

# Compliance of Distributed Energy Resources with Technical Settings: 2025 Update

August 2025

Compliance to AS/NZS4777.2:2020

A technical report for Australia





We acknowledge the Traditional Custodians of the land, seas and waters across Australia. We honour the wisdom of Aboriginal and Torres Strait Islander Elders past and present and embrace future generations.

We acknowledge that, wherever we work, we do so on Aboriginal and Torres Strait Islander lands. We pay respect to the world's oldest continuing culture and First Nations peoples' deep and continuing connection to Country; and hope that our work can benefit both people and Country.

'Journey of unity: AEMO's Reconciliation Path' by Lani Balzan

AEMO Group is proud to have launched its first [Reconciliation Action Plan](#) in May 2024. 'Journey of unity: AEMO's Reconciliation Path' was created by Wiradjuri artist Lani Balzan to visually narrate our ongoing journey towards reconciliation - a collaborative endeavour that honours First Nations cultures, fosters mutual understanding, and paves the way for a brighter, more inclusive future.

## Important notice

### Purpose

The purpose of this report is to provide a status update on the current state of compliance of distributed energy resources (DER) with technical settings, focusing on compliance of distributed photovoltaic (DPV) inverters with AS/NZS4777.2:2020. The report provides a status update since AEMO's report released in December 2023<sup>1</sup>. AEMO has prepared this report to meet its responsibility under clause 4.3.1(n) of the National Electricity Rules (NER) to refer to Registered Participants, as AEMO deems appropriate, information of which AEMO becomes aware in relation to significant risks to the power system where actions to achieve a resolution of those risks are outside the responsibility or control of AEMO.

### Disclaimer

To inform its review and the findings expressed in this report, AEMO has been provided with data by third parties, including original equipment manufacturers (OEMs) and distribution network service providers (DNSPs), and has also collated information from its own observations, records and systems. This report has been prepared by AEMO using data available and observations made at different times as indicated in the report, and other information available to AEMO as at August 2025. AEMO has made reasonable efforts to ensure the quality of the information in this report but cannot guarantee its accuracy or completeness. Any views expressed in this report are those of AEMO unless otherwise stated, and may be based on information given to AEMO by other persons.

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<sup>1</sup> AEMO (December 2023) *Compliance of Distributed Energy Resources with Technical Settings: Update*, [https://www.aemo.com.au/-/media/files/initiatives/der/2023/oem\\_compliance\\_report\\_2023.pdf?rev=11aeb76499ed4c49834b160cad75a38d&sc\\_lang=en](https://www.aemo.com.au/-/media/files/initiatives/der/2023/oem_compliance_report_2023.pdf?rev=11aeb76499ed4c49834b160cad75a38d&sc_lang=en).

# Executive summary

This report provides an update on the state of distributed energy resources (DER) compliance with the technical standard AS/NZS 4777.2 - 2020 (the '2020 Standard') for inverter-based DER installed in early 2024 (Q1/Q2).

The 2020 Standard includes disturbance ride-through requirements that are necessary to maintain power system security during periods of very high inverter-based DER contribution. This report provides an update to AEMO's previous reports on DER compliance to the 2020 Standard<sup>2</sup>. It finds the following:

- The available data from various sources consistently indicates that 80-90% of new DER inverters installed in early 2024 (Q1/Q2) Australia-wide were correctly configured to the 2020 Standard grid code.
- The observed improvements in compliance have been largely due to voluntary actions taken by inverter original equipment manufacturers (OEMs), such as removing legacy standards from their product menus to better support installers in selecting the correct standard at the time of installation. Amendments to product menu listings have now been mandated under AS/NZS4777.2:2020 Amendment 2, taking effect in August 2025.
- Poor disturbance ride-through outcomes persist for 30-100 kilowatts (kW) DPV and 100 kW-5 megawatts (MW) PV non-scheduled generation (PVNSG), despite improvements in inverter compliance. Based on limited evidence available to date, 5-30 MW PVNSG appear to successfully perform disturbance ride-through. Projections indicate a plateauing of the total size of the DPV fleet that demonstrates poor ride-through capabilities from 2024 onwards.
- AEMO continues to recommend that governance gaps in monitoring and maintaining compliance with technical standards are addressed as a priority, including defining roles and responsibilities for managing compliance, and ensuring availability of suitable datasets for monitoring compliance. Recommended actions include the following, noting that progress is underway in several cases:
  - **OEMs:** implement 2020 Standard amendments, improve datasets for compliance assessment and continue to improve compliance where feasible.
  - **DNSPs:** develop mature compliance assessment capabilities, consider regulatory changes required to govern remote inverter updates, and update technical standards to reflect recent AS/NZS4777.1:2024 changes.
  - **AEMO and DNSPs:** collaborate to investigate 30 kW–5 MW disconnections, improve visibility of 30 kW-30 MW systems, develop technical performance requirement for 200 kW-5 MW systems, improve DER register data and quantify DPV replacement rates.
  - **Consumer Energy Resources (CER) Roadmap Workstreams:** including governance arrangements relating to data collection, provision and use, and installation and commissioning. Roles and responsibilities for monitoring, assessing, and enforcing compliance are clarified.

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<sup>2</sup> At <https://aemo.com.au/initiatives/major-programs/nem-distributed-energy-resources-der-program/standards-and-connections/compliance-of-der-with-technical-settings>.



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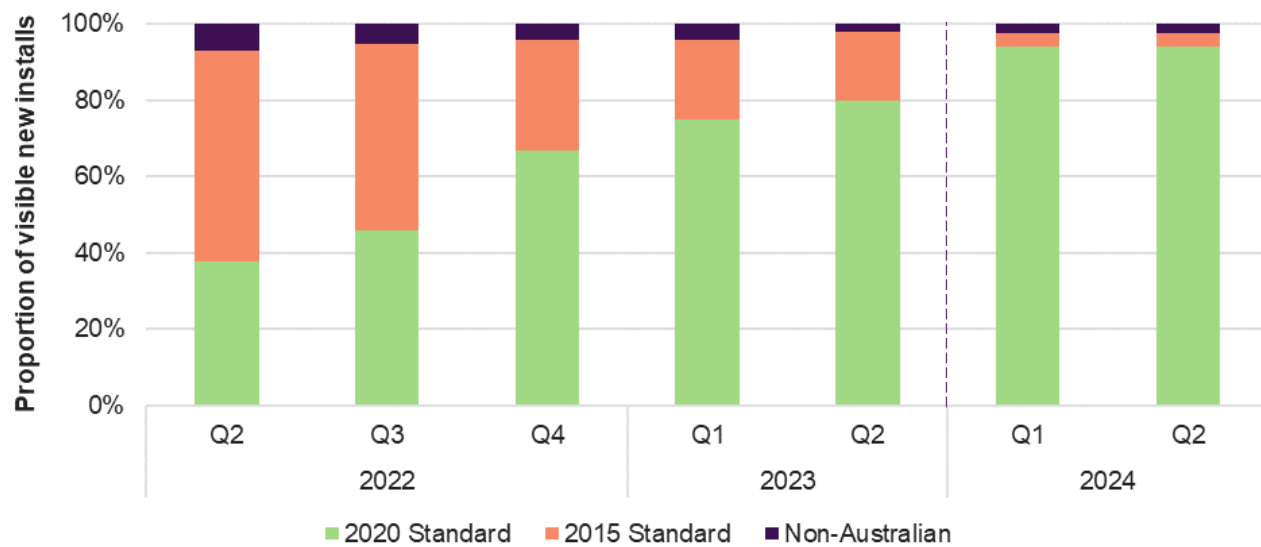
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# 1 Compliance estimates

