Generator	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.
System Capacity	The combined AC output nameplate rating of all embedded generating units installed at the generator's premises
Three phase	Connected to all phases and neutral (star) or connected between phases (delta)
Utilities Technical Regulation Team	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
CPEng	Chartered Professional Engineer of Engineers Australia
DC	Direct Current
DER	Distributed Energy Resource
DNSP	Distribution Network Service Provider
EG	Embedded Generation or Embedded Generating
ENA	Energy Networks Australia
ESS	Energy Storage System
FAT	Factory Acceptance Testing
GDL	Generation Dispatch Limiter
HV	High Voltage
IEC	International Electrotechnical Commission
IES	Inverter Energy System
LV	Low Voltage
MW	Megawatt
NBN	National Broadband Network
NEM	National Electricity Market
NER	National Electricity Rules
NMI	National Metering Identifier
PV	Photovoltaic
ROCOF	Rate of Change of Frequency

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

2.3 Terminology

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

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

2.3.1 Subcategories

To assist proponents in identifying technical requirements that are applicable to a specific system, Evoenergy have defined HV EG sub-categories. The definitions for each subcategory are outlined in Table 3.

TABLE 3. SUBCATEGORY DEFINITIONS

HV EG IES Connection	Exporting	Any HV EG system with a total system capacity less than 5 MW or with a system capacity greater than or equal to 5 MW that has been issued with a specific exemption by AEMO for a three-phase IES HV distribution network connection, meeting all relevant technical requirements set out in the Evoenergy technical requirements document
	Non-Exporting	
HV EG non-IES Connection	Exporting	Any HV EG system that is synchronous or asynchronous with a total system capacity less than 5 MW or with a system capacity greater than or equal to 5 MW that has been issued with a specific exemption by AEMO for a three-phase non-IES HV distribution network connection, meeting all relevant technical requirements set out in the Evoenergy technical requirements document
	Non-Exporting	

The AEMO automatic registration exemption threshold of 5 MW is the indicative limit for proponents implementing a HV connection under these requirements. Proponents applying to connect at or near this capacity should contact Evoenergy to discuss additional requirements.

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

- Partial-export HV EG systems limit the amount of export into the HV network to an agreed export threshold specified in the connection agreement
- Full-export HV EG systems can export into the HV distribution network to the full system capacity as specified in the connection agreement
- Non-exporting systems shall be considered as HV EG systems operating in parallel with the HV network that are limited to ensure they cannot export electricity into the network as defined in the connection agreement.

Clarification regarding the definitions and application of subcategories can be obtained by contacting Evoenergy via the contact details on the Evoenergy [website](#).

3. RELEVANT RULES, REGULATIONS, STANDARDS AND CODES

3.1 Evoenergy Documents

Table 4 lists the relevant Evoenergy documents that shall be read in conjunction with the application of the HV EG technical requirements.

TABLE 4. RELATED EVOENERGY DOCUMENTATION

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

3.2 Standards and Codes

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

TABLE 5. RELATED AUSTRALIAN AND INTERNATIONAL STANDARDS

STANDARD NUMBER	STANDARD NAME	STANDARD TYPE
AS 2067	Substations and high voltage installations exceeding 1 kV A.C.	Australian Standard
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 3010	Electrical installations – Generating Sets	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 61000.3.7	Electromagnetic compatibility (EMC) Limits - Assessment of emission limits for fluctuating loads in MV and HV power systems	Australian / New Zealand Joint Standard
AS/NZS 61000.3.100	Electromagnetic compatibility (EMC) Part 3.100: Limits - Steady state voltage limits in public electricity systems	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
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
IEC 60255-26	Electrical relays - Part 26: Electromagnetic compatibility requirements	International Standard
IEC 60255-27	Electrical relays - Part 27: Product safety requirements	International Standard
IEC 62109	Safety of power converters for use in photovoltaic power systems	International Standard
IEC 62116	Utility-interconnected photovoltaic inverters – Test procedure of islanding prevention measures	International Standard
IEC 62786	Distributed energy resources connection with the grid	International Standard
IEEE standard 1547-2018	IEEE Standard for Interconnecting Distributed Resources with Electric Power Systems	International Standard
SA/SNZ TR IEC 61000.3.14	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
SA/SNZ TR IEC 61000.3.15	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

AEMC REL00065	Australian Energy Market Commission Frequency Operating Standard	AEMC Reliability Standard
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In the event of an inconsistency between the Evoenergy technical requirements, Australian standards, international standards and industry codes, the Evoenergy technical requirements shall prevail.

3.3 Legislation and Regulation

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

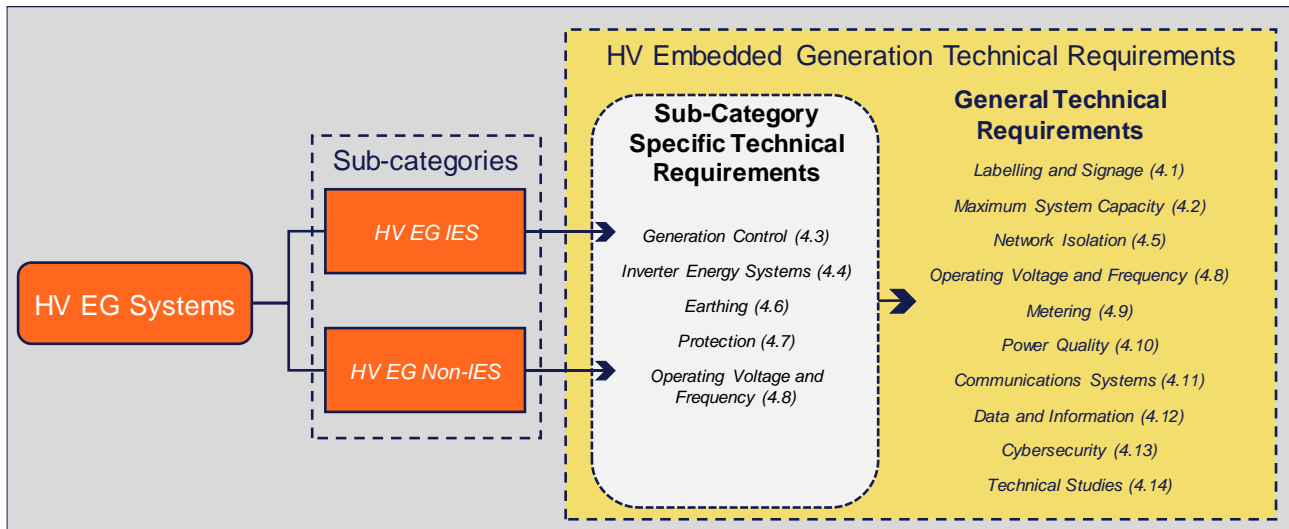
- Electrical Safety Act 1971
- Electrical Safety Regulation 2004
- Utilities Act 2000
- Utility Networks (Public Safety) Regulations 2001
- Utilities (Technical Regulation) Act 2014
- Electricity (Service and Installation Rules Code) Determination 2013
- Electricity (Network Boundary Code Determination) 2013
- Electricity (Distribution Supply Standards Code) Determination 2013
- Work Health and Safety Act 2011
- Work Health and Safety Regulation 2011
- National Electricity Rules

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 HV Embedded Generators. The technical requirements specified in this section should be interpreted as applying to all subcategories of HV EG connections unless otherwise specified. The relationship between the sub-categories and the associated technical requirements 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 2067 and in accordance with the *Electrical Safety Act 1971*. Any additional connection-specific labelling requirements will be determined by Evoenergy during the connection process and communicated to the proponent.

