DISTRIBUTED ENERGY RESOURCES INFORMATION GUIDELINES

DRAFT GUIDELINES

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CONTENTS

1. INTRODUCTION

1.1. Purpose and scope

These are the draft *DER information guidelines* (Guidelines) made under clause 3.7E(g) of the National Electricity Rules (NER).

These *Guidelines* have effect only for the purposes set out in the NER. The NER and the National Electricity Law prevail over these *Guidelines* to the extent of any inconsistency.

These *Guidelines* specify:

- The information *Network Service Providers* (NSPs) are required to provide to AEMO for use in the *DER register*
- Any *demand side participation information* that AEMO will use in the *DER register*
- When information from NSPs must be provided
- How information from NSPs must be provided
- How the *DER Register* will be stored by AEMO
- The manner and form in which AEMO will publish a report on the extent to which that information informed its *load* forecasts
- How information will be provided to NSPs
- The contents, form, timing and methodology for constructing of the *DER register report* to be published by AEMO
- AEMO's approach to the protection of any *confidential information* or personal information.

1.2. Definitions and interpretation

1.2.1. Glossary

Terms defined in the National Electricity Law and the NER have the same meanings in these Procedures unless otherwise specified in this clause.

Defined terms in the NER are intended to be identified in these Guidelines by italicising them, but failure to italicise a defined term does not affect its meaning.

The words, phrases and abbreviations in the table below have the meanings set out opposite them when used in these Procedures.

Term	Definition
DER	distributed energy resources
NER	National Electricity Rules

1.2.2. Interpretation

The following principles of interpretation apply to these Guidelines unless otherwise expressly indicated:

(a) These Guidelines are subject to the principles of interpretation set out in Schedule 2 of the National Electricity Law.

(b) References to time are references to Australian Eastern Standard Time.

(c) A reference to a clause is a reference to a clause of the NER.

1.3. Related documents

Title	Location
Demand side participation information guidelines	https://www.aemo.com.au/-/media/Files/Stakeholder_Consultation/Consultations/Electricity_Consultations/2017/DSPIG/Demand-Side-Participation-Information-Guidelines.pdf

2. REGISTER

Clause 3.7E(b) requires AEMO to establish, maintain and update a *DER register*.

The *DER register* is to include:

- *DER generation information* to be reported to AEMO by *Network Service Providers* (in accordance with clause 3.7E(d));
- Any *demand side participation information* provided to AEMO by *Registered Participants* (in accordance with clause 3.7D(b)) which in AEMO's reasonable opinion will assist NSPs to meet their *regulatory obligations or requirements* and/or assist AEMO in the exercise of its statutory functions under the NER; and
- Any other information in connection with the performance of *AEMO's* statutory functions or will assist NSPs to meet their regulatory obligations or requirements, in accordance with these *Guidelines*.

3. INFORMATION - DISTRIBUTED ENERGY RESOURCES

The *DER register* must include:

- *DER generation information* reported to AEMO by NSPs
- any *demand side participation information* provided to AEMO by *Registered Participants* which, in AEMO's reasonable opinion, will assist NSPs meet their *regulatory obligations or requirements* and/or assist AEMO in the exercise of its statutory functions.

3.1. DER generation information

DER generation information is defined in NER Chapter 10 as standing data in relation to a *small generating unit*. A *small generating unit* is a *generating unit*.

(a) with a *nameplate rating* less than 30MW; and

(b) which is owned, controlled or operated by a person that *AEMO* has exempted from the requirement to register as a *Generator* in respect of that *generating unit* in accordance with clause 2.2.1(c).

3.1.1. Minimum size of small generating units

Clause 3.7E(h)(1) of the NER requires any minimum size of *small generating units* to be included as *DER generation information* to be specified in these *Guidelines*.

The minimum size is 1 kW.

Question 1: Is 1 KW as appropriate minimum size of *small generating unit* to capture in the DER Register?

3.2. Demand Side Participation Information

Demand side participation information is defined in the NER as any information referred to in clause 3.7D(e)(1). At a high level, this includes:

- contracted demand side participation; and
- the curtailment of non-scheduled load or the provision of unscheduled generation in response to the demand for, or price of, electricity.

These Guidelines do not require the inclusion of any *demand side participation information*. AEMO's assessment is that access to the *demand side participation information* in its current formats through the *DER register* would not assist NSPs to meet their *regulatory obligations or requirements* due to:

- differences between the data format of *demand side participation information* and the *DER generation information*;
- restrictions on AEMO's ability to provide the *demand side participation information* to NSPs due to information confidentiality concerns; and
- misalignment between the data types, as the *demand side participation information* is not site-specific, in contrast to the *DER generation information.*

3.3. Information requirements

Clause 3.7E(g)(1) requires these Guidelines to specify the information that NSPs must provide to AEMO, for inclusion in the *DER register*. The *DER generation information* required to be provided to AEMO is specified in Appendix A.