Analysis of data provided by OEMs indicates that installation compliance has continued to improve, with **94% of new inverters installed in Q1 and Q2 2024 Australia-wide correctly configured to the 2020 Standard grid code**<sup>3</sup>, as illustrated in Figure 1. This finding is based on a sample of internet-connected DPV, representing around 65% of new installs, with data provided by 13 inverter OEMs.

**Figure 1** Estimates of quarterly compliance to the AS/NZS4777.2:2020 grid code



Note: the OEMs included in the aggregation vary by quarter, based on which OEMs responded to the data request. Market coverage associated with these OEMs varies from 52% to 95%. Compliance estimates in this plot are scaled by OEM market share in that calendar year and assume that the visible portion of an OEM’s fleet is representative of their entire fleet.

AEMO continues to recommend that governance gaps in monitoring and maintaining compliance with technical standards are addressed as a priority<sup>4</sup>. Maintaining high DER compliance is an essential underpinning of power system security – it delivers benefits to customers through increased DER hosting capacity (more DER able to be installed) and minimises intervention costs.

Voluntary and temporary actions taken by many stakeholders (particularly by a selection of OEMs who voluntarily updated product menus and commissioning<sup>5</sup> processes to better assist installers in selecting the correct grid codes) have achieved the 90% target. To ensure these levels are maintained and monitored, and that the rollout of future updates to standards is well managed, it is now essential to establish suitable governance frameworks to ensure clear roles and responsibilities and procedures in place to monitor and maintain compliance, and availability of suitable datasets.

<sup>3</sup> An inverter is taken to be ‘compliant’ when set to any 2020 Standard region code as the inverter is expected to perform disturbance ride-through requirements irrespective of region code (either Australia A, B, or C).

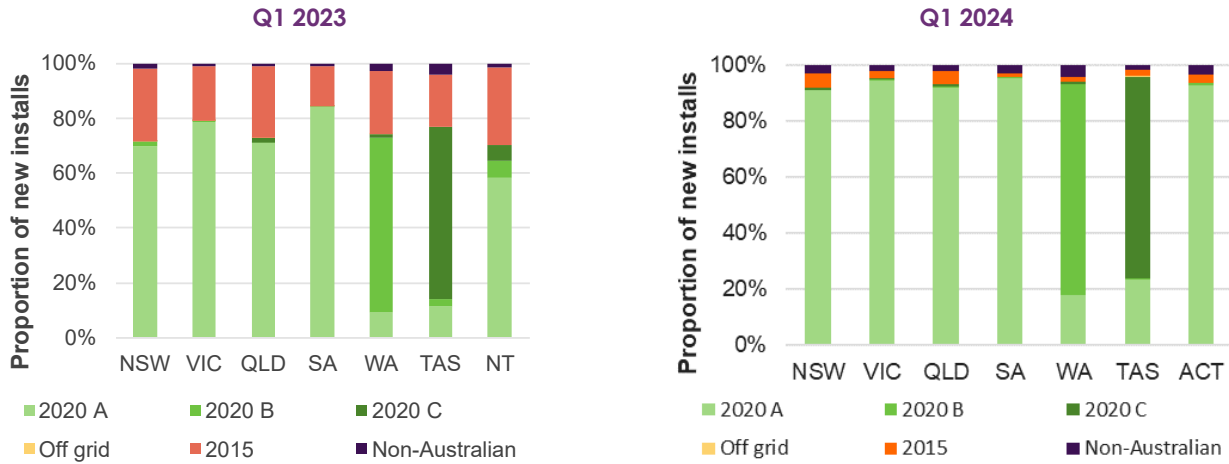
<sup>4</sup> See Section 7 (background provided in sections 3.2 and 4.2) in AEMO (Dec 2023) *Compliance of Distributed Energy Resources with Technical Settings: Update*, at [https://aemo.com.au/-/media/files/initiatives/der/2023/oem\\_compliance\\_report\\_2023.pdf?la=en](https://aemo.com.au/-/media/files/initiatives/der/2023/oem_compliance_report_2023.pdf?la=en).

<sup>5</sup> See work underway through the Federal Department of Climate Change, Energy, the Environment and Water (DCCEEW) seeking to establish a National Regulatory Framework for CER, at <https://consult.dcceew.gov.au/natl-cer-roadmap-tech-priorities-consult>.



AEMO’s analysis indicates that compliance rates have improved consistently across all regions, as shown in Figure 2. Compliance rates for new installations in all regions were between 91% and 95% in Q1 2024<sup>6</sup>.

**Figure 2** Estimated proportions of installations on each setting by region



Note: in Q1 2023, 7-11 OEMs provided data with regional breakdowns, depending on the state. In Q1 2024, 12 OEMs provided data with regional breakdowns. Data was scaled for state-based market share. Data provided was insufficient to separate Western Australia into South West Integrated System (SWIS) and non-SWIS.