4.2 Maximum System Capacity

For IES and non-IES systems, the maximum system capacity at the connection point shall be determined during the application stage and shall typically be less than 5 MW as defined by the AEMO registration guidelines.

4.3 Generation Control

4.3.1 Export Limits at Connection Point

Export limitation may be required for particular HV EG connections, this will be determined by Evoenergy upon the receipt of an application to connect or as requested by the proponent. The factors that will be considered in determining an export limit include, but are not limited to;

- Existing asset ratings
- Network power quality
- Existing and forecast DER penetration
- Existing demand at peak generation

The export limiting functionality may be of a “soft” or “hard” limitation type. 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 active power quality response modes.

4.3.2 Site Generation Limit Downstream of Connection Point

Generation limits are typically not used for HV Embedded Generation connections. Please consult with AEMO if you are intending to use a generation limit (derating) to justify a registration exemption. AEMO typically considers the nameplate rating of generation plant.

4.4 Inverter Energy System

For HV EG IES connections, the system shall comply with the following technical requirements:

- Shall comprise of inverters that are tested by an authorised testing laboratory and certified as being compliant with IEC 62116 for anti-islanding protection with an accreditation number or certificate of suitability.
- Shall comprise of inverters that have the following power quality response modes available:
 - Reactive power control
 - Central control
 - Volt response (i.e. volt-VAr and volt-watt)
 - Fixed power factor or reactive power
 - Power rate limit (i.e. ramp rate control)

4.5 Network Isolation

There shall be a visible method of ensuring the HV EG system is disconnected from the Evoenergy network for all systems. The method of isolation shall be safely accessible to Evoenergy personnel at all times. Operation, ownership and control of this device shall lie with Evoenergy.

The specific requirements for network connection and isolation will be determined by Evoenergy and communicated to the proponent in the connection application stage.

4.5.1 Shared Generation

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

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

4.6 Earthing

The HV EG system earthing shall be in compliance with the Evoenergy Service and Installation Rules in addition to the requirements specified in Table 6.

TABLE 6. EARTHING REQUIREMENTS

SUBCATEGORY	EARTHING REQUIREMENTS
HV EG IES Connection	IES systems, including those with ESS, shall have earthing requirements as per AS 2067, AS/NZS 3010, AS 3011 and AS 5139, ENA EG-0 and ENA EG-1
HV EG non-IES Connection	non-IES systems shall have earthing requirements as per AS 2067, AS/NZS 3010, ENA EG-0 and EG-1

4.7 Protection

This section specifies the protection requirements for HV embedded generators connected to the Evoenergy network. Protection systems for HV embedded generators shall be designed in accordance with the relevant Acts, regulations and Evoenergy requirements. Protection systems for HV embedded generators shall be designed with a main and backup protection philosophy. Where relevant, Evoenergy have provided indicative protection values for each requirement. All protection values implemented in central protection will require Evoenergy approval consistent with the findings of a connection-specific technical assessment.

4.7.1 Inverter Integrated Protection

For HV EG IES systems containing LV inverters, inverter integrated protection shall be the responsibility of the proponent. The settings shall grade appropriately with other protection systems and meet all jurisdictional, regulatory and safety obligations.

4.7.2 Central Protection

Central protection is required for all categories of HV embedded generators connected to the Evoenergy network. Central protection shall be implemented in the form of a protection relay compliant with AS 2067 and IEC 60255. Additional information regarding the suitability of protection relays can be obtained by contacting Evoenergy via the details listed on the [website](#).

The application of central protection parameters for the sub-categories are specified in Table 7.

TABLE 7. CENTRAL PROTECTION REQUIREMENTS BY SUBCATEGORY

PROTECTIVE FUNCTION	HV EG IES	HV EG non-IES
Passive anti-islanding: Under-voltage (21) and Over-voltage (59) Under-frequency (81U) and Over-frequency (81O) ROCOF (81R) Vector Shift (78)	✓ ✓ ✓ *	✓ ✓ ✓ *
Overcurrent facility fault, grid fault and earth fault protection (50/51)	✓	✓
Grid reverse power (32R), Grid low forward power (32F) and Generator Loss of Excitation (40G)	*	*
Synchronisation facilities (25)	*	✓
Generator Phase Balance Protection (47)	*	✓
Generator Pole Slip	✗	*
Neutral Voltage Displacement (59N)	#	✓
Inter-trip	#	✓
DC system or UPS integration Protection	✓	*
Failsafe tripping	*	*
Interlocking	*	*
Grid Isolation Device	✓	✓
Loss of Mains Protection	✓	✓

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

✓	Shall be required	✗	Shall not be required
*	May be required	#	Either Neutral Voltage Displacement (59N) or Inter-trip shall be required

The detailed protection parameters are specified in the following subsections. Protection systems for HV embedded generators shall be designed with a main and backup protection philosophy, depending on the connection configuration, protection systems may require duplication. Proponents will be advised of this requirement upon submitting a connection request to Evoenergy.

4.7.2.1 Passive Anti-Islanding Protection

Passive anti-islanding protection shall be implemented for all HV EG systems, indicative settings have been provided in Table 8. Passive anti-islanding settings will be confirmed via a connection-specific technical assessment to account for the ride-through capability of the generator and network configuration.

TABLE 8. PASSIVE ANTI-ISLANDING PROTECTION

SETTING PARAMETER	DISCONNECTION TIME	SETTING LIMIT
Stage 1 Over voltage (V>)	1 second	12,210 V
Stage 2 Over voltage (V>>)	Instantaneous	14,300 V
Stage 1 Under voltage (V<)	2 second time delay	8,800 V
Stage 2 Under voltage (V<<)	Instantaneous	4,400 V
Stage 1 Under frequency (F<)	2 seconds	49.5 Hz (10-minute average)
Stage 2 Under frequency (F<<)	Instantaneous	47 Hz
Stage 1 Over frequency (F>)	2 seconds	50.5 Hz (10-minute average)
Stage 2 Over frequency (F>>)	Instantaneous	52 Hz
Rate of Change of Frequency (ROCOF)	2 second time delay	1.0 Hz / 1 second
Vector Shift	2 second time delay	12 Degrees

4.7.2.1.1 Customer Islanded Mode

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

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

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

Bi-directional overcurrent and earth fault protection shall be enabled in central protection. This protection shall be set to detect faults within the proponent’s installation and the Evoenergy network, these settings shall be determined during the connection-specific technical assessment and shall grade with existing protection systems.

