Jemena Electricity Networks (Vic) Ltd

Embedded Generation Backstop Guideline (Above 30kVA)

DoE Over SCADA and Generation Monitoring Meter Methods

ELE-999-GL-EL-007

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Glossary

Connection Agreement	The agreement between JEN and the customer that allows the customer to connect and operate its Generating System, according to the terms of that agreement.
Control System	The controller or Embedded Generating Unit that is able to monitor and control the output of the Generating System as a whole, informed by an integrated (or external) export control device.
Curtailment	The amount of gross generation reduction required or applied by the EG Backstop.
Customer (or retail customer)	A person or entity who owns and/or operates an Electricity Distribution connection to the Jemena Electricity Network (JEN); and can be defined as an embedded Generating Unit Operator in line with the definition under National Electricity Rules (NER) Chapter 5A or Chapter 5.
DPV Installation	The aggregation of all Distributed Photovoltaic (DPV) systems located within a customer's site.
Dynamic Export Capable	A feature that enables the use of a Dynamic Operating Envelope (DOE) for flexible exports at a customer's installation.
EG Backstop	A control capability that is enacted by JEN (or indirectly by AEMO) when generation is required to be interrupted and/ or curtailed in response to situations where there is an imminent threat to power system security, or to the safe operation of the electricity distribution or transmission networks.
EG Installation	The aggregation of all embedded generation systems located within a customer's site, including the DPV Installation.
Embedded Generation Guidelines	Mid-Scale Embedded Generation Guidelines (JEN GU 0020) or Large Embedded Generation Guidelines (EUE GU 0004).
Embedded Generating Unit	A generating unit connected within a distribution system and not having direct access to the transmission network.
Embedded Generating Unit Operator	A person that owns, controls or operates an Embedded Generating Unit.
Fail-Safe	An action in response to an adverse event that would affect the ability of the Generating System to comply with this Guideline.
Fail-Safe Requirement	The functional requirements needed to provide a Fail-Safe EG Installation.
Generation Monitoring Meter	A CT-connected JEN-owned AMI meter (GMM) that monitors the aggregated gross generation of the Generating System, and is able to trip the Generating System through a hardwired contactor.
Generating System	All generating units within the customer's site, including the DPV Installation.

Master Station	JEN's backend SCADA or AMI system servers, being the centralised point for collection of field data and control of field devices.
Point of Connection	For the purposes of this Guideline, the Point of Connection (POC) is deemed to be at the location of the revenue metering measurement point.
Runback	The action of curtailing output from a Generating System.
Remote Communication Requirement	The functional requirements needed to establish communications between the customer's Generating System Control System and JEN's SCADA or AMI Master Station.
Remote Controls Requirement	The functional requirements needed for the customer to receive and act on EG Backstop or DOE controls from JEN's SCADA or AMI Master Station.
Remote Monitoring Requirement	The functional requirements needed for the customer to provide Point of Connection and Generating System measurements to JEN.

Abbreviations

AC	Alternating Current
AMI	Advanced Metering Infrastructure
API	Application Programming Interface
AS 3000	Electrical Installations Wiring Rules
AS 4777.2	Australian Standard for Inverter Requirements
AEMO	Australian Energy Market Operator
CEC	Clean Energy Council
CSIP-Aus	Common Smart Inverter Profile, based on IEEE 2030.5 applicable to Australia
CT	Current Transformer
DER	Distributed Energy Resources
DNP3	Distributed Network Protocol 3 based on IEEE 1815.1
DNSP	Distribution Network Service Provider
DOE	Dynamic Operating Envelope
DPV	Distributed solar Photo-Voltaic embedded generating unit(s)
EG	Embedded Generation
EXP. LIMIT	Export Limit prescribed in the Connection Agreement
GEN. RATING	Generating System Rating prescribed in the Connection Agreement
GMM	Generation Monitoring Meter
GPO	General-purpose Power Outlet based on AS 3112
IEEE 1815.1	SCADA Communications protocol for DNP3
IEEE 2030.5	Secure DER communications protocol U.S. technical standard
IEEE 802.11	Wireless local area network U.S. technical standard
IEEE 802.15	Wireless personal area network U.S. technical standard
JEN	Jemena Electricity Network
LV	Low Voltage
MSB	Main Switchboard
NEM	National Electricity Market
NER	National Electricity Rules
NMI	National Metering Identifier
NSP	Network Service Provider
P_GEN	Gross active power measured at the Generating System
P_POC	Net active power measured at the Point of Connection
POC	Point of Connection
SCADA	Supervisory Control and Data Acquisition
SNMP	Simple Network Management Protocol
TNSP	Transmission Network Service Provider
WiFi	Wireless local area network protocol based on IEEE 802.11
Zigbee	Wireless home area network protocol based on IEEE 802.15

1. Introduction

Jemena Electricity Network (JEN) is a Victorian licenced, registered Distribution Network Service Provider (DNSP) within the National Electricity Market (NEM), operating under the National Electricity Rules (NER).

This document has been developed by JEN in response to power system security concerns that the Australian Energy Market Operator (AEMO) has regarding the impact of the continued uptake of distributed Embedded Generation (EG), in particular solar PV (DPV), both across Victorian DNSPs and within JEN's electricity distribution network.

The uncontrolled and growing nature of certain types of EG means there is an increasing risk of an overabundance of power supplied by EG at certain times of the day. Self-consumption from EG and the export of excess power back to the grid by customers is reducing daytime operational demand to very low levels on sunny, mild days of the year. This is threatening AEMO's ability to maintain a supply-demand balance, and is placing the security of the power system at risk. As customer investment in EG continues, it is expected that the power system security risk will also increase.

Minimum demand is expected to fall below AEMO's technically acceptable minimum operating threshold in Victoria in coming years. This poses numerous power system security challenges for AEMO in relation to supply-demand balance and in maintaining the effectiveness of its under-frequency emergency control schemes for contingency conditions. The issue can be characterised as an oversupply of generation being exported into the distribution networks, caused by uncontrolled EG.

At such times, a reduction of generation or an increase in load is required to maintain power system security, however at present, neither the EG nor the load within the distribution networks can be controlled or dispatched by AEMO.

The purpose of this document is to present a standard set of guidelines to establish and facilitate an EG Backstop mechanism for AEMO, within JEN's electricity distribution network. This document is intended to be used by JEN's staff, who are involved in assessing and approving EG Installations within JEN's distribution network, and to provide guidance to customers in designing their EG Installations to meet this requirement.