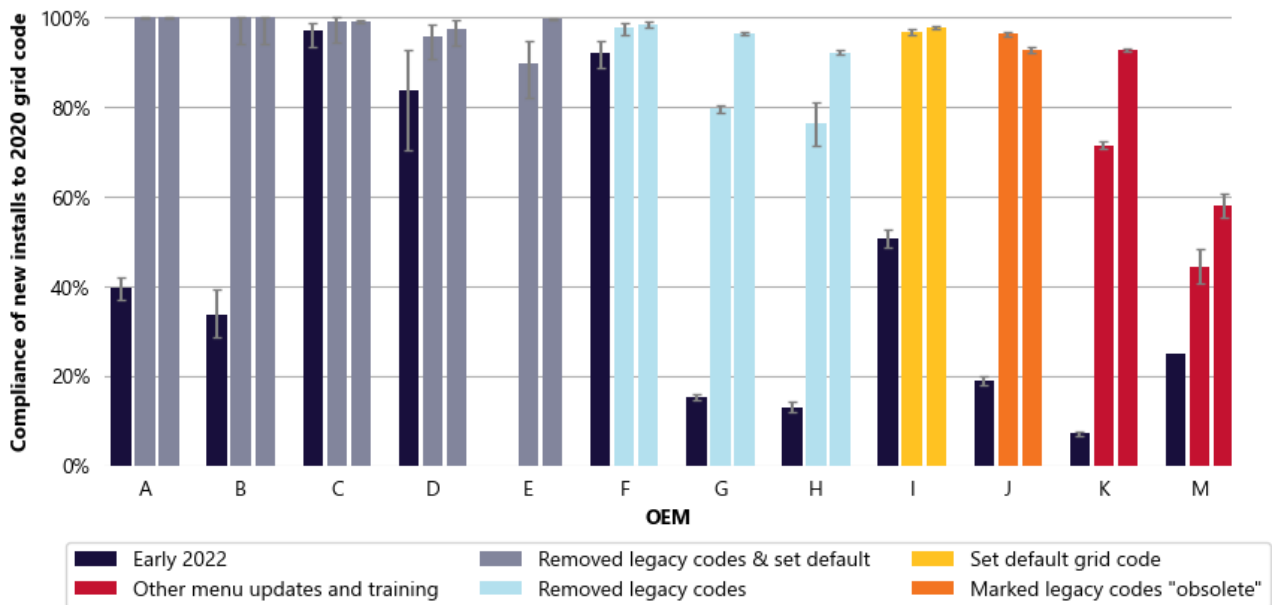
<sup>6</sup> An inverter is taken to be ‘compliant’ when set to any 2020 Standard region code as the inverter is expected to perform disturbance ride-through requirements irrespective of region code (either Australia A, B, or C). However, it is noted that inverters should be set to Australia B in the Western Australian South West Integrated System (SWIS) and Australia C in Tasmania and the Western Australian non-SWIS (Horizon) network.

## 2 Actions to improve compliance

The observed improvements in compliance have been largely due to voluntary actions taken by OEMs. As shown in Figure 3, updates to OEM menus that reduce accessibility of incorrect grid codes is effective, however taking action early is essential due to lag times<sup>7,8</sup>. One OEM that has relied on installer training alone showed a smaller and slower improvement in compliance outcomes.

An amendment to the 2020 Standard (AS/NZS4777.2 Amd 2:2024<sup>9</sup>) was released in August 2024. This introduced a requirement to label legacy grid codes as ‘obsolete’<sup>10</sup>, so installers are better guided toward correctly selecting the latest grid codes. This will come into effect from 23 August 2025 and be enforced through the Clean Energy Council’s (CEC’s) inverter listing process<sup>11</sup>.

Figure 3 Compliance rates of new installations to the 2020 Standard for individual OEMs, showing improvement between early 2022, Q1-Q2 2023 and Q1-Q2 2024



Note: compliance rates shown for earliest quarter in 2022 (first bar, dark blue), Q1&Q2 2023 (second bar, various colours) and Q1&Q2 2024 (third bar, various colours), as provided by each OEM. Compliance rates do not include any improvements due to remote updates. Error bars indicate uncertainty related to sample sizes of data provided by OEMs, but do not account for potential bias due to lack of visibility of non-internet-connected fleet. Information for OEM E was not available for early 2022.

<sup>7</sup> Several OEMs have also undertaken remote updates to inverter settings to correct to the 2020 Standard and have developed bulk remote update capabilities. However a lack of clear governance arrangements has meant that some OEMs are seeking authority from DNSPs to update inverter settings, and it is understood DNSPs require appropriate contractual arrangements to grant this authority as discussed in Section 3.2 of AEMO (Dec 2023) *Compliance of Distributed Energy Resources with Technical Settings: Update*, at [https://aemo.com.au/-/media/files/initiatives/der/2023/oem\\_compliance\\_report\\_2023.pdf?la=en](https://aemo.com.au/-/media/files/initiatives/der/2023/oem_compliance_report_2023.pdf?la=en).

<sup>8</sup> The impact of different OEM actions including lag times are discussed in greater detail in Section 3.1 of AEMO (Dec 2023) *Compliance of Distributed Energy Resources with Technical Settings: Update*, at [https://aemo.com.au/-/media/files/initiatives/der/2023/oem\\_compliance\\_report\\_2023.pdf?la=en](https://aemo.com.au/-/media/files/initiatives/der/2023/oem_compliance_report_2023.pdf?la=en).

<sup>9</sup> Standards Australia, at <https://www.standards.org.au/standards-catalogue/standard-details?designation=AS-NZS-4777-2-2020-Amd-2-2024>. Published on 23 August 2024, with a one-year transition period for manufacturers to implement.

<sup>10</sup> Where these legacy settings are provided for service and repair purposes. OEMs may also opt to remove legacy settings.

<sup>11</sup> See CEC 2024 inverter standards update and inverter products listing at <https://cleanenergycouncil.org.au/industry-programs/products-program/inverters/standards-change>, noting that this process involves a manufacturer self-declaration of compliance.

## 3 Other measures of compliance

The assessments above are based on data provided by OEMs on the settings applied to their devices in the field<sup>12</sup>. A number of other methods were also used to further validate these compliance estimates, as discussed below. Validation and cross-checks are critical to providing robust compliance estimates, given the known dataset limitations<sup>13</sup>.

### 3.1 Method 2: Volt-VAr assessment

United Energy (UE), Victorian Power Networks (VPN) and SA Power Networks (SAPN) have developed Volt-VAr compliance monitoring systems. These systems use smart meter data to assess individual DER device compliance with the Volt-VAr settings in technical standards. This method allows tracking of continuing compliance over time, enabling identification of issues that can emerge after installation such as firmware changes or batch issues that have been observed to affect compliance.

Compliance rates for installs in early 2024, based on Volt-VAr assessments of a sample of DPV, are shown in Table 1 and indicate compliance rates have improved to within a similar range across multiple regions. These estimates of compliance are lower than the 94% estimate based on OEM data, which may be caused by a bias towards internet connected sites in the OEM datasets<sup>14</sup>.

