Part of Energy Queensland

STNW3515

# Standard for Low Voltage Embedded Generating Connections to Isolated Networks

**Effective from 1 October 2025**

# Standard for LV EG Connections to Isolated Networks

If this standard is a printed version, then the Ergon Energy Network internet site must be referenced to obtain the latest version to ensure compliance.

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Abstract: This Standard has been prepared by Ergon Energy Network to provide Proponents of Fixed or Dynamic Embedded Generating (EG) Systems, connecting at Low Voltage, with information about their rights and obligations in respect of connecting to, and interfacing with, the Ergon Network Isolated System. This standard covers Inverter Energy System connections from 30 kVA up to and including 1,500 kVA and Rotating Machine connections less than or equal to 1,500 kVA.

Keywords: embedded, dynamic, fixed, generating, low voltage, LV, IES, inverter, solar, photovoltaic, wind, diesel, energy storage system, export, PV, Isolated Network, rotating, connection, rotating machine, 1500 kVA, 1.5 MVA

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# 1 Introduction

## 1.1 Purpose

The purpose of this Standard is to provide Proponents of a Fixed EG System or Dynamic EG System with information about their obligations in respect of connecting to, and interfacing with Ergon Energy Network's Isolated System. This Standard has been developed to ensure safe and stable Parallel operation[1] of EG Systems connected to the DNSP's Isolated Network without causing material degradation in the quality of supply to Isolated Network users.

## 1.2 Scope

This Standard applies to new connections and connection alterations that are Fixed EG Connections or Dynamic EG Connections that:

- are intended to be connected to, and capable of operating in Parallel with, any part of the LV portion of the Isolated Network;
- are comprised of Inverter Energy System connections greater than 30 kVA and less than or equal to 1,500 kVA and Rotating Machine connections less than or equal to 1,500 kVA or a combination thereof; and
- are capable, in the case of Dynamic EG Connections, of responding to Dynamic Operating Envelopes set by the DNSP.

This Standard does not apply to:

- Electric vehicles, unless the electric vehicle supply equipment (EVSE) is capable of supplying electricity to the Isolated Network or electrical installation (in which case the requirements of this Standard shall apply);
- Electrical equipment that does not generate electricity unless they impact on the ability of the EG System to meet the technical requirements of this Standard;
- Off-grid systems not connected in Parallel with the Isolated Network;
- Back-up generating systems with a Break-before-make changeover switch, configured to ensure the generating system cannot be connected in Parallel with the Isolated Network.
- EG systems covered by the following Ergon Network connection standards:

| Standard Number | Title |
|---|---|
| STNW1170 | Standard for Small IES Connections - 2970697 |
| STNW1174 | Standard for LV EG Connections - 27939029 |
| STNW1175 | Standard for HV EG Connections |
| STNW3510 | Dynamic Standard for Small IES Connections - 3403035 |
| STNW3511 | Dynamic Standard for LV EG Connections - 27939029 |
| STNW3514 | Standard for Small IES Connections to Isolated Networks - 27933442 |

[1] Section 225 of the *Electrical Safety Regulation 2013* requires that any person who has generating plant must comply with the DNSP's conditions for ensuring safe and stable Parallel operation of the private generating plant with the works of the electricity entity.

The technical requirements in this Standard comply with the framework of the National DER Grid Connection Guidelines for LV EG Connections as published by the Energy Networks Association (ENA) to the greatest extent possible; the ENA Guidelines do not contemplate dynamic connections, Output Smoothing or Isolated Networks.

### 1.3 Obligation of Proponents

Proponents shall:

a. obtain the consent from the DNSP before interconnecting their EG System with the Isolated Network.
b. ensure that the design is certified by a Registered Professional Engineer of Queensland (RPEQ).
c. comply with this Standard and the terms and conditions of the relevant Connection Contract.
d. ensure construction, operation and maintenance of the proposed EG System, and its connection to the Isolated Network, complies with the relevant Energy Laws, including any applicable regulations, standards, manuals, guidelines and codes of practice as they apply in Queensland.
e. not connect additional inverters, make modifications, or install additional EG Units (including any Energy Storage Systems), without the prior written agreement of the DNSP.
f. meet the commissioning requirements applicable for connections to the LV portion of the Isolate Network and and complete commissioning under a commissioning plan certified by an RPEQ unless stated otherwise in this Standard.

## 2 Definitions and abbreviations

### 2.1 Definitions

| Term | Definition |
|---|---|
| Accredited Person | A person that is properly licensed under the relevant laws and holds accreditation from a peak industry body as competent to design and/or install renewable Generating Units and/or ESS. Accredited Persons may include accredited installers, designers and supervisors operating in accordance with the terms of their accreditation. To be eligible to produce Renewable Energy Certificates a SAA accredited person must be engaged. |
| Affected Isolated Network | Any Isolated Network which has reached its Unmanaged Hosting Capacity which is listed on the Isolated Networks Solar Capacity Page. |
| Anti-islanding Protection | A protection system to detect islanded conditions and disconnect the inverter(s) or rotating plant from the Isolated System. |
| Break-before-make | Break-before-make operation is used in a switch that is configured to break (open) the first set of contacts before engaging (closing) the new contacts. |
| Connection | Means a physical link between an Isolated System and a Retail Customer's Premises to allow the flow of electricity. |
| Connection Assets | Those components of an Isolated System which are used to provide Connection Services. |
| Connection Contract | A contract formed by the making and acceptance of a connection offer between the Retail Customer and Ergon Network for the connection of an Embedded Generating Unit(s) to an Isolated System. |

| Term | Definition |
|---|---|
| Connection Point | An agreed point of supply established between the DNSP's Isolated System and a Proponent's Premises. |
| DER Technical Standards | Means the requirements for EG Units under AS/NZS 4777.2:2020 as in force from time to time. |
| Disconnection Device | Device designed to safely prevent the flow of current such as a circuit breaker, an ACR or a contactor. |
| Distribution Network Service Provider (or DNSP) | Means Ergon Energy Network who owns, controls and operates the Isolated Systems in Queensland. |
| Dynamic EG Connection | A Connection between a Dynamic EG System and the Isolated System having variable limits for select settings for the Dynamic EG System that are frequently reviewed and applied. |
| Dynamic Embedded Generating System(s) (or Dynamic EG System(s)) | One or more Embedded Generating Units and auxiliary equipment that comprise either an Inverter Energy System or Rotating Machines and interconnect with the Isolated System at a Connection Point. Variation of some settings for the Dynamic EG System, such as Import and Export, are supported through publishing of Dynamic Operating Envelopes (DOEs) by the DNSP for the Proponent's Connection Point. |
| Dynamic Operating Envelopes (or DOE(s)) | Dynamic Operating Envelopes are where Dynamic EG System setting limits, such as Import and Export limits, can vary over time and location |
| Embedded Generating Connection (or EG Connection) | Either refers to a Fixed EG Connection or a Dynamic EG Connection, depending on the context. |
| Embedded Generating System(s) (or EG System(s)) | One or more Embedded Generating Units and auxiliary equipment that are that comprise either an Inverter Energy System or Rotating Machines and interconnect with the Isolated System at a Connection Point. Both a Fixed EG System and a Dynamic EG System are types of an EG System. The term EG System in this Standard refers to either a Fixed EG System or Dynamic EG System, depending on the context. |
| Embedded Generating Unit(s) (or EG Units(s)) | A Generating Unit connected within an Isolated System and connected to the LV portion of the Isolated System. |
| Emergency Backstop Mechanism | Involves the use of Generation Signalling Devices to provide Demand Response that causes an IES to temporarily cease or reduce generation in emergency contingency events within the power system. The mechanism may be called upon to respond to a direction by AEMO issued in accordance with the NEL. It is not applicable to Isolated Networks. |
| Energy Laws | Relevant laws as they apply in Queensland relating to the subject matter of this Standard. |
| Energy Storage System (or ESS) | A system comprising one or more components (e.g. batteries) that store electricity generated by Distributed Energy Resources or directly from the grid, and that can discharge the electricity to loads. |
| Export | Net electricity that is fed from the Premises into the Isolated System through the Connection Point. |
| Fixed Default Dynamic Export Limit | The Fixed Default Dynamic Export Limit, as per Table 6, is the Export limit that shall be met at all times by the Dynamic EG System when the communication system (described in Section 4.12 of this Standard) is not fully operational (including, but not limited to, a loss of signal or, the Dynamic EG System is not receiving or not being able to respond to the dynamic Export limit). The Fixed Default Dynamic Export Limit applies at the Connection Point to the combined EG within the Premises (including any EG Units that may have been previously connected under different connection arrangements). |

| Term | Definition |
|---|---|
| Fixed Default Dynamic Import Limit | The Fixed Default Dynamic Import Limit, as per Table 9, is the Import limit that shall be met at all times by the Dynamic EG System when the communication system (described in Section 4.12 of this Standard) is not fully operational (including, but not limited to, a loss of signal or, the Dynamic EG System is not receiving or not being able to respond to the dynamic Import limit). The Fixed Default Dynamic Import Limit applies at the Connection Point to the combined EG within the Premises (including any EG Units that may have been previously connected under different connection arrangements). |
| Fixed Default Dynamic Site Load Limit | The Fixed Default Dynamic Site Load Limit, as per Table 10, is the Site Load Limit that shall be met at all times by the Dynamic EG System when the communication system (described in Section 4.12 of this Standard) is not fully operational (including, but not limited to, a loss of signal or, the Dynamic EG System is not receiving or not being able to respond to the dynamic Site Load Limit). The Fixed Default Dynamic Site Load Limit applies to the combined actively managed loads (including the combined EG) within the Premises (including any EG Units that may have been previously connected under different connection arrangements). |
| Fixed Default Dynamic Site Generation Limit | The Fixed Default Dynamic Site Generation Limit, as per Table 7, is the Site Generation Limit that shall be met at all times by the Dynamic Small IES when the communication system (described in Section 4.12 of this Standard) is not fully operational (including, but not limited to, a loss of signal or, the Dynamic Small IES is not receiving or not being able to respond to the dynamic Site Generation Limit). The Fixed Default Dynamic Site Generation Limit applies at the Connection Point to the combined EG within the Premises (including any EG Units that may have been previously connected under different connection arrangements). |
| Fixed EG Connection | A Connection between a Fixed EG System and the Isolated System having predetermined limits for settings applied to the Fixed EG System during installation and are not able to be changed. |
| Fixed Embedded Generating System(s) (or Fixed EG System(s)) | One or more Embedded Generating Units and auxiliary equipment that comprise either an Inverter Energy System or Rotating Machines and interconnect with the Isolated System at a Connection Point. |
| Generating Unit | The plant used in the production of electricity and all related equipment essential to its functioning as a single entity. For the avoidance of doubt, the term Generating Unit encompasses both distribution connected generating units and distribution connected bidirectional units (as defined in the NER). |
| Generation | The production of electrical power by converting another form of energy in a Generating Unit. |
| Generation Limit | The maximum active power that may flow from an inverter or multiple inverters towards the rest of the electrical installation as a result of Generation Limit Control. |
| Generation Limit Control | Function to limit the active power that can flow from an inverter or multiple inverters towards the rest of an electrical installation while meeting the requirements of AS/NZS 4777.2. |
| Generation Management | A method via which the output of electricity, typically from a renewable source, is controlled. Includes utilisation of technologies such as the use of use of Dynamic Operating Envelopes or, the use of energy storage to control the output profile of an IES Unit installation via Output Smoothing. |
| Generation Signalling Device | A DRED providing functionalities and capabilities to achieve Demand Response, which satisfies the requirements of AS/NZS 4755.1. |
| Grid Connected | See definition for Parallel. |
| High Voltage (or HV) | Any voltage greater than 1,000 V a.c. or 1,500 V d.c. |

| Term | Definition |
|---|---|
| Inverter Energy System Unit (or IES Unit) | A sub-type of EG Unit in which the technology comprises IES only. |
| Import | Net electricity that is supplied via the Isolated System through the Connection Point. |
| Interface Protection | Interface Protection is the protection system installed to perform the functions of: coordinating multiple EG Unit installations within the Premises, providing protection for the collective EG System installation and islanding protection to the connected Isolated System as well as preserving safety of grid personnel and the general public. |
| Inverter Energy System (or IES) | A system comprising one or more inverters together with one or more energy sources (which may include batteries for energy storage) and controls, where the inverter(s) satisfy the requirements of AS/NZS 4777.2. |
| Inverter Power Sharing Device (IPSD) | A device of the kind contemplated by, and meeting the requirements of, AS/NZS 4777.1 which is used to share the generation from an inverter or multiple inverters to supply loads on a number of electrical installations that are part of a multiple electrical installation. |
| Isolated Network | The relevant Network which:<br>a. is controlled and operated by the DNSP; and<br>b. supplies electricity to a community listed on the Isolated Networks Solar Capacity Page that can be found on the DNSP website (www.ergon.com.au).<br>For the avoidance of doubt a reference to an Isolated Network in this Standard is the relevant Isolated Network that the EG Unit(s) is, or will be, connected. |
| Isolated Networks Solar Capacity Page[2] | Means the Isolated Networks Solar Capacity Page available on the DNSP website (www.ergon.com.au). This page lists the Isolated Networks which are operated by the DNSP and their associated availability of Unmanaged Hosting Capacity, Managed Hosting Capacity and Dynamic EG Connections. |
| Isolated System | An Isolated Network, together with the Connection Assets associated with that Isolated Network, which is supplied by centralised electricity generating asset(s) owned and operated by the DNSP. For the avoidance of doubt a reference to an Isolated System in this Standard is the relevant Isolated System that the EG Unit(s) is, or will be, connected. |
| Limits | The collective set of limits comprising the Export limit, Import limit, Site Generation Limit and Site Load Limit. |
| Low Voltage (or LV) | A voltage of no more than 1,000 V a.c. or 1,500 V d.c. |
| Managed Hosting Capacity | The hosting capacity that can be made available for systems equipped with Generation Management. |
| Network | The apparatus, equipment, plant and buildings used to convey, and control the conveyance of, electricity excluding any Connection Assets. |
| Network Coupling Point | The point at which Connection Assets join the shared Isolated Network, used to identify the distribution service price payable by the Proponent. |
| Non-export | An EG Unit that is capable of operating in Parallel with the Isolated System and which is designed and configured to prevent any Export of electricity to the Isolated System across the Connection Point. |

[2] The information on this web page is indicative only and may change from time to time. Ergon Network makes no representations or warranties regarding the terms and conditions on which a Connection Applicant will be able to connect to the Isolated Network as this will be contained in the relevant connection offer.

| Term | Definition |
|---|---|
| Non-Isolated Networks | Ergon Network distribution networks which are not Isolated Networks. Non-Isolated Networks are defined as distribution networks in STNW1170, STNW1174, STNW1175, STNW3510 and STNW3511. |
| Off-grid | An EG Unit which can supply a customer load as back-up, also known as “non-parallel”. In this circumstance, the EG Unit(s) is not connected in Parallel and does not synchronise with the Isolated System. Loads shall be isolated from the Isolated Network when being supplied from the non-parallel EG Unit. |
| Output Smoothing | A form of Generation Management, defined by the additional requirements in Appendix H of this Standard, in which an energy storage system (ESS) is used to limit the rate-of-change of the generation output of a renewable source of electricity such as PV. |
| Parallel (or Grid Connected) | This is where the EG Unit is configured such that the EG Unit and the Isolated System supply the installation simultaneously from time to time (even if this is a very short period of time). This includes circumstances where energy storage systems can be tied directly or indirectly back to the Isolated System through an AS/NZS 4777.2 grid connect inverter. It is irrelevant whether the EG Unit (including any ESS) Exports. |
| Partial-export | An EG Unit that is capable of operating in Parallel with the Isolated System and which is designed and configured to only Export as prescribed to operate in Section 4.4.1 of this Standard. |
| Power Limiting | The ability to reduce or stop power output from the EG System when Export exceeds a defined value. |
| Premises | Means any land (whether a single block or multiple contiguous blocks), building(s) (whether whole or part), and structure(s) (or adjuncts thereto) that are owned, occupied or controlled by the Proponent in the vicinity of the proposed connection and which can reasonably be considered to be part of a single overarching operation. |
| Proponent | The Retail Customer that is the relevant owner, operator, or controller of the EG System (or their agent). |
| PSCAD™/EMTDC™ | Refers to a software package developed by the Manitoba-HVDC Research Centre that comprises a power systems computer-aided design package which includes an electromagnetic transients (including DC) simulation engine, and which is used to carry out electromagnetic transient type studies. |
| Reactive Power | The rate at which reactive energy is transferred, which is a necessary part of an alternating current system containing inductive and capacitive components, as it regulates the voltage within the system. Reactive Power is measured in vars within the scope of this Standard. |
| Retail Customer | Means the electricity retail account holder for the Premises or the person intending to be the electricity retail account holder for the Premises where it is a new connection. |
| Rotating Machines | Electric rotating machinery with an aggregate installed nameplate capacity less than or equal to 1,500 kVA. |
| Single Wire Earth Return (or SWER) | Parts of the electrical high voltage Isolated Network that use a single live conductor with the earth as the return current path. All Premises are supplied at LV either as single-phase or split-phase electric power. |
| SEP2 Utility Server | The server hosted by the DNSP and defined in IEEE 2030.5:2018 Standard for Smart Energy Profile Application Protocol. |
| Site Load | The net active power flowing towards the loads from the rest of the electrical installation where that power is considered as the aggregate across all loads downstream (on the customer side) of the Connection Point. |

| Term | Definition |
|---|---|
| Site Load Limit | The maximum net active power which may flow towards the loads from the rest of the electrical installation where that power is considered as the aggregate across all loads downstream (on the customer side) of the Connection Point. The Site Load Limit only applies to actively managed loads (such as ESS) covered under the dynamic connection agreement; the Site Load Limit does not apply to loads which are not part of the dynamic connection agreement. |
| Site Generation | The net active power flowing from the Embedded Generating Systems towards the rest of the electrical installation where that power from the EG Systems is considered as the aggregate across all Embedded Generating Units downstream (on the customer side) of the Connection Point. |
| Site Generation Limit | The maximum net active power which may flow from the Embedded Generating Systems towards the rest of the electrical installation where that power from the EG Systems is considered as the aggregate across all Embedded Generating Units downstream (on the customer side) of the Connection Point. Note: The function to achieve the Site Generation Limit is referred to as “generation limit control” in AS/NZS 4777. |
| Spinning Reserve | The amount of unused and immediately dispatchable generating capacity synchronised with, and helping to maintain stability of, the Isolated Network. |
| Split-phase SWER | A split-phase connection is a two-phase supply provided off a single SWER transformer. |
| Standard | This document that is titled “Standard for Low Voltage Embedded Generating Connections to Isolated Networks”. |
| Technical Study | A study to evaluate the effects that the proposed connection of the EG System will have on the Isolated System under different loading conditions or in the event of particular faults. A document will be produced for the Proponent that has requirements as part of the Connection Contract. |
| Three-Phase Balanced Inverters | Means a three-phase inverter configured for three-phase connection to the LV network. The inverter output shall be balanced across all three-phases at all times whilst connected to the Network and all three-phases simultaneously disconnect from, or connect to, the Isolated System in response to protection or automatic controls (e.g. Anti-islanding and subsequent reconnection). |
| Total Hosting Capacity | The limited capacity of the Isolated Network to accept or manage the output of renewable electricity generated by customers’ EG Units due to insufficient generation Spinning Reserve, minimum loading requirements or other technical limitations. This is defined as the sum of Unmanaged Hosting Capacity and Managed Hosting Capacity. |
| Unmanaged Hosting Capacity | The limit for hosting of EG Units without Generation Management capabilities. |
| Vehicle-to-Building (V2B) | Plug-in electric vehicle interaction with the Premises, including charging as well as discharging and bi-directional communication interface. |
| Vehicle-to-Grid (V2G) | Plug-in electric vehicle interaction with the electric grid, including charging as well as discharging and bi-directional communication interface. |