The scope of this Guideline applies to EG Installations in JEN's distribution network of:

- 1 MVA and above installed or modified after 1 September 2022,
- greater than 200 kVA with a connection application made from 25 October 2023; or
- of greater than 30kVA and up to 200kVA with a connection application made from 1 July 2024 (where Jemena has reviewed and approved that CSIP-AUS is not available).

Qualifying EG Installations are required to sign a *Dynamic Export Capable* Connection Agreement with JEN.

This Guideline is structured as follows:

- Section 2 details the regulatory framework for power system security in relation to EG Backstop.
- Section 3 details the EG Backstop Functional Requirements for new or modified EG Installations.
- Section 4 details the application of EG Backstop Functional Requirements to EG Installations.
- Section 5 lists acceptable solution options for applying the Functional Requirements to EG Installations.
- Section 6 details the testing requirements for confirming the operation of the EG Backstop.
- Section 7 appendix provides links to reference material and other relevant information.

This Guideline supplements and shall be read in conjunction with JEN's Embedded Generation Guidelines (JEN GU 0020[1] or ELE GU 0004[2], as appropriate). Where there are overlapping requirements in those guidelines that are more stringent than this Embedded Generation Backstop Guideline, then JEN's Embedded Generation Guidelines shall prevail.

[1] Mid-Scale Embedded Generation Guidelines (JEN GU 0020), JEN, November 2021.

[2] Large Embedded Generation Guidelines (EUE GU 0004), JEN, September 2014.

2. Regulatory Framework

This section details the regulatory framework for power system security in relation to an EG Backstop mechanism.

JEN is registered with AEMO as a DNSP in the NEM, and holds an electricity distribution licence in Victoria. This places specific obligations on JEN to plan, operate and maintain its network in accordance with relevant statutory codes and rules.

AEMO has primary responsibility for system security under Clause 4.3.1 of the NER. However, there is a general obligation on TNSPs and DNSPs under Clause 4.3.3 of the NER, to develop and implement solutions to mitigate power system security risks, at AEMO's direction.

AEMO is responsible for dispatching generation in the NEM to maintain a supply-demand balance, and historically TNSPs are responsible for disconnecting load in response to under-frequency events. This approach to setting responsibilities made sense when most generation was large, centralised, controllable and connected to the transmission networks, and when transmission points of connection were always net loads.

However, with significant growth in distributed EG, much of which is uncontrolled DPV, solutions at the transmission level are becoming increasingly ineffective, as transmission points of connection (at times) transition from net loads to net generators. Granular solutions are needed at the lower distribution level to redress the associated power system security issues that are forecast in Victoria over coming years.

In August 2021, AEMO issued a directive[3] to JEN and other Victorian NSPs, asking network service providers to identify and implement measures to restore power system security from the threats caused by increasing levels of uncontrolled EG within their respective networks.

This Guideline has been developed by JEN in response to this directive as well as the Ministerial Order Specifying Licence Condition 2023 (No.1) [4] and Ministerial Order Specifying Licence Condition 2024[5] placed on JEN's licence, to address the power system security concerns that AEMO has, regarding the impact of the continued uptake of EG within JEN's electricity distribution network.

[3] in its letter dated 9 August 2021.

[4] The Electricity Industry Act 2000 - Ministerial Order Specifying Licence Condition 2023 (No. 1) was released on 11 October 2023 and applies from 25 October 2023 for new or modified Generating Unit sizes of 200 kVA or more. Victoria Government Gazette No. S 542 Wednesday 11 October 2023 https://www.gazette.vic.gov.au/gazette/Gazettes2023/GG2023S542.pdf

[5] The Electricity Industry Act 2000 - Ministerial Order Specifying Licence Condition 2024 was released on 31 January 2024 and applies from 1 July 2024 for new or modified Generating Unit sizes of 200 kVA or less. Victoria Government Gazette No. S 31 Wednesday 31 January 2024 https://www.gazette.vic.gov.au/gazette/Gazettes2024/GG2024S031.pdf

3. JEN EG Backstop Functional Requirements

JEN requires that (as a minimum) new or modified EG Installations connected to its distribution network with a capacity greater than 200 kVA (**Scope Requirement**) have the ability to:

1. communicate reliably[6] and securely with JEN's SCADA Master Station for control and monitoring using the DNP3[7] protocol (**Remote Communications Requirement**);
2. accept SCADA signals from JEN[8] in the form of a Dynamic Operating Envelope (DOE)[9] , to Runback (and restore) the Generating System to an output that satisfies (at the Point of Connection) the most recent DOE, subject to any limitations prescribed by the customer's generator Connection Agreement (**Remote Controls Requirement**);
3. provide to JEN, at least every five-minutes (and on demand), voltage and bi-directional net active and reactive power measurements at the Point of Connection to the grid, and aggregated gross active power and (preferably) reactive power and (preferably) AC voltage measurements, of the Generating System (**Remote Monitoring Requirement**); and
4. implement a Fail-Safe for loss of communications that will Runback the Generating System to levels that ensure there is net-zero export at the Point of Connection, after 30 minutes, or six consecutive five-minute intervals, of there being no communications (**Fail-Safe Requirement**).

JEN requires that (as a minimum) new or modified EG Installations connected to its distribution network with a capacity greater than 30 kVA and up to 200kVA (**Scope Requirement**) have the ability to:

1. communicate reliably[6] and securely with JEN's AMI Master Station for control and monitoring using a JEN-owned Generation Monitoring Meter (GMM) through JEN's existing AMI meshed radio network, being connected at the customer's main switchboard to the incomer(s) from the customer's Generating System (**Remote Communications Requirement**);
2. accept signals from JEN GMM's internal load contactor, to trip (and restore) the Generating System via an external hardwired supply contactor(s)[10] (**Remote Controls Requirement**); and
3. provide to JEN's GMM, hardwired voltages and CT currents, for JEN's GMM to calculate at least every five-minutes (and on demand), aggregated gross active power and reactive power, of the Generating System, and AC voltage measurements at the Point of Connection to the grid (**Remote Monitoring Requirement**).

3.1 Scope Requirement

The scope of this Guideline applies to EG Installations in JEN's distribution network of:

- 1 MVA and above installed or modified after 1 September 2022,
- greater than 200 kVA with a connection application made from 25 October 2023; or
- of greater than 30kVA and up to 200kVA with a connection application made from 1 July 2024 (where Jemena has reviewed and approved that CSIP-AUS is not available).

6 The end-to-end customer-side communication system for the EG Backstop, shall be unavailable for no more than 336 hours per annum.