DER generation information is stored in a 3-level database structure (as shown in appendix A), and includes information that is:

- Aggregated at the NMI level to provide total capacity and export capacity for the site
- Aggregated at the AC Connection level, where devices are linked together to form a DER Installation, and can provide separation of device types and technologies.
- At a device level, where technical details and capacities of individual devices are recorded.

4. RESPONSIBILITIES

Clause 3.7E(d) requires NSPs to provide information to AEMO in accordance with these *Guidelines*.

Clause 3.7E(g)(1) requires AEMO to specify the information that NSPs must provide under this rule in this Guideline. The information required by AEMO is specified in Appendix A.

4.1. DER generation information collection process

The collection process is covered in the Draft Report published with this Guideline.

4.2. Existing DER generation information

Clause 11.108.3 requires that NSPs must provide existing *DER generation information* that they hold to AEMO, by no later than the commencement date (1 December 2019). This exisiting *DER*

generation information must be provided to AEMO in the form and manner specified in the *DER register information guidelines*.

AEMO is seeking to accommodate differences in datasets held by NSPs to facilitate the delivery of existing datasets and their integration into the DER Register. AEMO requires NSPs to provide all existing *DER generation information* that the NSPs hold by the commencement date (1 December 2019) in a manner agreed between the NSP and AEMO.

4.3. Data submission timing and frequency

The *DER generation information* that has been collected in relation to an installation is submitted to the *DER register* directly after completion of installation. This includes new installations, and modification of existing installations.

Except for the existing *DER generation information* provided under clause 4.2, *DER generation information* must be submitted to the *DER register* as soon as possible after the installation and related collection of *DER generation information* has been completed.

The maximum period for a completed submission of *DER generation information* for a site installation is 20 *business days* following the date of the installation.

Data will be submitted electronically to AEMO's digital platform.

There will be two options for submissions:

- API link with application.
- Web interface.

The details on the use of the API and Web interface, the interface standards, and data formats will specified in associated user information for DNSPs and other users. A list of the specified APIs will also be made available. AEMO will also publish swagger files for the specified APIs.

4.4. Format of Data submission

Clause3.7E(g)(4)(1) provides that AEMO must provide the format for the data to be submitted as *DER generation information* in these Guidelines.

This information will be submitted through an API or Web interface, and the format will be specified in a companion guideline "Guide to the DER Register – how to submit and receive information".

4.5. Assessing the accuracy of information

Rule 3.7G(4)(2) requires AEMO to explain any information needed to assess the accuracy of the information provided in these Guidelines.

4.5.1. Information to be provided to assist AEMO

The information required to be provided by NSPs includes information at the National Metering Identifier (NMI) level. This is to enable AEMO to reconcile the *DER generation information* provided in accordance with these Guidelines with other data sources, such as the *metering database*, to assess the accuracy of the data provided.

4.5.2. AEMO's methodology for assessing accuracy of information

The methodology that AEMO will use to verify the accuracy of the *DER generation information* provided will be to:

- Establish a clear and accessible process to facilitate accurate capture of information.
- Ensure that, as a minimum, make and model of device are captured on site.
- Validate device make and model through system design.
- Allow NSP validation of *DER generation information* in the submission process.
- Review information against alternative data sets, such as *metering data* stored in MSATS, to determine where incorrect or incomplete information may have been provided.

5. STORAGE

The *DER register* will be stored in an AEMO-managed database with data encrypted at rest and access protected with appropriate authentication and authorisation. The data will be stored with respect to the grid connected site identified by the NMI.

MSATS will be used for validation, lookups and reporting. The *DER register information* is intended to be identified by NMI and is tightly coupled to *NMI Standing Data*.

6. ACCESS TO DER GENERATION INFORMATION

The NER (clause 3.7E(g)(7), 3.7E(n)) provides that AEMO must provide access to *DER register* information to each NSP in relation to that NSP's network in accordance with these Guidelines. .

AEMO will provide access for NSPs to obtain the *DER generation information* that they are entitled to via an API and web digital platform interface. This will be limited to *DER generation information* that relates to NMIs within the network of the relevant NSP. Through this interface, NSPs will be able to use interactive visualisation design and extract custom reports as needed.