4.7.2.3 Grid Reverse Power Protection, Grid Low Forward Power Protection and Generator Loss of Excitation

Grid reverse power protection shall be implemented for all non-exporting systems. Grid low forward power protection may be required for some non-IES systems in addition to generator loss of excitation protection.

Grid reverse power protection 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. The specific settings for grid reverse power protection will be determined via a connection-specific technical assessment.

Grid low forward power protection may be required for some systems where inter-trip protection is not installed. The settings for grid low forward power protection will be determined via a connection-specific technical assessment.

Generator loss of excitation protection may also be required and will be determined via a connection-specific technical assessment.

TABLE 9. GRID REVERSE AND FORWARD POWER PROTECTION

SETTING PARAMETER	DISCONNECTION TIME	SETTING LIMIT
Grid Reverse Power (32R)	<i>Determined upon connection-specific technical assessment</i>	
Grid Low Forward Power (32F)	<i>Determined upon connection-specific technical assessment</i>	
Generator Loss of Excitation (40G)	<i>Determined upon connection-specific technical assessment</i>	

4.7.2.4 Synchronisation Facilities

To prevent non-synchronised connection to the Evoenergy HV network, 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. Connection of the generating unit in parallel with the distribution network shall be prevented unless all phases of the HV network at the connection point are energised.

HV EG IES connections shall comprise of inverters with internal synchronisation facilities and HV non-IES connections shall have synchronisation facilities installed.

4.7.2.5 Phase Balance Protection

HV EG connections shall have voltage unbalance protection implemented as outlined below. Nominal settings for unbalance protection are displayed in Table 10, these settings will be confirmed upon the completion of a connection-specific technical assessment.

4.7.2.5.1 Current Unbalance Protection

Evoenergy does not specify any requirements regarding current unbalance protection.

4.7.2.5.2 Voltage Unbalance Protection

Where voltage unbalance protection is implemented, the nominal settings required in central protection are specified in Table 10.

TABLE 10. VOLTAGE UNBALANCE PROTECTION

PROTECTION ELEMENT	NEGATIVE SEQUENCE LIMIT	ELEMENT DELAY
Voltage Unbalance (47)	3% of Nominal Voltage	5 seconds

4.7.2.6 Generator Pole Slip

HV EG connections shall have generator pole slip protection implemented for Non-IES systems as outlined in Table 7. Pole slip protection shall disconnect synchronous EG units following a loss of synchronism. The settings for pole slip protection will be determined via a connection-specific technical assessment as per Table 11.

TABLE 11. GENERATOR POLE SLIP PROTECTION

PROTECTION ELEMENT	SETTING THRESHOLD	ELEMENT DELAY
Generator Pole Slip	<i>Determined upon connection-specific technical assessment</i>	

4.7.2.7 Neutral Voltage Displacement

Either Neutral Voltage Displacement (NVD) or Inter-trip protection shall be required for IES based EG systems. NVD protection shall be required for Non-IES based EG systems as outlined in Table 7. NVD protection will be implemented using voltage transformers installed at the point of central protection and maintained by the proponent. This is most commonly achieved using either three single phase voltage transformers or a five-limb three phase voltage transformer, three-limb three phase voltage transformers do not provide the required functionality.

The application and settings for NVD protection will be determined via a connection-specific technical assessment as per Table 12.

TABLE 12. NEUTRAL VOLTAGE DISPLACEMENT PROTECTION

PROTECTION ELEMENT	SETTING THRESHOLD	ELEMENT DELAY
Neutral Voltage Displacement (59N)	<i>Determined upon connection-specific technical assessment</i>	

4.7.2.8 Inter-tripping

Either Neutral Voltage Displacement (NVD) or Inter-trip protection shall be required for IES based EG systems. Inter-trip protection shall be required for Non-IES based EG systems as outlined in Table 7. Evoenergy will work with the proponent to establish the following information:

- Design parameters for the communication interface
- The responsibilities for implementation and monitoring of the communication link
- The philosophy of the inter-trip scheme

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

4.7.2.9 DC System or UPS Integration Protection

To ensure all protection and control systems are capable of operation, they must be supplied by a DC system that maintains functionality in the event of auxiliary supply failure. Systems may require duplicate DC supplies to support duplicate protection systems, this will be identified by Evoenergy and communicated to the proponent during the connection-specific technical assessment.

Evoenergy will specify the required protection philosophy in the event of DC supply failure upon performing a connection-specific assessment.

4.7.2.10 Failsafe Tripping

Failsafe tripping may be required for both IES and non-IES HV systems. The requirement to implement failsafe protection will be determined by Evoenergy and communicated to the proponent during the connection-specific technical assessment.

4.7.2.11 Interlocking

Depending on the connection configuration, HV IES and non-IES systems may require interlocking of generation sources and earth switches. Interlocking shall be implemented in compliance with AS 2067. The requirement for interlocking will be determined by Evoenergy and communicated to the proponent during the connection-specific technical assessment.

4.7.2.12 Grid Isolation Device

The grid isolation device shall meet Evoenergy requirements for the defined HV voltage level and connection configuration. The specific requirements regarding the grid isolation device shall be determined via a connection-specific technical assessment, operation and ownership of this device shall lie with the proponent.

4.7.2.13 Loss of Mains Protection

Loss of mains protection shall be required for both IES and non-IES HV EG systems. Loss of mains protections comprises of the following protection schemes: undervoltage, overvoltage, negative sequence voltage, under and over frequency, rate of change of frequency, vector shift and low set overcurrent protection. The settings for Loss of Mains Protection schemes will be determined via a connection-specific technical assessment

4.7.3 Additional Requirements for Non-IES

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

4.7.4 Runback Schemes

Runback schemes may be required for specific connection configurations in certain locations on the Evoenergy network. Where applicable, Evoenergy will advise proponents of runback scheme requirements upon receiving a connection request.

4.8 Operating Voltage and Frequency

As per the Evoenergy Service and Installation Rules, the HV EG system shall be designed and installed to maintain compliance with AS 2067, AS 61000.3.7 and AS 61000.3.100. The nominal frequency shall be maintained with reference to the parameters specified in the AEMC Frequency Operating Standard.

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

4.9 Metering

HV 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 installations are fulfilled prior to energising the system.

4.10 Power Quality

4.10.1 Quality of Supply

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

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

Evoenergy's obligations with respect to power quality are outlined in the *Utilities (Electricity Distribution Supply Standards Code) Determination 2013* under the *Utilities Act 2000*.

4.10.2 Quality of Generation

The HV EG connection shall not adversely impact Evoenergy's ability to meet quality of supply obligations and shall comply with all Evoenergy requirements in addition to relevant jurisdictional based regulations and licence conditions regarding power quality parameters including, but not limited to:

- Voltage Fluctuations and Step Voltage
- Harmonics
- Voltage Balance
- Current Balance
- Ramp Rates
- Power Factor

4.10.3 Power Quality Response

All HV EG systems shall manage power quality response through either:

- Activating in-built power quality responses where the capabilities exist, or;
- A central control mode via a master / slave system

All HV EG systems shall have voltage power quality response modes enabled, the response settings shall be site-specific and determined via a connection-specific technical study. Evoenergy shall review and approve all power quality response settings prior to implementation.