7 DNP3 level 3 compliant.

8 EG Backstop signals from AEMO will be directed to JEN, which once processed by JEN, may then be relayed to the customer.

9 A DOE is applicable at the Point of Connection, comprising of a SCADA analog setpoint value for the active power export limit, and only if required by JEN (on a case-by-case basis), a reactive power control mode target setpoint, power factor control mode target setpoint or voltage control mode target setpoint for the Point of Connection. The active power export limit can be positive (power flows to customer site) or negative (power flow to grid), but applies only to generation Curtailment, not to load increases.

10 Hardwired active power output limiting (or tripping) features of the Generating System Control System can be be used in-lieu of an external supply contactor.

Installations installed before this date that are subsequently repaired, replaced like-for-like with the same make and model, or relocated to a different area within the site, are deemed out of scope of this Guideline.

Installations that fall within the scope of this Guideline are required to have a *Dynamic Export Capable* Connection Agreement with JEN that allows for export limits to be updated remotely by JEN.

This Guideline supplements and shall be read in conjunction with JEN's Embedded Generation Guidelines (JEN GU 0020[11] or ELE GU 0004[12] as appropriate). Where there are overlapping requirements in those guidelines that are more stringent than this Embedded Generation Backstop Guideline, then JEN's Embedded Generation Guidelines shall prevail.

3.2 Remote Communications Requirement

3.2.1 Generating Systems with a capacity greater than 200kVA

A SCADA digital communication link shall be established between the customer's site and JEN's SCADA Master Station for EG Backstop remote control and monitoring purposes. The form of this communication may consist of a fibre optic cable, 4G or 5G, meshed or point-to-point radio, or some other communication media nominated or approved by JEN. The communication link used may be the same link used for other purposes prescribed by JEN's Embedded Generation Guidelines, if applicable.

JEN shall (at the customer's expense) provide, own, operate and maintain a communications link and communications equipment (e.g., modem) between the customer's installation and JEN's SCADA Master Station. The communications equipment shall:

- Be housed securely. If a modem is used as a standalone solution, then it shall be housed securely in a separate lockable customer-owned cabinet at the customer's main switchboard or another location as nominated by JEN (where the door lock is owned by JEN);
- Have available strong communication signal coverage;
- Have clear and unhindered access for JEN's authorised personnel at any time;
- Where required, be housed in a customer-owned cabinet with the following specifications:
  - made of marine grade aluminium, with dimensions approximately 450H x 350W x 225D, with the cabinet door flush mounted with the surrounds to help prevent forceable access;
  - have a three-point locking mechanism and the door lock will have a half-euro barrel to fit JEN supplied proprietary comms bi-lock; and
  - The IP-A453522-0-T33 model from IP Enclosures[13] is an example of a cabinet that meets JEN's requirements.
- This equipment shall be powered from the customer-owned LV power supply, which may be from its LV switchboard on site.

The customer is responsible for providing communications equipment within their premises between JEN's modem and the customer's Generating System Control System.

The customer is responsible for all cybersecurity risks for equipment on their site. Furthermore, the customer shall take meaningful steps to minimise any cyber security risks to JEN owned communications equipment emanating

11 Mid-Scale Embedded Generation Guidelines (JEN GU 0020), JEN, November 2021.

12 Large Embedded Generation Guidelines (EUE GU 0004), JEN, September 2014.

13 https://www.ipenclosures.com.au/pole-mounted-aluminium-field-cabinets/

from the customer site. Specifically, the customer shall establish and maintain an effective cybersecurity framework on their site to minimise the risk to their asset and JEN SCADA network.

The customer shall conduct independent (and annual) security assessments and, based on the assessment recommendations, shall establish and maintain the necessary technical and procedural controls to mitigate security vulnerabilities to the site and JEN. The controls may include the establishment of appropriate authentication/ authorisation services, locking of unused ports, and physical access tools and procedures.

The customer shall own, monitor and maintain all communications cabling, and devices within their site connecting to JEN owned communications equipment.

Duplication of the communication system or its power supplies for redundancy purposes is not required unless it is a requirement of JEN's Embedded Generation Guidelines. The end-to-end customer-side communication system for the EG Backstop, shall be unavailable for no more than 336 hours per annum (per system) in total for planned maintenance or forced outages only.

The communications protocol will be DNP3 level 3 compliant. The customer shall provide gateways / protocol converters (if needed) to convert the control and monitoring protocols used by the customer's Generating System Control System to DNP3 format, and vice-versa.

3.2.2 Generating Systems with a capacity greater than 30 kVA and up to 200kVA

An AMI communication link shall be established between the customer's site and JEN's AMI Master Station for EG Backstop remote control and monitoring purposes. The form of this communication link shall utilise the existing ubiquitous Itron[14] meshed radio by way of a standard JEN-owned AMI 3-phase CT-connected Generation Monitoring Meter (GMM) specified with an internal load contactor. This GMM shall be a non-market meter and shall not be assigned an official NMI.

JEN shall provide, own, operate and maintain this communications link and the communications equipment (i.e., the GMM) between the customer's site and JEN's AMI Master Station. The communications equipment shall:

- Be housed within the customer's main switchboard or another location as nominated by JEN;
- Have available strong communication signal coverage;
- Have unhindered access for JEN's authorised personnel at any time.

The customer is responsible for providing hardwired voltage, current, CTs and external supply contactor equipment and connections within their premises between JEN's GMM and the customer's Generating System in accordance with AS 3000. The customer shall own and maintain in good condition, all hardwired cabling and devices within their site connecting to JEN's GMM. The end-to-end customer-side hardwired communications for the EG Backstop, shall be unavailable for no more than 336 hours per annum (per system) while the inverters are in an operating state.

3.3 Remote Controls Requirement

The EG Backstop can be initiated by either AEMO or JEN. In the absence of any requirement for AEMO to communicate directly to the customer, EG Backstop signals from AEMO will be directed firstly to JEN, which once processed by JEN, may then be relayed to the customer in a form identical to signals initiated by JEN. This approach shall provide a more seamless and consistent method of communication with the customer.

Currently, a signal triggered by AEMO, is manually activated by the JEN Control Room operator.

[14] https://www.itron.com

3.3.1 Generating Systems with a capacity greater than 200kVA

The customer's Generating System Control System shall be able to accept DNP3 SCADA signals from JEN in the form of a DOE, to Runback (and restore) the Generating System to an output that satisfies (at the Point of Connection), the most recent DOE, subject to any limitations prescribed by the customer's generator Connection Agreement. It is important to note that the Generating System includes the DPV Installation and any other generation technologies within the customer's site; therefore both may be subject to Runback in order to comply with the DOE.