## 2.2 Abbreviations

| Term, abbreviation or acronym | Definition |
|---|---|
| AC or a.c. | Alternating current |
| ACR | Automatic Circuit Recloser |

| Term, abbreviation or acronym | Definition |
|---|---|
| AEMO | Australian Energy Market Operator |
| AFLC | Audio Frequency Load Control |
| API | Application Programming Interface |
| AS/NZS | A jointly developed Australian and New Zealand Standard |
| AS | Australian Standard |
| ANSI | American National Standards Institute |
| CBD | Central Business District |
| CBF | Circuit Breaker Fail |
| CEC | Clean Energy Council |
| CSIP | Common Smart Inverter Profile |
| CSIP-AUS | Australian Implementation of CSIP |
| DC or d.c. | Direct current |
| DER | Distributed Energy Resources |
| DOE | Dynamic Operating Envelope |
| DRED | Demand Response Enabling Device |
| EG | Embedded Generation or Embedded Generating |
| EMC | Electromagnetic Compatibility |
| EV | Electric Vehicle |
| EVSE | Electric Vehicle Supply Equipment |
| GSD | Generation Signalling Device |
| HV | High Voltage |
| IEC | International Electrotechnical Commission |
| IEEE | Institute of Electrical and Electronics Engineers |
| IES | Inverter Energy System |
| IPR | Interface Protection Relay |
| IPSD | Inverter Power Sharing Device |
| LV | Low Voltage |
| NEL | National Electricity Law |
| NER | National Electricity Rules |
| NERL | National Energy Retail Law |
| NVD | Neutral Voltage Displacement |
| PV | Photovoltaic |
| QECM | Queensland Electricity Connection Manual |
| RPEQ | Registered Professional Engineer of Queensland |
| SAA | Solar Accreditation Australia |
| SEP2 | IEEE 2030.5:2018 *Standard for Smart Energy Profile Application Protocol* |
| SLD | Single Line Diagram |

| Term, abbreviation or acronym | Definition |
|---|---|
| TSE | Transfer Switching Equipment |
| UPS | Uninterruptible Power Supply |
| V2B | Vehicle-to-Building |
| V2G | Vehicle-to-Grid |
| VPP | Virtual Power Plant |

## 2.3 Terminology

In this Standard:

- the word “shall” indicates a mandatory requirement that the Proponent must comply with;
- the word “should” indicates a recommended requirement that will not be mandatorily imposed on the Proponent; and
- the word “may” indicates a requirement that the DNSP may determine the Proponent must comply with.

### 2.3.1 Subcategories

The technical requirements set out in this Standard shall apply to the following subcategories of Fixed EG Systems described in Table 1 and Dynamic EG Systems described in Table 2.

**Table 1 Subcategories for Fixed EG Systems**

| LV EG IES ≤ 30 kVA fixed connection[1] | LV EG IES > 30 kVA and ≤ 200 kVA fixed connection | LV EG IES > 200 kVA fixed connection | LV EG Rotating Machines fixed connection | LV EG non-standard fixed connection |
|---|---|---|---|---|
| System capacity ≤ 30 kVA | System capacity > 30 kVA and ≤ 200 kVA | System capacity > 200 kVA and ≤ 1,500 kVA | System capacity > 0 kVA and ≤ 1,500 kVA | Premises with more than one LV Connection Point, connections on SWER[1] or connections utilising IPSD. |

Note 1: LV Fixed EG Connections for SWER which are not covered by the standard STNW3514.

**Table 2 Subcategories for Dynamic EG Systems**

| LV EG IES ≤ 200 kVA Dynamic EG Connection | LV EG IES > 200 kVA Dynamic EG Connection | LV EG Rotating Machines Dynamic EG Connection | LV EG non-standard Dynamic EG Connection |
|---|---|---|---|
| System capacity > 30 kVA and ≤ 200 kVA | System capacity > 200 kVA and ≤ 1,500 kVA | System capacity > 0 kVA and ≤ 1,500 kVA | Premises with more than one LV Connection Point, Connections on SWER[1] or connections utilising IPSD. |

Note 1: LV Fixed EG Connections for SWER which are not covered by the standard STNW3514.

The following arrangements are considered to be non-standard for this Standard and shall be assessed for technical limitations identified on a case-by-case basis:

- Connections involving a Premises with has more than one LV Connection Point, or the Proponent's network(s) is connected to more than one LV Connection Point. These will be considered in terms of their aggregated impact on the Isolated Network;
- LV connections with aggregated capacity > 1.5 MVA;
- Premises connected (or connecting) to SWER networks, which are not covered in the standard STNW3514; and
- Premises connected (or connecting) to the Isolated System utilising IPSD.

EG connected to Non-Isolated Networks are outside the scope of this Standard and are covered by other connection standards as follows:

- Premises connected (or connecting) to a Non-Isolated Network at LV with a Fixed EG connection are covered under
  - STNW1170 "Standard for Small IES Connections" or
  - STNW1174 "Standard for Low Voltage EG Connections"
- Premises connected (or connecting) to a Non-Isolated Network at LV with a Dynamic EG connection are covered under
  - STNW3510 "Dynamic Standard for Small IES Connections" or
  - STNW3511 "Dynamic Standard for Low Voltage EG Connections".
- Premises connected (or connecting) to a HV network are covered under STNW1175 "Standard for High Voltage EG Connections" for Non-Isolated Networks.

Premises connected (or connecting to) an Isolated Network at LV where the IES capacity is no greater than 30 kVA is typically covered by STNW3514 "Standard for Small IES Connections to Isolated Networks".

Further details regarding the categories of LV EG that are capable of being connected under the DNSP Standards are set out in Appendix F: LV EG Connection arrangement requirements summary (informative).

If further clarification is required to determine which subcategory applies to a Proponent, please contact

Ergon Network – ergongeneration@energyq.com.au

# 3 Relevant rules, regulations, standards and codes

## 3.1 Standards and codes

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

In the event of any inconsistency between:

- an applicable Australian and international standards and industry codes (except for legislated industry codes where compliance is mandated by law); and
- this Standard,

this Standard will prevail.

### 3.1.1 Ergon Network controlled documents

A copy of the latest version of this Standard may be obtained by searching for STNW3515 from the following website: https://www.ergon.com.au/

Other controlled documents include:

| Document number | Document name | Document type |
|---|---|---|
| 01811 | Queensland Electricity Connection Manual - 2912908 | Reference |
| STNW1170 | Standard for Small IES Connections - 2970697 | Standard |
| STNW1174 | Standard for LV EG Connections - 27939029 | Standard |
| STNW1175 | Standard for HV EG Connections | Standard |
| STNW3510 | Dynamic Standard for Small IES Connections - 3403035 | Standard |
| STNW3511 | Dynamic Standard for LV EG Connections | Standard |
| STNW3514 | Standard for Small IES Connections to Isolated Networks - 27933442 | Standard |

### 3.1.2 Australian and New Zealand Standards

| Document number | Document name | Document type |
|---|---|---|
| AS/NZS 3000 | Electrical Installations – Wiring Rules | AU/NZ Joint Standard |
| AS/NZS 3010 | Electrical Installations – Generating Sets | AU/NZ Joint Standard |
| AS/NZS 4755.1 | Demand response capabilities and supporting technologies for electrical products – Part 1: Demand response framework and requirements for demand response enabling devices (DREDs) | AU/NZ Joint Standard |
| AS/NZS 4777.1 | Grid connection of energy systems via inverters Part 1: Installation requirements | AU/NZ Joint Standard |

| Document number | Document name | Document type |
|---|---|---|
| AS/NZS 4777.2 | Grid connection of energy systems via inverters Part 2: Inverter requirements | AU/NZ Joint Standard |
| AS/NZS 5033 | Installation and Safety Requirements for Photovoltaic (PV) Arrays | AU/NZ Joint Standard |
| AS/NZS 5139 | Electrical Installations - Safety of battery systems for use with power conversion equipment | AU/NZ Joint Standard |
| AS 5385 | Smart Energy Profile Application Protocol | Australian Standard |
| AS 60034.1 | Rotating electrical machines, Part 1: Rating and performance | Australian Standard |
| AS 60038 | Standard Voltages | Australian Standard |
| AS 61869 | Instrument transformers (multiple parts) | Australian Standard |
| AS 61000.3.100 | Electromagnetic compatibility (EMC) limits – Steady state voltage limits in public electricity systems | Australian Standard |
| AS/NZS IEC 60947.6.1 | Low-voltage switchgear and controlgear | AU/NZ Joint Standard |
| AS/NZS 61000.4.30 | Electromagnetic compatibility (EMC) – Part 4.30: Testing and measurement techniques - Power quality measurement methods | AU/NZ Joint Standard |
| AS 62040.1 | Uninterruptible power systems (UPS) | Australian 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 Joint Standard |
| 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 |
| AS/NZS IEC 62116 | Utility-interconnected photovoltaic inverters – Test procedure of islanding prevention measures | AU/NZ Joint Standard |
| SA HB 218:2023 (or CSIP-AUS) | Common Smart Inverter Profile —Australia with Test Procedures | Australian Standard Handbook |

### 3.1.3 International Standards

| Document number | Document name | Document type |
|---|---|---|
| CSIP | IEEE 2030.5 Common California IOU Rule 21 Implementation Guide for Smart Inverters | International Standard |
| IEC 60255-1 | Measuring relays and protection equipment – Part 1: Common requirements | 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 60255-127 | Measuring relays and protection equipment – Part 127: Functional requirements for over/under voltage protection | International Standard |
| IEC 60255-181 | Measuring relays and protection equipment – Part 181: Functional requirements for frequency protection | International Standard |
| IEC 60617 | Graphical symbols for diagrams | International Standard |
| IEEE Std 519 | IEEE Recommended Practice and Requirements for Harmonic Control in Electric Power Systems | IEEE Standard |
| IEEE Std C37.2 | IEEE Standard Electrical Power System Device Function Numbers, Acronyms, and Contact Designations | IEEE Standard |
| IEEE 2030.5 (or SEP2) | 2030.5-2018 - IEEE Standard for Smart Energy Profile Application Protocol | International Standard |

## 3.2 Legislation and regulation

Set out below is a list of the applicable legislation and regulations (which may be amended, replaced, repealed or have further instruments enacted from time to time).

In the event of any inconsistency between:

- any applicable legislation and regulation; and
- this Standard,

the legislation and regulations will prevail.

| Document name | Document type |
|---|---|
| Construction and operation of solar farms – Code of Practice 2019 | Code of Practice |
| *DER Technical Standard* | Regulation |
| *Electricity Act 1994* (Qld) | Legislation |
| *Electricity Regulation 2006* (Qld) | Regulation |
| *Electrical Safety Act 2002* (Qld) | Legislation |
| *Electrical Safety Regulation 2013* (Qld) | Regulation |
| *Electricity - National Scheme (Queensland) Act 1997* (Qld) | Legislation |
| National Electricity (Queensland) Law, as defined in the *Electricity - National Scheme (Queensland) Act 1997* (Qld) | Regulation |

| Document name | Document type |
|---|---|
| *National Energy Retail Law (Queensland) Act 2014* (Qld) | Legislation |
| National Energy Retail Law (Queensland), as defined in the *National Energy Retail Law (Queensland) Act 2014* (Qld) | Regulation |
| National Electricity Rules | Regulation |
| *Professional Engineers Act 2002* (Qld) | Legislation |

# 4 Technical requirements

## 4.1 General

Due to the nature of Ergon Network's Isolated Networks and their inherent differences from the larger, more interconnected networks (in particular, the type and size of relevant baseload generation), there are restrictions on how much customer LV EG capacity can be connected. This is typically the case irrespective of whether those LV EG units will, or will not, be exporting. As the LV EG capacity increases, the available capability of the Isolated Networks to cope with these LV EG units and still maintain reliable and economical electricity supply correspondingly reduces. This requires there to be increased control over the output of the LV EG installations and/or augmentation of the relevant power station or network to facilitate the connections.

A concept called "hosting capacity" is used to ensure the reliable and cost-effective supply of electricity to isolated communities. Total Hosting Capacity is divided into Unmanaged Hosting Capacity and Managed Hosting Capacity (refer to Figure 1).

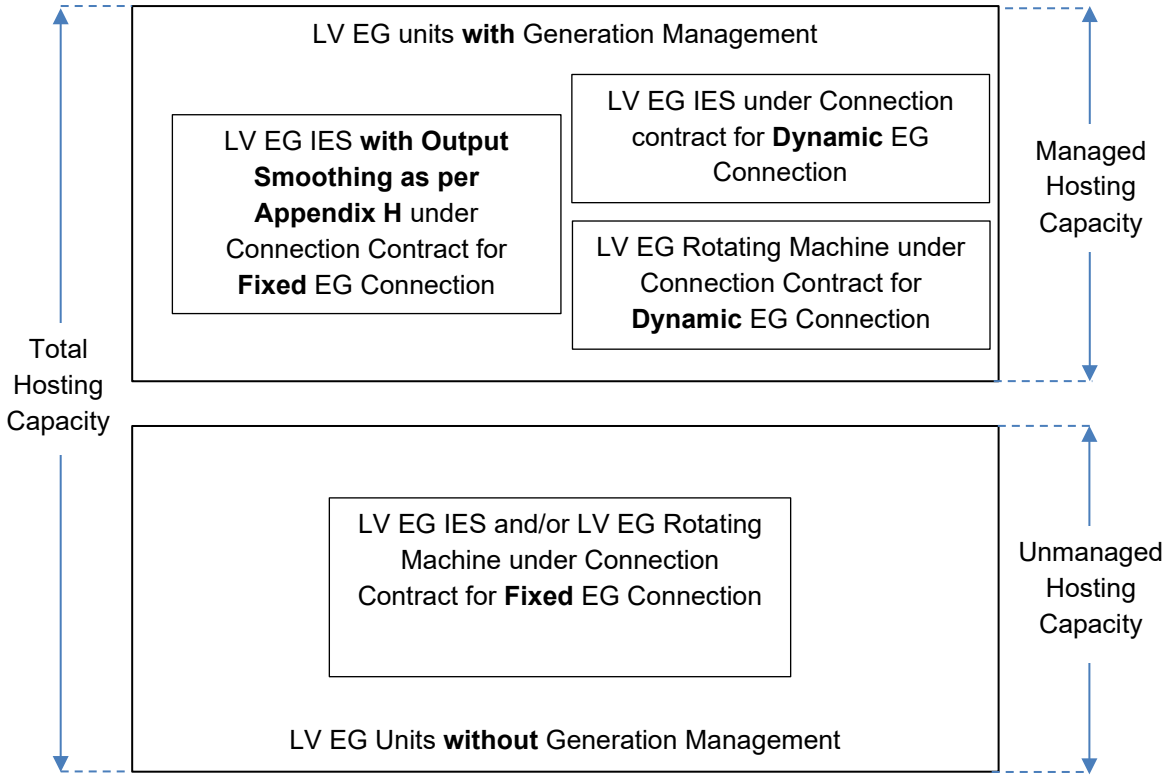



**Figure 1: Total Hosting Capacity**

Once any Isolated Network reaches its Unmanaged Hosting Capacity limit, that Isolated Network is referred to as an Affected Isolated Network. Any future LV EG units to be connected to that network must be controlled with Generation Management to ensure that they do not adversely affect the operation of the Isolated Network and the relevant power station. Generation Management is a method of controlling the output of such LV EG units either through:

- LV Dynamic EG Connections; or
- use of energy storage systems (ESS) to limit the rate-of-change of the generation output from a renewable source of electricity which is known as Output Smoothing as detailed in Appendix H.

For a list of Isolated Networks operated by Ergon Network and their availability of Unmanaged Hosting Capacity, Managed Hosting Capacity and Dynamic EG Connections, please visit the Isolated Networks Solar Capacity Page. Note that (due to factors such as changes to infrastructure, advances in technology or withdrawal of customer applications) further Managed Hosting Capacity or Unmanaged Hosting Capacity may be released from time to time.

Process flow charts are presented for the connection of LV EG to Isolated Networks as follows:

- Figure 2 illustrates assessment of proposed LV IES EG.
- Figure 3 illustrates assessment of proposed LV EG Rotating Machine.