In some cases, Evoenergy may request alternate settings be enabled, including the application of fixed power factor, for specific systems and will be determined by Evoenergy and communicated to the proponent during the connection-specific technical assessment.

Proponents shall ensure that power quality settings are uniform across systems with multiple generators. Replacement generating units shall be configured to have power quality response modes enabled and response modes and settings shall not be altered without written approval from Evoenergy.

Evoenergy may require the proponent to install additional power quality response devices such as synchronous condensers, static VAR compensators or synchronous compensators depending on the connection configuration. The requirement for the installation of additional devices will involve an assessment including, but not limited to, the following factors:

- The availability of power quality response modes
- Existing demand
- Generation capacity

- ESS ramp rate control or flicker management

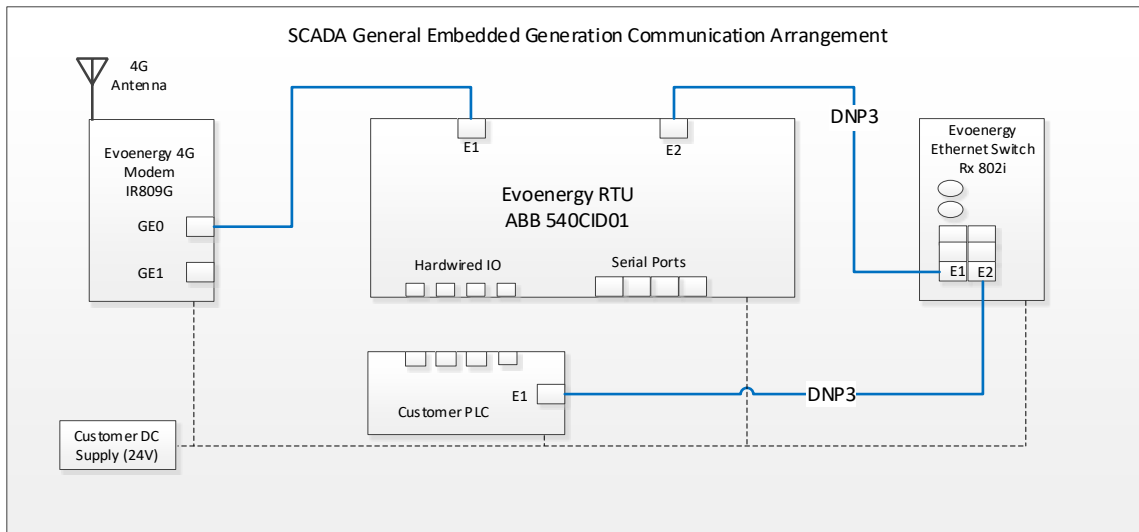
4.11 Communication Systems

4.11.1 HV EG Communications Systems

HV EG connections shall adhere to the following communication requirements.

4.11.1.1 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.

4.11.1.2 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.

4.11.1.2.1 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.

4.11.1.2.2 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.

4.11.1.3 SCADA IO Requirements

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

4.11.1.3.1 Digital Outputs

I/O	DESCRIPTION
Generator CB Trip	<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>
Generator CB Close Enable/Disable	<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"> • ‘Generator CB Trip’ Control is sent by the Evoenergy RTU. • A ‘Protection Operated’ signal is received from the PLC by Evoenergy’s RTU. <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>
Communications Heartbeat	<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</p>

	<p>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"> • Allow the generation to continue operating (if currently running) but prevent the generation from re-connecting if not already connected. • Limit the generation export to a predefined set value. • Initiate an automatic controlled shut down of the generating system.
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Additional Digital Outputs may be required on a project specific basis.

4.11.1.3.2 Digital Inputs

I/O	DESCRIPTION
Protection Operated	This signal indicates whether the proponent’s generation protection relay has operated and tripped the generator circuit breaker.
CB Close Enabled	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.
CB Closed	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.
DC Supply Fail	Fail indication for the proponent’s DC system.
PLC Fail	Fail indication from proponent’s PLC or protection relay.

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

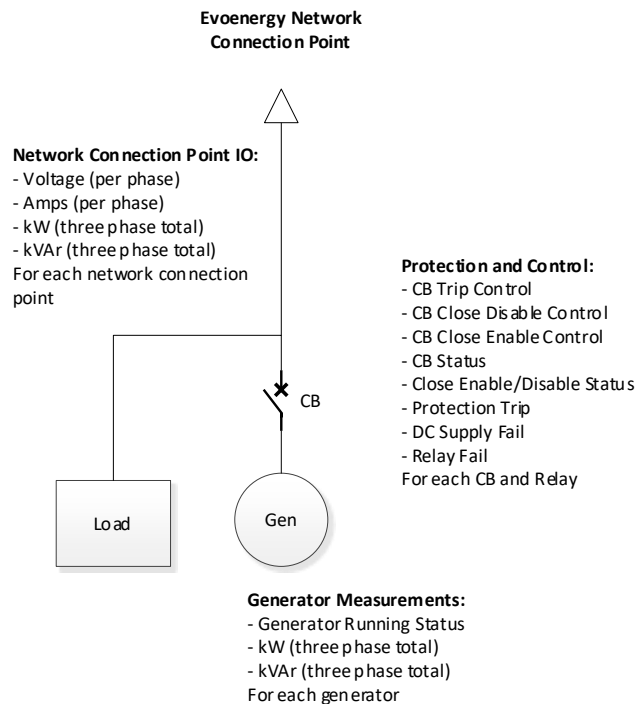
4.11.1.3.3 Analog Inputs

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

Additional Analog Inputs may be required on a project specific basis

4.11.1.3.4 SCADA Single Line Diagram

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



4.11.1.3.5 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).

4.11.1.4 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.

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

Evoenergy shall apply appropriate cyber security measures for the connections to Evoenergy's systems and may specify additional cyber security requirements that will be detailed in the proponent connection agreement.

4.14 Technical Studies

Technical studies for HV EG connections shall be performed for all systems. The proponent shall engage a suitably qualified engineer to perform the study for Evoenergy to review prior to installation. Evoenergy shall contact the proponent and specify the DNSP inputs, scope of the studies and criteria for assessment upon receiving an initial enquiry.

Steady state studies that may be undertaken as part of the connection application process include:

- Protection study
- Harmonics, flicker and unbalance study
- Fault level study
- Active and reactive power flow study
- Voltage level (including voltage step change) study
- Earthing study

Dynamic technical studies may be required due to the outcomes of steady state studies, system strength calculations (short circuit ratio), the proposed connection of non-standard equipment (e.g. STATCOM) or the network configuration at the proposed connection point. Evoenergy shall advise the proponent of any additional dynamic studies, these may include, but are not limited to:

- Transient / step frequency disturbance
- Transient / step voltage fluctuation
- Generator stability
- Generator governor control / excitation control
- Frequency response
- Fault ride through

All technical studies shall be presented to Evoenergy as a formal report containing detailed assumptions, processes, supporting material, models, data and overall findings. The report shall comply with, and state, jurisdictional requirements and standards that are relevant to the development of the study. Evoenergy shall work with proponents to provide any network information required to perform detailed technical studies.