The customer-specific DOE is applicable for the customer's Point of Connection to JEN's distribution network. This means for correct application of the DOE, the customer will need to have an export monitoring device at the Point of Connection to the grid. The DOE shall be calculated periodically (by exception) by JEN and it shall comprise of a SCADA analog setpoint control value, representing for the active power export limit in kW for the customer's entire site.

The active power export limit (i.e., the DOE) can be positive (i.e., active power flow imports into the customer site) or negative (i.e., active power flow exports into the grid), but is intended to apply only to generation Curtailment within the site. There is no expectation from JEN for the customer to increase load as an alternative to curtailing generation, unless it is in the interest of the customer to do so. The customer's Generating System Control System shall have the capability to manage the gross generation setpoint of all electricity generating plant on site in response to the DOE provided by JEN. The generation Curtailment which may be imposed by a change in the DOE value can be achieved either through the interaction of the Generating System Control System with the native functions of the embedded generating unit(s), or in conjunction with additional devices, utilising the net active power measured at the Point of Connection.

The Generating System active power output setpoint would be capped by the DOE as follows:

Generation maximum gross active power output required to satisfy the DOE ($P_{SET\ POINT}$) =
Minimum (
Maximum (
Gross active power measured at the Generating System (P_{GEN})[15] *plus*
Net active power measured at the Point of Connection (P_{POC})[16] *minus*
Maximum (
Export Limit prescribed in the Connection Agreement[17]**,**
DOE[18]),
0),
Generating System Rating prescribed in the Connection Agreement[19])

[15] P_GEN must be greater than or equal to zero.

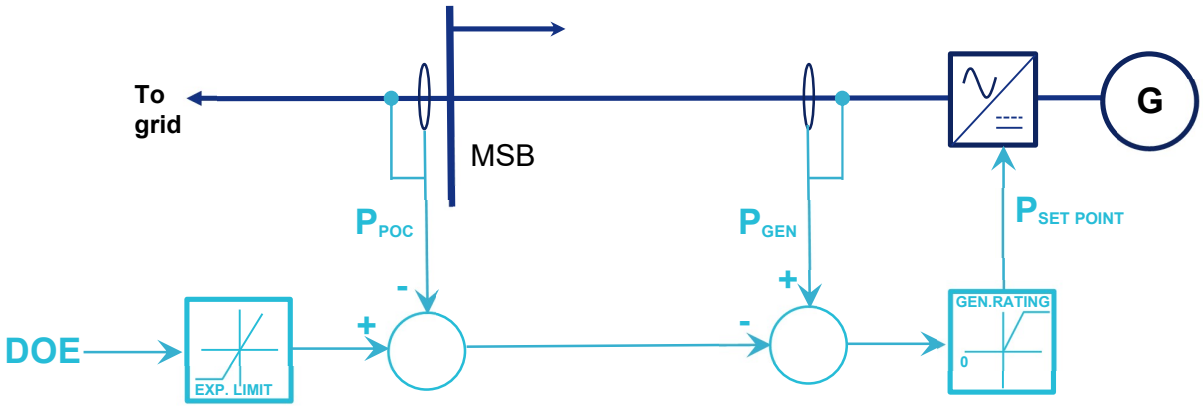
[16] P_POC can be a positive value representing import from the grid, or a negative value representing export to the grid, or zero.

[17] EXP. LIMIT must be less than or equal to zero. If no export limit is set in the generator Connection Agreement, set the EXP. LIMIT to a negative value of the GEN. RATING.

[18] DOE is the most recent received value and maintains its value until a new DOE is received. It can be positive, negative or zero. A negative value represents a limit on exports to the grid.

[19] GEN. RATING must be greater than zero, up to the value prescribed in the generator Connection Agreement.

All values above are in kilowatts. The control diagram for the above is illustrated below.



If the calculated generation maximum active power output required to satisfy the DOE is zero, then the customer may choose to temporarily disconnect any parts of its Generating System from the grid at its discretion.

JEN may also require the Generating System Control System to be able to regulate reactive power, power factor or voltage at the Point of Connection. Any such special requirement shall be assessed and advised by JEN on a case-by-case basis at the time of connection. In such cases, the DOE will be accompanied by a reactive power control mode target setpoint, power factor control mode target setpoint, or voltage control mode target setpoint, applicable at the Point of Connection.

3.3.2 Generating Systems with a capacity greater than 30 kVA and up to 200kVA

The customer's Generating System Control System shall accept EG Backstop signals from the JEN GMM's internal load contactor, to trip (and restore) the Generating System via external hardwired supply contactors to each system. Hardwired active power output limiting (or tripping) features of the Generating System Control System can be used in-lieu of an external supply contactor.

3.4 Remote Monitoring Requirement

3.4.1 Generating Systems with a capacity greater than 200kVA

The customer's Generating System Control System shall have the capability to provide remote monitoring telemetry to JEN at least once every five-minutes (and on demand) as DNP3 SCADA analog measurement values, comprising of:

Description	DNP3 Index	Abbre-viation	Preferred	Alternate	Unit	Master Read / Write	Range	
Line-to-line voltage at the Point of Connection to the grid	1	V_{PoC-RW}	V_{PoC-RW}	V_{PoC-RW}	Volt	Read	0	500 for LV 24,000 for HV
	2	V_{PoC-WB}	V_{PoC-WB}		Volt	Read		
	3	V_{PoC-BR}	V_{PoC-BR}		Volt	Read		
Bi-directional net active power at the Point of Connection to the grid (export = EG into the grid)	4	P_{PoC}	P_{PoC} +ve = Import -ve = Export	-	kW	Read	Note 5	Note 1
Bi-directional net reactive power at the Point of Connection to the grid	5	Q_{PoC}	Q_{PoC} +ve = Import -ve = Export	-	kVAr	Read	Note 5	Note 1
Current at the Point of Connection to the grid	6	I_{PoC-R}	I_{PoC-R}	I_{PoC-W}	Amp	Read	0	Note 3
	7	I_{PoC-W}	I_{PoC-W}		Amp	Read		
	8	I_{PoC-B}	I_{PoC-B}		Amp	Read		
Aggregated gross active power generation of the Generating System	9	P_{GEN}	P_{GEN}	-	kW	Read	0	Note 2
Aggregated bi-directional gross reactive power generation of the Generating System	10	Q_{GEN}	Q_{GEN} +ve = Import -ve = Export	-	kVAr	Read	0	Note 2
Dynamic Operating Envelope - (Maximum Export allowed – positive means power import, negative means power export)	11	KW_{DOE_Send}	KW_{DOE_Send}	-	kW	Write	Note 2	Note 1
Dynamic Operating Envelope – receive (Note 4)	12	KW_{DOE_Recv}	KW_{DOE_Recv}	-	kW	Read	Note 2	Note 1
Watchdog Signal - send	13	Wd_{Send}	Wd_{Send}	-	Unit	Write	0	10,000
Watchdog Signal – receive (Note 4)	14	WD_{Recv}	WD_{Recv}	-	Unit	Read	0	10,000

Note 1: based on the contracted maximum demand of the site.