**Table 1 Compliance rate for new installations in early 2024 based on Volt-VAr assessments**

Network	Compliance rate for new installs	Date range for new installs
United Energy (UE)	92%	Q1&Q2 2024
Victorian Power Networks (VPN)	89%	Q1&Q2 2024
SA Power Networks	82%	Q2 2024
AusGrid <sup>A</sup>	72-84%	Q1&Q2 2024

A. A range is provided for Ausgrid, as both the methods used by UE/VPN and SAPN were applied to the Ausgrid dataset.

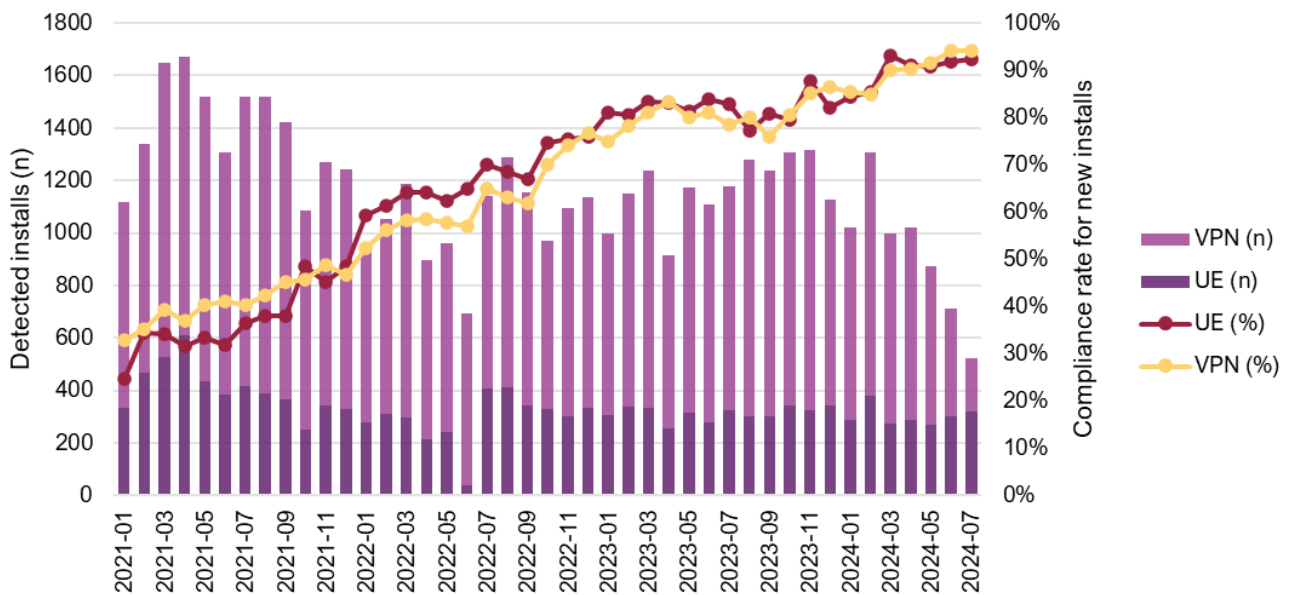
Compliance rates measured via Volt-VAr assessment in the VPN/UE networks over time are shown in Figure 4, showing the considerable improvement achieved. This provides an important validation of the datasets provided by OEMs.

<sup>12</sup> An inverter is taken to be 'compliant' when set to any 2020 Standard region code as the inverter is expected to perform disturbance ride-through requirements irrespective of region code (either Australia A, B, or C). However, it is noted that inverters should be set to Australia B in the WA SWIS and Australia C in Tasmania and the WA non-SWIS (Horizon) network.

<sup>13</sup> For further information on dataset limitations, see Section 4.1 in AEMO (Dec 2023) *Compliance of Distributed Energy Resources with Technical Settings: Update*, at [https://aemo.com.au/-/media/files/initiatives/der/2023/oem\\_compliance\\_report\\_2023.pdf?la=en](https://aemo.com.au/-/media/files/initiatives/der/2023/oem_compliance_report_2023.pdf?la=en).

<sup>14</sup> It is also plausible that the discrepancy is in part due to cases where the 2020 Standard was selected correctly, however changes have then been made to the Volt-VAr settings during or after commissioning.

**Figure 4 United Energy and Victorian Power Networks compliance rates over time**



Note: the sample size reduces over winter due to fewer cases where voltage exceeds the threshold (248 volts [V]) to undertake Volt-Var assessment.

### 3.2 Method 3: Disturbance ride-through in the field

When power system disturbances occur, AEMO assesses the ride-through performance of DPV inverters in the field based on active power measurements from a sample of DPV inverters. Analysis of DPV performance during disturbance events in 2024 has indicated that rooftop DPV (<30 kW) installed since April 2023 (likely set to the 2020 Standard) shows significantly improved ride-through performance<sup>15,16,17</sup>. However, sample sizes in the datasets available for DPV on the 2020 Standard are small. Improved datasets are required to confirm this finding.

### 3.3 Method 4: Physical inspections

The Clean Energy Regulator (CER) undertakes physical site inspections as part of its administration of the Small-scale Renewable Energy Scheme (SRES)<sup>18</sup>. A statistically significant sample of DPV installations are inspected at random on a

<sup>15</sup> Based on available data during the 13 February 2024 event, only 1%-8% DPV installed post April 2023 experienced shake-off compared with 6-9% installed prior to April 2023. During 25 and 27 March 2024 events there were zero observations of < 30 kW DPV installed post April 2023 experiencing shake-off, compared with ~8-16% of DPV installed prior to April 2023.

<sup>16</sup> AEMO (July 2025) *Final Report – Trip of Moorabool – Sydenham 500 kV No. 1 and No. 2 lines on 13 February 2024*, at [https://aemo.com.au/-/media/files/electricity/nem/market\\_notices\\_and\\_events/power\\_system\\_incident\\_reports/2024/final-report---loss-of-moorabool---sydenham-500-kv-lines-on-13-feb-2024.pdf?la=en](https://aemo.com.au/-/media/files/electricity/nem/market_notices_and_events/power_system_incident_reports/2024/final-report---loss-of-moorabool---sydenham-500-kv-lines-on-13-feb-2024.pdf?la=en).

<sup>17</sup> AEMO (October 2024) *Addendum on DPV and load behaviour: 275 kV current transformer failures in South Australia 14-27 March 2024*, at [https://aemo.com.au/-/media/files/electricity/nem/market\\_notices\\_and\\_events/power\\_system\\_incident\\_reports/2024/addendum-on-dpv-and-load-behaviour275-kv-current-transformer-failures-in-south-australia-1427-march.pdf?la=en](https://aemo.com.au/-/media/files/electricity/nem/market_notices_and_events/power_system_incident_reports/2024/addendum-on-dpv-and-load-behaviour275-kv-current-transformer-failures-in-south-australia-1427-march.pdf?la=en).