Information on use of the API and web interface, and instructions on how to use the interactive visualisation on aggregated data, will be specified in associated user information for DNSPs and other users.

Question 2: Are standard, packaged reports also required for NSPs? If so, what information is required?
Question 3: What is the most effective way to communicate and inform key stakeholders on how to use the DER Register?

6.1. Access to DER Generation Information for Emergency Services

Emergency service agencies are able to receive *DER generation information* on request from AEMO. The process to do this is under development.

7. REPORTING

The NER requires AEMO to publish a regular *DER register report*, to report on the usage distribution of DER generation.

Clause E7(g)(8) requires that the information in the *DER register report* must be aggregated such that it does not:

- Directly or indirectly disclose *confidential information*; or
- Result in a breach of applicable privacy legislation.

7.1. DER register report

The *DER register report* will comprise aggregated data will be published to the AEMO website, no less than quarterly. There are 3 options currently being considered:

- Interactive visualisation on aggregated data on the web page
- In a csv format, and
- A graphic pdf file.

The variables available for analysis in the *DER register report* are detailed in Appendix B. The *DER register report* will contain *DER register information* on region, installed capacity (MW, MWh) and fuel type, aggregated at a postcode level and state level. AEMO will only publish data where there are sufficient numbers in the aggregation group (postcode or state) that such publication is is appropriate in the context of privacy and confidentiality requirements.

Interactive visualisation allows flexible and custom visual and graphic reports to be created easily. The reports can use any of the variables captured and reported, and for public reports will maintain the anonymity and privacy of the data.

7.2. Load Forecasting

Clause 4.9.1(c)(6)(a) provides that AEMO must take into account *DER register information* it receives in the development of *load* forecasts, to the extent that it is relevant to the forecasts.

AEMO publishes several reports that address the forecasting of *load*. At least once a year, in one or more of those reports, AEMO will include a discussion on the extent to which *DER generation information* informed AEMO's *load* forecasts.

These reports include:

- Annual consumption forecasting – including the Integrated System Plan (ISP).
- Maximum demand forecasting – including the National Electricity Forecasting Report (NEFR) and the associated DSP, and Transmission Connection Point Forecasting (TCPF) reports.
- Operational forecasting – such as the pre-dispatch forecasts, Short Term Projected Assessment of System Adequacy (STPASA), and Medium Term Projected Assessment of System Adequacy (MTPASA).

8. PROTECTION OF INFORMATION

AEMO is assessing the proposed *DER register information* to determine the information that is *confidential information* and information which is to be protected on the basis it is personal information, or may be considered personal information in the context of other datasets (whether held by AEMO or a third party).

The *DER register* is being developed using a 'privacy by design' approach, including in the design and development of authentication and verification processes to apply to the *DER register* and data access arrangements, which will be calibrated according to the identitiy of the access party.

The end-to-end process has been designed around robust cyber security principles, and leverages off existing secure data interchange arrangements that AEMO uses with Participants.

The *DER register report* as set out in these Guidelines is designed to minimise the risk of any disclosure of personal information or *confidential information* and will further be subject to a review process to address any residual risk.

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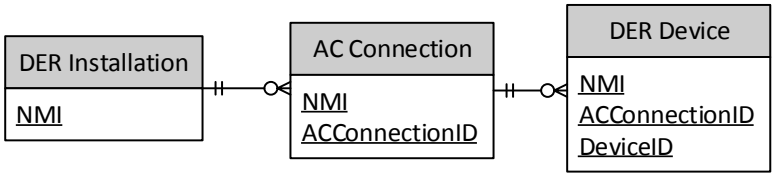
APPENDIX A. DATA MODEL

The proposed data model will be split into three levels, as described in the table below. Figure 1 depicts the relationships between the three levels.

	Description
Level 1: DER Installation	• This level applies to a DER at a NMI DER installation in aggregate. • Records the Master NMI record information as per the MSATS Procedures. • Each NMI may have many DER Installations referenced to it. • Each DER Installation may only be associated with 1 NMI. • Each DER installation may have many AC connections related to it.
Level 2: AC connection	• Each Inverter is uniquely identified by NMI and ACconnectionID. • Each AC connection may only be associated with 1 DER Installation. • Each AC connection may have many DER devices related to it. • A DER installation comprises an AC Connector and the DER Devices connected to it.
Level 3: DER Devices	• Each DER Device is uniquely identified by NMI, ACconnectionID and DeviceID. • Contains information relating to the DER Device specifications (e.g. solar panel, battery cell, etc), including device type, nominal capacity, etc. • A DER device may be one or many devices that have exactly the same specifications. • Each DER Device is related to a single AC connection.

