# Jemena Electricity Networks (Vic) Ltd

## Embedded Generation Backstop Guideline (Above 200kVA)

ELE-999-GL-EL-007

**An appropriate citation for this paper is:**

Embedded Generation Backstop Guideline (Above 200kVA)



**History**

| Rev No | Date | Description of changes |
|---|---|---|
| 1.0 | 05/04/2023 | Original Issue |
| 1.1 | 23/08/2023 | Amended 1MVA threshold to 200kVA and DPV to EG to cover different embedded generation technologies |
| 1.2 | 11/10/2023 | Updated to reflect commencement date |

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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 generation output reduction required or applied. |
| 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 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 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. |
| Generating System | All generating units within the customer's site, including the DPV Installation. |
| Master Station | JEN's backend SCADA 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 Master Station. |
| Remote Controls Requirement | The functional requirements needed for the customer to receive and act on DOE controls from JEN's SCADA 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 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 |
| 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 |
| GPO | General-purpose Power Outlet |
| 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 |
| 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 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 of 1 MVA (or larger) connected to JEN's distribution network that are installed or modified after 1 September 2022, or
- EG Installations of greater than 200 kVA with a connection application made after 25 October 2023.

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

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

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

that are more stringent than this Embedded Generation Backstop Guideline, then JEN's Embedded Generation Guidelines shall prevail.

It should be noted that this Guideline will need to be updated as the threshold for EG Backstop coverage is lowered over time. Future updates will incorporate AS 4777.2-2020, and possibly advanced metering infrastructure (AMI) and CSIP-Aus feature sets, for the smaller mass-market EG Installations. This is particularly needed for EG Installations below 200 kVA, to incorporate AS 4777.2-2020, and possibly AMI, with a view to migrating towards CSIP-Aus (based on IEEE 2030.5-2018, applicable to Australia), for enabling a secure means of EG Backstop for the smaller, mass-market EG Installations.

# 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 respond to AEMO's direction by developing and implementing solutions to mitigate power system security risks, at AEMO's direction.

AEMO is responsible for dispatching generation in the NEM to maintain 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 expected Ministerial Order Specifying Licence Condition 2023 (No.1) placed on JEN's licence[4], 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] At the time of preparing this Guideline, JEN is expecting a Ministerial Order to be released in October 2023, outlining embedded generation backstop implementation requirement for EG >200kVA.

# 3. JEN EG Backstop Functional Requirements

This section details the EG Backstop Functional Requirements for new or modified EG Installations.

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

1. communicate reliably[5] and securely with JEN's SCADA Master Station for control and monitoring using DNP3[6] (**Remote Communications Requirement**);
2. accept SCADA signals from JEN[7] in the form of a Dynamic Operating Envelope (DOE)[8] , 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**).

## 3.1 Scope Requirement

The scope of this Guideline applies to:

- EG Installations of 1 MVA (or larger) connected to JEN's distribution network that are installed or modified after 1 September 2022, or
- EG Installations of greater than 200 kVA with a connection application made after 25 October 2023.

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[9] or ELE GU 0004[10] 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

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

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

6 DNP3 level 3 compliant

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

8 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.

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

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

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[11] 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 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.