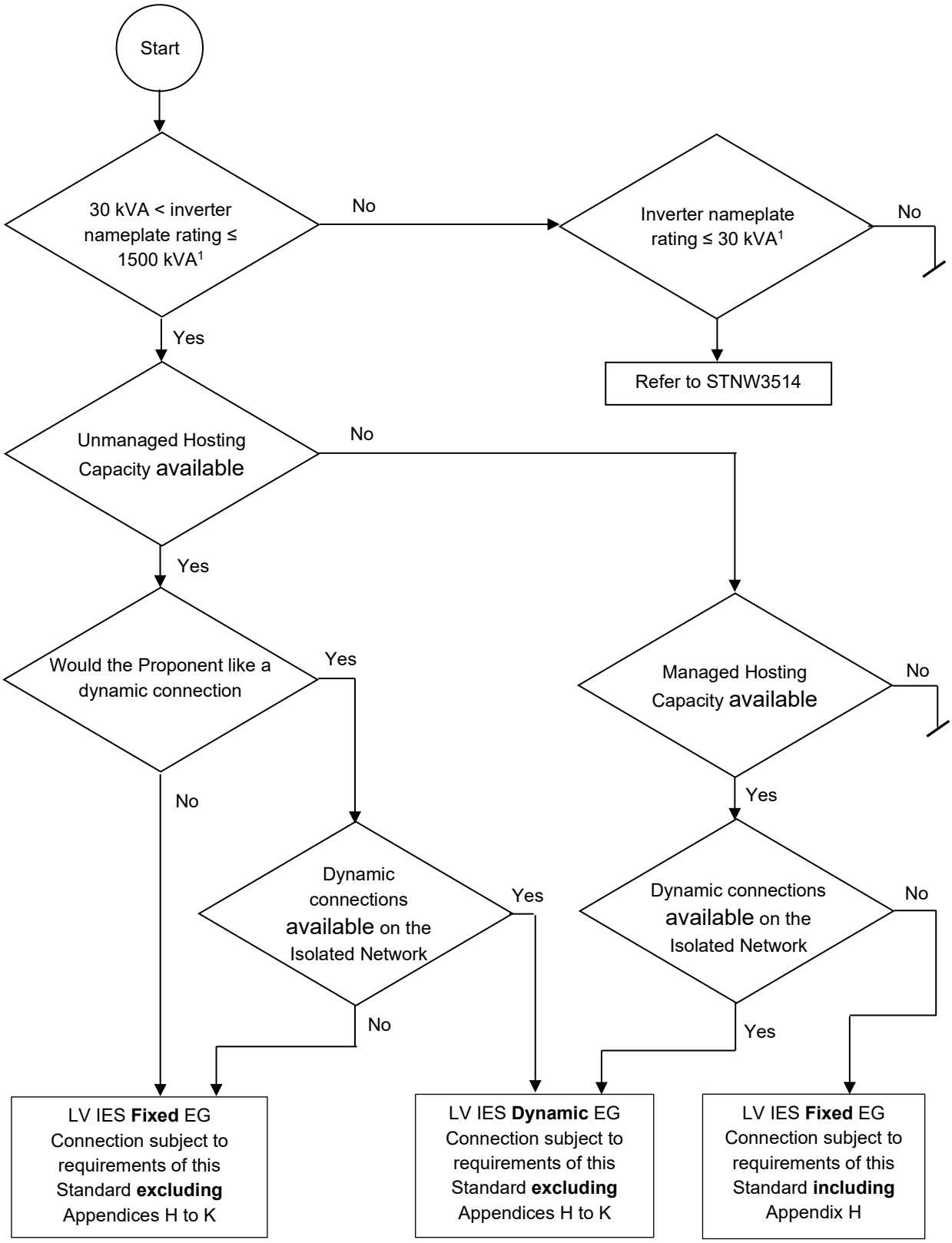



**Figure 2: Process flow chart for assessment of proposed connection of IES Unit to Isolated Network**

Note 1: There are some non-standard LV IES EG fixed connections to Isolated Networks under 30kVA which are not covered by STNW3514 and are instead assessed under STNW3515; refer to Section 2.3.1 for details.

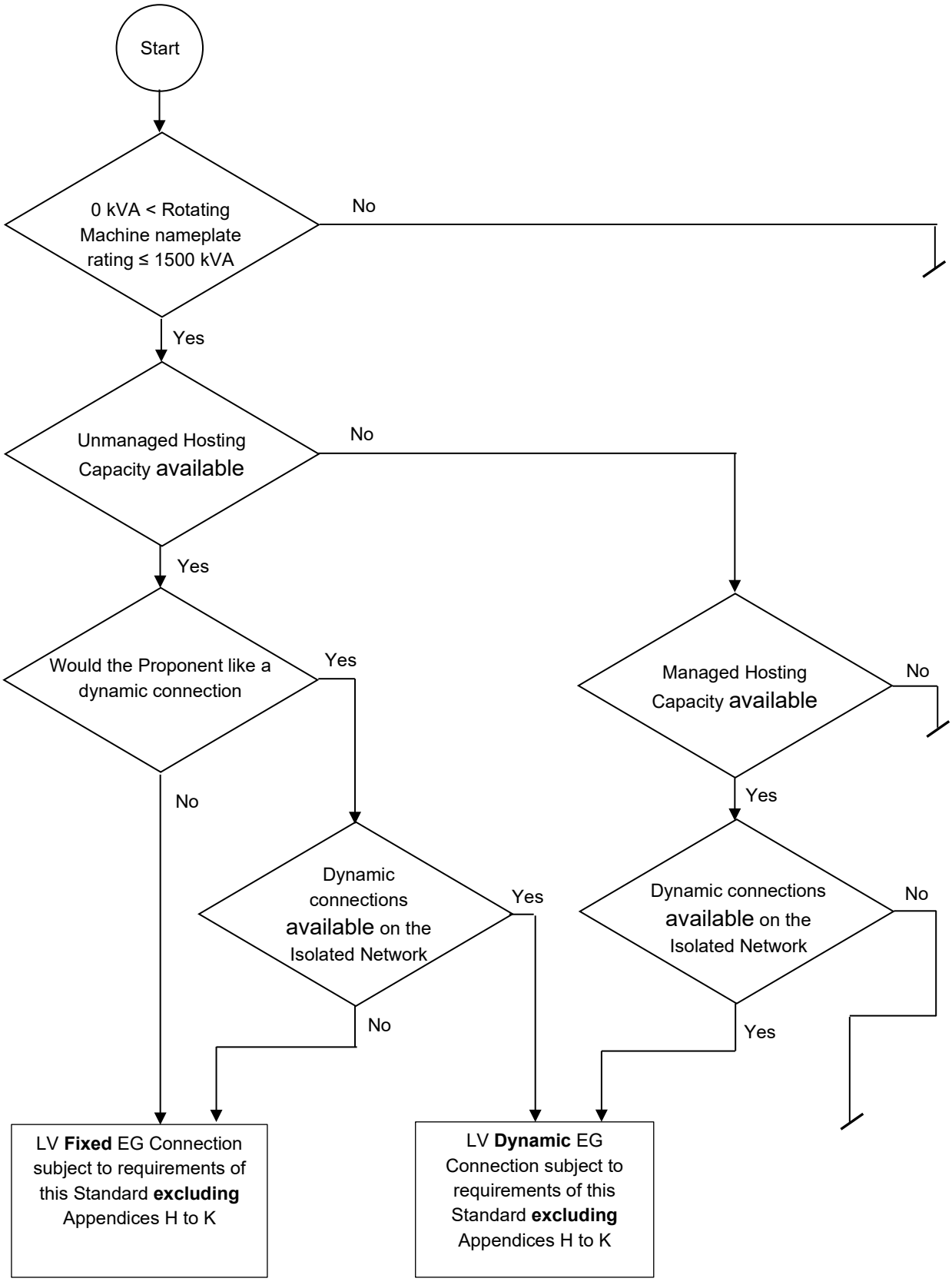



**Figure 3: Process flow chart for assessment of proposed connection of Rotating Machine to an Isolated Network**

### 4.1.1 Isolated Networks with Unmanaged Hosting Capacity available

Where a Proponent wishes to connect a LV EG unit to an Isolated Network which has Unmanaged Hosting Capacity available the Proponent has the option to apply for either:

a. a Fixed EG Connection; or
b. a Dynamic EG Connection (provided that Dynamic EG Connections are available on that particular Isolated Network).

Please note that Output Smoothing (as per Appendix H) is not offered in these cases and the LV EG will be subject to the requirements of this standard excluding Appendices H to K.

### 4.1.2 Isolated Networks which only have Managed Hosting Capacity available

Where a Proponent wishes to connect a LV EG unit to an Isolated Network which does not have Unmanaged Hosting Capacity available but, has Managed Hosting Capacity available, the Proponent may:

a. apply for a LV Dynamic EG Connection (provided that Dynamic EG Connections are available on that particular Isolated Network) subject to the requirements of this standard excluding Appendices H to K; or
b. if Dynamic EG Connections are not yet available on that Isolated Network the Proponent of an LV IES EG may apply for a Fixed EG Connection provided that the LV IES EG unit meets the requirements of this standard including the additional requirements of Appendix H (Output Smoothing). Note that Rotating Machines do not qualify to utilise Appendix H (Output Smoothing) in this instance.

## 4.2 Labelling and signage

All EG Systems shall comply with AS/NZS 3000.

Labels and signs on the LV IES EG systems, including cables, shall meet the requirements of AS/NZS 4777.1, AS/NZS 5033 and AS/NZS 5139.

Labels and signs on Fixed Rotating Machines, including cables, shall additionally meet the requirements of AS/NZS 3010.

## 4.3 Maximum system capacity

Provided there is no constraint identified by the DNSP, the maximum aggregate system capacity permitted varies based on both subcategory and whether the LV EG is connected under a Connection Contract for

a. Fixed EG Connection (refer to Section 4.3.1); or
b. Dynamic EG Connection (refer to Section 4.3.2).

Under this Standard, the aggregate maximum system capacity of an EG System at a Connection Point is 1,500 kVA.

There is no limit on DC-coupled DER capacity. The limits for a Technical Study will be based on the aggregated AC capacity of the EG Units at the Premises.

For Premises with multiple LV Connection Points, Premises with network(s) connected to multiple Connection Points, or EG system(s) within a Premises being connected to multiple Connection Points:

a. The maximum capacity for a Connection Point in respect of a Premises is based on the aggregate of all EG Units connected or proposed to be connected within the Premises.
b. The requirements set out in this Standard and the Technical Study will be applied and determined based on the aggregate maximum capacity of all the EG Units connected, or proposed to be connected, within the Premise.

The EG System (comprising all EG Units capable of connecting to the Isolated System through a Connection Point) shall be designed so that it does not exceed the ratings of equipment both within the Isolated System and the Proponent's side of the Connection Point when the EG System operates in Parallel.

Nameplate rating for any EG Unit shall be based on the maximum continuous rating of the EG Unit throughout this Standard.

### 4.3.1 Fixed EG Connection

Provided that there is no constraint identied by the DNSP, the maximum aggregate system capacity permitted for standard Fixed EG Connections for each subcategory covered under this Standard shall be as per Table 3.

**Table 3 Maximum system capacity by subcategory for Fixed EG Connections**

| LV EG IES ≤ 30 kVA fixed connection | LV EG IES > 30 kVA and ≤ 200 kVA fixed connection | LV EG IES > 200 kVA fixed connection | LV EG Rotating Machines fixed connection | LV EG non-standard fixed connection[1] |
|---|---|---|---|---|
| 10 kVA per phase | 200 kVA | 1,500 kVA | 1,500 kVA | As per Technical Study |

Note 1 : Refer to Section 2.3.1 for more information on LV EG non-standard fixed connections.

### 4.3.2 Dynamic EG Connection

Provided there is no constraint identified by the DNSP, the maximum aggregate system capacity for standard Dynamic EG Connections for each subcategory covered under this Standard shall be as per Table 4.

**Table 4 Maximum system capacity by subcategory for Dynamic EG Connections**

| Dynamic LV EG IES ≤ 200 kVA Connection | Dynamic LV EG IES > 200 kVA Connection | Dynamic LV EG Rotating Machines Connection | Dynamic LV EG non-standard Connection |
|---|---|---|---|
| 200 kVA | 1,500 kVA | 1,500 kVA | As per Technical Study |

A Dynamic EG System registered with the DNSP SEP2 Utility Server may be approved for an aggregate system capacity that exceeds ratings within the Isolated System at the Connection Point at the sole discretion of the DNSP. For IES connections to a dedicated distribution transformer, a solution is accepted as per Appendix G.

If a Proponent is unable to meet the dynamic operation at any time, the maximum capacity of the Dynamic EG System shall be reduced to below the rated capacity of the DNSP network assets. The Proponent shall automatically disconnect EG Unit(s) from the Isolated Network to reduce the capacity the Dynamic EG System below the rated capacity of the Isolated Network.

## 4.4 Generation Control and Limits for Export, Site Generation, Import and Site Load

For all EG Systems that may connect and operate in Parallel to the Isolated System, Table 5 defines the operation types, applicable system type(s), nature of Parallel operation and Export capability.

**Table 5 Types of EG Systems**

| Operation Type | Applicable System Type(s) | Parallel Operation | | Export Capability |
|---|---|---|---|---|
| | | Duration | Frequency | |
| Bumpless transfer | Fixed EG Systems[2] | up to 2 seconds | N/A | Non-export only |
| Stand-by[1] (for testing only) | Both Fixed EG Systems and Dynamic EG Systems | up to 6 hours | Every 3 months | Either Export or Non-export |
| Continuous Parallel | Both Fixed EG Systems and Dynamic EG Systems | Greater than 24 hours | In a year | Either Export or Non-export |

Note 1: Stand-by operation is for operating EG System for maintenance purposes. If the EG System is part of a generation aggregation system (such as a VPP), then it is automatically classified as continuous Parallel regardless of planned duration or frequency.

Note 2: Exception: An EG system with bumpless transfer can be considered as a Dynamic EG System only where a Premises has at least one other EG Unit with Stand-by or Continuous Parallel operation which is compliant with the requirements for Dynamic EG System under this Standard (see section 4.6.1).

### 4.4.1 Export limits at Connection Point

#### 4.4.1.1 Export limit study

The fixed Export limit (in the case of Fixed EG Systems) or the Fixed Default Dynamic Export Limit (in the case of Dynamic EG Systems) shall be assessed and determined by the DNSP based on:

a. penetration of Fixed EG Systems and Dynamic EG Systems on the Isolated System;
b. asset capacity limits on the Isolated System;
c. power quality checks on the Isolated System;
d. voltage regulation impacts on the Isolated System; and
e. Isolated System protection impacts.

Additional constraints may apply to non-standard Fixed EG Connections (including those referred to in Section 2.3.1). An indicative Export limit or indicative Fixed Default Dynamic Export Limit may be provided by the DNSP at the enquiry stage of the applicable connection process.

#### 4.4.1.2 Export limit types for EG Systems

A Proponent can elect to have a Non-export, Partial-export or Full-export EG System, subject to capacity availability of the Isolated System.

Partial-export EG Systems shall be designed and operated to limit the amount of Export into the Isolated System to an agreed export threshold as set out in the relevant Connection Contract.

Full Export EG Systems will not incorporate any such limitations and can Export into the Isolated System to the full nameplate capacity (full AC rating) of that EG System.

#### 4.4.1.3 Export limits for a Dynamic EG System

The Export limits for a Dynamic EG System shall meet the following requirements:

a. The dynamic Export limits are supplied by the DNSP for the Dynamic EG System; the will be no less than the 'Fixed Default Dynamic Export Limit' and no more than the 'maximum dynamic Export limit' shown in Table 6.
b. Any time that the communication system (described in Section 4.12 of this Standard) is not fully operational (including, but not limited to, a loss of signal, or the Dynamic EG System not receiving or not being able to respond to the dynamic Export limit), the permitted Export shall be limited to the 'Fixed Default Dynamic Export Limit' as set out in Table 6. This Export limit will apply at the Connection Point to the combined EG within the Premises (including any EG Units that may have been previously connected under different connection arrangements).
c. For Premises with multiple Connection Points, the Export limit is the total for the Premises and the aggregate Export across the Connection Points shall stay below the Export limit. The Export limit will be in the range set out in Table 6.
d. The Export limits shall meet the measurement and control requirements in Section 4.4.6.

**Table 6 Dynamic Export limits for Dynamic EG Systems**

| Fixed Default Dynamic Export Limit | Maximum dynamic Export limit | Technical Study Required |
|---|---|---|
| 0 kW | As per Technical Study[1,2,3] | Yes |

Note 1: Multiple-phase EG Systems shall meet phase balance requirements from Section 4.4.7 of this Standard.

Note 2: Availability of Export limits greater than the 'Fixed Default Dynamic Export Limit' set out in Table 6, are subject to capacity availability of Isolated System.

Note 3: A Dynamic EG System shall be designed to prevent Export to the Isolated Network that exceeds ratings of connection equipment on the Isolated Network.

The ability of the Dynamic EG System to Export into the Isolated System will be subject to the limitations of the Isolated System from time to time, and the DNSP is unable to, and does not, represent, warrant or guarantee that the Dynamic EG System will be able to Export electricity into the Isolated System at any time. Circumstances which may cause the Export to be constrained include, but are not limited to, times of low Isolated Network operational demand, local or widespread communication issues, or when power quality response modes are in operation.

Additional constraints may apply to non-standard Dynamic EG Connections (including those referred to in Section 2.3.1).

### 4.4.2 Site Generation Limit downstream of Connection Point

#### 4.4.2.1 Fixed EG Systems

Site Generation Limits do not apply to Fixed EG Systems.

#### 4.4.2.2 Dynamic EG Systems

The Site Generation Limit for a Dynamic EG System shall meet the following requirements:

a. Meet the requirements of generation limit control specified in AS/NZS 4777.
b. The dynamic Site Generation Limits[3] are supplied by the DNSP for the Dynamic EG System; they will be no less than the 'Fixed Default Dynamic Site Generation Limit' and no more than the 'maximum dynamic Site Generation Limit' shown in Table 7.
c. Any time that the communication system (described in Section 4.12 of this Standard) is not fully operational (including, but not limited to, a loss of signal or, the Dynamic EG System not receiving or not being able to respond to the dynamic Site Generation Limit), the permitted Site Generation shall be limited to the 'Fixed Default Dynamic Site Generation Limit' as set out in Table 7. This Site Generation Limit will apply at the Connection Point to the combined EG within the Premises (including any EG Units that may have been previously connected under different connection arrangements).
d. For Premises with multiple Connection Points, the Site Generation Limit is the total for the Premises and the aggregate Site Generation across the Connection Points shall stay below the Site Generation Limit. The Site Generation Limit will be in the range set out in Table 7.
e. The Site Generation Limit shall meet the measurement and control requirements in Section 4.4.6.

**Table 7 Dynamic Site Generation Limits for Dynamic EG Systems**

| Subcategory | Fixed Default Dynamic Site Generation Limit | Maximum dynamic Site Generation Limit | Technical Study required |
|---|---|---|---|
| All | 0 kW | As per Technical Study[1,2,3] | Yes |

Note 1: Multiple-phase EG Systems shall meet phase balance requirements from Section 4.4.7 of this Standard.

Note 2: Availability of Site Generation Limits greater than the Fixed Default Dynamic Site Generation Limit set out in Table 7 are subject to capacity availability of the Isolated System.