Relationships between levels



This appendix provides a description of the data model, followed by four examples of how the DER Register might be populated for different DER system scenarios.

Data Model Level 1 – CATS_NMI_DATA table and DER Installation

Level 1 applies to DER installed at a NMI in aggregate. Each DER installation is uniquely identified (in level 2) by NMI and ACconnectionID. All fields are mandatory, where relevant.

Interpretation of Data Model level 1:

- Where a field type of 'pick list' is indicated, one of the listed options must be selected. A field type of 'Multi-select' indicates that one or more options must be selected.
- Where relevant, the provision of a 'null' value indicates that the settings are not enabled.

Category of data	Description	Field type/ validation	Data source	Other comments
NMI(s)	Unique identifier for each connection point where DER installation is	Alpha-numeric	AEMO	This is a representation of the CATS_NMI_DATA table, which records Master NMI Record information. AEMO do not intend to alter this table to accommodate the DER Register, but propose to have several relational tables, that reference the CATS_NMI_DATA table[1].

[1] For more information on the CATS_NMI_DATA table, please see MSATS Procedures: CATS Procedure Principles and Obligations on the AEMO website.

Category of data	Description	Field type/ validation	Data source	Other comments
Installer identification	Unique identifier for the current/last installer to install devices at this NMI	Alpha-numeric	Installer	This identifier could be the installer's DER Register account number, installer licence number, electrical tradesperson licence or an electrical contractor's licence (TBC).
Connection Agreement 'Job number'	Unique identifier associated with the DNSP's connection offer/agreement for the approved DER works.	Alpha-numeric	NSP	This identifier is specified by the DNSP as per its connection process.
Number of phases available	the number of phases that DER is installed on	Pick list (1, 2, 3)	Installer/NSP	
Number of phases with DER installed	the number of phases that DER is installed on	Pick list (1, 2, 3)	Installer/NSP	
Central protection and control	For DER installations where DNSPs specify the need for additional forms of protection above those inbuilt in an inverter.	Pick list (yes/no)	NSP	Used to describe the type(s) of central protection to be applied to the DER system.

Category of data	Sub-category of data	Applies to category	Description	Field type/ validation	Data source	Other comments
Protection and control modes		If 'Additional Central Protection' = yes	Protection settings			These fields will be optional and are expected to capture all forms of central protection in use for all forms of DER.
	Export limitation		Export limit (kVA)	Numeric	NSP	Maximum amount of energy (kVA) that may be exported form an electrical installation to the grid. Exceeding this limit will require the installation to disconnect. A null value indicates no limit. For example, the default value for inverter connected energy systems is 47Hz (Aust) under AS/NZS 4777.1:2016 table 2. These settings may differ for other energy devices.

Category of data	Sub-category of data	Applies to category	Description	Field type/ validation	Data source	Other comments
	Under-frequency protection (F<)		Frequency (Hz)	Numeric	NSP	For a DER installation indicates the protection function limit for underfrequency protection (F<). A null value indicates that these settings are not enabled. For example, the default value for inverter connected energy systems is 47Hz (Aust) under AS/NZS 4777.1:2016 table 2. These settings may differ for other energy devices.
	Over-frequency protection (F>)		Frequency (Hz)	Numeric	NSP	For a DER installation indicates the protection function limit for over-frequency protection (F>). A null value indicates that these settings are not enabled. For example, the default value for inverter connected energy systems is 52Hz under AS/NZS 4777.1:2016 table 2. These settings may differ for other energy devices.
	Undervoltage protection (V<)		Volts (V)	Numeric	NSP	For a DER installation indicates the protection function limit for undervoltage protection (V<). A null value indicates that these settings are not enabled. For example, the default value for inverter connected energy systems is 180V (Aust) under AS/NZS 4777.1:2016 table 2. These settings may differ for other energy devices.
	Overvoltage protection 1 (V>)		Volts (V)	Numeric	NSP	For a DER installation indicates the protection function limit for overvoltage protection (V>). A null value indicates that these settings are not enabled. For example, the default value for inverter connected energy systems is 260V (Aust) under AS/NZS 4777.1:2016 table 2. These settings may differ for other energy devices.