<sup>18</sup> Discussed further in Section 2.2 of AEMO’s April 2023 report, *Compliance of Distributed Energy Resources with Technical Settings*, at <https://aemo.com.au/-/media/files/initiatives/der/2023/compliance-of-der-with-technical-settings.pdf?la=en>. Further information on the SRES scheme is at <http://www.cleanenergyregulator.gov.au/RET/Scheme-participants-and-industry/Agents-and-installers/Small-scale-Renewable-Energy-Scheme-inspections>.

rolling basis<sup>19</sup>. Two CER audits have been completed that inspected compliance with the 2020 Standard. Overall, only half the sites inspected had settings visible to the inspector during both audit rounds<sup>20</sup>. Compliance outcomes<sup>21</sup> from the FY23-24 and FY24-25 audits are summarised in Table 2, with compliance rates based on OEM data for the same period shown for comparison. The audit outcomes are aligned with the compliance rates observed in OEM datasets. This higher compliance rate based on OEM data for the FY23-24 audit round may be caused by a bias towards internet connected sites in the OEM datasets. There is a noticeable drop in the visibility of the CER audit inspections, it is understood that this is due to the challenges with the accessibility of settings data, such as challenges with password protection, or OEMs shifting from physical displays on the inverter, to an app-based interface.

**Table 2 Compliance rate for new installations based on CER physical site inspections**

Audit round	Installation period	Sample size <sup>A</sup> (number of sites)	Visible proportion of sites	Compliance rate <sup>B</sup> (physical inspections)	Compliance rate (based on OEM data)
FY23-24	1 July 2022 – 30 June 2023	2,799	68%	69%	75%
FY24-25	1 July 2023 – 30 June 2024	2,532	42%	89%	-
Subset FY24-25 <sup>C</sup>	1 January 2024 – 30 June 2024	1,197	40%	92%	94%

A. Including visible and non-visible sites.

B. Compliance rate calculated based on visible portion only.

C. AEMO requested OEM data for installations from 1 January 2024 to 30 June 2024.

### 3.4 Method 5: Laboratory bench testing of inverters

AEMO is collaborating with researchers at University of NSW Sydney and University of Wollongong to perform laboratory bench testing of individual inverters and loads to investigate potential risks related to their performance under various grid conditions. This work is funded through the CSIRO and GPS-T research roadmap partnership<sup>22</sup>.

A total of 21 inverters set to the 2020 Standard have been tested. Several inverters failed to pass ride-through tests as well as reconnection and power quality responses, as stipulated in the 2020 Standard. This could mean that even if inverters are set correctly to the 2020 standard, some may demonstrate poor ride-through performance in the field. On investigation, this identified challenges around the interpretation of the standard test requirements, and highlights limitations in the current Standards testing and evaluation process.

Additionally, the bench testing sought to test for scenarios beyond the Standard requirements, that represent realistic or plausible future cases. This included testing for altered grid parameters (such as weak grid conditions) and DPV parameters (such as its power output levels), resulting in the inverters performing undesirable responses. This highlights the continued challenge of understanding these devices and the need for visibility of their behaviour in the field.

<sup>19</sup> This sample is taken from across Australia for installations where SRES applications have been created in the previous 12-18 months. This time delay is to allow for small-scale technology certificates (STCs) to be claimed.

<sup>20</sup> In the FY23-24 audit 42% were not visible, and in 3% of cases the inspector left all fields blank. In the FY24-25 audit, 58% were not visible and in 4% of cases the inspector left all fields blank. For further details refer to Section 2.2.1 of AEMO's April 2023 report, *Compliance of Distributed Energy Resources with Technical Settings*, at <https://aemo.co.gov.au/-/media/files/initiatives/der/2023/compliance-of-der-with-technical-settings.pdf?la=en>.

<sup>21</sup> An inverter was generally taken to be correct when a 2020 Standard was selected (that is, Region A, B or C irrespective of the local network requirements). In the FY23-24 audit, 17% were on the incorrect standard, and 14% partially correct. In the FY24-25 audit, 5% were on the incorrect standard, and 6% partially correct.

<sup>22</sup> GPS-T Consortium Research Roadmap; for more information, see <https://globalpst.org/csiro-aemo-and-g-pst-release-research-roadmap-to-support-australias-energy-transition/>.

## 4 Disturbance ride-through

To fulfil its responsibility to manage power system security, AEMO needs to understand the likely disturbance ride-through performance of the installed DPV and PVNSG fleet. Table 3 provides a summary of observed behaviours for the various size categories of DPV and PVNSG.

**Table 3 Observed disturbance ride-through performance of DPV by installed capacity**

Category of DPV	Available evidence	Dataset limitations	Considerations for power system analysis (based on evidence available as at August 2025) <sup>A</sup>
<b>Rooftop (&lt;30 kW)</b>	Analysis of behaviour in power system disturbances suggests that rooftop DPV (<30 kW) installed since April 2023 demonstrates significantly improved ride-through performance.	Sample sizes in the available datasets remain small at present. AEMO will continue to monitor performance and seek improved datasets to verify this finding.	It is likely appropriate to assume that <30 kW DPV installed after 1 April 2023 successfully rides through power system disturbances as per specifications in the 2020 Standard, and that <30kW DPV installed prior to April 2023 has poor disturbance ride-through capabilities.
<b>30-100 kW</b>	<ul style="list-style-type: none"> <li>Analysis since 2018 consistently shows that these systems have a higher disturbance shake-off rate than systems &lt;30 kW; in some events this can be up to 20 times greater.</li> <li>These systems have not shown any observable improvement in ride-through behaviours in disturbances since introduction of the 2020 Standard.</li> <li>Shake-off is apparent across all National Electricity Market (NEM) regions and inverter manufacturers.</li> <li>Central protection<sup>B</sup> has been identified as a possible cause of these high disconnection rates, but suitable data to confirm this have not been sourced.</li> <li>Recent updates to AS/NZS4777.1 seek to address this possible issue, but the extent to which governance arrangements effectively ensure correct application of the new requirements is unclear for some jurisdictions.</li> </ul>	Suitable datasets to diagnose the cause of 30-100 kW DPV disturbance shake-off are very limited at present. AEMO is working with DNSPs to improve availability of this data.	Based on available evidence, it is likely appropriate in power system studies to assume very poor disturbance ride-through capabilities, until further evidence becomes available to confirm improvements.
<b>PVNSG 100-200 kW</b>	<p>Based on preliminary assessment of disturbance events occurring from mid-2023 to mid-2025:</p> <ul style="list-style-type: none"> <li>This size category demonstrates high disturbance shake-off rates, similar to 30-100 kW DPV.</li> <li>Shake-off is apparent across all NEM regions and inverter manufacturers.</li> </ul>	Analysis has relied on third party monitoring to date as DNSPs monitoring requirements typically only apply for sites exporting above 200 kW. Datasets can be complex to interpret due to multiple monitoring points and varied inverter configurations.	As above.
<b>PVNSG 200 kW to 5 MW</b>	<p>Based on assessment in South Australia:</p> <ul style="list-style-type: none"> <li>This size category demonstrates high disturbance shake-off rates, similar to 30-100 kW DPV.</li> <li>This applies to both 100-500 kW and 500 kW-5 MW PVNSG.</li> </ul>	Analysis has been limited to South Australia to date due to limited data availability for this size category in other regions.	As above.