Note 3: Aggregate Site Generation Limits will not be permitted to exceed Isolated System capacity limits.

The ability of the Dynamic EG System to generate in Parallel with the Isolated System will be subject to the limitations of the Isolated System from time to time and, the DNSP is unable to, and does not, represent, warrant or guarantee that the Dynamic EG System will be able to generate electricity in Parallel with the Isolated System at any time. Circumstances which may cause the generation to be constrained include, but are not limited to, times of low Isolated Network operational demand, local or widespread communication issues, or when power quality response modes are in operation.

[3]The dynamic Site Generation Limit is defined in CSIP-AUS as opModGenLimW.

### 4.4.3 Generation Limit Control as a means of reducing the EG Unit nameplate rating

For Premises with a multiple-phase connection to the network, Generation Limit Control as specified in AS/NZS 4777.2 may be applied to control the active power output levels of EG Unit(s) to enforce a Generation Limit as per Table 8. Where such Generation Limit Control has been applied, the Generation Limit in Table 8 shall be substituted for the EG's nameplate rating[4].

[4] Note: The Generation Limit and nameplate ratings have different units of kW and kVA respectively. The Generation Limit is in kW so as not to interfere with the volt-watt and volt-var response.

**Table 8 Generation Limit Categories**

| Category | Generation Limit | Single-Phase Inverter Maximum Nameplate Rating |
|---|---|---|
| V2G | 5 kW per phase[1] | 8 kVA per phase |
| V2B | 5 kW per phase[1] | 8 kVA per phase |

Note 1: Generation Limits may need to be used to meet system capacity and phase balance requirements in this Standard.

### 4.4.4 Import limits at Connection Point

#### 4.4.4.1 Fixed EG Systems

Import limits do not apply to Fixed EG Systems.

#### 4.4.4.2 Dynamic EG Systems

Dynamic EG Systems capable of importing electricity from the Isolated Network, such as an ESS, shall be subject to Import limits. The Import limits for a Dynamic EG System shall meet the following requirements:

a. The dynamic Import limits are supplied by the DNSP for the Dynamic EG System; they will be no less than the 'Fixed Default Dynamic Import Limit' and no more than the 'maximum dynamic Import limit' shown in Table 9.
b. Any time that the communication system (described in Section 4.12 of this Standard) is not fully operational (including, but not limited to, a loss of signal or, the Dynamic Small IES not receiving or not being able to respond to the dynamic Import limit), the permitted Import limit shall be limited to the 'Fixed Default Dynamic Import Limit' as set out in Table 9.
c. For Premises with multiple Connection Points, the Import limit is the total for the Premises and the aggregate Import across the Connection Points shall stay below the Import limit. The Import limit will be in the range set out in Table 9.
d. The Import limits shall meet the measurement and control requirements in Section 4.4.6.

**Table 9 Dynamic Import limits for Dynamic EG Systems**

| Subcategory | | Fixed Default Dynamic Import Limit | Maximum dynamic Import limit | Technical Study required |
|---|---|---|---|---|
| Three-phase | | 1.5 kW | As per Technical Study[1,2,3] | Yes |
| SWER | Single-phase | 1.5 kW | As per Technical Study[1,2,3] | Yes |
| | Split-phase | 1.5 kW | As per Technical Study[1,2,3] | Yes |

Note 1: Multiple-phase EG Systems shall meet phase balance requirements from Section 4.4.7 of this Standard.

Note 2: Availability of Import limits greater than the Fixed Default Dynamic Import limit set out in Table 9 are subject to capacity availability of the Isolated System.

Note 3: Aggregate Import limits will not be permitted to exceed Isolated System capacity limits.

Note 4: This Standard applies to SWER proponent with aggregate capacity > 30 kVA only.

The Proponent shall not exceed the maximum supply limits in the QECM or the limits within the Connection Contract for supply.

### 4.4.5 Site Load Limit downstream of Connection Point

#### 4.4.5.1 Fixed EG Systems

Site Load Limits do not apply to Fixed EG Systems.

#### 4.4.5.2 Dynamic EG Systems

Dynamic EG Systems capable of consuming electricity, such as an ESS, shall be subject to Site Load Limits. The Site Load limits for a Dynamic EG System shall meet the following requirements:

a. The dynamic Site Load Limits are supplied by the DNSP for the Dynamic EG System; they will be no less than the 'Fixed Default Dynamic Site Load Limit' and no more than the 'maximum dynamic Site Load Limit' shown in Table 10.
b. Any time that the communication system (described in Section 4.12 of this Standard) is not fully operational (including, but not limited to, a loss of signal or, the Dynamic EG System not receiving or not being able to respond to the dynamic Site Load Limit), the permitted Site Load Limit shall be limited to the 'Fixed Default Dynamic Site Load Limit' as set out in Table 10.
c. For Premises with multiple Connection Points, the Site Load Limit is the total for the Premises and the aggregate Site Load across the Connection Points shall stay below the Site Load Limit. The Site Load Limit will be in the range set out in Table 10.
d. The Site Load Limits shall meet the measurement and control requirements in Section 4.4.6.
e. Site Load Limits only apply to actively managed loads covered under a dynamic connection agreement.

**Table 10 Dynamic Site Load Limits for Dynamic EG Systems**

| Subcategory | | Fixed Default Dynamic Site Load Limit | Maximum dynamic Site Load Limit | Technical Study required |
|---|---|---|---|---|
| Three-phase | | 1.5 kW | As per Technical Study[1,2,3] | Yes |
| SWER | Single-phase | 1.5 kW | As per Technical Study[1,2,3] | Yes |
| | Split-phase | 1.5 kW | As per Technical Study[1,2,3] | Yes |

Note 1: Multiple-phase EG Systems shall meet phase balance requirements from Section 4.4.7 of this Standard.

Note 2: Availability of Site Load Limits greater than the Fixed Default Dynamic Site Load Limit set out in Table 10 are subject to capacity availability of the Isolated System.

Note 3: Aggregate Site Load Limits will not be permitted to exceed Isolated System capacity limits.

Note 4: This Standard applies to SWER proponent with aggregate capacity > 30 kVA only.

The Proponent shall not exceed the maximum supply limits in the QECM or the limits within the Connection Contract for supply.

### 4.4.6 Measurement and control of the Limits for Export, Site Generation, Import and Site Load

#### 4.4.6.1 General

Measurement and control of Export limits shall comply with the requirements of Section 4.4.6 for both:

- Fixed EG Systems; and
- Dynamic EG Systems.

Measurement and control of Import limits, Site Generation Limits and Site Load Limits:

- Is not required for Fixed EG Systems.
- Shall comply with the requirements of Section 4.4.6 in the case of Dynamic EG Systems.

The total aggregate Export or Import of all the inverters at the Connection Point shall not exceed the approved limits (as applicable).

The total aggregate generation (or total aggregate Site Load) of all the EG Units downstream of the Connection Point shall not exceed the Site Generation Limit (or Site Load Limit) for Dynamic EG Systems.

The Limits will be used herein as a term for the collective set of limits comprising the Export limit, Import limit, Site Generation Limit and Site Load Limit (as applicable).

For Premises with multiple LV Connection Points, Premises with network(s) connected to multiple Connection Points, or EG system(s) being connected (directly or indirectly) to multiple Connection Points, the standard shall be applied to meet the following:

a. The minimum and maximum of each of the Limits are applied to the Premises and the Connection Points must collectively achieve these Limits.
b. In addition to the maximum Export and Import limits, a Proponent may be required to design the EG system to meet Export or Import limits applied to an individual Connection Point. No Export or Import limit for an individual Connection Point shall exceed the maximum Export and Import limit for the Premises.
c. All criteria in this Standard and the Technical Study will be applied for the Premises and the Connection Points collectively.
d. Another entity (such as a VPP or mobile application) shall not cause the EG Systems to exceed the Limits.

#### 4.4.6.2 Measurement of Export and Import limits

The reference point for the measurement of Export and Import limits shall be:

a. Measured at a point as close to the Connection Point as practicable, referencing a single point beyond the Connection Point within the Premises.
b. Connected at a location that has a lower impedance to the Connection Point than any EG Unit connected within the Premises.

#### 4.4.6.3 Measurement device compliance for the Export and Import limit

The measurement equipment for Interface Protection Relay (IPR) may be utilised for Export and Import limit control.

#### 4.4.6.4 Control of Export and Import limit

Export limits for EG Systems shall be interpreted as “soft”, respond within 15 s, and meet the definition of soft Export limits in Clause 3.4.8 of AS/NZS 4777.1.

For EG Systems, Export limits shall be set to meet Table 11.

**Table 11 Export limit settings for EG Systems**

| | Non-export | Partial-export |
|---|---|---|
| Export limit setting (kW) | 0 | *k* of total inverter rating |

Note 1: Where *k* is equal to the approved Partial-export power value as a per unit value of the inverter capacity. For example, where the approved Partial-export value is 2.5 kW of a 5 kVA inverter, k = 0.5 (or 50%).

The control function for Export (and Import) limitation shall meet the following requirements for Dynamic EG Systems:

a. have a limit that will cause the Dynamic EG System to reduce its generation (or consumption), preventing Export (or Import) at the Connection Point greater than the Export (or Import) limit[5];
b. where the Export (or Import) limit is exceeded, the Export (or Import) control function shall operate to ensure the Dynamic EG System meets the export (or import) conditions within 15 seconds;
c. the Export (or Import) control device settings shall be secured against inadvertent or unauthorized tampering. Changes to settings shall require the use of a tool and special instructions not provided to unauthorized personnel.

Where the Export (or Import) control function loses connection with an external device, or detects any fault or loss of operation of the Export (or Import) control function, it shall reduce Export (or Import) as relevant to the Fixed Default Dynamic Export Limit (or Fixed Default Dynamic Import Limit respectively).

The Export (and Import) limit shall apply to all of the EG Units connected within the Premises. Total Export (and Import) at the Connection Point to the electrical installation will remain within the limits described in the Connection Contract[6].

The control of the EG System for Export and Import limitation shall not interfere with Anti-islanding Protection of the inverter(s).

[5] Unmanaged loads, such as cooking equipment, may still cause the Import limit to be exceeded; the dynamic Small IES under a Connection Contract for Dynamic EG Connection agreement may only consume whilst the Import limit is not exceeded.

The ability of the EG System to Export into or Import from the Isolated System at the limits described in Table 6, Table 9 and Table 11 will be subject to the limitations of the Isolated System from time to time, and the DNSP is unable to, and does not, represent, warrant or guarantee that the EG System will be able to Export/Import at any time. Circumstances which may affect the Export and Import to be constrained include, but are not limited to, times of low Isolated Network operational demand, local or widespread communication issues, or when power quality response modes are in operation.

#### 4.4.6.5 Measurement of Site Generation (and Site Load)

The measurement of Site Generation (and Site Load), for the purposes of controlling Dynamic EG Systems to meet the Site Generation Limit (and Site Load Limit), shall have the measurement accuracy as described in AS/NZS 4777.2 Clause 2.13. The measurement may be made by an inverter or an external measurement device. The measurement may be made by aggregation of measurements made by inverter(s) and/or external measurement device(s) provided that the measurement accuracy, as described in AS/NZS 4777.2 Clause 2.13, is maintained for measurement of the Site Generation (and Site Load).

#### 4.4.6.6 Control of Site Generation Limit (and Site Load Limit)

The control function for the Site Generation Limit (and Site Load Limit) shall meet the following requirements:

a. have a limit that will cause the Dynamic EG System to reduce its generation (or load), preventing Site Generation (or Site Load) downstream (i.e. on the customer side) of the Connection Point greater than the Site Generation Limit (or Site Load Limit respectively);
b. where the Site Generation Limit (or Site Load Limit) is exceeded, the Site Generation Limit (or Site Load Limit) control function shall operate to ensure that the Dynamic EG System meets the Site Generation Limit (or Site Load Limit) conditions within 15 seconds;
c. the Site Generation Limit (and Site Load Limit) control device settings shall be secured against inadvertent or unauthorized tampering. Changes to settings shall require the use of a tool and special instructions not provided to unauthorized personnel.

Where the Site Generation Limit (or Site Load Limit) control function loses connection with an external device, or detects any fault or loss of operation of the Site Generation Limit (or Site Load Limit) control function, it shall reduce the Site Generation (or Site Load) to the Fixed Default Dynamic Site Generation Limit (or Fixed Default Dynamic Site Load Limit respectively).

The Site Generation Limit (and Site Load Limit) shall apply to all of the dynamic EG Units connected within the Premises. Site Generation (and Site Load) downstream (i.e. on the customer side) of the Connection Point to (from) the electrical installation will remain within the limits described in the Connection Contract.

The control of the EG System for the Site Generation Limit (and Site Load Limit) shall not interfere with Anti-islanding Protection of the inverter(s).

The ability of the Dynamic EG System to generate (and consume) at the limits described in Table 7 (and Table 10) will be subject to the limitations of the Isolated System from time to time, and the DNSP is unable to, and does not represent, warrant or guarantee that the Dynamic EG System will be able to generate (or consume) at any time. Circumstances which may affect the Site Generation Limit (or Site Load Limit) to be constrained include, but are not limited to, times of low Isolated Network operational demand, local or widespread communication issues, or when power quality response modes are in operation.

### 4.4.7 Phase Balance for Multiple-Phase Connections

For all multiple-phase connections to the grid, the phase balance requirements in AS/NZS 4777.1 Appendix C applies including:

a. Customers that may have a combination of single-phase and/or three-phase inverters in compliance with AS/NZS 4777.2.
b. All multiple-phase IES Units shall have a balanced a.c. output.
c. Where single-phase inverters are installed for both PV and ESS they shall be installed on the same phase.
d. For IES with an aggregate rating ≤ 50 kVA the additional phase balance requirements in Section 4.4.7.1 of the Standard apply.
e. For IES with an aggregate rating > 50 kVA the additional phase balance requirements in Section 4.4.7.2 of the Standard apply.

#### 4.4.7.1 Phase Balance for Connections with IES 50 kVA and under

For multiple-phase connections where the aggregate IES nameplate rating for single-phase and balanced three-phase inverters are ≤ 50 kVA, the limits in Table 12 shall be met.

**Table 12 Phase Balance Requirements for Multiple-Phase Connections with IES ≤ 50 kVA**

| Multiple-Phase Connections with IES ≤ 50 kVA | Single-Phase Inverter Aggregate Nameplate Rating Limit | Balanced Three-Phase Inverter Aggregate Nameplate Rating Limit |
|---|---|---|
| PV Inverters | 5 kVA per phase | 50 kVA |
| ESS Inverters | 5 kVA per phase | 50 kVA |
| V2G or V2B Inverters[1] | | |
| Aggregate of Combined IES | 10 kVA per phase | 50 kVA |

Note 1: Generation Limit may be applied to V2G or V2B single-phase inverter as per Section 4.4.3 of this Standard to meet phase balance requirements.

Where there is a combination of single-phase inverters, the maximum nameplate rating imbalance of all IES shall not exceed 5 kVA between phases.

#### 4.4.7.2 Phase Balance for Connections with Multiple-Phase IES greater than 50 kVA

For multiple-phase IES where the aggregate nameplate rating is greater than 50 kVA, each phase shall meet the following phase balance requirement:

$$\frac{\text{The difference between aggregate single-phase rating of inverters on a phase (kVA)}}{\text{Aggregate rating of all inverters in a multiple-phase IES (kVA)}} \leq 10\%$$

### 4.4.8 Emergency Backstop Mechanism

Emergency Backstop Mechanism and GSDs are not applicable to Isolated Networks due to these networks lacking AFLC communication infrastructure.

## 4.5 Inverter Energy Systems

The following requirements apply to all IES regardless of whether it is part of a Fixed EG System or a Dynamic EG System:

a. Inverters shall be tested and certified by an authorised testing laboratory as being compliant with AS/NZS 4777.2 (with an accreditation number issued).
b. The inverters should be registered with CEC as approved grid connect inverters.
c. The inverters shall be tested and certified by an authorised testing laboratory as being compliant with AS/NZS IEC 62116 for active Anti-islanding Protection.
d. The inverters shall be installed in compliance with AS/NZS 4777.1.
e. The inverters shall have both volt-var and volt-watt response modes available and be capable of operating the modes concurrently, as per Section 4.11.2 of this Standard.
f. The inverters shall be set to the regional setting “Australia A”.

IES, which is part of a Dynamic EG System, shall be capable of sending and receiving information via SEP2 protocol using CSIP-AUS directly or via a third party.

### 4.5.1 Energy Storage System (ESS)

The connection of an ESS (such as batteries or EV and EVSE) capable of supplying electricity to an electrical installation such as the Premises or the Isolated System is considered Grid Connected, unless the inverter is connected behind a Break-before-make switch in compliance with AS/NZS IEC 60947.6.1 or is an UPS in accordance with AS 62040.1.

Where the ESS is considered to be Grid Connected:

a. The ESS shall be subject to the requirements of this Standard.
b. The inverters for the ESS shall be installed in accordance with Section 4.5 of this Standard;
c. The installation of battery ESS shall comply with AS/NZS 5139 (EVs are excepted from this requirement).
d. ESS are either externally DC coupled to an inverter or packaged as a product into an integrated system with an inverter and AC-coupled. The following requirements shall apply to ESS inverters:

1. The inverter capacity for any ESS inverter will be included in the aggregated nameplate rating[6] of inverters within the Premises behind the Connection Point (forming part of the Proponent's installation).
2. The Export limit for the ESS inverter will be considered as part of the aggregated Export limit at the Connection Point.

The installation and commissioning of an ESS shall be certified as compliant by an Accredited Person.

### 4.5.2 Electric vehicles (EVs)

EVSE that is only capable of charging from the grid is not considered an IES Unit but rather a load and is subject to the requirements outlined in Section 8.14.2.2 of the QECM.

EVSE shall be considered an ESS and is subject to the requirements set out in Section 8.16.2 of the QECM and Section 4.5.1 of this Standard, where:

a. The EVSE is capable of supplying electricity into the Premises but not the Isolated System, resulting in a Non-export configuration (also referred to as Vehicle-to-Building or V2B);
b. The EVSE is capable of Export into the Isolated System, resulting in either a full- or Partial-export configuration (also referred to as Vehicle-to-Grid or V2G); or
c. The EVSE being installed has the capability to supply electricity into either the Premises or the Isolated System.

Where an EVSE is capable of either supplying electricity into the Premises or Export to the Isolated System, its nameplate rating shall be counted toward the ESS inverter capacity for the purposes of determining maximum system capacity as per Section 4.3 of this Standard.