Category of data	Sub-category of data	Applies to category	Description	Field type/ validation	Data source	Other comments
	Overvoltage protection 1 (V>>)		Volts (V)	Numeric	NSP	For a DER installation indicates the protection function limit for overvoltage protection (V>>). A null value indicates that these settings are not enabled. For example, the default value for inverter connected energy systems is 265V (Aust) under AS/NZS 4777.2:2015, table 13. These settings may differ for other energy devices.
	Rate of Change of Frequency (RoCoF)		Rate of change of frequency (Hz/s)	Numeric	NSP	If these schemes are applied as forms of central protection.
	Voltage Vector Shift		Trip angle (Deg.)	Numeric	NSP	
	Inter-trip scheme		Description of the form of inter-trip (e.g. "from local substation")	Text	NSP	
	Neutral voltage displacement		Trip voltage (V)	Numeric	NSP	

Data Model Level 2 – AC Connection

Level 2 applies to the AC grid connection source of a DER installation (e.g. inverter). In the case of AC sources (e.g. rotating machines) that are connected to a DER installation, only the AC Connection ID and AC equipment type need to be populated. All fields are mandatory, where relevant. A DER installation comprises an AC Connector and the DER Devices (level 3) connected to it.

Interpretation of level 2:

- Some categories of data have sub-categories that are only mandatory under certain conditions. For example, when filling in data for underfrequency protection settings, specific information on setting limits will only be mandatory if underfrequency protection settings are enabled.
- Categories that have sub-categories are shown in orange, alongside the options that may be selected for that category. Sub-categories are listed underneath, alongside the categories that they apply to.

- Where a field type of 'pick list' is indicated, one of the listed options must be selected. A field type of 'Multi-select' indicates that one or more options must be selected.

Category of data	Sub-category of data	Applies to category	Description	Field type/ validation	Data source	Other comments
AC connection ID		All	Unique identifier for each AC connection in a DER installation.	Alpha-numeric	AEMO	Obtained on request from AEMO via API call
Number of AC Connections			Number of AC Connections in the group. Note the AC Connections must have the same attributes.	Numeric	Installer	
AC equipment type		All	Indicates whether the DER device is connected via an inverter (and what category of inverter it is) or not (e.g. rotating machine).	Pick list {Inverter, other}	Installer	There is the option to expand this pick list to align with the CEC Equipment Categories: grid connect PV inverter, stand along inverter - battery only, Standalone PV inverter, grid connect inverter – other energy source, multiple mode inverter – other energy source, UPS multiple mode inverter – other energy source, grid connect inverter – PV and battery, multiple mode inverter – PV and battery, UPS multiple mode inverter – PV and battery, Grid connect inverter – Battery only, multiple mode inverter – battery only, UPS multiple mode inverter – battery only, power conversion equipment, integrated energy storage system.
Inverter/ small generating unit Manufacturer		If AC connection type = inverter	The name of the inverter manufacturer.	Codified or pick-list	Installer	Definitions align to the CEC accredited inverters list (here). May be limited relevance for non-inverter connections.

Category of data	Sub-category of data	Applies to category	Description	Field type/ validation	Data source	Other comments
Inverter Series		If AC connection type = inverter	The inverter series.	Codified or pick-list	Installer	Definitions align to the CEC accredited inverters list (here).
Inverter Model Number		If AC connection type = inverter	The model number of the inverter.	Codified or pick-list	Installer	Definitions align to the CEC accredited inverters list (here).
Inverter serial number		If AC connection type = inverter	The serial number of the device(s)	Alpha-numeric	Installer	Primary generation device serial number(s)
Status code		If AC connection type = inverter	Code used to indicate the status of the Inverter. This will be used to identify if an inverter is active or inactive or decommissioned.	Pick list {active, inactive decommissioned)	Installer	This status will also track commissioning and decommissioning date. When a new record is inserted in the database, the installation date/ start date is defined by the user and may be backdated. This is not a duplicate of the Aggregate installation table, as inverters may become active or inactive without a change of status to the overall system.
Inverter device capacity (kVA)		If AC connection type = inverter	The rated AC output power that is listed in the product specified by the manufacturer.	Numeric	Model/ Manufacturer data source	Using kilovolt-amperes (kVA) (rather than kW) for values up to 30 kVA aligns with the Clean Energy Council's publication of AS/NZS 4777-compliant inverters.
What standard applies to the inverter		If AC connection type = inverter	What standard is the inverter manufactured and installed under.	Pick list	Installer	This should be the most stringent standard that tis applicable. Examples include AS4777.2:2015.
$V_{nom-max}$ (sustained operation overvoltage limit)		If AC connection type = inverter	Indicates the sustained operation overvoltage limit, when the average voltage for a 10-minute period exceeds the $V_{nom-max}$	Numeric	Standards data source (if default settings enabled)	For example, the default value for inverter connected energy systems is 255V (Aust), but may vary between 244-258V (see AS/NZS 4777.2:2015, section 7.5.2). These settings may differ for other energy devices.