Category of DPV	Available evidence	Dataset limitations	Considerations for power system analysis (based on evidence available as at August 2025) <sup>A</sup>
PVNSG 5-30 MW	Based on assessment in South Australia, this size category appears to ride-through disturbances successfully (no evidence of disturbance shake-off is observed).	Analysis has been limited to South Australia to date due to limited data availability for this size category in other regions.	Based on available evidence, it is likely appropriate to assume that these systems successfully ride-through power system disturbances in power system analysis.

Note: The AEMO distributed PV model (DERAEMO1) for PSS®E does not currently incorporate the assumed poor ride-through performance of systems sized 30 kW to 5 MW, where only 50% of installed capacity is expected to ride through power system disturbances. This exclusion is due to limited evidence to date for PVNSG >200kW, the relatively small installed fleet compared to the 0 to 30 kW range, and the minimal difference such systems would have on dynamic simulations given known error margins (±30%) for DPV shake-off behaviour. If the 30 kW to 5 MW fleet continues to demonstrate poor ride-through characteristics, AEMO may revise the DERAEMO1 model parameters accordingly.

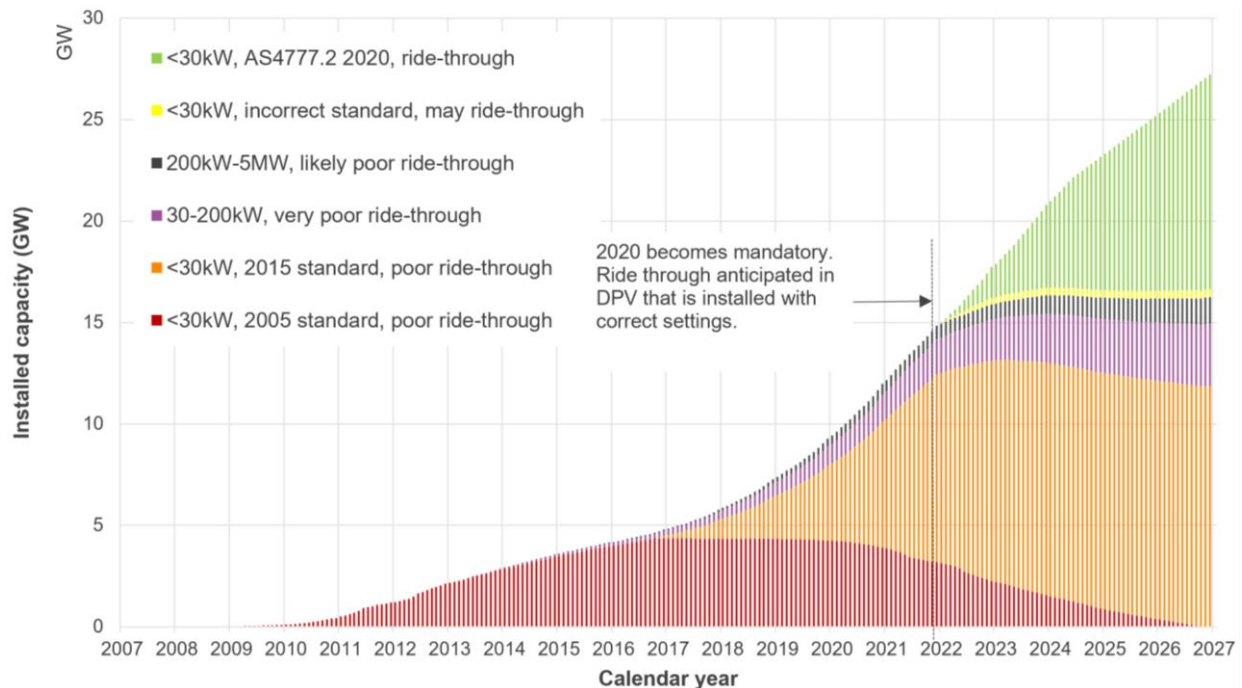
A. Subject to change as more information becomes available over time.

B. Also referred to as Interface Protection in AS/NZS4777.1:2024.

AEMO is collaborating with DNSPs and other stakeholders to understand the underlying causes of shake-off, and to clarify technical requirements for 200 kW-5 MW DER connections<sup>23</sup>.

Figure 5 provides a forward projection of the total DPV and <5 MW PVNSG fleet in the National Electricity Market (NEM) that is expected to correctly perform the necessary disturbance ride-through behaviours. This projection assumes that legacy DPV systems retire after a 10-year lifetime<sup>24</sup>, and indicates a plateauing of the total size of the DPV fleet that demonstrates poor ride-through capabilities from 2024 onwards.

**Figure 5 Ride-through capabilities of installed DPV and PVNSG fleet up to 5 MW in the NEM (historical and future)**



Note: OEM compliance rates prior to January 2024 are weighted by state-based market share in Q1 2023, while compliance rates after this date are weighted by their state-based market share in Q1 2024.