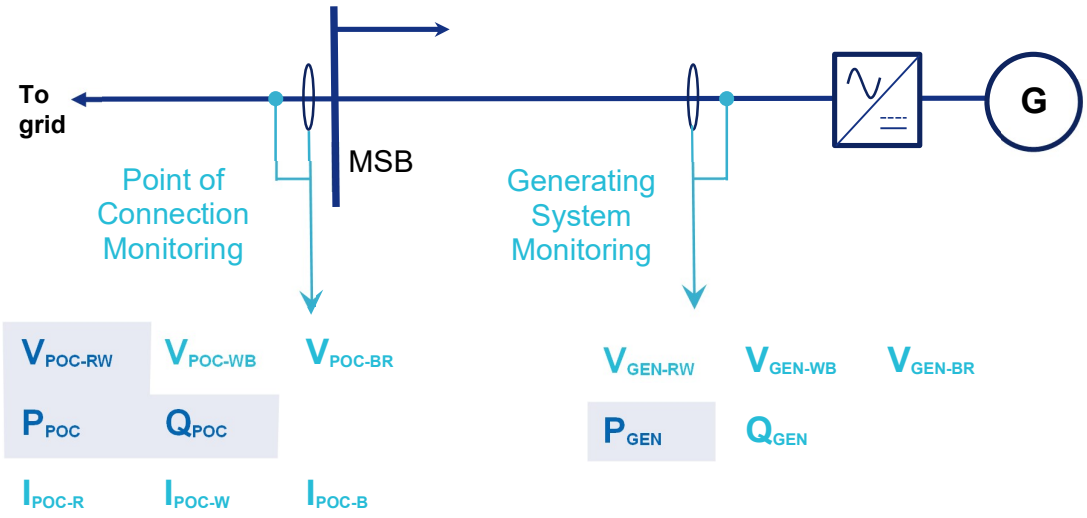
Note 2: based on the total installed generation capacity (negative if using a bi-directional DNP3 address).

Note 3: calculated from the higher of the absolute values applicable from Note 1 and Note 2, assuming 216 Volts per phase (positive value).

Note 4: the expected response time is within 30 seconds.

Note 5: based on export limit prescribed in the Connection Agreement.

This is illustrated below, with the shaded measurement quantities being mandatory.



Note, the aggregated gross active power generation of the Generating System (P_GEN) is required by JEN, so as to be able to confirm compliance with this Guideline, particularly at times when the DOE is a positive value.

3.4.2 Generating Systems with a capacity greater than 30 kVA and up to 200kVA

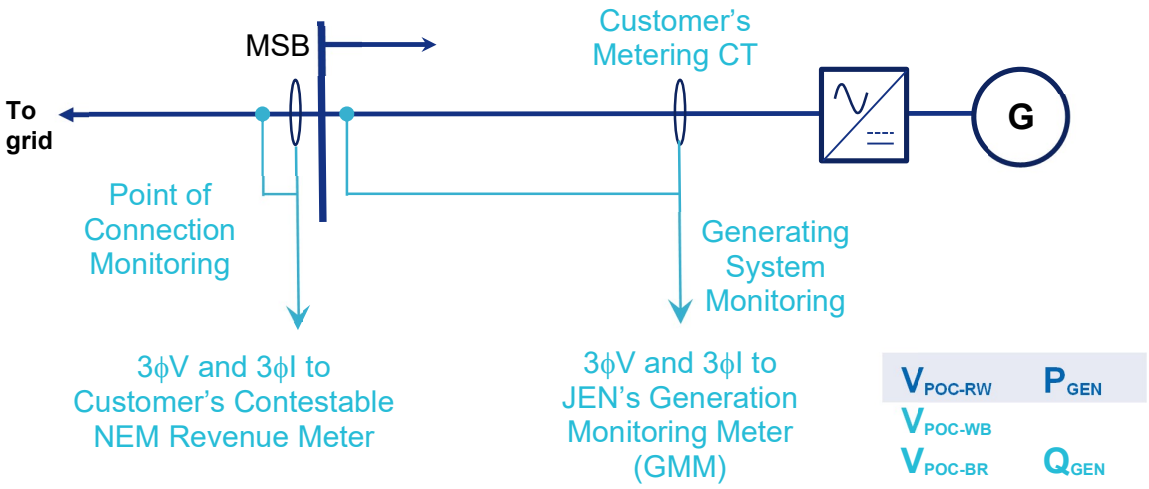
The customer's Generating System shall provide to JEN's GMM, using hardwired connections, three-phase voltage at the Point of Connection to the grid, and three-phase aggregated current (through the use of customer-owned CTs) from the Generating System. CTs shall be metering class 0.5M rated for 5 Amp secondary and shall have a primary rating that is aligned with the rating of the Generating System.

JEN may record at least every five-minutes (and on demand), aggregated gross active power and reactive power and AC voltages from the measurements using its GMM as follows:

Description	Abbre-viation	Preferred	Alternate	Unit	Master Read / Write	Range	
Line-to-line voltage at the Point of Connection to the grid	V_{PoC-RW}	V_{PoC-RW}	V_{PoC-RW}	Volt	Read	0	500
	V_{PoC-WB}	V_{PoC-WB}		Volt	Read		
	V_{PoC-BR}	V_{PoC-BR}		Volt	Read		
Aggregated gross active power generation of the Generating System	P_{GEN}	P_{GEN}	-	kW	Read	0	Note 1
Aggregated bi-directional gross reactive power generation of the Generating System	Q_{GEN}	Q_{GEN} +ve = Import -ve = Export	-	kVAr	Read	0	Note 1

Note 1: based on the total installed generation capacity.

This is illustrated below, with the shaded measurement quantities being mandatory.