Note: An EV coupled with EVSE capable of supplying electricity into the Premises or Isolated System is a type of energy storage system however is excluded from the scope of AS/NZS 5139.

### 4.5.3 Inverter Power Sharing Device (IPSD)

The following requirements apply for the use of Inverter Power Sharing Device (IPSD) on Premises with multiple electrical installations:

a. The IPSD shall not interfere with the safety, functional and performance requirements for an IES conforming with AS/NZS 4777.2.
b. IPSD shall be installed in compliance with AS/NZS 4777.1.
c. The design and implementation of the IPSD installation shall be completed under engineering supervision of an RPEQ.
d. IPSD(s) with a connected aggregated IES capacity greater than 30 kVA shall have Interface Protection installed as shown in Table 14.

[6] Nameplate rating for any inverter shall be based on the maximum continuous rating of the inverter throughout this Standard.

## 4.6 Network connection and isolation

EG Systems can be connected to the Isolated System through a shared or dedicated transformer arrangement. Connection to, and Parallel operation with, any part of the Isolated System is dependent upon compliance with the requirements outlined in this Standard at each Connection Point where the EG System can Parallel.

Unless the DNSP otherwise agrees in writing, an EG System shall only connect to the Isolated System via one Connection Point.

It is the Proponent's responsibility to provide a Disconnection Device at the Connection Point, EG System transformer(s) (if required) and all associated protection controls and ancillary equipment.

The Proponent shall provide a means of disconnection that is capable of disconnecting the whole of the EG System from the Isolated System. Where the EG System is an aggregate of smaller distributed EG Units, multiple disconnection points may exist.

EG Systems that supply only part of the Proponent's installation shall have approved mechanisms in place to prevent the following:

a. Parallel connection of the DNSP's distribution transformers; and

b. connection of the EG System to the Isolated System occurring without synchronisation and the operation of associated protection systems.

Network connection and isolation requirements shall be in accordance with AS/NZS 3000 for all EG Systems. Furthermore, network connection and isolation requirements shall be in accordance with

- AS/NZS 4777.1 for IES; and
- AS/NZS 3010 for Rotating Machines.

In addition, the following conditions shall apply:

a. mechanical isolation shall be in accordance with AS/NZS 3000 including that the isolator must always be readily accessible;

b. any means of isolation (where lockable) shall be able to be locked in the open position only.

### 4.6.1 Changeover switches for bumpless transfer

Bumpless transfer for EG Units shall incorporate a Make-before-break automatic transfer switch (including TSEs) compliant with AS/NZS IEC 60947.6.1. Parallel operation with the Isolated System shall comply with the duration limits shown in Table 5.

An EG system with bumpless transfer shall be considered as a Dynamic EG System only where a Premises has at least one other EG Unit with Stand-by or Continuous Parallel operation which is compliant with the requirements for Dynamic EG System under this Standard.

## 4.7 Earthing

The earthing requirements shall include:

a. for all EG Systems including IES and EV or EVSE capable of suppyling electricity, earthing requirements shall be as per AS/NZS 4777.1 and AS/NZS 3000.

b. all EG Systems including Rotating Machines shall have earthing requirements as per AS/NZS 3000 and AS/NZS 3010.

c. any battery ESS shall have earthing requirements as per AS/NZS 3000 and AS/NZS 5139.

### 4.7.1 Multiple Earth Neutral

EG Systems that are connected to the Isolated System via a delta/star transformer (delta on the Isolated System side), may have the neutral directly connected to earth via a Multiple Earth Neutral (MEN) link, in accordance with AS/NZS 3000.

### 4.7.2 Neutral harmonics

Effective isolation of the neutral may be required to inhibit the flow of harmonic currents through the neutral. The Proponent shall advise the DNSP of their proposed method to limit harmonic currents through the neutral.

## 4.8 Protection

Fault levels shall not exceed the equipment rating of the EG System, Isolated Network equipment, associated switchgear and protection equipment. Where the EG System is able to contribute to fault levels, the DNSP shall:

a. conduct fault studies which include the fault contribution from the Proponent's EG System; and

b. provide the Proponent with the existing fault levels and protection equipment ratings to assess whether the design of the EG System exceeds relevant equipment ratings.

Where it is determined the design of the EG System has the potential to raise the fault levels on the Isolated Network beyond the capacity of the DNSP's protection device(s) and/or equipment, the Proponent shall meet the cost to upgrade the protection device(s) and/or equipment, and ensure that their switchboard and equipment can withstand the total prospective fault currents.

Fault level considerations shall be made for both HV and LV Isolated Systems for all configurations of EG Systems with Rotating Machines.

### 4.8.1 Inverter integrated protection

The inverter integrated protection requirements for inverters connected to the Isolated System shall comply with AS/NZS 4777.2 for active anti-islanding requirements. Other inverter settings including passive anti-islanding settings shall be set to the values given in Table 13 that is consistent with Table 4.1 and Table 4.2 from AS/NZS 4777.2.

**Table 13 Prescribed Inverter Settings**

| Parameter | Settings | Trip delay time | Maximum disconnection time |
|---|---|---|---|
| Undervoltage 2 (V<<) | 70 V | 1 s | 2 s |
| Undervoltage 1 (V<) | 180 V | 10 s | 11 s |
| Overvoltage 1 (V>) | 265 V | 1 s | 2 s |
| Overvoltage 2 (V>>) | 275 V | — | 0.2 s |
| Under-frequency (F<) | 47 Hz | 1 s | 2 s |
| Over-frequency (F>) | 52 Hz | — | 0.2 s |
| Reconnect time | 60 s | N/A | N/A |

## 4.8.2 Interface Protection

### 4.8.2.1 Interface Protection Functional Requirements

The functional requirements for Interface Protection are outlined in Table 14. The DNSP may have additional Interface Protection requirements in some cases, subject to technical assessment.

**Table 14 Interface Protection Functional Requirements**

| Protection Requirements | LV EG IES | | | | | LV EG Rotating Machines | |
|---|---|---|---|---|---|---|---|
| | ≤ 30 kVA | > 30 kVA and ≤ 200 kVA | | > 200 kVA | | | |
| | Export | Export | Non-export | Export | Non-export | Export | Non-export |
| Grid reverse power (32R) | No | No | No | No | No | No | No |
| Power Limit protection (32) | No[1] | No[1] | No[1] | No[1] | No[1] | No[1] | Yes |
| Generator circuit phase balance protection (46/47) | No | No | No | No | No | No | No |
| Grid overcurrent fault and earth fault protection (50/51) | No | No | No | No | No | Yes | Yes |
| Passive Anti-islanding Protection (27U/O, 59U/O, 81U/O, 81R) | No | Yes[2] | Yes[2] | Yes[3] | Yes[3] | Yes | Yes |
| Inter-tripping | No | | | | | | |

Note 1: Non-export or Partial-export systems shall meet the requirements of Section 4.7.2.6 Power Limiting Protection.

Note 2: Only required if an IPSD is utilised for IES with aggregated capacity greater than 30 kVA.

Note 3: Properties within an LV bulk metered connection which classify as a ‘detached house’ Class 1a building as defined under the National Construction Code will not need interface Protection.

#### 4.8.2.2 Interface Protection Relay

The IPR shall be installed to provide back-up protection functions to ensure the Isolated Network (at the Connection Point) and the installation are not exposed to a hazardous condition from the EG System.

The IPR shall meet the following requirements:

a. coordinate multiple EG System installations for one Connection Point[1];
b. provide protection functionality using one relay for all EG installations for the one Connection Point[1];
c. provide level 1 backup protection functions as prescribed in Table 15 for IES and Table 16 for Rotating Machines to meet the requirements of this Standard[2];
d. be integrated in such a way that it fails safe, and EG System(s) do not generate whilst the IPR is out of service[3];
e. open the Disconnection Device at either the Proponent's Connection Point or the EG System(s)[4]; and
f. preserve safety of grid personnel and the general public.

The IPR shall be connected as close to the Connection Point as practicable, referencing a single point beyond the Connection Point within the Premises.

The IPR reference point shall be connected at a location that has a lower impedance to the Connection Point than any EG Unit connected within the Premises.

Where the EG Systems comprise multiple inverters protected by an IPR, all the inverters on all three phases of the EG System shall simultaneously disconnect from the Isolated Network in response to the operation of protection or automatic controls.

Note 1: Where there are both IES and Rotating Machine EG Systems connected at a single Connection Point, two IPRs are allowed to be installed where one IPR shall coordinate all IES and one IPR shall coordinate all Rotating Machines.

Note 2: One IPR may be used for the entire Premises, to coordinate IES and Rotating Machine EG Systems connected at a single Connection Point, where voltage and frequency setpoints align with Table 16. NVD and Power Limiting requirements shall continue to apply as per Rotating Machine requirements.

Note 3: The IPR shall provide self-supervision through a normally open (N/O) or normally closed (N/C) contact that are held in an off normal state when the relay is healthy. When the relay is powered down or not in a state to provide protection, the contacts shall automatically return to the normal state. The states where the contacts shall be in their unasserted (normal) state are found in AS/NZS 4777.1 Clause 3.4.5.3.2. The design of the self-monitoring function that operates the supervision contacts shall be implemented, or specified on how to be implemented, by the protection relay manufacturer.

Note 4: The IPR and Disconnection Device forms an integrated tripping system. Tripping of the Disconnection device shall occur for:

- Loss of signal where the contact opens on IPR's utilising a normally open contact.
- Applications where the contact closes on IPR's utilising a normally closed contact. The disconnection device should provide the auxiliary voltage to monitor the contact.

Further information on IPR arrangements can be found in Appendix B: Connection arrangement requirements (normative).

Protection equipment shall operate the Disconnection Device either directly or through interposing equipment. Such protection equipment and any interposing equipment shall have certified compliance with the following:

- IEC 60255-1 Common requirements;
- IEC 60255-26 EMC requirements;
- IEC 60255-27 Product safety requirements;
- IEC 60255-127 Functional requirements for over/under voltage protection; and
- IEC 60255-181 Functional requirements for frequency protection.

Marshalling of protection trips through control equipment shall be compliant with IEC 60255.

The instrument transformers used to interface the protection equipment with the Proponent's installation shall have certified compliance with:

- AS 61869.1:2021 General requirements
- AS 61869.2:2021 Additional requirements for current transformers;
- AS 61869.3:2021 Additional requirements for inductive voltage transformers; and
- AS 61869.4:2021 Additional requirements for combined transformers.

#### 4.8.2.3 Interface Protection Relay Settings

The IPR settings in Table 15 and Table 16 shall apply to all EG Systems. Under and over voltage protection shall be installed to monitor all three phases. The Level 1 backup protection is for passive Anti-Islanding Protection.

**Table 15 IES IPR Functions and settings**

| Protection functional description | ANSI/IEEE C37.2 Code | IEC 60617 Code | Default Setting | Time Delay |
|---|---|---|---|---|
| Level 1 backup protection | | | | |
| Under voltage 2 (UV) | 27P | U< | 69 $V_{l-n}$ | 2.5 s |
| Under voltage 1 (UV) | 27P | U< | 179 $V_{l-n}$ | 11.5 s |
| Over voltage (OV) | 59P | U> | 267 $V_{l-n}$ | 2.5 s |
| Under frequency (UF) | 81U | f< | 47 Hz | 2.5 s |
| Over frequency (OF) | 81O | f> | 52 Hz | 1.0 s |
| Rate of change of frequency (ROCOF) | 81R | df/dt | ±4 Hz/s | 0.5 s[1] |
| **IES connections on a dedicated distribution tranformer** | | | | |
| Network overload protection[2] overcurrent | 51 | I> | 120% transformer nominal low voltage nameplate rating | 10 s |

Note 1: Sampling period for calculation of ROCOF specific to the IPR can be additional to the time delay setting.

Note 2: Network overload protection is only required where aggregate inverter capacity exceeds distribution transformer rating. The IES shall also incorporate a system to restrict export to no more than 100% of the transformer rating. Refer to Figure 8 for protection arrangement.

**Table 16 Rotating Machine IPR Functions and default settings**

| Protection functional description | ANSI/IEEE C37.2 Code | IEC 60617 Code | Default Setting | Time Delay |
|---|---|---|---|---|
| Level 1 backup protection | | | | |
| Under voltage (UV) | 27P | U< | 180 $V_{l-n}$ | 11.0 s |
| Over voltage (OV) | 59P | U> | 265 $V_{l-n}$ | 1.0 s |
| Under frequency (UF) | 81U | f< | 47 Hz | 2.0 s |
| Over frequency (OF) | 81O | f> | 52 Hz | 2.0 s |
| Rate of change of frequency (ROCOF) | 81R | df/dt | See Note 1 | 0.5 s[1] |
| Level 2 backup protection | | | | |
| Neutral voltage displacement (NVD)[2] | 59N / 59G | U0> | 120% | 3.0 s |
| Non-Export Fixed EG Systems | | | | |
| Power Limit protection | 32 | P→ | From Technical Study[3] | From Technical Study[3] |

Note 1: ROCOF calculated by the Proponent to ensure an island is not sustained when the Isolated System is de-energised. Where the calculated value is greater than 3 Hz/s, the DNSP shall be consulted. Sampling period for calculation of ROCOF specific to the IPR can be additional to the time delay setting.

Note 2: HV NVD as per Section 4.8.7.2 of this Standard.

Note 3: As per Section 4.8.2.5 of this Standard.

### 4.8.2.4 Grid reverse power protection

This section has been left intentionally blank.

### 4.8.2.5 Power Limit protection

Where the EG System has been approved by the DNSP as either a Non-export or Partial-export system and does not employ “soft” controls as described in Section 4.4.6.4 of this Standard, Power Limit protection shall be installed at the Connection Point or upstream of all EG unit(s) within the Connection Point. Any Power Limiting protection settings shall meet the requirements of Table 11.

### 4.8.2.6 Generator Circuit Phase balance protection

Rotating Machine installations may require phase balance protection if connected across more than one phase at a Connection Point; specific settings for current unbalance protection shall be determined by a connection-specific Technical Study.

Voltage unbalance protection may be required for Rotating Machine EG Systems and shall be specified from a Technical Study at the time of the connection.

### 4.8.2.7 Overcurrent and earth fault protection

Overcurrent and earth fault protection shall be provided at the Rotating Machines disconnection switch in accordance with the equipment rating. The overcurrent and earth fault protection relays

shall provide compensation for under voltage field weakening. Compensation for under voltage field weakening is not required where the Proponent can demonstrate that voltage depression at the EG System during fault events shall not adversely impact on the operation of the protection scheme.

Overcurrent and earth fault protection for the facility shall also be provided at the EG System in accordance with AS/NZS 3000. This protection shall be set to detect faults within the Proponent's installation. Any additional requirements for overcurrent facility fault, overcurrent grid fault and earth fault protection may be advised by the DNSP in the Technical Study.

#### 4.8.2.8 Passive Anti-islanding Protection

Passive anti-islanding settings shall be as per Table 13 for IES EG System inverters.

Rotating Machine EG Unit(s) protection shall have the Level 1 backup protection functions from Table 16 that form the passive Anti-islanding Protection unless otherwise specified in the Technical Study. These functions shall have settings coordinating with the Rotating Machine's IPR settings as outlined in Table 16.

An additional Anti-islanding Protection relay shall be installed if the Rotating Machine EG Unit(s) protection do not incorporate Level 1 backup protection as per Table 16. This relay is to operate the Disconnection Device at the Connection Point. This relay shall provide backup protection functions in Parallel with the IPR for loss of mains.

#### 4.8.2.9 Inter-tripping

The Proponent's design should not require an inter-trip from the DNSP.

### 4.8.3 Interlocking

Fail-safe interlocking mechanisms shall be required as specified in Table 17 for installations with multiple transformers and/or Connection Points, bumpless transfer and off-grid connections.

**Table 17 Interlocking requirements**

| Connection arrangement | Fail-safe interlocking[1] requirements |
|---|---|
| Multiple transformers and/or DNSP Service Points | No distribution transformers are connected in Parallel |
| Bumpless transfer | During the transfer from one source to another, the interlock operation cannot enable the EG Unit and the Isolated System to both supply the load at the same time longer than the maximum allowable duration for bumpless transfer in Table 5 of Section 4.4 of this Standard. No distribution transformers will be connected in Parallel any point during the bumpless transfer. |
| Off-grid EG unit | During the transfer from one source to another the interlock operation cannot allow the Generating Unit and the Isolated System to both supply the load at the same time. |

Note 1: The interlocking mechanism should be a manual (key based) fail-safe system. Automated controlled fail-safe interlocking systems may be allowed upon approval of a functional design and operational specification certified by an RPEQ in the application stage.

### 4.8.4 Disconnection Device fail protection

Loss of mains and Anti-islanding Protection scheme design shall make allowance for the failed operation of a Disconnection Device.

The protection scheme shall not operate the same Disconnection Device for both primary and backup protection. There may be multiple Disconnection Devices for either primary or backup protection.

The Proponent may elect to use another form of Disconnection Device fail protection, such as a circuit breaker fail (CBF) scheme, subject to the DNSP's agreement.

### 4.8.5 Wireless Transfer

Where an EG System's IPR and export monitoring device is remote from the EG System's Disconnection Device or inverters, a wireless communication system may be used. Where a wireless communication system is used to provide integrated tripping, it shall be demonstrated that failure of the IPR or any part of the communication system on which it relies operates in a fail-safe manner. An IPR and export monitoring device utilising a wireless communication system shall meet the following requirements:

a. have a supervised wireless communications link;

b. have a communication delay that does not exceed 0.5 seconds; and

c. disconnect the EG System from the Isolated System for any loss of communications longer than 5 seconds.

### 4.8.6 Synchronisation

The DNSPs apply an automatic feeder re-closing scheme on the majority of their Isolated Network. Automatic re-energisation of the feeder during this process opens the circuit breaker (with minimum delay) following a power system fault, and then attempts to automatically re-energise the feeder component after a predefined disconnected time (dead time). Automatic reclosing can happen multiple times depending on the Isolated Network location.

The EG System shall disconnect within this dead time upon a loss of mains power to ensure safe restoration. Failure of the EG System to so disconnect when there is a loss of supply from the Isolated System may result in damage to the EG System.

When the system voltage has been restored on the Isolated System side of the Connection Point, and the voltage and frequency have been maintained within protection limits for a period of no less than 60 seconds, the EG System may reconnect with the Isolated Network.

The EG System shall incorporate either automatic or operator-controlled equipment that ensures the frequency, voltages, and phase sequence of the EG System is identical with (synchronised to) those in the Isolated Network before it connects to the Isolated System. The EG System shall not reconnect until it is synchronised with the Isolated Network.