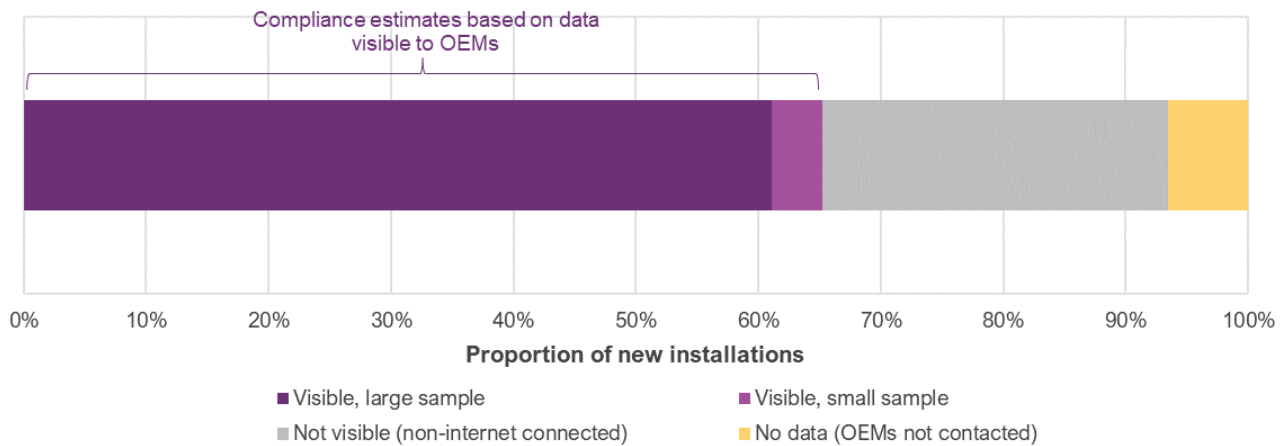
<sup>23</sup> AEMO (September 2024), *Technical Requirements for 200 kW to 5 MW DER connections*, Public consultation report, at [https://aemo.com.au/-/media/files/initiatives/engineering-framework/2024/aemo\\_technical-requirements-for-200kw-to-5mw-der-connections\\_sept-2024\\_final\\_.pdf?la=en](https://aemo.com.au/-/media/files/initiatives/engineering-framework/2024/aemo_technical-requirements-for-200kw-to-5mw-der-connections_sept-2024_final_.pdf?la=en).

<sup>24</sup> It is assumed that inverters retiring from December 2021 will be replaced with new inverters set correctly to the 2020 Standard at the same compliance rate observed for the fleet during that quarter (that is, compliance rates based on OEM data, as shown in Figure 1).

## 5 Datasets

One of the most important datasets for assessing compliance is the data on inverter settings applied in the field, which has been provided voluntarily by selected OEMs to date. There are currently no guidelines or obligations for OEMs to collect data on compliance of their product settings in the field, or to provide this data to external parties. OEM capabilities to collect and extract this data vary considerably. It is estimated that the OEM datasets used in this analysis represent around 65% of new installs, as shown in Figure 6, taking into account market share and approximate internet connectivity rates.

**Figure 6** Estimated visibility of the Q1&2 2024 inverter installations provided by OEM datasets



Overall, these OEM datasets have improved in quality since AEMO’s previous assessment<sup>25</sup>, with the majority of OEMs providing larger sample sizes and an increased number of OEMs providing regional information (such as postcode or state). However, all datasets continue to be provided in OEM-specific formats, with varying degrees of completeness. Further, OEMs have varied capabilities to extract data; some are able to automatically extract data for all online sites in Australia, whereas others require a list of serial numbers to extract data<sup>26</sup> and some rely on a manual extraction process.

Minimal data on DPV replacement rates is available. The DER Register will ideally provide this visibility going forward, however the DER Register has a number of data quality challenges including uneven regional coverage and poor data quality<sup>27</sup>.

<sup>25</sup> AEMO (Dec 2023) *Compliance of Distributed Energy Resources with Technical Settings: Update*, at [https://aemo.com.au/-/media/files/initiatives/der/2023/oem\\_compliance\\_report\\_2023.pdf?la=en](https://aemo.com.au/-/media/files/initiatives/der/2023/oem_compliance_report_2023.pdf?la=en).

<sup>26</sup> For some sites, AEMO can extract serial numbers from the DER Register to provide to OEMs. However, the DER Register has significant data quality issues that limit the number of sites where this can be successfully achieved.

<sup>27</sup> Observed issues with the DER Register include:

- uneven regional coverage (for instance in New South Wales around 10,000 were listed in the DER Register compared with 60,000 in the CER Register for the same period),
- poor serial number quality (approximately 35-55% of serial numbers for six OEMs not conforming with the standard format as advised by each OEM), and
- incorrect Standard information (where specific sites were able to be matched between the OEM provided data and DER Register, up to ~30% of sites in the DER Register did not contain a standard version (such as the 2020 Standard) consistent with that provided by the OEM.

## 6 Governance arrangements

High rates of compliance have been achieved following voluntary product menu and other improvements by OEMs in 2023. However, the process of working with OEMs and other stakeholders on these improvements has revealed significant gaps in the governance processes around assessing and managing compliance to CER technical performance standards. These gaps relate to the need for a clear definition and regulation of roles and responsibilities in monitoring, enforcing, and rectification of compliance to technical standards, both at point of install and ongoing. Specific activities that should be pursued include:

- recognising the crucial role and influence of OEMs in managing compliance, with clear guidelines and obligations defined,
- collection and provision of suitable datasets to monitor and assess compliance,
- managing firmware updates that can affect ongoing compliance with technical standards,.
- evaluating the testing and certification process for inverter products to ensure that testing laboratories interpret and satisfy the Standard specifications as intended, and certification processes more robustly confirm compliance,
- developing appropriate processes to address and enforce non-compliance with technical settings – the existing and available lever for DNSPs to disconnect the customer from the network is considered excessive and penalises the incorrect party (the customer), and
- improved installation accreditation frameworks that extend to power system security needs and capture the end-to-end installation process, including commissioning.

AEMO is engaging in the National CER Technical Regulatory Framework, Data Sharing Arrangements<sup>28</sup>, and Redefining Roles for Market and power system operations<sup>29</sup> workstreams as part of the National CER Roadmap<sup>30</sup>, aiming to address these gaps. These workstreams are focused on establishing a nationally consistent regulatory framework, enabling secure and coordinated data exchange, and clarifying roles and responsibilities across the ecosystem. AEMO sees these workstreams as the appropriate avenue to address the identified gaps in compliance governance.

In parallel, AEMO acknowledges the Government of Western Australia's DER Roadmap<sup>31</sup> is developing a DER Compliance Framework for the South West Interconnected System (SWIS), aimed at establishing DER device compliance mechanisms tailored to Western Australia's unique grid conditions, regulatory environment and existing linear contracting relationship between the Network Operator and Network User (Retailer) in the non-contestable market.

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<sup>28</sup> DCCEEW, National CER Roadmap – Data Sharing Arrangements (M2), at <https://app.converlens.com/climate-au/national-cer-roadmap-data-sharing-arrangements-m2>.

<sup>29</sup> DCCEEW, National CER Roadmap – Redefine roles for market and power system operations (M3/P5), at <https://app.converlens.com/climate-au/national-cer-roadmap-redefine-roles-m3-p5>.

<sup>30</sup> Energy and Climate Change Ministerial Council (ECMC) National CER Roadmap, at <https://www.energy.gov.au/sites/default/files/2024-07/national-consumer-energy-resources-roadmap.pdf>.

<sup>31</sup> Government of Western Australia, Distributed Energy Resources Roadmap, Third Progress Report, July 2024, Status of Actions, Table 2, Action 4, at [https://www.wa.gov.au/system/files/2024-07/248948epwaderrroadmap26\\_july.pdf](https://www.wa.gov.au/system/files/2024-07/248948epwaderrroadmap26_july.pdf).