Note, the aggregated gross active power generation of the Generating System (P_GEN) is required by JEN, so as to be able to confirm compliance with this Guideline.

3.5 Fail-Safe Requirement

3.5.1 Generating Systems with a capacity greater than 200kVA

The customer's Generating System Control System shall have the capability to manage site export to net zero by implementing a Fail-Safe for loss of communications.

The Fail-Safe shall Runback the Generating System to levels that ensure there is net zero export at the Point of Connection after 30 continuous minutes, or six consecutive five-minute intervals, of no communications.

Loss of communications between JEN's SCADA Master Station and its modem at the site shall be monitored via an SNMP system.

The Generating System Control System may restore the Generating System following restoration of the communications link, if it is safe to do so, based on the most recent DOE.

A watchdog system shall be implemented to provide regular monitoring of the monitored values. The principle of the watchdog function is:

i) Jemena sends a WDSend to the site every 5 minutes. If the site's communication system detects a stale flatlined value for 30 minutes then the site shall initiate a loss of comms scenario.

ii) The site will write the received WDSend value to a separate DNP3 address for JEN to read as a WDRecv back from the site. This allows JEN to also know if the communications has been down and for how long.

3.5.2 Generating Systems with a capacity greater than 30 kVA and up to 200kVA

There is no fail-safe capability within the GMM, however, Jemena will continue to explore any alternatives in the near future.

4. Application of Requirements

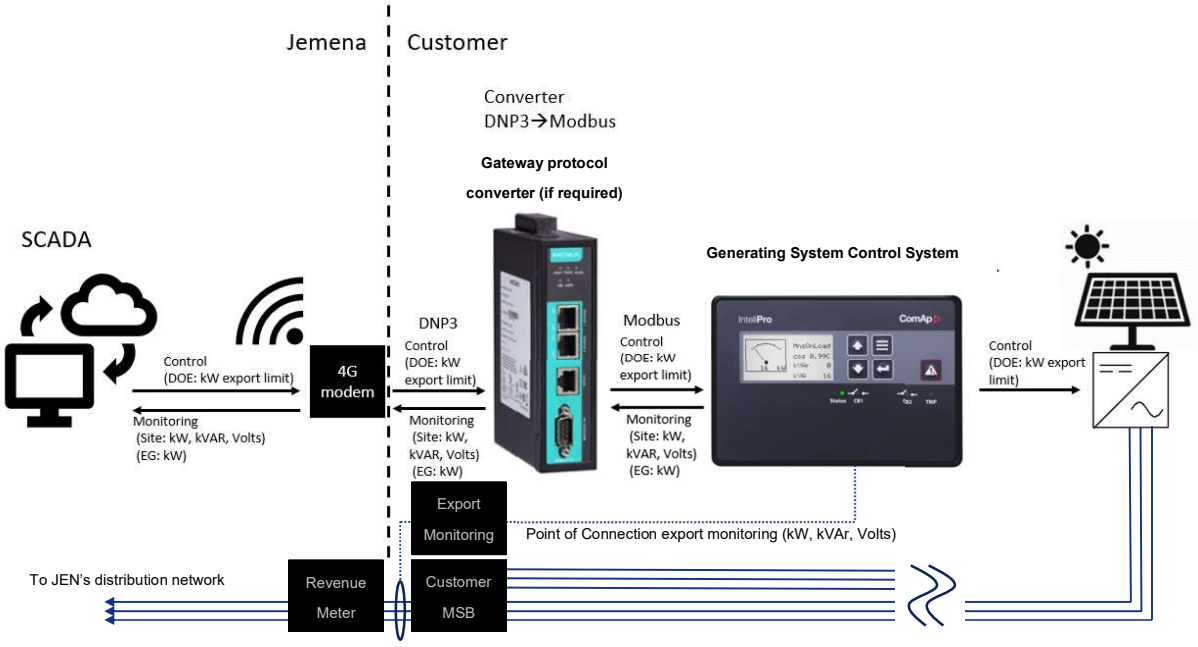
4.1.1 Generating Systems with a capacity greater than 200kVA

This section details the application of the EG Backstop Functional Requirements to a qualifying EG Installation.

As part of the application for connection, the customer shall provide a listing of all equipment intended to be used to support the EG Backstop functions, including their make, model, quantity, high-level specifications, firmware/software name and version.

The customer shall also provide a high-level electrical and communication schematic diagram showing how that equipment is connected to form the system that supports the EG Backstop functions. The diagram shall include protocols and quantities intended to be used.

The following is an example of such a diagram for Generating Systems with a capacity greater than 200kVA, showing a typical single inverter site installation using Modbus, with a gateway device to JEN's modem and SCADA Master Station using DNP3.

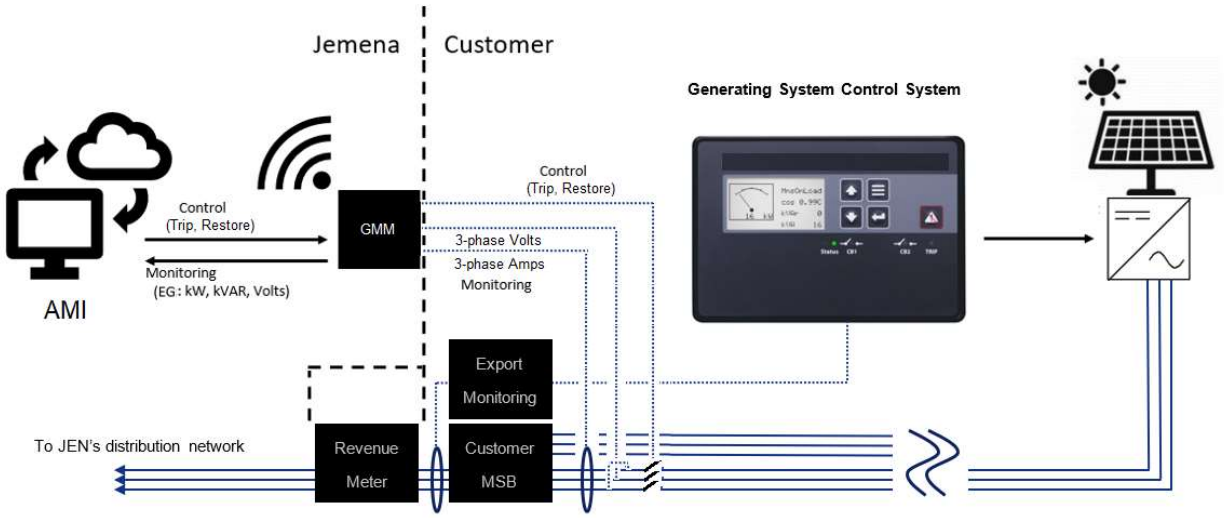


The type of equipment and communications software used by the customer on its site to achieve compliance with the EG Backstop Requirements in this Guideline shall be published on a list of compliant *Dynamic Export Capable* equipment maintained by the Clean Energy Council (CEC) as being certified and approved as interoperable.