Category of data	Sub-category of data	Applies to category	Description	Field type/ validation	Data source	Other comments
F_{stop} (over-frequency)		If AC connection type = inverter If device type = battery storage	Frequency (stop)	Numeric	Standards data source (if default settings enabled)	For example, the default value for inverter connected energy systems is 52 Hz (Aust), but may vary between 51 – 52 Hz under AS/NZS 4777.2:2015, section 7.5.3.1. These settings may differ for other energy devices.
$F_{stop-CH}$ (under frequency)		If AC connection type = inverter If device type =battery storage	Frequency (stop)	Numeric	Standards data source (if default settings enabled)	For example, the default value for inverter connected energy systems is 49 Hz (Aust), but may vary between 47 – 49 Hz under AS/NZS 4777.2:2015, section 7.5.3.2. These settings may differ for other energy devices.
Inverter – DRED interaction	Does the inverter interact with a demand response enabling device (DRED)	If AC connection type = inverter		Pick list {yes, no}	Installer	
Inverter power quality response modes - Voltage response modes – volt-watt response		If AC connection type = inverter	These fields are auto-populated. If the manufacturer/ installer has made changes from the default, they must be able to update/ edit the data to submit to the register.	Enabled/ Not Enabled	Model/ Manufacturer data source	This mode is described in AS4777.2:2015, section 6.3.2.1 An inverter may have the capability of operating in modes which will (a) contribute to maintaining the power quality at the point of connection with the customer installation; or (b) provide characteristics which are outside the typical operation of an inverter for the purpose of providing support to a grid.
	V1	If Inverter power quality response modes - Voltage response modes – volt-watt response = Enabled	Only to be populated if mode enabled. These settings are described in AS4777.2:2015, section 6.3.2.1. These fields are auto-populated. If the manufacturer/	Numeric	Standards data source (if default settings enabled)	
	V2			Numeric		
	V3			Numeric		
	V4			Numeric		
	P at V1			Numeric		
	P at V2			Numeric		
	P at V3			Numeric		

Category of data	Sub-category of data	Applies to category	Description	Field type/ validation	Data source	Other comments
	P at V4		installer has made changes from the default, they must be able to update/ edit the data to submit to the register.	Numeric		
Inverter power quality response modes - Voltage response modes – volt-var response		If AC connection type = inverter		Enabled/ Not Enabled	Model/ Manufacturer data source	This mode is described in AS4777.2:2015, section 6.3.2.1 An inverter may have the capability of operating in modes which will (a) contribute to maintaining the power quality at the point of connection with the customer installation; or (b) provide characteristics which are outside the typical operation of an inverter for the purpose of providing support to a grid.
	V1	If Inverter power quality response modes - Voltage response modes – volt-var response = Enabled	These settings are described in AS4777.2:2015, section 6.3.2.1.	Numeric	Standards data source (if default settings enabled)	
	V2			Numeric		
	V3			Numeric		
	V4			Numeric		
	Q at V1			Numeric		
	Q at V2			Numeric		
	Q at V3			Numeric		
	Q at V4			Numeric		
Inverter power quality response modes - Reactive power mode		If AC connection type = inverter	Select which power quality response modes are enabled on the inverter.	Enabled/ Not Enabled	Model/ Manufacturer data source	Default not enabled. Must be not enabled if either of the voltage response modes are enabled.

Category of data	Sub-category of data	Applies to category	Description	Field type/ validation	Data source	Other comments
	Fixed reactive power	If Inverter power quality response modes - Reactive power mode = Enabled	Reactive Power. Specified in % rating of the system.	Numeric	Standards data source (if default settings enabled)	
Inverter power quality response modes - Fixed power factor mode		If AC connection type = inverter	Select which power quality response modes are enabled on the inverter.	Enabled/ Not Enabled	Model/ Manufacturer data source	Default not enabled. Must be not enabled if either of the voltage response modes are enabled.
	Fixed power factor	If Inverter power quality response modes - Fixed power factor mode = Enabled	Power factor (0.8 source to 0.8 sink)	Numeric (0.8 – 1.0)	Standards data source (if default settings enabled)	To be populated if mode enabled. Must be between 0.8 lead and 0.8 lag. To reduce fields, a convention on sign required.
	Fixed power factor quadrant		Power factor quadrant	Pick List {source, sink}		
Inverter power quality response modes - Power factor curve / power response mode		If AC connection type = inverter	Select which power quality response modes are enabled on the inverter.	Enabled/ Not Enabled	Model/ Manufacturer data source	Default not enabled. Must be not enabled if either of the voltage response modes are enabled.
	P1	Inverter power quality response modes - Power factor curve / power response mode = Enabled	Reference point for P1	Numeric (0 – 100%)	Standards data source (if default settings enabled)	To be populated if mode enabled. The curve is described in AS4777.2:2015, section 6.3.4. Needs to be defined by NSP and provided to installation.
	P2		Reference point for P2	Numeric (0 – 100%)		
	Power factor at P1		Power factor (0.9 to 1.0 source)	Numeric (0.9 – 1.0)		
	Power factor quadrant at P1		Power factor quadrant	Pick List {source, sink}		
	Power factor at P2		Power factor (0.9 to 1.0 source)	Numeric (0.9 – 1.0)		
	Power factor quadrant at P2		Power factor quadrant	Pick List {source, sink}		