# 7 Recommendations

There is a broad suite of recommended actions by various parties in the industry to maintain and improve compliance with the 2020 Standard. Detailed recommendations are outlined in Table 4, noting that progress is underway in a number of cases. AEMO is actively engaging with all the parties noted on these actions, and will continue to monitor compliance rates based on the datasets available.

**Table 4 Recommendations**

Key parties	Proposed actions
OEMs	<ul style="list-style-type: none"> <li>• <b>Implement 2024 amendments to AS/NZS4777.2:2020:</b> update product menus as detailed in the amendment as soon as possible, if not already done so, in line with the August 2025 requirement.</li> <li>• <b>Improve data:</b> <ul style="list-style-type: none"> <li>– Develop robust data systems that can be readily queried to provide ongoing assessment of compliance to the 2020 standard as well as individual 2020 standard settings.</li> <li>– Recommended fields include accurate and complete regional information (postcode/region), grid code/standard and settings, installation date (or first online date), inverter serial number, National Metering Identifier (NMI) where available, inverter model, firmware version, installer.</li> </ul> </li> <li>• <b>Continue to improve compliance where feasible:</b> <ul style="list-style-type: none"> <li>– Continue pursuing all available actions to maximise compliance rates for all new installs.</li> <li>– Where feasible, undertake remote updates to maximise compliance for all installs from December 2021 (when the 2020 standard became mandatory)</li> </ul> </li> </ul>
DNSPs	<ul style="list-style-type: none"> <li>• <b>Continue to develop conformance monitoring capabilities to assess and support ongoing compliance to Standard:</b> formalisation of conformance monitoring roles is being considered in the National CER Workstreams (as mentioned below). Other short-term activities could include developing: <ul style="list-style-type: none"> <li>– standard compliance reporting processes for new and existing installs such as identifying compliance through volt-var assessments,</li> <li>– dashboards to allow for frequent reporting, ideally including breakdowns by OEM and ideally by specific inverter models,</li> <li>– suitable cross-checks (for instance between smart meter and OEM datasets), and</li> <li>– close out processes that are underpinned by compliance checks and rectification pathways.</li> </ul> </li> <li>• <b>Remote inverter updates:</b> consider regulatory changes required in all regions in partnership with relevant regulatory bodies to govern remote inverter updates. Work with Standards bodies and industry to develop remote update use-cases and capability.</li> <li>• <b>Update technical standards:</b> as part of updating embedded generation technical standards to reflect AS/NZS4777.1:2024 changes (particularly regarding interface protection and disturbance withstand requirements), ensure governance arrangements assess and validate compliance.</li> </ul>

Key parties	Proposed actions
<p><b>AEMO &amp; DNSPs</b></p>	<ul style="list-style-type: none"> <li>• <b>Investigate 30 kW-5 MW disconnections:</b> investigate and address high rates of disconnection for 30-100 kW DPV and 100 kW-5 MW PVNSG systems.</li> <li>• <b>Develop technical performance requirements for 200 kW- 5 MW systems:</b> continue to collaborate on technical requirements, starting with DNSP adoption of AEMO’s guidelines<sup>A</sup> within their connection policy and practices.</li> <li>• <b>Improve visibility of 30 kW-30 MW systems:</b> establish appropriate operational visibility of the performance of these systems (may consider existing metering options and investigation of future options), collate standing data and develop suitable analysis tools to assess disturbance ride-through.</li> <li>• <b>Improve DER register data:</b> continue to work together<sup>B</sup> on improving the quality of new and existing DER Register data through improved data collection, cross-checking and validation, updating the DER Register guidelines to reflect the 2020 Standard and improve consistency between the guidelines and Application Programming Interface (API).</li> <li>• <b>Quantify replacement rates:</b> AEMO and DNSPs collaborate to develop improved estimates of replacement/retirement rates.</li> <li>• <b>Engage with Standards Australia relevant Technical Committees and industry:</b> <ul style="list-style-type: none"> <li>– <b>Improve inverter settings compliance through remote validation and update of settings:</b> standardise and map inverter parameters and functions to communication protocols (such as CSIP-Aus), to improve the pathways in which inverter settings data is accessed, collected, and in future rectified.</li> <li>– <b>Standardise test reporting (as part of AS/NZS4777.2):</b> develop a standardised test report format that all test labs are required to follow and provide. This could include specification of the methodology followed, results reporting structure and content. A clear and consistent reporting format could ensure that the test reporting assessment and approval can be correctly evaluated.</li> </ul> </li> </ul>
<p><b>CER Roadmap Workstreams (T.2, M.2, and M.3/P.5)<sup>C</sup></b></p>	<ul style="list-style-type: none"> <li>• <b>Data collection, provision, and use governance arrangements:</b> the governance arrangements around the collection and provision of data, and monitoring of data for the purpose of compliance assessment to technical standards (at both install and ongoing operation) and for the purpose of enforcement, should be considered.</li> <li>• <b>Device testing and certification:</b> the governance arrangements for device certification and testing should consider identified challenges with the existing certification process, and address issues around interpretation of testing, and clear guidelines on reporting and assessment.</li> <li>• <b>Installation, and commissioning governance arrangements:</b> the governance arrangements around the installation, commissioning, and point of sale of product should be extended to ensure compliance of devices to technical standards and technical settings.</li> <li>• <b>Clear roles and responsibilities for monitoring, assessing, and enforcing compliance:</b> clear roles and responsibilities for relevant parties in monitoring datasets, assessing compliance, and enforcing requirements to enhance regulatory oversight.</li> </ul>

A. AEMO is working closely with DNSPs to align the 200 kW to 5 MW connection standards with the minimum performance requirements needed to manage bulk power system risks; systems of this size are not currently addressed under AS 4777 or NER Chapter 5 technical standards. AEMO is seeking to publish guidelines in Q4 2025, incorporating technical feedback through ongoing engagement with DNSPs, and providing a first step towards nationally consistent requirements.

B. AEMO is engaging with the New South Wales “Smart Connect” project as a step towards improved DER Register data capture. More information is available at <https://arena.gov.au/knowledge-innovation/smart-connect-initiative/#:~:text=Smart%20Connect%20is%20focused%20on%20supporting%20industry%20collaboration,key%20activity%20or%20coordination%20gaps%20in%20these%20areas>.

C. T.2 refers to National regulatory framework for CER to enforce standards; M.2 refers to Data sharing arrangements to inform planning and enable future markets; M.3/P.5 refers to Redefining roles for market and power system operations.