### 4.8.7 Additional requirements for Rotating Machine EG Systems

#### 4.8.7.1 Standards compliance

All EG Systems comprising a Rotating Machine EG Unit(s) that are installed under this Standard shall be compliant with AS 60034.1 Rotating electrical machines, Part 1: Rating and performance.

#### 4.8.7.2 Neutral Voltage Displacement (NVD) protection

EG Systems comprising Rotating Machine EG Unit(s) installed under this Standard, shall meet the protection requirements in Table 18 for NVD, loss of mains and Anti-islanding Protection based on operation type.

**Table 18 Requirements for Rotating Machine EG Systems**

| | Bumpless transfer[1] | Stand-by | Continuous Parallel |
|---|---|---|---|
| HV NVD | No | No | Yes |
| Loss of mains protection | No | Yes | Yes |
| Anti-islanding Protection | No | Yes | Yes |

Note 1: Bumpless transfer EG Unit(s) shall be considered as a Dynamic EG System only where a Premises has at least one other EG Unit with Stand-by or Continuous Parallel operation.

NVD protection is required to ensure that an EG System disconnects if there is a high voltage network earth fault. NVD protection requires either phase-neutral or an open delta voltage measurement of the relevant part of the HV Isolated Network.

NVD protection requires equipment to be installed on the DNSP's assets.

## 4.9 Operating voltage and frequency

The proposed installation shall be able to operate within the limits of supply voltage:

$V_{phase\text{-}to\text{-}neutral}$ = 230V ±10%.

The maximum sustained voltage set point for IES EG Systems, $V_{nom\_max}$ as per AS/NZS 4777.2, shall be set at 258 V.

The EG System shall be designed and operated to not cause more than 2% voltage rise at the Connection Point. Voltage rise is calculated from the EG Unit terminals to the Connection Point using a method contained in Clause 3.3.3 of AS/NZS 4777.1.

## 4.10 Metering

### 4.10.1 Bulk metered connections

Where connections are bulk metered, like a strata titled development (such as townhouses or a retirement village), the maximum installed EG System capacity is based on the aggregate of all EG Units connected or proposed to be connected.

In accordance with Section 4.8.2 of this Standard, properties within a LV bulk metered connection which classify as a detached house Class 1a Building as defined under the NCC will not require Interface Protection. IES Units within these properties are not aggregated when assessing IPR capacity requirements.

Figure 10 of Appendix B, illustrates three bulk metered connection scenarios when assessing IPR requirements:

- Option 1 – all properties within the bulk metered connection are detached house Class 1a Buildings that does not require Interface Protection. An IPR is not required for the connection.
- Option 2 – a mixture of detached house Class 1a Buildings and a community clubhouse. The community clubhouse has an IES Unit greater than 200kVA; an IPR is required for the connection.
- Option 3 – a mixture of detached house Class 1a Buildings, a community clubhouse and a community EG. The aggregated EG Unit capacity on the community clubhouse and community EG is greater than 200 kVA; an IPR is required for the connection.

## 4.11 Power quality

### 4.11.1 General

All power quality measurements and limits are with reference to the Connection Point.

#### 4.11.1.1 Voltage changes and flicker

The Proponent shall ensure that the EG System is designed and commissioned to:

a. achieve the acceptable level and frequency of step voltage changes advised by the DNSP following the Technical Study.

b. the flicker contribution limits for EG Systems is as per Table 19. The limits are considered as the direct contribution of the EG System (i.e. the difference in flicker values between when the EG is operational and not operational).

**Table 19 Flicker contribution limits**

| Connection type | $P_{st}$ | $P_{lt}$ |
|---|---|---|
| Dedicated distribution transformer | 0.50 | 0.40 |
| Shared distribution transformer | 0.30 | 0.25 |

#### 4.11.1.2 Short duration over voltages

The Proponent should comply with Section 7.6 of SA/SNZ TR IEC 61000.3.15 in order to minimise damage to its equipment from short duration over voltages.

The transient voltage limits for EG Systems comprising an IES EG unit(s) specified in Clause 2.9 of AS/NZS 4777.2 shall be met by Proponents.

#### 4.11.1.3 Harmonic Distortion

Harmonic voltage limits permitted to be injected into the Isolated System at the Network Coupling Point shall be as agreed with the DNSP and specified in the Connection Contract.

Harmonic current emission limits shall be allocated in accordance with IEEE 519. The harmonic current distortion level of the EG System should be less than the emission limits specified by the DNSP when all the EG Units of the EG System are in service.

#### 4.11.1.4 Voltage Unbalance

The Proponent shall ensure that the current injected in each phase at each of the LV Connection Point is balanced so as to achieve average voltage unbalance less than or equal to the values set out in Table 20, where the average voltage unbalance is determined using the following formula:

$$\text{average voltage unbalance (\%)} = \text{average}_{\text{period}}\left(\frac{\text{negative sequence voltage}}{\text{positive sequence voltage}}\right) \times 100$$

**Table 20 Voltage Unbalance levels**

| Condition | Averaging period | Voltage Unbalance |
|---|---|---|
| No contingency | 30 minutes | 2.0% |
| Credible contingency event | 30 minutes | 2.0% |
| General | 10 minutes | 2.5% |
| Once per hour | 1 minute | 3.0% |

#### 4.11.1.5 Disturbance Issues

Disturbance to the LV network shall be assessed against SA/SNZ TR IEC 61000.3.14.

Measurement of voltage disturbances shall be in accordance with AS/NZS 61000.4.30 using Class A instruments.

### 4.11.2 IES power quality response modes

The volt–var and volt–watt response modes specified in Clause 3.3.2.2 and Clause 3.3.2.3 of AS/NZS 4777.2 shall both be enabled as per below Table 21 and Table 22 for IES. For IES with energy storage the volt-watt response mode when charging, specified in Clause 3.4.3 of AS/NZS 4777.2, shall be enabled as per Table 23.

**Table 21 Volt–var response mode settings**

| Reference | Voltage | Inverter reactive power level (Q) % of $S_{rated}$ |
|---|---|---|
| $V_{V1}$ | 207 V | 44% supplying[1] |
| $V_{V2}$ | 220 V | 0% |
| $V_{V3}$ | 240 V | 0% |
| $V_{V4}$ | 258 V | 60% absorbing[1] |

Note 1: Absorbing is when the IES Unit absorbs reactive power from the Isolated System and supplying is when the IES Unit acts as a source of reactive power into the Isolated System.

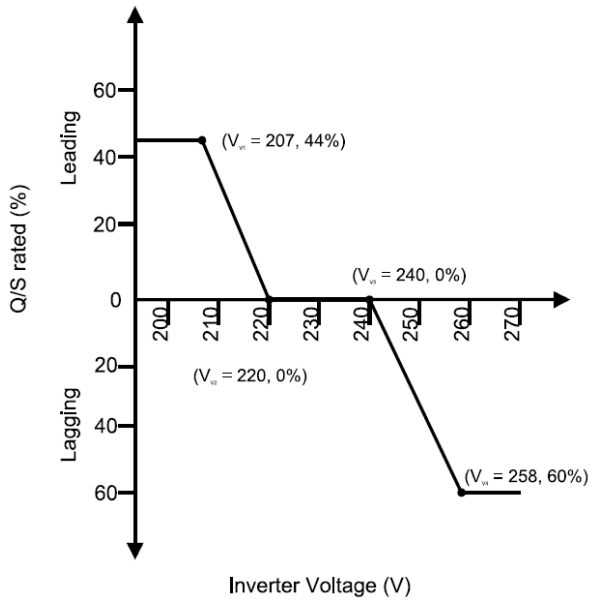



**Figure 4 Volt-var response mode**

**Table 22 Volt-watt response mode settings**

| Reference | Voltage | Inverter maximum active power output level (P) % of $S_{rated}$ |
|---|---|---|
| $V_{W1}$ | 253 V | 100% |
| $V_{W2}$ | 260 V | 20% |

Note 1: Where P is the output power of the inverter and $P_{rated}$ is the rated output power of the inverter.

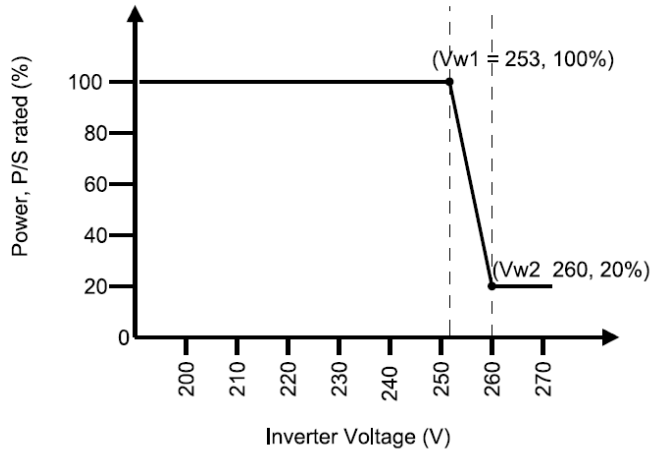



**Figure 5: Volt-watt response mode**

**Table 23 Volt-watt response mode settings for inverters with energy storage when charging**

| Reference | Voltage | Power Input, $P_{charge}/P_{rated\text{-}ch}$ (%) |
|---|---|---|
| $V_{W1\text{-}ch}$ | 207 V | 20% |
| $V_{W2\text{-}ch}$ | 215 V | 100% |

Power quality response modes shall commence and complete in accordance with their defined characteristics in Clause 3.3.2 and Clause 3.4.3 in AS/NZS 4777.2 within the relevant times specified in Table 24 below:

**Table 24 Maximum response time for power quality response modes**

| Response commencement time | Response completion time |
|---|---|
| 1 s | 10 s |

### 4.11.3 LV EG rotating machines power quality response

An EG System comprising a Rotating Machine EG Unit(s) shall be designed and operated to adequately control real and reactive power output to achieve a power factor at the Connection Point of greater than 0.8 lagging and not leading unless otherwise agreed to in writing by the DNSP.

## 4.12 Communications systems

### 4.12.1 General

A Dynamic EG System shall support the sending and receiving of information to the DNSP with communication systems that meets the following requirements:

a. Connection of the Dynamic EG System to the public internet; and
b. Compliance with SEP2 using CSIP-AUS.

### 4.12.2 Connection of communication system

The communication systems for a Dynamic EG System shall be met by one of the following methods of connection for information exchange via SEP2 using CSIP-AUS:

a. direct connection of an EG Unit; or
b. third-party device which communicates with the EG Unit(s); or
c. cloud based vendor which communicates with the EG Unit(s).

For installations of Dynamic EG Systems with multiple EG Units for which the communication system cannot support communication with all the installed EG Units, the EG Unit(s) installed prior to 23 February 2025 that cannot be communicated with must be set to non-export and non-import. If an inverter installed prior to 23 February 2025 is replaced or altered, the replaced or altered inverter must be capable of information exchange via SEP2 using CSIP-AUS.

### 4.12.3 Information exchange

The communications system for Dynamic EG Systems shall be able to support sending and receiving information with the following frequency and capacity:

a. polling frequency of once per minute or better (i.e. polling at intervals of no greater than one minute); and
b. forecast information with thirty-second intervals for the next immediate quarter hour (30 events) for each of the following limits; dynamic Export limit, dynamic Import limit, dynamic Site Generation Limit and dynamic Site Load Limit (i.e. 120 events total).

## 4.13 Data and information

### 4.13.1 Static data and information

Static data and information shall be provided by the Proponent to the DNSP in accordance with

Appendix D: Static data and information (informative).

### 4.13.2 Dynamic data and information

Dynamic data and information that is required to be provided by the Proponent to the DNSP as per Appendix E: Dynamic data and information for Dynamic EG Systems (informative).

## 4.14 Cybersecurity

This section has been left intentionally blank.

## 4.15 Technical Studies

Technical Studies shall be undertaken by the DNSP as part of the connection application and in accordance with jurisdictional requirements. Technical Study requirements are shown in Table 25 and Table 26. Unless otherwise specified in the notes for Table 26, the DNSP shall be performing the Technical Study.

**Table 25 Technical Study requirements for IES EG Systems**

| Technical Study | ≤ 30 kVA | > 30 kVA and ≤ 200 kVA | | > 200 kVA | |
|---|---|---|---|---|---|
| | Export | Export | Non-export | Export | Non-export |
| Voltage regulation | Yes | Yes | No | Yes | No |
| Power flow | Yes | Yes | No | Yes | No |
| Fault level | No | Yes[1] | Yes[1] | Yes[1] | Yes[1] |
| Protection grading | No | Yes[1] | Yes[1] | Yes[1] | Yes[1] |

Note 1: Depending on the Isolated Network a fault and protection grading study may not be required. Ergon Network will advise if this requirement is not required on receipt of connection application.

**Table 26 Technical Study requirements for Rotating Machine EG Systems**

| Technical Study | Bumpless transfer | Stand-by | | Continuous Parallel | |
|---|---|---|---|---|---|
| | | Non-export | Export | Non-export | Export |
| Voltage regulation | No | No | Yes | No | Yes |
| Power flow | No | No | Yes | No | Yes |
| Fault level | No | Yes | Yes | Yes | Yes |
| Protection grading | No | Yes | Yes | Yes[1] | Yes[1] |

Note 1: The Proponent shall do the study based on DNSP's upstream protection settings.

Where the EG System is greater than 200 kVA and is identified to be connecting to an Isolated System with constraints, the DNSP may require the Proponent to provide a manufacturer-developed EMT model of the EG unit(s) with relevant site-specific settings. The EMT model shall be developed using PSCAD™/EMTDC™.

# 5 Connection application proess, fees and charges

Information regarding fees and charges applicable to Proponents is available at the following Ergon Network link: https://www.ergon.com.au/network/connections/residential-connections/connection-services-charges

# 6 Testing and commissioning

Testing and commissioning requirements for EG Connections include:

a. testing and commissioning plans shall be prepared by the Proponent and may be required to be approved by the DNSP under the Connection Contract.

b. the commissioning plan, certification and acceptance shall be provided by an RPEQ[7].

c. testing and commissioning acceptance may require the DNSP to carry out witnessing at the DNSP's expense.

d. for IES, testing and commissioning requirements shall be in accordance with AS/NZS 4777.1, AS/NZS 3000, AS/NZS 3017 and AS/NZS 5033 (where applicable), the equipment manufacturer's specifications and the DNSP technical requirements to demonstrate that the EG Systems including IES complies with the requirements set out in the Connection Contract.

[7] Engineering supervision by an RPEQ need not be required for the commissioning of an EG System with bumpless transfer connection to the Distribution System if compliant with Section 4.5.1 and Section 4.7.3.

e. for Rotating Machines, testing, and commissioning requirements shall be in accordance with AS/NZS 3010, the equipment manufacturer's specifications and the DNSP's technical requirements and shall demonstrate that the LV EG Rotating Machines system meets the requirements of the Connection Contract.

f. the Proponent shall submit a compliance report as outlined in the Connection Contract that comprises (but is not limited to) the final approved drawings, test results and specifications.

The application of testing and commissioning requirements shall be applied to specific subcategories as shown in Table 27.

**Table 27 Testing and commissioning requirements**

| Testing and commissioning requirements | LV EG IES | | | | | LV EG Rotating Machines | |
|---|---|---|---|---|---|---|---|
| | ≤ 30 kVA | > 30 kVA and ≤ 200 kVA | | > 200 kVA | | | |
| | Export | Export | Non-export | Export | Non-export | Export | Non-export |
| Protection settings and performance | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Power quality settings and performance | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Export limits settings and performance | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Communications settings and performance | Yes[1] | Yes[1] | Yes[1] | Yes[1] | Yes[1] | Yes[1] | Yes[1] |
| Shutdown Procedures | No | No | No | No | No | Yes | Yes |
| Confirm system is as per specifications | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Confirm SLD is located on site | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

Note 1: Required for all Dynamic EG Systems however only required for Fixed EG Systems if wireless transfer / communication is utilised as part of the EG System design.

# 7 Operations and maintenance

## 7.1 General

Operations and maintenance requirements for EG Connections shall include, but are not be limited to:

a. an operation and maintenance plan shall be produced, with a copy to remain on site.

b. the EG System shall be operated and maintained to ensure compliance at all times with the Connection Contract and all applicable legislation (including Energy Laws), codes, and/or other regulatory instruments.

c. operation and maintenance reports may be required by the DNSP at a specified interval no more frequently than annually.

d. the electrical installation at the supply address shall be maintained in a safe condition.

e. subject to item f below, the Proponent shall ensure 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;

f. the Proponent shall seek DNSP approval prior to altering the connection in terms of an addition, upgrade, extension, expansion, augmentation, or any other kind of alteration, including changing inverter/IPR settings.

g. The Proponent shall notify the DNSP of any scheduled and unscheduled protection or communications outages or failures.

The DNSP may at its own cost inspect the Proponent's EG System at any time. The DNSP may require access to the site of the EG System and disconnection points for Isolated System maintenance and testing purposes.

Isolated System maintenance may cause interruptions to the operation of the EG System. Co-operative scheduling of these activities should be undertaken to reduce the outage period and minimise the associated impacts.

If the DNSP through an audit or an investigation determines that the EG System is non-compliant with the Connection Contract, the Proponent shall be advised of this in writing. If the concern has a material impact, the DNSP shall disconnect the EG System until the non-compliance has been remediated by the Proponent to the DNSP's satisfaction.

The DNSP does not guarantee the operation of any customer appliances, including EG Units and their associated components. The Proponent shall take necessary steps to ensure their Dynamic EG System operates as anticipated and also adhere to their applicable Connection Contract.

## 7.2 Dynamic operation

A Dynamic EG System shall be operated in fixed default limits or dynamic limits as per Table 28.