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

## 3.3 Remote Controls Requirement

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 ($P_{GEN}$)**[12] *plus*

**Net active power measured at the Point of Connection ($P_{POC}$)**[13] *minus*

*Maximum* (

**Export Limit prescribed in the Connection Agreement**[14]**,**

**DOE**[15] ),

**0** ),

**Generating System Rating prescribed in the Connection Agreement**[16] )

12 P_GEN must be greater than or equal to zero.

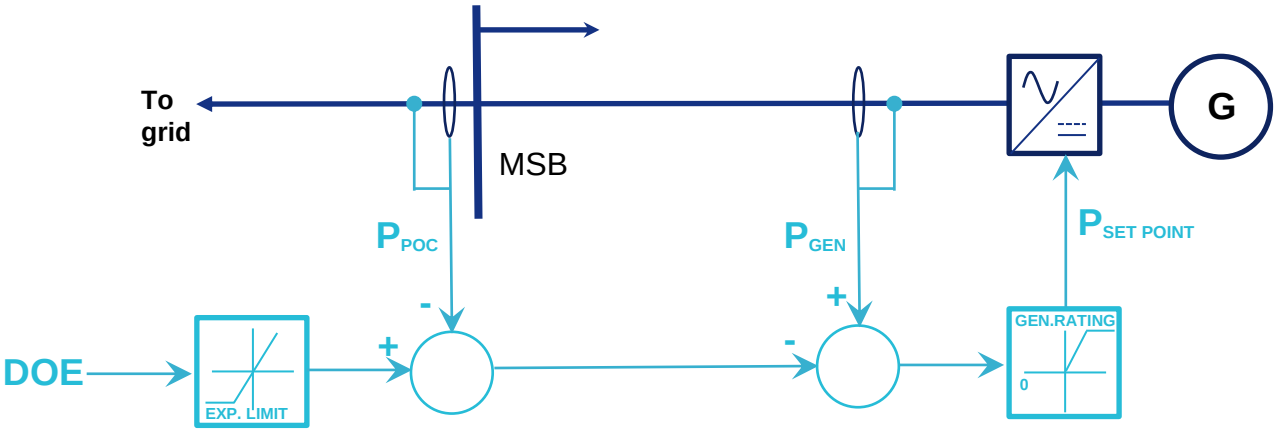
13 P_POC can be a positive value representing import from the grid, or a negative value representing export to the grid, or zero.

14 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.

15 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.

16 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.

Given 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.

## 3.4 Remote Monitoring Requirement

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 | $V_{PoC-RW}$ | $V_{PoC-RW}$ | $V_{PoC-RW}$ | Volts | Read | 0 | 500 for LV 24,000 for HV |
| | 2 | $V_{PoC-WB}$ | $V_{PoC-WB}$ | | Volts | Read | | |
| | 3 | $V_{PoC-BR}$ | $V_{PoC-BR}$ | | Volts | 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 | - | kVArs | Read | Note 5 | Note 1 |
| Current at the Point of Connection to the grid | 6 | $I_{PoC-R}$ | $I_{PoC-R}$ | $I_{PoC-W}$ | Amps | Read | 0 | Note 3 |
| | 7 | $I_{PoC-W}$ | $I_{PoC-W}$ | | Amps | Read | | |
| | 8 | $I_{PoC-B}$ | $I_{PoC-B}$ | | Amps | 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 | - | kVArs | 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.

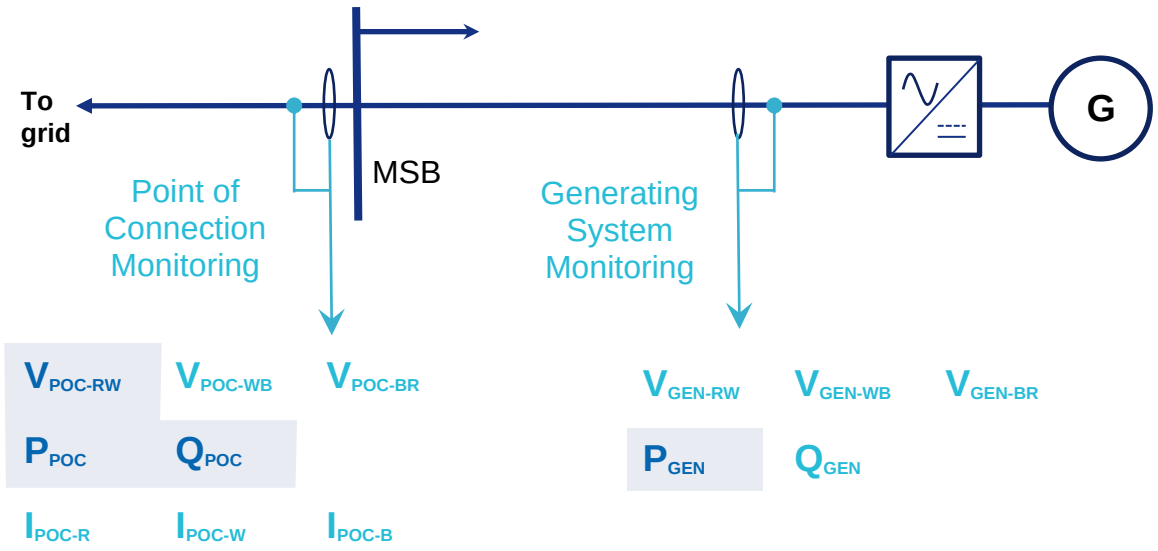
Note 2: based on the total installed generation capacity (negative if using a bi-directional DNP3 address).