Category of data	Sub-category of data	Applies to category	Description	Field type/ validation	Data source	Other comments
Inverter power quality response modes - Power rate limit mode – ac operation and control change		If AC connection type = inverter	Select which power quality response modes are enabled on the inverter.	Enabled/ Not Enabled	Model/ Manufacturer data source	This mode is described in AS4777.2:2015, section 6.3.5.3.3 An inverter may have the capability of operating in modes which will (a) contribute to maintaining the power quality at the point of connection with the customer installation; or (b) provide characteristics which are outside the typical operation of an inverter for the purpose of providing support to a grid.
	Power ramp gradient (Wgra)	Inverter power quality response modes - Power rate limit mode – ac operation and control change = Enabled	Power ramp rate (default 16.67 %)	Numeric	Standards data source (if default settings enabled)	As described in AS4777.2:2015, section 6.3.5.1.
Inverter power quality response modes - Voltage response modes – volt-watt response for energy storage systems		If AC connection type = inverter AND If device type = battery storage		Enabled/ Not Enabled	Model/ Manufacturer data source	This mode is described in AS4777.2:2015, section 6.3.2.1 An inverter may have the capability of operating in modes which will (a) contribute to maintaining the power quality at the point of connection with the customer installation; or (b) provide characteristics which are outside the typical operation of an inverter for the purpose of providing support to a grid.
	V1	If Inverter power quality response modes - Voltage response modes – volt-watt response = Enabled	Only to be populated if mode enabled. These settings are described in AS4777.2:2015, section 6.3.2.1.	Numeric	Standards data source (if default settings enabled)	
	V2			Numeric		
	V3			Numeric		
	V4			Numeric		
	P at V1			Numeric		
	P at V2			Numeric		

Category of data	Sub-category of data	Applies to category	Description	Field type/ validation	Data source	Other comments
	P at V3			Numeric		
	P at V4			Numeric		
Non-inverter generator – voltage/reactive power regulation		If AC connection type NOT inverter		None/ Voltage droop/ fixed power factor	NSP	
	Voltage set point	If generator voltage/reactive power regulation mode = voltage droop	Only to be populated if mode enabled.	Numeric	NSP	% Nominal voltage, or V
	Deadband			Numeric		± x%
	Droop			Numeric		In %
	Base for droop			Numeric		In MVA
	Reactive power source limit			Numeric		
	Reactive power sink limit			Numeric		
	Fixed power factor	If generator voltage/reactive power regulation mode = fixed power factor	Power factor (0.8 source to 0.8 sink)	Numeric (0.8 – 1.0)	NSP	To be populated if mode enabled. Must be between 0.8 source and 0.8 sink. To reduce fields, a convention on sign required.
	Fixed power factor quadrant		Power factor quadrant	Pick List {source, sink}	NSP	
Non-inverter Generator ramp rate		If AC connection type NOT inverter	Generator ramp rate	Enabled/ Not Enabled	NSP	A generator may have a ramp rate applied.
	Power ramp gradient	If generator ramp rate = Enabled	Power ramp rate (%/min)	Numeric	NSP	
Non-inverter Generator frequency response mode		If AC connection type NOT inverter	Frequency sensitive mode	Enabled/ Not Enabled	NSP	A generator may operate in a frequency sensitive mode whereby it adjusts output to help support frequency control.
	Frequency deadband	If frequency sensitive mode = Enabled		Numeric	NSP	

Category of data	Sub-category of data	Applies to category	Description	Field type/ validation	Data source	Other comments
	Frequency droop			Numeric	NSP	
Protection and control modes			Protection settings			These fields will be optional and are expected to capture all any additional protection requirement if used.
	Rate of Change of Frequency (RoCoF)		Rate of change of frequency (Hz/s)	Numeric	NSP	If these schemes are applied in central protection.
	Voltage Vector Shift		Trip angle (Deg.)	Numeric	NSP	
	Inter-trip scheme		Description of the form of inter-trip (e.g. "from local substation")	Text	NSP	
	Neutral voltage displacement		Trip voltage (V)	Numeric	NSP	

Data Model Level 3 – DER Device

Level 3 applies to DER energy sources (e.g. battery modules, solar panels, tri/co-generation units, micro wind turbines, etc). These energy sources may or may not be inverter connected technologies. All fields are required to be completed, where data is available.