**Table 28 Dynamic operation criteria**

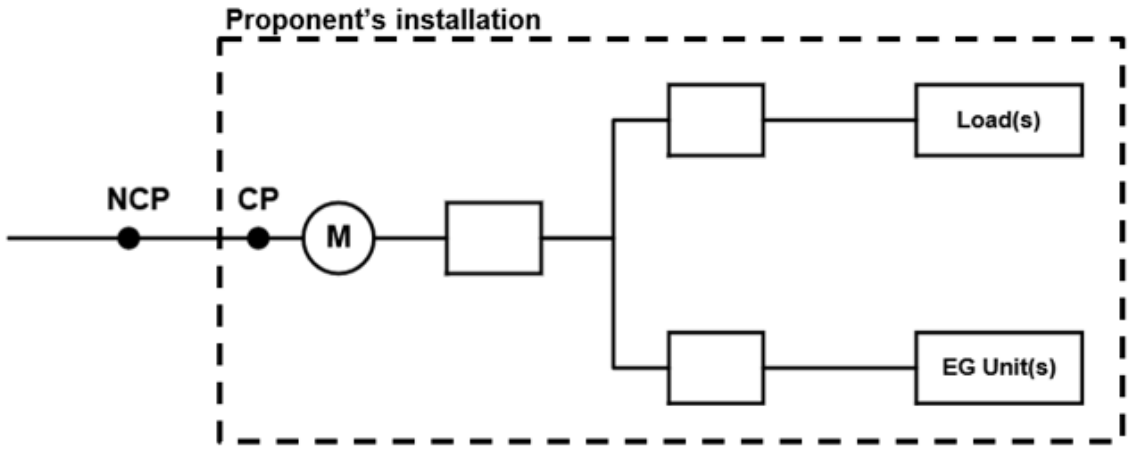
| Operational function | Requirements |
|---|---|
| Fixed default limits | • Connection Contract for a Dynamic EG System.<br>• Installed in compliance with this Standard. |
| Dynamic limits | • Connection Contract for a Dynamic EG System.<br>• Installed in compliance with this Standard.<br>• Registered to the DNSP IEEE SEP2 Utility Server.<br>• Receive dynamic Export limits, dynamic Site Generation Limits, dynamic Import limits and dynamic Site Load Limits.<br>• Operate Dynamic EG System to meet dynamic Export, dynamic Site Generation Limits, dynamic Import limits and dynamic Site Load Limits. |

## Appendix A: Deviations from the National DER Connection Guidelines (informative)

There are no current National DER Connection Guidelines for dynamic connections or connections to Isolated Networks. This Standard has been developed in alignment with the framework of the National DER Connection Guidelines.

## Appendix B: Connection arrangement requirements (normative)

Following is a representation for a LV EG Unit Connection as considered in this Standard.




| | |
|---|---|
| **NCP** | Network Coupling Point |
| **CP** | Connection Point |
| **M** | Metering |
| ▭ | Isolation Device |

**Figure 6: LV EG Connection installation representation**

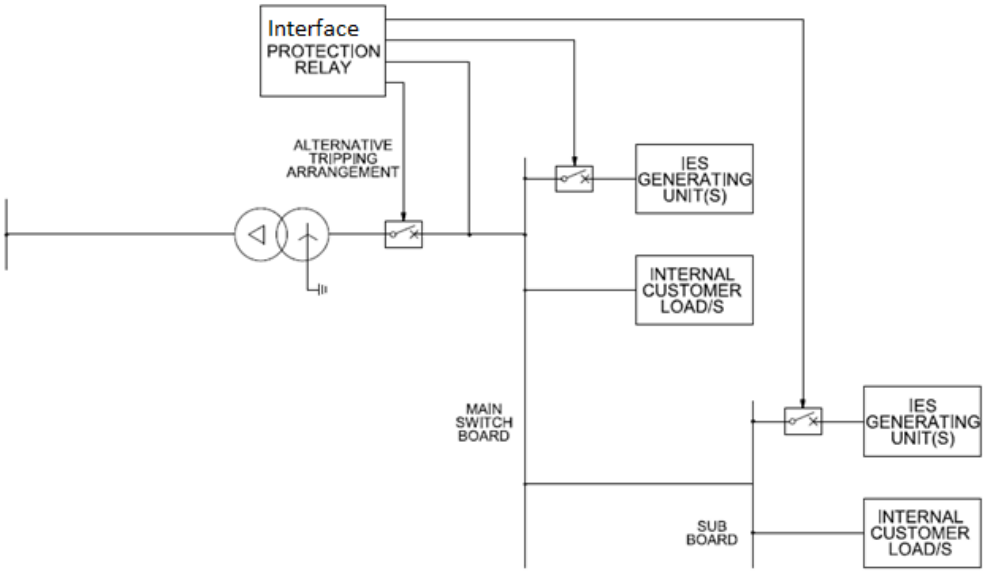



**Figure 7: Protection arrangement for EG Systems comprising IES EG Unit(s) where an IPR is required**

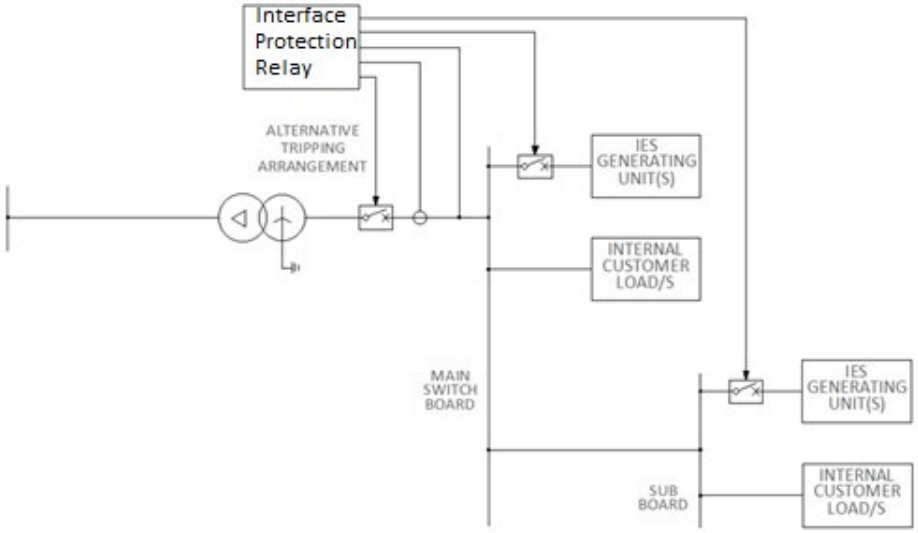



**Figure 8: Protection arrangement for EG Systems comprising IES EG Unit(s) where an IPR is required and with Network Overload Protection**

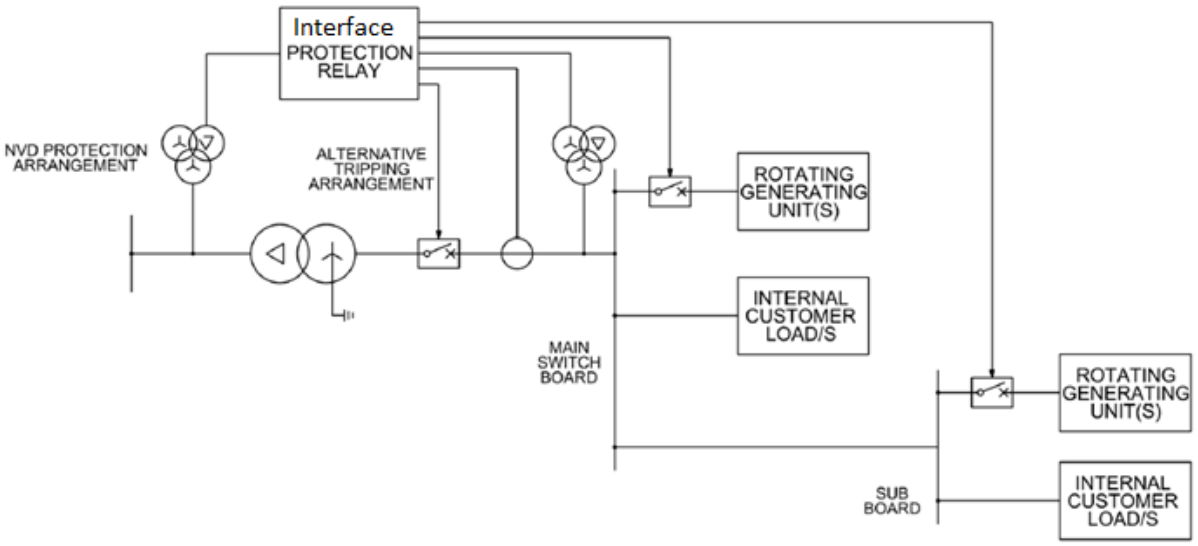



**Figure 9: Protection arrangement for EG Systems comprising Rotating Machine EG Unit(s) where NVD and IPR are required**

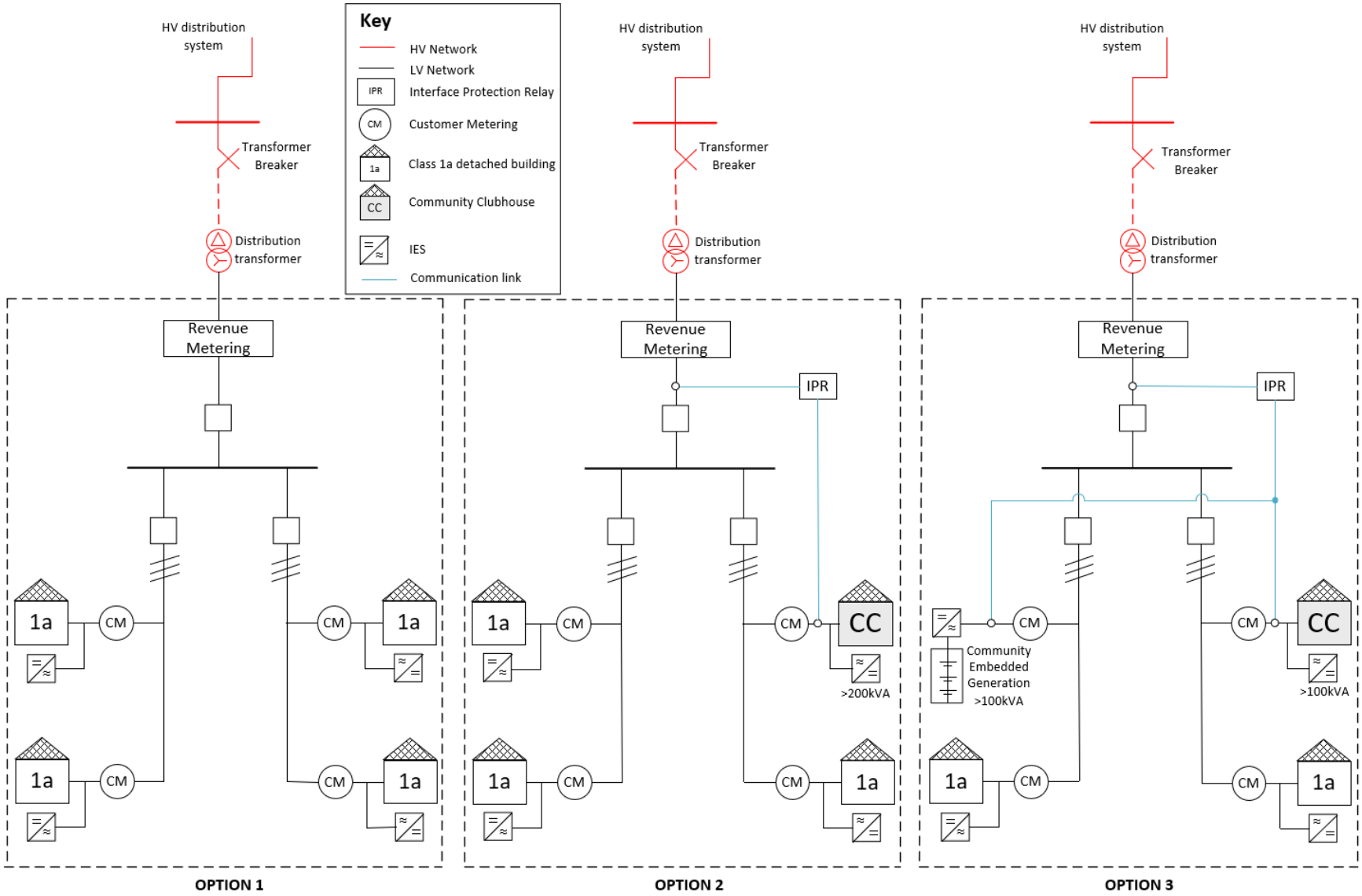



**Figure 10: IPR arrangement for EG Systems within an LV Bulk Metering Connection**

## Appendix C: Model Standing Offer (informative)

Model Standing Offers are not currently offered for EG Systems connecting to Isolated Networks.

## Appendix D: Static data and information (informative)

Static data and information shall be provided by the *Proponent* to the *DNSP* based on your application type and may include some of the following below (but not limited to):

1. NMI and physical meter number(s).
2. System information:
    a. Detailed single line diagram demonstrating motors, large loads, EG Units connected, and proposed for connection, at the Premises (including detail of any interlocking).
    b. Number of phases available and number of phases that DER is installed on.
    c. Energy source.
    d. Maximum demand, capacity, and output rating.
    e. Any proposed Export limit for DER (Full / Partial- / Non- / minimal) and method of Export control.
    f. Metering scheme information (gross or net).
3. Inverter / Rotating Machines
    a. Make, model and manufacturer
    b. Number installed
    c. Power quality modes
4. Device information:
    a. Type (e.g., motor, pump, mill, chiller, panel, battery).
    b. Make, model and manufacturer.
    c. Number installed.
5. Applicant and Customer information:
    a. Type.
    b. Full customer name or name of other legal entity capable of contracting with the DNSP.
    c. Retail Customer / Retail Account Holder
    d. Address and contact information.
6. Electrical Contractor, RPEQ, Consultant and/or Installer information.
7. DER Registration information.

# Appendix E: Dynamic data and information for Dynamic EG Systems (informative)

For Dynamic EG Systems, dynamic data and information shall be provided by the Proponent to the DNSP or by the DNSP to the Proponent based on the application type and may include (but is not limited to) the following:

**Table 29 Dynamic monitoring information via CSIP-AUS**

| Measurement | Data Qualifier | Site | DER[1] |
|---|---|---|---|
| Real Power (W/phase) | Average | Mandatory | Mandatory |
| Reactive Power (Var/phase) | Average | Mandatory | Mandatory |
| Voltage (V/phase) | Average | Mandatory | Optional |

Note 1 – Measurements from Metering Mirror function set.

Note 2 – DER telemetry is total of aggregated actively managed devices.

Note 3 – At least one site or device voltage must be reported. Where site voltage is available, it must be reported.

**Table 30 Dynamic control functions via CSIP-AUS**

| Category | Support Function | DER control requirements |
|---|---|---|
| Export limit | DERControlBase within the DERControl. | DERControlBase:csipaus:opModExpLimW (Watts) |
| Import limit | DERControlBase within the DERControl. | DERControlBase:csipaus:opModImpLimW |
| Site Load Limit | DERControlBase within the DERControl. | DERControlBase:csipaus:opModLoadLimW |
| Site Generation Limit | DERControlBase within the DERControl. | DERControlBase:csipaus:opModGenLimW and DERControl:opModEnergize |
| Forecasting[1] | Forecasting using DERControl | Using DERControl events |
| Loss of communications revert to fixed default limits | DefaultDERControl. | DefaultDERControl; and setGradW |

Note 1 – Capable of supporting a minimum of thirty-second interval envelope events, polled every 60 seconds, for the next quarter hour, updated every minute under normal circumstances. (30 events per Connection Point per DER Control).

## Appendix F: LV EG Connection arrangement requirements summary (informative)

| | ≤ 30 kVA IES (3 Phase or SWER) (Fixed non-standard IES EG Systems only) | > 30 kVA ≤ 1,500 kVA IES (3 Phase) | | | | > 30 kVA ≤ 1,500 kVA rotating machines (3 Phase) | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Shared or dedicated transformer | Shared transformer | | Dedicated transformer | | Shared or dedicated transformer | | | |
| | | | | | | Limited Parallel operation | | Continuous Parallel operation | |
| | Export | Non-export | Export | Non-export | Export | Bumpless transfer | Stand-by (6 hr per 3 months) | Non-export | Export |
| Level 1 Backup protection[1] | No | Yes[6] | Yes[6] | Yes[6] | Yes[6] | No | Yes | Yes | Yes |
| Level 2 Backup protection[2] | No | No | No | No | No | No | No | Yes[2] | Yes[2] |
| Grid reverse power protection | No | No | No | No | No | No | No | Yes | Yes |
| AS/NZS 4777.2 inverters required with active anti-islanding to AS/NZS IEC 62116 requirements | Yes | Yes | Yes | Yes | Yes | Not Applicable | | | |
| Isolated System capacity review required | Yes | No | Yes | No | Yes | No | No | No | Yes |
| Power quality to AS/NZS 61000 series requirements | Yes | Yes | Yes | Yes | Yes | No | Yes | No | Yes |
| Fault level contribution to the Isolated System included in the DNSP's Technical Study[3] | No | No | No | No | No | Yes | Yes | Yes | Yes |
| Compliant with SEP2 CSIP-AUS. Register EG System with SEP2 Utility Server | Not Applicable | Yes[5] | Yes[5] | Yes[5] | Yes[5] | No | Yes[5] | Yes[5] | Yes[5] |
| RPEQ design and commissioning plan | Yes | Yes | Yes | Yes | Yes | Yes[4] | Yes | Yes | Yes |

1. Level 1 backup protection – Over and under voltage, over and under frequency and rate of change of frequency.
2. Level 2 backup protection – Neutral voltage detection/unbalance.
3. Fault current contribution is dependent on size, number, and hours of operation
4. RPEQ commissioning is not required if there is no electronically controlled interlocking arrangement as per Section 4.8.3 and transfer switch's standards compliance in Section 4.6.1.
5. Applies only if the EG System is a Dynamic EG System i.e. Fixed EG Systems are exempt from this requirement.
6. Required if an IPSD is utilised for IES with aggregated capacity greater than 30 kVA or for IES with aggregated capacity greater than 200 kVA.

## Appendix G: Requirements for Dedicated transformer dynamic connections with higher IES capacity (normative)

1. The Proponent must have a fail-safe control system managing the Fixed Default Dynamic Import/Export Limit, Fixed Default Dynamic Site Generation Limit and Fixed Default Dynamic Site Load Limit when the Dynamic Operating Envelope (DOE) schedule/update is not received that will limit the EG Systems to meet the Import/Export/generation/load respectively for the Premises to the predetermined fixed default values from the Technical Study and Dynamic Connection Contract.
2. The Proponent shall also have its control system limiting the export to 100% of the distribution transformer rating or other applicable network limit (when DOE is functional) – this shall constitute the primary control owned by the Proponent. It shall also prevent charging if import exceeds 120% of the transformer rating.
3. The DOE also manages the Export limit up to 100% of the network limit (as provided in the Technical Study). For the quarter hour ahead, the DOE will have schedules that are enforced if communications are lost. DOE will also manage the import level up to the maximum 120% of the transformer rating or the limit from the Technical Study.
4. A Proponent owned protection relay (e.g. Interface Protection Relay) that shall have non-directional power overload setting enabled up to 120% of the transformer rating (for Import as well as Export if the IES is capable of charging). This shall be set to 30 second trip setting.