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.

## 3.5 Fail-Safe Requirement

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.

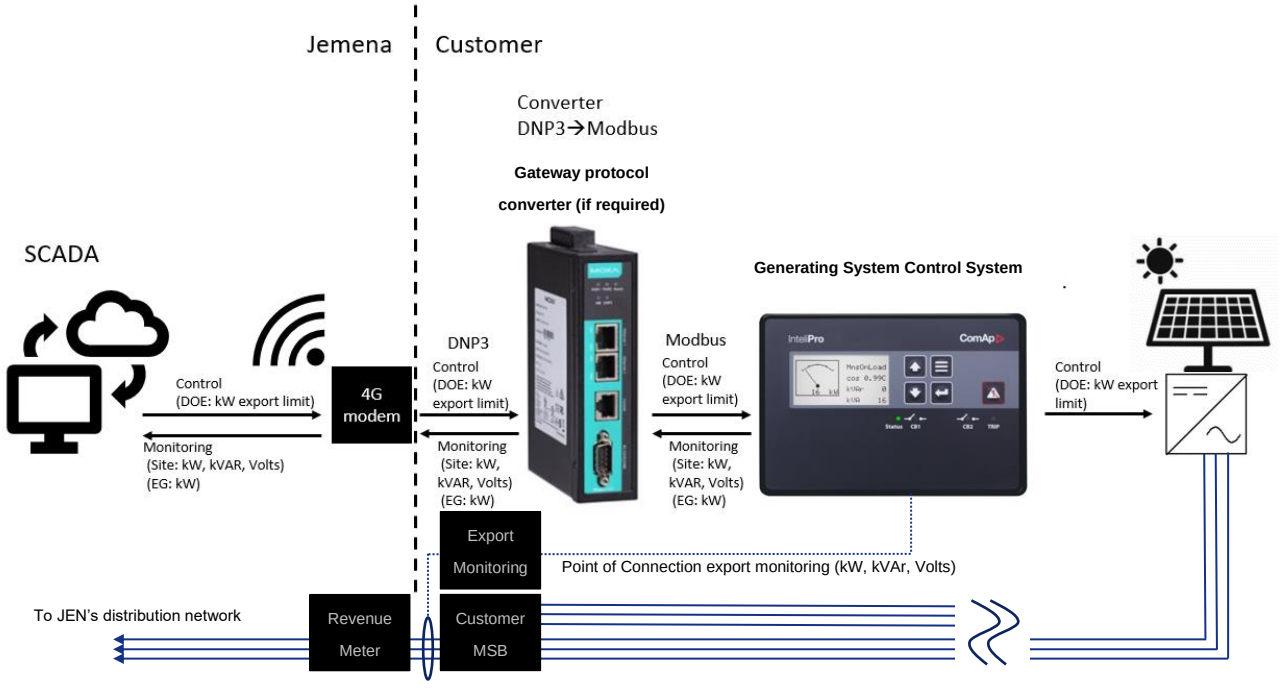
# 4. Application of Requirements

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 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.

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.

| EG Backstop Functional Requirement | Implementation details to demonstrate compliance |
|---|---|
| 1. Remote Communication Requirement | The customer shall explain how it will implement a solution that complies with the EG Backstop Remote Communication Requirement.<br>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.<br>The customer shall explain how the interface to JEN will be provided.<br>The customer shall explain how it will provide secure physical access to JEN's modem for authorised JEN personnel. |
| 2. Remote Controls Requirement | The customer shall explain how it will implement a solution that complies with the EG Backstop Remote Controls Requirement.<br>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.<br>The customer shall explain how it will maintain compliance with its Connection Agreement irrespective of the DOE.<br>The customer shall explain how it will implement export limiting.<br>The customer shall explain (if required) how it will control the voltage, reactive power or power factor (as appropriate) at its Point of Connection. |
| 3. Remote Monitoring Requirement | The customer shall explain how it will implement a solution that complies with the EG Backstop Remote Monitoring Requirement.<br>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.<br>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. |
| 4. Fail-Safe Requirement | The customer shall explain how it will implement a solution that complies with the EG Backstop Fail-Safe Requirement.<br>The customer shall explain how it will detect a loss of communications on JEN's communication link, and on its own communication system.<br>The customer shall explain how the Fail-Safe will operate for loss of communications.<br>The customer shall indicate whether it will either trip or Runback the Generating System for a loss of communications.<br>The customer shall explain how it will maintain net zero export at the Point of Connection.<br>The customer shall explain how the Generating System will respond once the communication link is restored. |