Technical studies shall be assessed against the following criteria:

- Load flow parameters including power quality considerations and thermal loading
- Fault levels

- Protection coordination
- Risk of islanded operation

The outputs of technical studies will shall, but not be limited to the following:

- Maximum system capacity
- Site specific protection settings
- Power quality response settings
- Site specific operational protocols

Evoenergy shall define an assessment outcome specifying the approval or rejection of the application. 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)

5. FEES AND CHARGES

The following fees and charges for a HV EG connection are specified in the Evoenergy schedule of charges available on the Evoenergy [website](#). All fees are specified by system class, where the class of EG systems are outlined in Table 16.

TABLE 13. CHARGING CLASS TABLE

SYSTEM FEE CLASS	SYSTEM CAPACITY
Class 1	≤ 30 kVA
Class 2	Exceeding 30 kVA and up to 60 kVA
Class 3	Exceeding 60 kVA and up to 120 kVA
Class 4	Exceeding 120 kVA and up to 200 kVA
Class 5	Exceeding 200 kVA and up to 1500 kVA
Class 6	From 1500 kVA up to 5000 kVA

In addition to the connection enquiry charge, the system shall be subject to connection-specific charges that will typically consist of the following items:

- Network augmentation and design work
- Provision of data and technical study review
- Project management
- SCADA and Communications
- Inter-trip and Neutral Voltage Displacement
- Testing and Commissioning

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 may be applicable for HV EG connections. Additional details are available by contacting Evoenergy via the contact details on the Evoenergy [website](#).

6. TESTING AND COMMISSIONING

All HV EG connections shall be subject to testing and commissioning prior to being placed in service. Commissioning shall only occur after the installation of all primary and secondary equipment, including metering and communications infrastructure, is complete.

The proponent shall ensure the installation is approved for connection and meets all of the requirements specified by the ACT Government Electrical Inspectorate and Utilities Technical Regulation Team prior to commencing testing and commissioning.

Testing and commissioning plans shall be produced by the proponent and submitted to Evoenergy prior to finalising the connection. These plans shall be developed and carried out by a suitably qualified Evoenergy-approved person engaged by the proponent. Evoenergy shall witness the testing and commissioning and provide approval prior to the connection of the system to the network.

Testing and commissioning shall include, but not be limited to, confirming the primary, secondary and tertiary equipment is operating in accordance with the system design and meets the following requirements:

- Labelling and signage
- Maximum system capacity and any generation control schemes
- Network isolation point and associated primary equipment
- Earthing system
- Protection schemes and settings
- Power quality response settings
- Communication and control systems

Testing and commissioning shall demonstrate that the system meets the requirements specified in the connection agreement and shall involve installation tests, not type tests, with the exception of IEC 62116. Evoenergy may specify additional tests depending on the connection configuration.

In addition to performing the required tests, the proponent shall ensure that operating protocols and procedures are finalised by both the proponent and Evoenergy prior to commissioning. The proponent shall also submit an energisation and generation schedule to Evoenergy specifying the proposed generation sequence following commissioning.

Where a system is deemed non-compliant prior to energisation, the proponent shall prepare a rectification plan and submit an amended testing and commissioning plan for Evoenergy's approval to demonstrate system compliance.

Completed copies of test reports and commissioning approvals shall be maintained by the proponent and may be requested by Evoenergy to demonstrate requirements that were tested, equipment used, specification of criteria, test methods in addition to the date, time and duration of testing.

7. OPERATIONS AND MAINTENANCE

The HV EG system shall be operated and maintained to ensure compliance with the connection agreement, applicable legislation, codes and other regulatory instruments at all times. The generator shall be responsible for developing and adhering to a maintenance plan and shall provide operation and maintenance reports to Evoenergy on an annual basis. Evoenergy may inspect a system at any time to confirm compliance to the connection agreement.

7.1 Operating Protocol

HV EG connections may require a joint operating protocol, this will be identified during the connection-specific assessment by Evoenergy and communicated to the proponent. Evoenergy and the proponent shall work together to produce an operating protocol that will be approved by both parties and contain the following information:

- Planned and unplanned outage procedures including notification periods
- Standard switching procedures
- Inter-tripping protection philosophy
- Interlocking procedures and philosophy
- Designated points of contact for Evoenergy and the generator
- System monitoring responsibilities
- Fault identification and rectification procedures
- Site access procedures

In addition to operating protocol, the proponent shall adhere to the requirements of the Utilities Technical Regulation Team regarding operating certificates in accordance with the *Utilities (Technical Regulation) Act 2014* and *Utilities Act 2000*.

7.2 Maintenance

To ensure the electrical installation is maintained in a safe condition, the proponent shall develop a maintenance plan that specifies the maintenance schedule for all equipment and details the frequency and types of maintenance. The generator shall ensure the following maintenance requirements are met:

- Records of all maintenance activities are retained for all equipment
- Changes to the electrical installation are performed by suitably qualified personnel and the generator holds a certificate of compliance issued in respect of any of the changes
- Approval is obtained from Evoenergy prior to altering the connection for any 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.
- Protection systems are to be tested by suitably qualified personnel at an interval no greater than five years after commissioning

In the event a system is deemed to be non-compliant, Evoenergy will contact the generator to 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 network are met. This process may vary depending on the severity of the risk posed by the system.

Where the severity of the non-compliance and associated rectification actions result in commissioning activities, the requirements specified in Section 6 will apply.

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	Minor changes in IES based HV EG system requirements	W. Cleland – Asset Standards Mgr
2.0	Updated SCADA Requirements and Shared Generation Update document number from SM5063 to PO0843	W. Cleland – Asset Standards Mgr
2.1	Updated figures to show new document numbers	M Lloyd – Customer Technical Services Manager
2.2	Minor review to update definitions due to 4777 updates and renaming of micro to small. Full technical review to be done before 30/06/2025	Ellie Leiper – Acting Market Transactions Manager

DOCUMENT CONTROL

DOCUMENT OWNER	DOCUMENT CUSTODIAN	PUBLISH DATE	REVIEW DATE
Group Manager Customer Delivery	Embedded Generation Team Lead	07/01/2025	30/06/2025