# Appendix H: Output Smoothing (normative)

## H.1 Overview

### H.1.1: Purpose

The object of this Appendix is to provide Proponents of LV EG IES Units with additional information about their obligations (over and above those set out in the main body of this Standard) in respect of connecting to, and interfacing with, certain Isolated Networks in situations when those Isolated Networks have reached their Unmanaged Hosting Capacity and the Isolated Network does not support dynamic (IEEE2030.5 SEP2) solar PV connections. Any new LV EG IES Units connecting to such networks must be equipped with Output Smoothing which is compliant with this Appendix H (principally, to smooth generation output) so that their operation will not adversely affect the continued security and stability of the relevant Isolated Network.

The communities that are supplied by Isolated Networks and do not support dynamic (IEEE2030.5 SEP2) solar PV connections are listed on Ergon Network's Isolated Networks Solar Capacity Page.

### H.1.2: Scope

This Appendix supplements the main body of this Standard, and applies to the connection of LV EG IES Units in any of the Affected Isolated Networks (being those Isolated Networks that have reached their Unmanaged Hosting Capacity) where Ergon Network is not yet able to make available an offer for LV IES Dynamic EG Connections. This is achieved through effective Output Smoothing to maintain stability of the Isolated Network and the relevant power station. LV EG IES Units required to comply with this Appendix H are classed as a sub-type of LV IES Fixed EG Connections.

### H.1.3: Disclaimers

We are not responsible or liable for any loss, damage, cost or expense users might incur as a result of the use of, or reliance on, any of the material contained in this Appendix.

## H.2: Introduction

Please refer to Section 4.1 and H.1 for an introduction and background to Output Smoothing.

## H.3: General Requirements

A Proponent required to comply with the additional requirements of this Appendix H (Output Smoothing) must also comply with the requirements of this Standard applicable to LV IES Fixed EG Connections, as well as other applicable Ergon Network and Australian Standards in respect of any LV EG IES Unit connections to an Affected Isolated Network.

Ergon Network may, in its absolute discretion and without limiting any of its other rights, reject an application or disconnect a Proponent from the Affected Isolated Network if the Proponent's installation does not comply, or, no longer complies with, all the requirements of this Appendix H if the Connection Contract requires compliance with Appendix H.

The cases in which compliance with Appendix H is required by a Proponent is described in Section 4.1.2 and is illustrated as one of the outcomes from the LV EG IES Unit connection assessment process illustrated in Figure 2.

### H.3.1: Documentation

The following additional documentation must be supplied by the Proponent as part of an application to connect:

- Compliance checklist;
- System and circuit diagrams; and
- Registered Professional Engineer of Queensland (RPEQ) sign-off.

The above diagrams must include the following elements:

- A point of connection to Ergon Network's Isolated Network
- Details of the electrical installation, including the LV EG IES Unit installation, switchboards, Proponent loads and meters.
- Details of the installation, including, but not limited to, the following elements:
    - Generation sources;
    - Inverters;
    - ESS (i.e. batteries and energy management system); and
    - Any associated auxiliary, control or monitoring equipment.

Ergon Network may request additional information needed to perform an impact assessment or to demonstrate that the Proponent's proposed installation meets the requirements of this Appendix.

### H.3.2: RPEQ sign-off

For all LV EG IES Units with Output Smoothing, an RPEQ must validate and certify that the design of the LV EG IES Units with Output Smoothing is compliant with the requirements of this Appendix H. Refer to Appendix J for an example RPEQ sign-off template. A RPEQ sign-off will be valid for more than one Fixed EG Connection (comprising LV EG IES Unit(s) with Output Smoothing) provided that the IES the subject of the connection application replicate the following details from the RPEQ certified design:

- Make and model of inverters;
- System diagram;
- Circuit diagram (changes to protection and cable sizes permitted);
- Electrical arrangement of the installation;
- Changes to firmware that affect compliance with this Appendix;
- Changes to equipment that affect compliance with this Appendix; and
- Changes to the type of technology or methodology used to achieve compliance with this Appendix.

Where a previous RPEQ sign-off is being submitted as part of an application to connect by a Proponent, the Proponent must include a letter in the form set out in Appendix K that specifies the project and date of the RPEQ reference design and confirms that the IES the subject of the connection application is the same as the IES that was certified by the RPEQ in the above respects.

## H.4: Technical requirements

Figure 2 outlines the process flow chart used by Ergon Network when assessing proposed LV EG IES Unit connections to Isolated Networks. This Appendix sets out additional requirements that apply to LV EG IES Units to be connected to Isolated Networks that have reached the limits of their Unmanaged Hosting Capacity (that is, Affected Isolated Networks), where there is available Managed Hosting Capacity but not yet availability of LV IES Dynamic EG Connections. Due to minimum loading of baseload diesel generation and other technical requirements, Managed Hosting Capacity is finite and its availability is location-dependent.

Note that Ergon Network reserves the right to require remote control of LV EG IES Units for installations with Output Smoothing. The specifics of control are to be determined through negotiation.

**Note:** No direct connection is permitted between a Proponent's LV EG IES Unit installation and the Proponent's final loads. Connection must be made via the switchboard.

### H.4.1: Export capable and non-export installations

The requirements of this Appendix apply to both export- and non-export-capable LV EG IES Unit installations, unless otherwise specified.

Non-exporting LV EG IES Unit installations are required to have Output Smoothing (refer to Section H.4.4) to be eligible for the allocation of Managed Hosting Capacity. This is to maintain the stability of Affected Isolated Networks during cloud events, and to ensure reliable electricity supply in these networks. Rapid change in load can lead to instability of isolated power stations, regardless of whether the installation is non-export- or export-capable.

### H.4.2: Export only for energy storage systems

The Proponent's LV EG IES Unit installation must not be capable of importing power from the Ergon Network Isolated Network to charge ESSs. The installation must also be resistant to tampering that would enable energy storage to be charged from the Isolated Network. Ergon Network reserves the right to exclude an inverter make and model from connection if it considers that the method to prevent energy import is not satisfactory.

### H.4.3: Permission to export

The inverter must be prevented from supplying the Proponent's loads or exporting power to the Isolated Network at all times unless the ESS has sufficient energy stored to meet the ramp rate requirements described in Section H.4.4.

### H.4.4: Output Smoothing requirements

The method of Generation Management covered by this Appendix is Output Smoothing. This requires the Proponent to install an ESS that releases energy back into the Isolated Network to mitigate sharp changes in output of the LV EG IES Units, as shown in Figure 11. This allows sufficient time for Ergon Network to ramp up generation to cover a loss of output from customer generation.

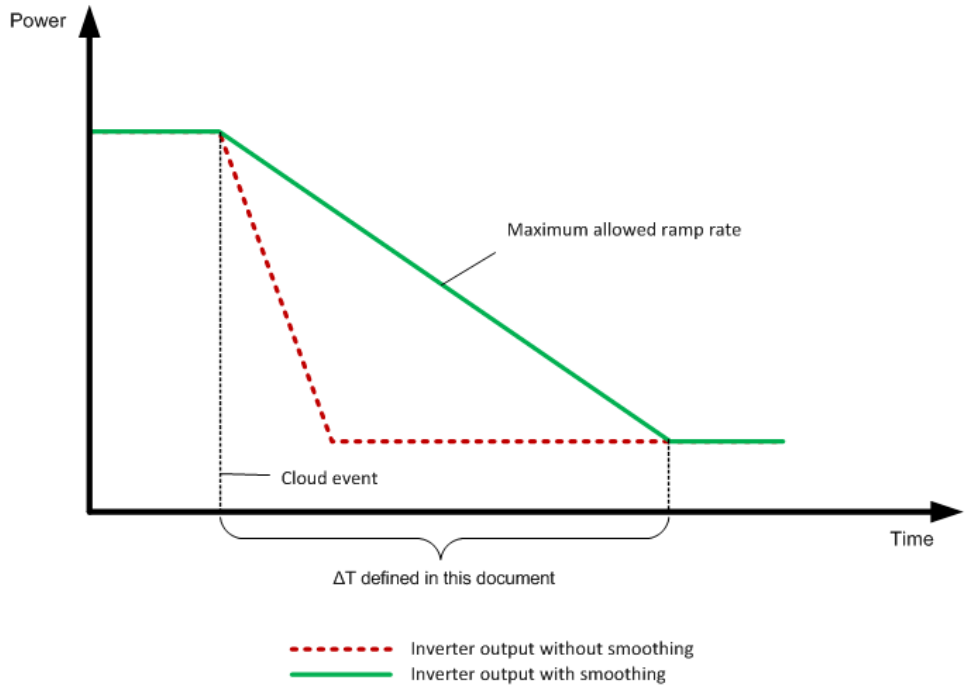



**Figure 11: Concept of inverter output smoothing**

**Note:** that this Appendix defines the required output behaviour of the system. The control methodology, system, type and capacity of the ESS are determined by the Proponent.

#### H.4.4.1: Ramp down time

All installations that require Output Smoothing must have a ramp down time (being the time taken for the inverter to ramp down from its rated output value to 0 kW) of 720 seconds. This is to mitigate a sudden decrease in the output of LV EG IES Units, and to enable the isolated power system to adjust to a change in load.

It is expected that under this scenario the ESS will be discharging to maintain the defined ramp down rate. Output smoothing is required when the ramp down rate of the LV EG IES Unit generation source exceeds the rate defined as:

$$R_{down} = \frac{Nominal\ Inverter\ Rating}{Ramp\ Down\ Time}$$

#### H.4.4.2: Ramp up time

All installations that require Output Smoothing must have a ramp up time (being the time taken for the inverter to ramp up from 0 kW to its rated output value) of at least 360 seconds. This is to mitigate a sudden increase in the output of LV EG IES Unit installation and enable the isolated power system to adjust to a change in output.

It is expected that this action will be achieved by either charging the ESS, curtailing some of the output of the LV EG IES Unit installation, or both, to maintain the required ramp up rate. Output Smoothing is required when the ramp up rate of the LV EG IES Unit generation source exceeds the rate defined as:

$$R_{up} = \frac{Nominal\ Inverter\ Rating}{Ramp\ Up\ Time}$$

#### H.4.4.3: Selection of Energy Storage System

**Note:** that the requirements set out in this Appendix describe the behaviour of the output of the inverter only. The rating, type, equipment and control algorithms required for the ESS to achieve these requirements are up to the Proponent to determine.

#### H.4.4.4: Compliance

**Note:** that the Proponent's installation is considered to have met the ramp down requirements if it passes the ramp down test described in Section H.4.5. Ergon Network needs to ensure that the installation complies with the ramp rate requirements set out in this Appendix. This is achieved through validation by a RPEQ that the LV EG IES Unit smoothing system meets the requirements specified in this Appendix.

The inverter must be prevented from exporting power or supplying the Proponent's loads until the ESS has sufficient energy stored to meet the ramp rate requirements described in this Appendix.

ESSs must be resistant to tampering, to prevent any changes that might render the system non-compliant with Ergon Network's ramp rate requirements. Ergon Network reserves the right at its absolute discretion to perform testing, request additional evidence of compliance and disconnect the LV EG IES Unit installation until sufficient evidence of compliance is provided.

### H.4.5: Testing

Both of the following methods of evaluating functionality of the ESS are to be provided:

1) Self-test function.

   Test sequence (described in Sections H.4.5.1 to H.4.6) is initiated by the system. The means of activating the sequence manually is also to be provided via a push button, menu selection or other means, and is to be accessible by Ergon Network.

2) Energy storage health indicator

   An indicator that guarantees the health of the battery system and shows there is sufficient capacity in the battery system to perform the ramp down test. This indicator must be clearly visible in the meter box. Output of the inverter is to be displayed. For non-exporting systems, total Proponent load is also to be indicated.

### H.4.5.1: Testing procedure

The following process is to be followed at all times when a ramp down test is performed (including automatic self-tests):

1) Measure and record the inverter output power prior to commencement of the test. The output of the inverter must be at least 60% of the nominal inverter rating at the time of commencement of the test. For non-exporting systems, the Proponent's loads must exceed the output of the inverter throughout the test for the result to be considered valid.
2) Isolate the generation source (e.g. solar PV) from the rest of the LV EG IES Unit installation.
3) Measure and record power output of the inverter at points in time identified in Table 31.

   $P_0$ – output of the inverter at the beginning of the testing sequence.

**Note:** Power measurements are to be accurate within 4%. Measurements that lie outside of the pass bounds but within measurement uncertainty bounds will be considered passed.

$T_d$ – ramp down time, as defined in Section H.4.4.1.

**Table 31: Output measurements for the testing procedure**

| Time of measurement (seconds) | Required inverter output | Margin of error |
|---|---|---|
| $\frac{1}{5}T_d$ | $\frac{4}{5}P_0$ | ±10% |
| $\frac{2}{5}T_d$ | $\frac{3}{5}P_0$ | |
| $\frac{3}{5}T_d$ | $\frac{2}{5}P_0$ | |
| $\frac{4}{5}T_d$ | $\frac{1}{5}P_0$ | |
| $T_d$ | $0$ | |

4) If the measured values meet the requirements outlined in Table 31, then the LV EG IES Unit installation passes the test. Otherwise, it fails the test.
5) Indicate the result of the test and perform the relevant control action listed in Table 32:

**Table 32: Control Actions**

| Result of the test | Control actions |
|---|---|
| Passed | Allow the inverter to connect, or remain connected, to the network. |
| Failed | Disconnect the inverter from the network. |

6) Reconnect the LV EG IES Unit generation source to the rest of the Proponent's installation.

#### H.4.5.2: Temporary reconnection for testing

If the LV EG IES Unit installation fails the ramp down test, the system must wait at least 24 hours before reconnecting the LV EG IES Unit installation to the network for the purpose of performing the ramp down test. This reconnection is a temporary connection only for testing purposes.

If, after a maximum of 3 attempts, the test is not passed, the inverter is to remain permanently disconnected from the network. Reconnection by the Proponent is to be prevented by software interlock or other method.

#### H.4.5.3: Recording of Data

Data associated with the previous 12 ramp down tests is to be stored, and prevented from tampering that would allow the test results to be erased. The data is to include:

- date and time of test;
- $P_0$ output of the inverter prior at the commencement of the test;
- times of measurement (to resolution of seconds);
- inverter output measurement values; and
- results of the test: pass or fail.

### H.4.6: Frequency of testing

Ergon Network requires evidence that ramp down self-tests (as described in Section H.4.5.1) will be automatically performed on a regular basis in accordance with the frequency of testing requirements outlined in Table 33.

If the ramp down test is not performed within the prescribed timeframes, the LV EG IES Unit installation must automatically disconnect from the network until the testing procedure outlined in section H.4.5.1 has been performed and the ramp down requirements are met.

**Table 33: Frequency of testing**

| Type | Inverter rating | Minimum self-test frequency requirements |
|---|---|---|
| Automatic self-test | Less than or equal to 10kW | Every 12 months |
| | Greater than 10kW | Every 6 months |
| Manually activated self-test | All sizes | Upon request from Ergon Network |

### H.4.7: Commissioning

Commissioning and verification must be in accordance with all applicable standards. A ramp down test is to be performed after the installation is commissioned and prior to its use. Ergon Network reserves the right to witness commissioning, or request evidence of commissioning results, prior to granting final approval.

## Appendix I: Compliance checklist for Output Smoothing (informative)

| Description | Applicable sections | Complies | Comments |
|---|---|---|---|
| General requirements - system and circuit diagrams | Appendix H.3.1: Documentation | ☐ | |
| General requirements - RPEQ sign-off | Appendix H.3.2: RPEQ sign-off | ☐ | |
| General technical requirements - export only for ESSs | Appendix H.4.2: Export only for energy storage systems | ☐ | |
| General technical requirements - permission to export | Appendix H.4.3: Permission to export | ☐ | |
| Smoothing requirements – ramp down time | Appendix H.4.4.1: Ramp down time | ☐ | |
| Smoothing requirements – ramp up time | Appendix H.4.4.2: Ramp up time | ☐ | |
| Testing – testing procedure | Appendix H.4.5.1: Testing procedure | ☐ | |
| Testing – recording of data | Appendix H.4.5.3: Recording of Data | ☐ | |
| Testing – frequency of testing | Appendix H.4.6: Frequency of testing | ☐ | |
| Commissioning | Appendix H.4.7: Commissioning | ☐ | |

## Appendix J: RPEQ sign-off templates for Output Smoothing (informative)

**New reference design**

Ergon Energy Network

420 Flinders Street

Townsville QLD 4810

National Metering Identifier for the installation: <NMI>

<Date>

Subject: Connection of LV EG IES Unit with Output Smoothing – NMI: < National Metering Identifier>, <Installation Site Address>

Please find attached our submission for the above installation.

This letter is to certify that as a Registered Professional Engineer of Queensland the submission documentation provided together with this letter complies with the requirements of Appendix H of STNW3515 “Standard for LV EG Connections to Isolated Networks” <state latest revision>.

The following documentation has also been submitted as part of the application:

- Compliance checklist
- System diagram
- Circuit diagrams

Regards,

<Full name of the RPEQ>

<Registration number>

<Professional title>

<Company name>

<Company address>

<Contact details (including phone, email and postal addresses)>

## Appendix K: Reused reference design for Output Smoothing (informative)

Ergon Energy Network

420 Flinders Street

Townsville QLD 4810

National Metering Identifier for the installation: <NMI>

<Date>

Subject: Connection of LV EG IES Unit with Output Smoothing – NMI: < National Metering Identifier>, <Installation Site Address>

Please find attached our submission for the above installation.

As part of this submission we make reference to the RPEQ sign-off dated <date> for an IES reference design that is attached to this connection application (RPEQ Certified Design). We confirm that the design of the IES installation the subject of this connection application located at <Installation Site Address>, NMI <NMI> dated <Date> replicates the key elements of the RPEQ Certified Design without alteration (in accordance with Item H.3.2 of Appendix H of STNW3515 “Standard for LV EG Connections to Isolated Networks” <state latest revision>).

The following documentation is also attached in support of the connection application as required by the Standard:

- Compliance checklist
- System diagram
- Circuit diagrams

Regards,

<Full name>

<Professional title>

<Company name>

<Company address>

<Contact details (including phone, email and postal addresses)>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