# 5. Acceptable Solution Options

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

| Requirement | Options |
|---|---|
| 1. Communication media to the customer provided by JEN | 1. Optic fibre<br>2. 4G<br>3. 5G<br>4. Meshed radio<br>5. Point to point radio<br>6. NBN |
| 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. |
| 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). |
| 4. JEN owned modem (if applicable) | 1. Hardened specification |
| 5. JEN modem housing (if applicable) | 1. 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).<br>2. JEN built housing compartment within existing kiosk. |
| 6. Access requirement for JEN communications equipment (e.g., modem) | 1. JEN shall have physical access to its communications equipment at all times. |
| 7. JEN ownership interface | 1. JEN ownership ends at the serial port of JEN owned communications equipment. |

| Requirement | Options |
|---|---|
| 8. JEN DOE SCADA signal in DNP3 format | 1. DOE – signal sent as kW export limit only for the Point of Connection..<br>2. DOE – signal sent as kW export limit, and kVAr control mode target for the Point of Connection.<br>3. DOE – signal sent as kW export limit, and Volt control mode target for the Point of Connection.<br>4. DOE – signal sent as kW export limit, and power factor control mode target for the Point of Connection.<br>Note: Options 2, 3 and 4 will need to be assessed and advised by JEN on a case-by-case basis. |
| 9. LV supply (if applicable) | 1. Customer to provide 230 V GPO within lockable cabinet. |
| 10. Point of Connection Monitoring signals | 1. kW, kVAr, R-W Volts at grid Point of Connection.<br>2. kW, kVAr, R-W Volts, W Amps at grid Point of Connection.<br>3. kW, kVAr, R-W Volts, W-B Volts, B-R Volts at grid Point of Connection.<br>4. kW, kVAr, R-W Volts, W-B Volts, B-R Volts, R Amps, W Amps, B Amps at grid Point of Connection. |
| 11. Generation Monitoring signals | 1. kW at Generating System.<br>2. kW, kVAr, R-W Volts at Generating System.<br>3. kW, kVAr, R-W Volts, W-B Volts, B-R Volts at Generating System. |
| 12. Runback | 1. Generating System trips.<br>2. Generating System modulates its output to satisfy the DOE at the grid Point of Connection. |
| 13. Fail-Safe for loss of communications | 1. Generating System trips.<br>2. Generating System modulates its output to ensure net zero export at the grid Point of Connection. |
| 14. Customer uses DNP3 signal to trip or Runback Generating System | 1. Use DNP3 signal from JEN within customer's installation.<br>2. Convert DNP3 signal to a compatible protocol signal to be used within customer's installation. |

# 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, including the DOE.

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 | Outcome |
|---|---|
| 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.<br>2. Ensure values are periodically updating at least every five-minutes.<br>3. Ensure values are updated when requested on demand.<br>4. 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.<br>2. Ensure values are periodically updating at least every five-minutes.<br>3. Ensure values are updated when requested on demand.<br>4. Ensure the types of values being reported match the full range of those agreed to with JEN. |
| 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.<br>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.<br>3. Confirm the Generating System output is based on the last published DOE signal.<br>4. Retest using a credible range of DOE values (from negative to positive and zero). |

| Requirement | Outcome |
|---|---|
| 4. Loss of communications on JEN's communication network<br>a) JEN's communications link interruption<br>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.<br>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.<br>3. Alternatively, observe customer's EG is tripped and remains tripped for while there is a loss of communications.<br>4. Check there is no response to loss of communications if the interruption is intermittent or less than 30 minutes in duration. |
| 5. Loss of communications on customer's communications network<br>a) Customer communications link between its Generating System Control System and JEN's communications equipment (e.g.,modem) is disconnected | 1. Check that the customer's Generating System Control System detects the loss of communications on the customer side.<br>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.<br>3. Alternatively, observe customer's EG is tripped and remains tripped while there is a loss of communications.<br>4. Check there is no response to loss of communications if the interruption is intermittent or less than 30 minutes in duration. |
| 6. Re-establish communications | 1. Observe customer's Generating System reconnects (if applicable) and returns to normal generation levels as designed. |

# 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, June 2023.
8. Approved Product List, Clean Energy Council (CEC).