Interpretation of table 4:

- Some categories of data have sub-categories that are only required under certain conditions. For example, when filling in data for device sub-type, specific information on the device sub-type if that device is installed.
- Categories that have sub-categories are shown in orange, alongside the options that may be selected for that category. Sub-categories are listed underneath, alongside the categories that they apply to.
- Where a field type of 'Pick List' is indicated, one of the listed options must be selected. A field type of 'Multi-select' indicates that one or more options must be selected.

Category of data	Sub-category of data	Applies to category	Description	Field type/ validation	Data source	Other comments
Device ID			Unique identifier for a group of DER devices with the same attributes.	Alpha-numeric	AEMO	Needs to be autogenerated by system
Number of devices			Number of devices in the group. Note the devices must have the same attributes.	Numeric	Installer	
Manufacturer			The name of the device manufacturer.	Pick list	Installer	Definitions align to the CEC approved modules list (here).
Model Number			The make/brand of the device.	Pick list	Installer	Definitions align to the CEC approved modules list (here).
Status			Code used to indicate the status of the device. This will be used to identify of the device is active or inactive or decommissioned.	Pick list {active, inactive, decommissioned}	Installer	This status will also track commissioning and decommissioning date. When a new record is inserted in the database, the installation date/ start date is defined by the user and may be backdated. This is not a duplicate of the Aggregate installation table, as devices may become active or inactive without a change of status to the overall system.
Device Type			Used to indicate the primary technology used in the DER device.	Pick list {Fossil, Hydro, Wind, Solar PV, Renewable/Biomass/Waste, Geothermal, Storage. Other}	Model/ Manufacturer data source	May potentially use an expanded version of the NEM generator registration guide list of primary and secondary fuel sources, available at: https://www.aemo.com.au/-/media/Files/Electricity/NEM/Participant_Information/Application-forms-and-supporting-documentation/NEM_GENERATOR_REGISTRATION_GUIDE.pdf Selecting "Other" will open a free text field

Category of data	Sub-category of data	Applies to category	Description	Field type/ validation	Data source	Other comments
	Device sub-type		Used to indicate the primary technology used in the DER device.	Pick list {list is dependent on the device type selection}	Model/ Manufacturer data source	For example, if Solar PV is selected the pick list should contain monocrystalline, polycrystalline, thin-film, concentrating PV, silicon, biohybrid, cadmium telluride, if battery storage is selected the pick list should contain lithium-ion, lead acid, lead carbon, sodium nickel, lead crystal, absorbed glass matt, vanadium, aqueous hybrid ion, tubular gel, zinc bromide, etc.
Nominal export capacity (kW)			Maximum output in kW that is listed in the product specification by the manufacturer. This refers to the capacity of each unit within the device group.	Numeric	Model/ Manufacturer data source	E.g. for a system comprised of 10 x 0.37kW solar PV panels of the same make/ model, you would put 0.37kW as the nominal export capacity, rather than 3.7kW for the whole system
Nominal storage capacity (kWh)		If device type = battery storage	Maximum storage capacity in kWh. This refers to the capacity of each storage module within the device group.	Numeric	Model/ Manufacturer data source	E.g. for a system comprised of 3 x 14kWh battery modules of the same make/ model, you would put 14kWh as the nominal storage capacity, rather than 42kWh for the whole system.

APPENDIX B. DER REGISTER REPORT

The standard set of variables for the published DER Register report are contained in the table below. These variables will also be available for the interactive visualisation reporting. Details on how to use the interactive reporting will be specified in associated user information for DNSPs and other users.

Variable	Unit	Definition
Postcode		Aggregator variable
State		{NSW1, VIC1, QLD1, SA1, TAS1}
Total installed DER capacity	kW	
Number of DER installations	Numeric	
Installed capacity of solar	kW	
Number of solar installations	Numeric	
Installed capacity of batteries	kW	
Installed storage capacity of batteries	kWh	
Number of battery installations	Numeric	
Installed capacity of other DER	kW	
Building type	String	{residential, commercial, industrial}