APPENDIX A – DEVIATIONS FROM THE NATIONAL DER CONNECTION GUIDELINES

TABLE 14. 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
Introduction	Removal of temporary systems from the scope - by definition the scope of the document applies to temporary connected systems	Administrative	To improve ease of understanding and clearly state scope of the requirements
Introduction	Connection process is linked to Evoenergy embedded generation website	Administrative	To enable update of the process independently to the requirements
Definitions and Abbreviations	Incorporation of System Capacity definition, amendment to Energy Storage System definition and addition of jurisdictional abbreviations and definitions	Administrative	To remove ambiguity in the interpretation and application of definitions throughout the document
Subcategories	Relocation of applicability of technical requirements statement to the technical requirements section	Administrative	To improve ease of understanding and clearly state application of technical requirements
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	Omitted statement regarding DC-coupled ESS not effecting system limit	Administrative	System capacity is already defined as the AC output of the system
Export Limits at Connection Point	Removal of protection capability and performance as a factor in export limits	Jurisdictional	Existing protection system capability and performance will be addressed through existing asset ratings
Inverter Energy System	Removed statements about LV inverters preferably being in compliance to AS/NZS 4777 series and registered with CEC	Promotes improved benefit to electricity system	These requirements are not mandated from an Evoenergy perspective for HV connected systems
Earthing	Inclusion of ENA EG-0 and EG-1	Jurisdictional	Both ENA EG-0 and EG-1 are included in AS 2067 which is

			required for HV installations under jurisdictional legislation
Inverter Integrated Protection	Omitted inverter integrated protection settings	Promotes improved benefit to electricity system	Evoenergy will not be able to enforce or determine LV protection settings for HV connections, this will be the responsibility of the proponent. Network protection will occur at the HV level
Islanding Protection	Permitted customer islanding operation	Promotes improved benefit to electricity system	Inclusion of customer islanded mode to specify requirements allowing customers to safely retain supply during network outages
Central Protection	Inclusion of Generator Loss of Excitation protection	Jurisdictional	Inclusion of element 40G - may be included for asynchronous generators depending on the outcomes of technical studies
Central Protection	Omission of statement specifying interlock requirements with vector shift	Jurisdictional	Interlocking of ROCOF and vector shift will be determined based off the connection configuration, vector shift may not be required
Neutral Voltage Displacement	Specifications for voltage transformer, ownership and costs omitted	Administrative	These items are commercial, not protection related and will be determined on a connection-specific basis
Inter-tripping	Omitted content regarding responsibilities, actions and tripping logic for the inter-trip link from section	Administrative	These items are commercial, not protection related and will be determined on a connection-specific basis. Responsibilities are addressed under the operation and maintenance section
DC System or UPS Integration Protection	Section does not prescribe protection operating logic in the event of DC supply failure	Administrative	Unable to specify general protection philosophy in the event of DC supply failure, will be dependent on connection-specific factors (e.g. duplicate protection)
Protection Relay	Section contents relocated to the introduction of Central Protection section. Included information that duplicate protection may be required	Administrative	To improve ease of understanding and clearly state requirements for central protection
Operating Voltage and Frequency	Inclusion of AEMC reference for system frequency and removal of AS/NZS 4777.2	Jurisdictional	AEMC standard provided for frequency reference and LV standard removed as requirements are not mandated from an Evoenergy perspective
Power Quality	Inclusion of two subsections, quality of supply and generation	Administrative	To improve ease of understanding, specified the parameters for Evoenergy's quality of supply and

			separately specified the parameters required by proponents
Power Quality	Removal of section headings for IES and non-IES and inclusion of statement that settings should be uniform across generating units	Administrative	To improve understanding and remove duplication of information, the parameters will be the same between both system types
Communication Systems	Inclusion of statement that fail-safe schemes will be determined on a connection-specific basis	Jurisdictional	Fail-safe schemes will be dependent on several connection-specific factors
Communication Systems	Protocol information omitted	Administrative	To avoid duplication of information, is detailed within the dynamic data section
Communication Systems	Omission of 200 kVA communication threshold	Jurisdictional	All HV embedded generators connected to the Evoenergy network will require communications systems
Cyber Security	Removal of statement regarding the integrity of channels and trust	Jurisdictional	These are Evoenergy responsibilities, not requirements for the proponent
Technical Studies	Removal of SCR system strength limits	Jurisdictional	These calculations are not a jurisdictional requirement for Evoenergy when non-market generators are connecting and may only be used in some cases
Technical Studies	Specification that all studies will be performed by the proponent	Jurisdictional	All technical studies for HV connections will be performed by the proponent, not Evoenergy
Fees and Charges	Payment process not specified in this section	Administrative	The Evoenergy payment process is managed separately to the technical governance of connections. Proponents are able to seek clarity around this process during the application stage
Testing and Commissioning	Inclusion of statement to meet jurisdictional requirements	Jurisdictional	All systems will have to abide by the requirements specified by the technical regulator and electrical inspections team
Testing and Commissioning	Restructured tests and checks to align with requirements specified in the document	Administrative	All tests should be in relation to the requirements set out in the document to avoid ambiguity
Testing and Commissioning	Removal of requirement that commissioning shall be to Australian standards where applicable	Administrative	LV standards will not apply to the Evoenergy connection point, this may be a regulator requirement and fall under the legislative obligations of the proponent
Testing and Commissioning	Inclusion of generation sequence	Promotes improved benefit to electricity system	Enables controlled energisation of generation systems minimising risks to the electricity network and other customers

Operations and Maintenance	Inclusion of sub-sections and five yearly maintenance requirement	Jurisdictional	To clearly define that an operating protocol may be established to cover the connection and define the obligations as per jurisdictional Service and Installation Code
Operations and Maintenance	Removal of statements regarding cost and commercial impacts of loss resulting from maintenance	Jurisdictional	These obligations will be covered by separate commercial processes including the Evoenergy connection agreement
Appendix D	Appendix links to Evoenergy website to specify static data requirements	Administrative	Link to the application form specifying the data will enable independent update of the requirements with the establishment of the DER register
General	Removal of New Zealand settings from protection tables	Administrative	New Zealand values removed for ease of interpretation
General	Removal of references to MV and HV and referred to all connections above 1 kV as HV	Jurisdictional	To align with the terminology used in the Service and Installation Rules and jurisdictional legislation

APPENDIX B – CONNECTION ARRANGEMENT REQUIREMENTS

The figures below display the common connections for HV Embedded Generators. Meters are not shown; however, the connections shall comply with all metering requirements. For additional information about connection arrangements please contact Evoenergy via the contact details listed on the [website](#).

Connection arrangements are shown for indication only. Actual connection arrangements are dependent on specific installation configurations.