For equipment not on the CEC listing, the equipment will need to be reviewed and approved by JEN.

4.1.2 Generating Systems with a capacity greater than 30 kVA and up to 200kVA

For Generating Systems with a capacity greater than 30 kVA and up to 200kVA, the following is an example of such a diagram showing a typical single inverter site installation with an external supply contactor.



As part of the application for connection, the customer shall tabulate how the system to be installed, supports each of the EG Backstop Functional Requirements, in order to demonstrate compliance with this Guideline, as shown below.

4.1.3 Summary of application requirements

EG Backstop Functional Requirement	Generating Systems with a capacity greater than 200kVA	Generating Systems with a capacity greater than 30 kVA and up to 200kVA
1. Remote Communication Requirement	The customer shall explain how it will implement a solution that complies with the EG Backstop Remote Communication Requirement. The customer shall explain how it will provide and maintain communications within their premises that are reliable, secure and compatible with JEN's DNP3 protocol. The customer shall explain how the interface to JEN will be provided. The customer shall explain how it will provide secure physical access to JEN's modem for authorised JEN personnel. Refer to Section 3.2.1.	The customer shall explain how it will implement a solution that complies with the EG Backstop Remote Communication Requirement. Refer to Section 3.2.2
2. Remote Controls Requirement	The customer shall explain how it will implement a solution that complies with the EG Backstop Remote Controls Requirement. The customer shall explain how it can accept and apply SCADA signals from JEN in the form of a DOE to Runback (and restore) the Generating System to an output that satisfies (at the Point of Connection), the most recent DOE. The customer shall explain how it will maintain compliance with its Connection Agreement irrespective of the DOE. The customer shall explain how it will implement export limiting. The customer shall explain (if required) how it will control the voltage, reactive power or power factor (as appropriate) at its Point of Connection. Refer to Section 3.3.1.	The customer shall explain how it will provide and maintain a hardwired system within their premises that is reliable, secure and how it will interface with JEN's GMM. Refer to Section 3.3.2
3. Remote Monitoring Requirement	The customer shall explain how it will implement a solution that complies with the EG Backstop Remote Monitoring Requirement. The customer shall explain how it will provide to JEN, every five-minutes and on demand, voltage and bi-directional net active and reactive power measurements at the Point of Connection to the grid. The customer shall explain how it will provide to JEN, every five-minutes and on demand, aggregated, gross active power of the Generating System, and if applicable, how it will provide reactive power and AC voltage measurements of the Generating System. Refer to Section 3.4.1	The customer shall explain where the GMM is proposed to be installed such that physical access is available for authorised JEN personnel. Refer to Section 0
4. Fail-Safe Requirement	The customer shall explain how it will implement a solution that complies with the EG Backstop Fail-Safe Requirement. The customer shall explain how it will detect a loss of communications on JEN's communication link, and on its own communication system. The customer shall explain how the Fail-Safe will operate for loss of communications. The customer shall indicate whether it will either trip or Runback the Generating System for a loss of communications. The customer shall explain how it will maintain net zero export at the Point of Connection. The customer shall explain how the Generating System will respond once the communication link is restored. Refer to Section 3.5.1	Not Applicable.

5. Acceptable Solution Options

This section lists acceptable solution options, when applying the Functional Requirements of this Guideline to a qualifying EG Installation.

Requirement	Generating Systems with a capacity greater than 200kVA	Generating Systems with a capacity greater than 30 kVA and up to 200kVA
1. Communication media to the customer provided by JEN	1. Optic fibre 2. 4G 3. 5G 4. Meshed radio 5. Point to point radio 6. NBN	1. AMI Itron meshed radio.
2. Security of customer's own communications system	1. The customer-side end-to-end communications shall be secure from both cyber and physical attack.	1. The customer-side end-to-end hardwired cabling and equipment connected to JEN's GMM shall be secure from physical interference.
3. Communications availability by customer	1. The customer-side end-to-end communications shall be unavailable for no more than 336 hours per annum (per redundant system if applicable).	1. The Customer-side end-to-end hardwired cabling and equipment (including CTs and external contactors) connected to JEN's GMM, shall be unavailable for no more than 336 hours per annum (per system) while the inverters are in an operating state).
4. JEN owned equipment	Where relevant: 1. Modem is to have a hardened specification. 2. Customer provides (and installs) separate lockable cabinet mounted on customer's MSB with 230V GPO, noting customer owns all this equipment (except for the modem and the lock). 3. JEN built housing compartment within existing kiosk.	1. GMM to be JEN's standard 3-phase AMI CT meter with internal load contactor and Itron meshed radio communications.
5. Access requirement for JEN communications equipment	1. JEN shall have physical access to its communications equipment at all times.	1. JEN shall have physical access to its GMM at all times.
6. JEN ownership interface	1. JEN ownership ends at the serial port of JEN-owned modem. 2. JEN ownership ends at the Customer's Point of Connection to the grid.	1. JEN ownership ends at the load contactor of the JEN-owned GMM. 2. JEN ownership ends at the Customer's Point of Connection to the grid.