FIGURE 3. HV IES GENERATOR CONNECTION

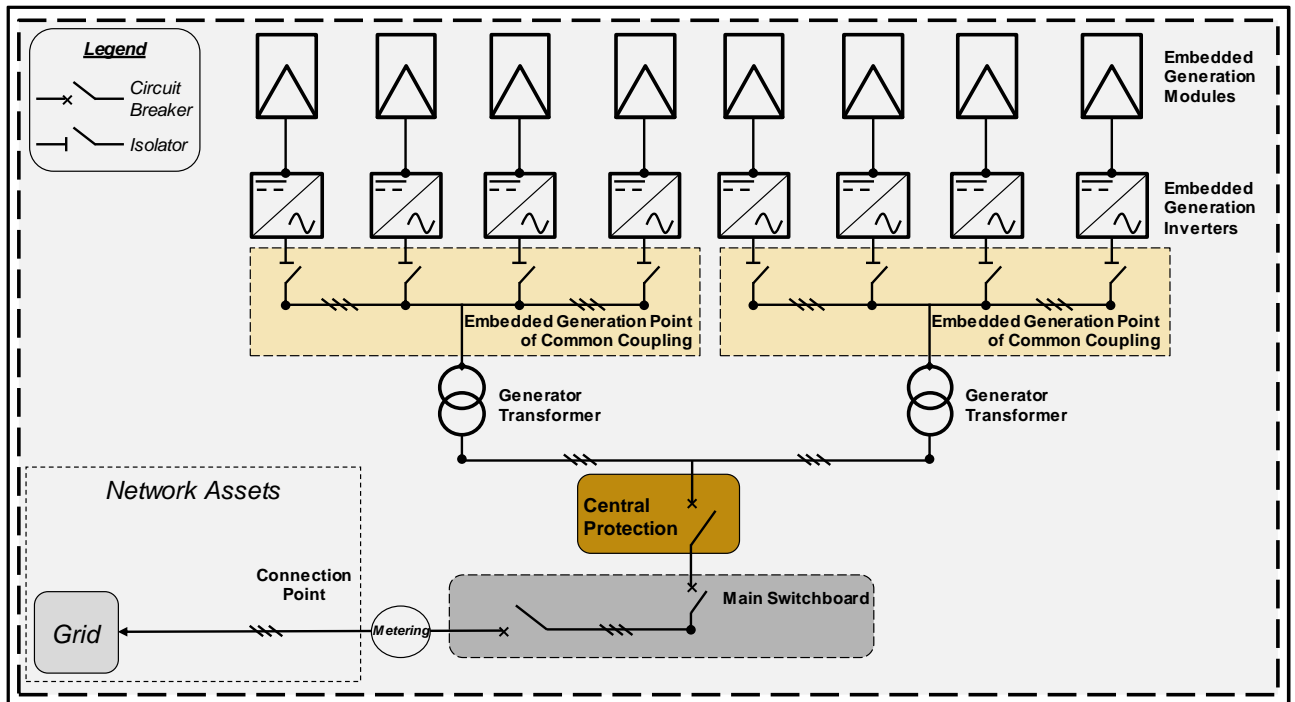


FIGURE 4. HV NON-IES GENERATOR CONNECTION

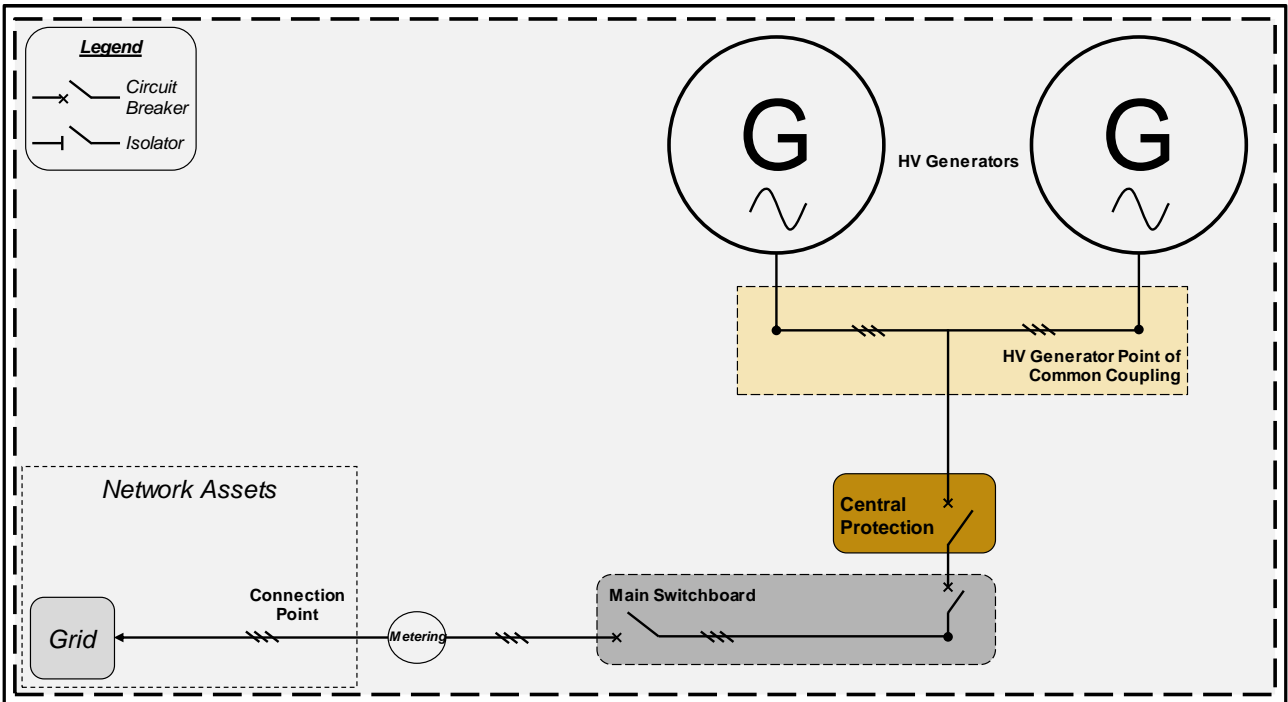


FIGURE 5. HV IES GENERATOR CONNECTION FOR HV PROPONENT

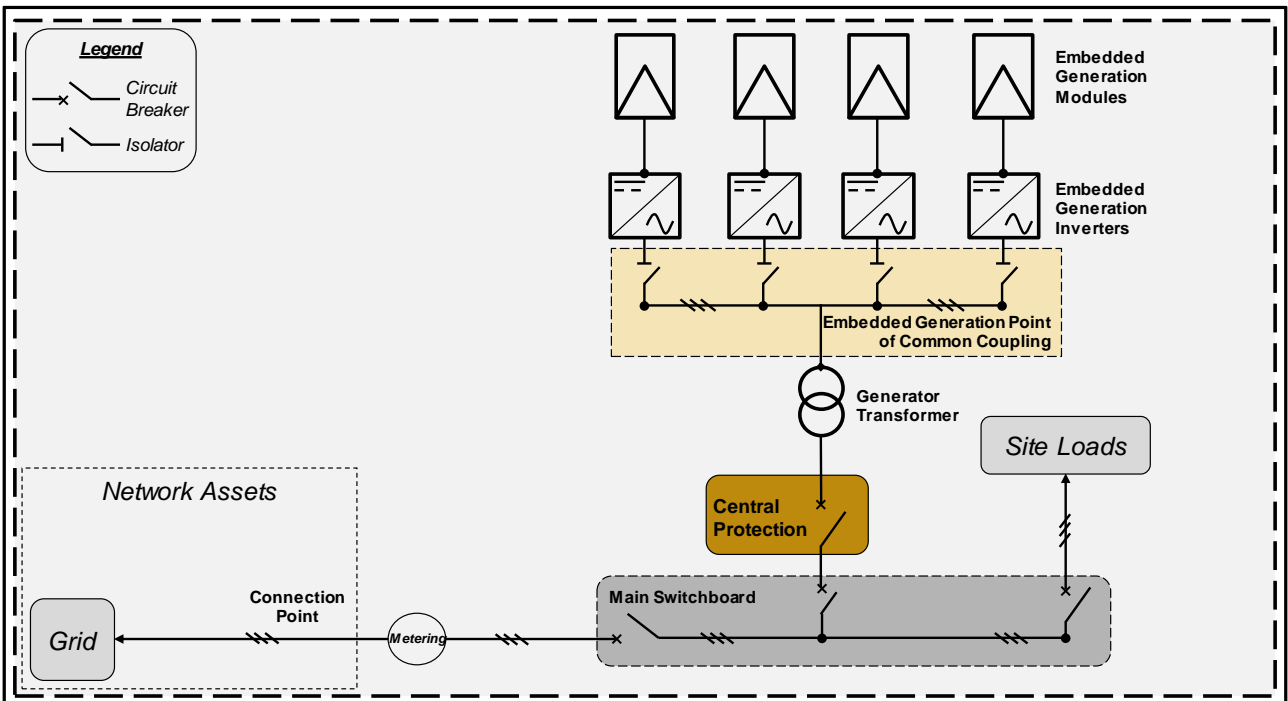


FIGURE 6. HV NON-IES GENERATOR CONNECTION FOR HV PROPONENT

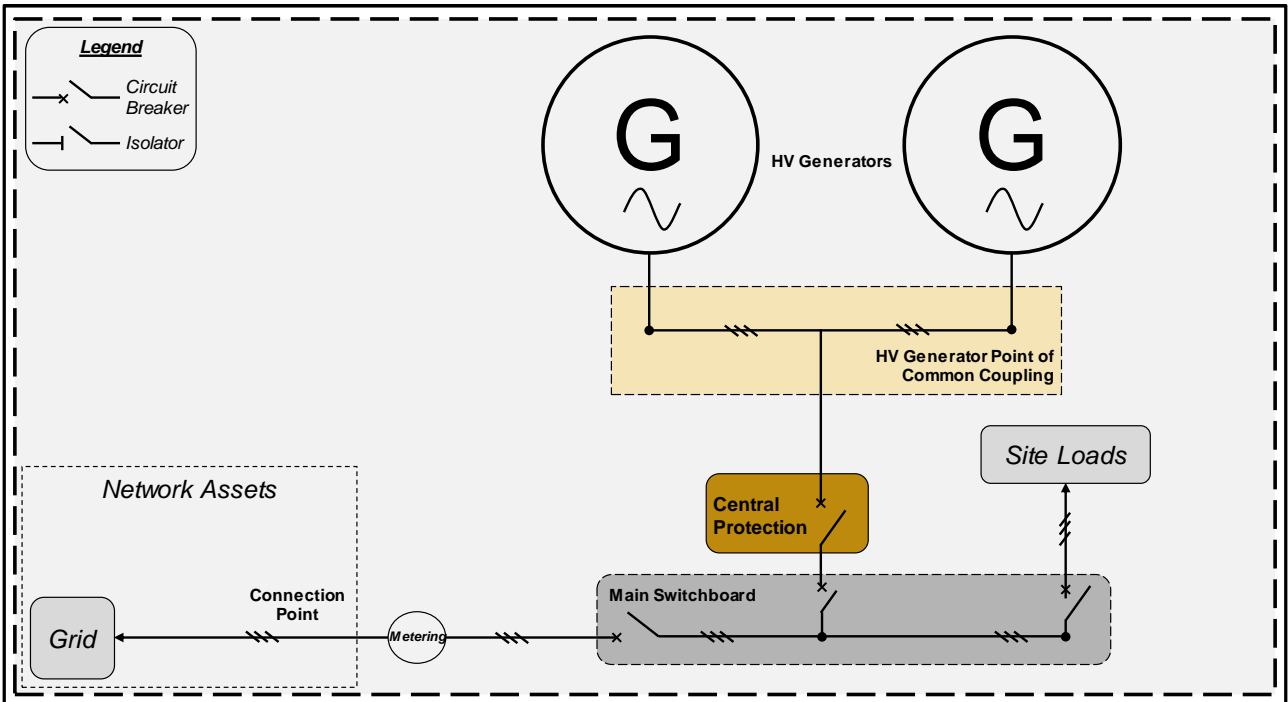
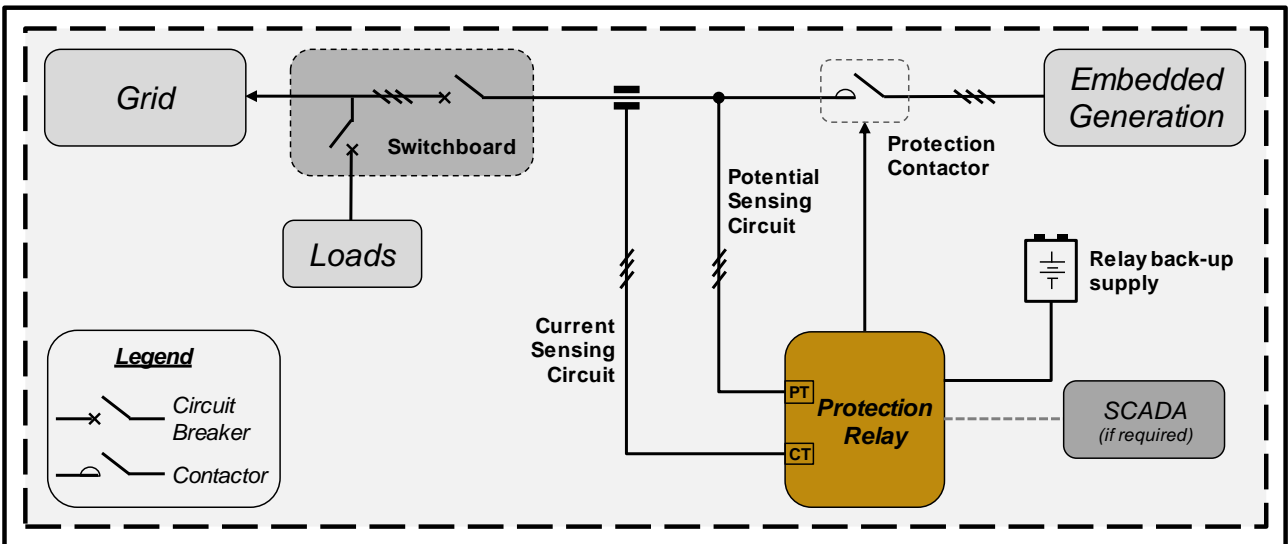


FIGURE 7. EXAMPLE ARRANGEMENT OF CENTRAL PROTECTION



Central protection settings can be found in Section 4.7.

APPENDIX C – CONNECTION AGREEMENT

HV 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 outlined on the Embedded Generation application form available on the Evoenergy [website](#). Any additional connection-specific static data requirements will be specified by Evoenergy upon receiving an application to connect.