Requirement	Generating Systems with a capacity greater than 200kVA	Generating Systems with a capacity greater than 30 kVA and up to 200kVA
7. Dynamic Operating Envelope (DOE)	JEN DOE SCADA signal in DNP3 format: 1. DOE – signal sent as kW export limit only for the Point of Connection.. 2. DOE – signal sent as kW export limit, and kVAr control mode target for the Point of Connection. 3. DOE – signal sent as kW export limit, and Volt control mode target for the Point of Connection. 4. DOE – signal sent as kW export limit, and power factor control mode target for the Point of Connection. Note: Options 2, 3 and 4 will need to be assessed and advised by JEN on a case-by-case basis.	1. Not Applicable.
8. LV supply (if applicable)	1. Customer to provide 230 V 10 Amp GPO within lockable cabinet.	1. Not Applicable.
9. Point of Connection Monitoring signals	1. kW, kVAr, R-W Volts at grid Point of Connection. 2. kW, kVAr, R-W Volts, W Amps at grid Point of Connection. 3. kW, kVAr, R-W Volts, W-B Volts, B-R Volts at grid Point of Connection. 4. kW, kVAr, R-W Volts, W-B Volts, B-R Volts, R Amps, W Amps, B Amps at grid Point of Connection.	1. R-W Volts at grid Point of Connection. 2. R-W Volts, W-B Volts, B-R Volts at grid Point of Connection.
10. Generation Monitoring signals	1. kW at Generating System. 2. kW, kVAr, R-W Volts at Generating System. 3. kW, kVAr, R-W Volts, W-B Volts, B-R Volts at Generating System.	1. kW at Generating System. 2. kW, kVAr at Generating System.
11. Runback	1. Generating System trips. 2. Generating System modulates its output to satisfy the DOE at the grid Point of Connection.	1. Not Applicable.
12. Fail-Safe for loss of communications	1. Generating System trips. 2. Generating System modulates its output to ensure net zero export at the grid Point of Connection.	1. Not Applicable.
13. Communication protocol.	1. Use DNP3 signal from JEN within customer's installation. 2. Convert DNP3 signal to a compatible protocol signal to be used within customer's installation.	1. Interface to AMI mesh via hardwired load contactor within GMM.

6. Testing Requirements

This section details the testing requirements for confirming the operation of the EG Backstop functionality.

The customer may want to perform bench-testing of each device within the customer's installation to ensure that their equipment is compatible with JEN's EG Backstop Requirements.

Following the customer's own testing, the customer will be required to undertake a full end-to-end test with JEN to prove operation of the EG Backstop solution.

The following items summarise the key commissioning requirements to ensure that all Functional Requirements are implemented, and full end-to end-testing is complete.

Requirement	Generating Systems with a capacity greater than 200kVA	Generating Systems with a capacity greater than 30 kVA and up to 200kVA
1. Monitoring EG Generating System measurements	1. Observe SCADA readings at the SCADA Master Station and compare accuracy (scaling, offsets and range – positive and negative as applicable) with local EG Generating System analogs from the customer's EG Generating System Control System. 2. Ensure values are periodically updating at least every five-minutes. 3. Ensure values are updated when requested on demand. 4. Ensure the types of values being reported match the full range of those agreed to with JEN.	1. Testing shall be undertaken according to AMI Meter installation procedures, noting that this is a non-market AMI meter. 2. Observe AMI readings at the AMI Master Station and compare accuracy (scaling, offsets and range – positive and negative as applicable) with local DPV Generating System analogs from the Customer's DPV Generating System Control System. 3. Ensure values are periodically updating at least every five-minutes. 4. Ensure values are updated when requested on demand. 5. Ensure the types of values being reported match the full range of those agreed to with JEN.
2. Monitoring Point of Connection (POC) measurements	1. Observe SCADA readings at the SCADA Master Station and compare accuracy (scaling, offsets and range – positive and negative as applicable) with local Point of Connection analogs from the customer's EG Generating System Control System or export limiting device. 2. Ensure values are periodically updating at least every five-minutes. 3. Ensure values are updated when requested on demand. 4. Ensure the types of values being reported match the full range of those agreed to with JEN.	1. As Above

Requirement	Generating Systems with a capacity greater than 200kVA	Generating Systems with a capacity greater than 30 kVA and up to 200kVA
3. Control of generation based on most recent published DOE signal	1. Test 'Runback' as DOE is published, and observe customer's generation to Runback such that the Point of Connection active power is within the DOE's export limit for ~30 minutes. 2. Test restoration as revised DOE is published, and observe customer's generation restore output as designed for 30-60 minutes. Note: this does not preclude the requirement of net export limit of zero for loss of communications, or any requirement under the customer's Connection Agreement. 3. Confirm the Generating System output is based on the last published DOE signal. 4. Retest using a credible range of DOE values (from negative to positive and zero).	1. Not Applicable
4. Loss of communications on JEN's communication network a) JEN's communications link interruption b) LV power supply interruption to JEN's communications equipment (e.g., modem)	1. Check that the customer's Generating System Control System detects the loss of communications on the JEN side. 2. Observe customer's site generation is reduced to a level that ensures and maintains a net zero export at the grid Point of Connection while there is a continuous loss of communications after 30 minutes. 3. Alternatively, observe customer's EG is tripped and remains tripped for while there is a loss of communications. 4. Check there is no response to loss of communications if the interruption is intermittent or less than 30 minutes in duration.	1. Not Applicable.
5. Loss of communications on customer's communications network a) Customer communications link between its Generating System Control System and JEN's communications equipment is interrupted	1. Check that the customer's Generating System Control System detects the loss of communications on the customer side. 2. Observe customer's site generation is reduced to a level that ensures and maintains a net zero export at the grid Point of Connection while there is a continuous loss of communications after 30 minutes. 3. Alternatively, observe customer's EG is tripped and remains tripped while there is a loss of communications. 4. Check there is no response to loss of communications if the interruption is intermittent or less than 30 minutes in duration.	1. Not Applicable.
6. Re-establish communications	1. Observe customer's Generating System reconnects (if applicable) and returns to normal generation levels as designed.	1. Not Applicable.

Requirement	Generating Systems with a capacity greater than 200kVA	Generating Systems with a capacity greater than 30 kVA and up to 200kVA
7. Trip and restoration of Generating System	1. Not Applicable.	1. Test trip of Generating System from AMI Master Station and confirm status of supply contactor (if applicable), Generating System Control System status, and active power measurements. 2. Test restoration of Generating System from AMI Master Station and confirm status of supply contactor (if applicable), Generating System Control System status, and active power measurements.

7. Appendix A – References and Additional Information

1. National Electricity Rules (NER) – Australian Energy Market Commission.
2. Victorian standard inverter settings for small generators connected to distribution networks – Jemena Electricity Network.
3. Inverter energy systems connection guidelines for systems between 30kVA and 200kVA (ELE GU 0014) – Jemena Electricity Network, November 2021.
4. Generation connection guidelines for systems up to 5MW (ELE GU 0020) – Jemena Electricity Network, November 2021.
5. Generation connection guidelines for systems greater than 5MW (ELE GU 0004) – Jemena Electricity Network, September 2014.
6. Customer Connection Policy, Jemena Electricity Network, January 2021.
7. Technical Regulator Guideline, Government of South Australia, November 2023, link: 2022D066388-Technical-Regulator-Guidelines-Distributed-Energy-Resources-Version-1.5-1.pdf (energymining.sa.gov.au)
8. Approved Product List, Clean Energy Council (CEC).