

RULE

Australian Energy Market Commission

DRAFT RULE DETERMINATION

**NATIONAL ELECTRICITY AMENDMENT
(TECHNICAL STANDARDS FOR
DISTRIBUTED ENERGY RESOURCES)
RULE 2021**

**NATIONAL ENERGY RETAIL
AMENDMENT (TECHNICAL
STANDARDS FOR DISTRIBUTED
ENERGY RESOURCES) RULE 2021**

PROPONENT

AEMO

3 DECEMBER 2020

INQUIRIES

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ABOUT THE AEMC

The AEMC reports to the Council of Australian Governments (COAG) through the COAG Energy Council. We have two functions. We make and amend the national electricity, gas and energy retail rules and conduct independent reviews for the COAG Energy Council.

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SUMMARY

- 1 The Australian Energy Market Commission (Commission) has decided to make a more preferable draft rule to introduce technical standards that will enable distribution network service providers (DNSPs) and the Australian Energy Market Operator (AEMO) to better manage the growing number of micro-embedded generators connecting across the national electricity market (NEM).
- 2 In making this draft rule determination, the Commission recognises the importance of promptly addressing the concerns of AEMO and the Energy Security Board (ESB) regarding the impact that the significant growth in connections of distributed solar PV generation units is having on networks and the power system, particularly in the ability of DNSPs and AEMO to manage voltage disturbances.
- 3 The Commission's draft rule determination has been made in response to a rule change request from AEMO. It is one step in implementing the ESB's priority to integrate DER effectively into the NEM.

The draft rule

- 4 The key features of the more preferable draft rule are:
 - the creation of DER Technical Standards which embedded generating units connecting by way of a micro EG connection service must comply with
 - DER Technical Standards that include the requirements set out in both AS 4777.2:2015 and a new Schedule 5A.2 of the NER (which incorporates AEMO's short duration undervoltage response testing requirements)
 - a requirement that model standing offers for basic connection services for embedded generating units include that the embedded generating units the subject of the basic micro EG connection service must be compliant with the DER Technical Standards
 - an obligation on DNSPs that the information to be provided to connection applicants in order for them to negotiate a connection contract must include the requirement that if the connection applicant is proposing to connect an embedded generating unit by way of a basic micro EG connection service, that the micro embedded generating unit must be compliant with the requirements of the DER Technical Standards
 - a requirement that the minimum content requirements of connection offers under Schedule 5A.1 to the NER must include the requirement that if the connection applicant is proposing to connect an embedded generating unit by way of a basic micro EG connection service, that the embedded generating unit the subject of the connection application is compliant with the DER Technical Standards.
 - the DER Technical Standards will apply only to new connection and replacement inverters and connection alterations (including upgrade, extension, expansion or augmentation)
 - the rule will commence six months after it is made, to allow for the implementation of the new requirements

- transitional provisions have been included so that if before the commencement date of the rule:
 - a connection applicant in relation to a basic micro EG connection service has made a connection application but not received a connection offer, the new Chapter 5A will apply to that connection offer and connection contract
 - if a connection applicant in relation to a basic micro EG connection service has received a connection offer from the relevant DNSP but has not yet entered into a connection contract, the old Chapter 5A will apply to that connection offer and connection contract.

5 It should be noted that if Standards Australia releases the updated version of AS 4777.2 (that is, AS 4777.2:2020) before the publication of the final rule determination, then the Commission anticipates that the final rule will refer to AS 4777.2:2020 alone rather than AS 4777.2:2015 and the short duration undervoltage response testing requirements which are specified in the draft rule.

The rule change request

6 The rule change request submitted was prepared by the ESB and AEMO following a direction given by the COAG Energy Council in March 2020. In it, AEMO proposed the creation of a new obligation upon it to establish and maintain minimum technical standards for distributed energy resources (DER) in an instrument subordinate to the National Electricity Rules (NER). AEMO proposed that the initial minimum technical standard should encompass inverter performance and grid responsiveness; interoperability and communication interfaces; and cyber security measures.

7 The request also proposed the creation of a high-level definition of DER in the NER which would describe the DER devices that the proposed minimum technical standards would apply to. This descriptive definition included solar PV, batteries, electric vehicles as well as controllable loads such as air conditioners and hot water systems.

8 In addition, the rule change request sought that compliance with the initial technical standards be included as a requirement in the DNSP connection processes to ensure compliance of connected DER. It also proposed that the AER be required to develop a light-touch monitoring and compliance framework, primarily for the purpose of transparency.

9 While the focus of the rule change request was to make amendments to the NER, AEMO did suggest that the NERR may also require amending.

10 AEMO subsequently indicated that the focus of this rule change process should be on addressing DER capability to withstand power system disturbances.

Commission's response

11 The Commission has assessed whether AEMO's proposal would, or would be likely to, contribute to the achievement of the national electricity objective and the national energy retail objective. It has concluded that the changes to the NER made by the draft rule adequately address the immediate issues of concern identified by AEMO and stakeholders.

12 The following outlines the reasons for the Commission’s draft rule determination. Further details are set out in the relevant chapters of the draft rule determination.

Scope and duration of the standard

13 The Commission recognises the particular concern of the ESB, AEMO and other stakeholders that small scale solar generation is having a detrimental impact on the operation of some distribution networks and the power system when voltage disturbances occur.

14 Accordingly, the Commission has focused on addressing these immediate concerns. As a result, the draft rule establishes DER Technical Standards in regard to inverter performance and grid responsiveness. This is consistent with AEMO’s recent approach to DER technical standards set out in its consultation paper on the content of the initial standard.

15 The DER Technical Standards established by the draft rule comprise two components: the current Australian Standard AS 4777.2:2015; and AEMO’s short duration undervoltage response testing requirements. These standards will apply to new connections and replacements of inverters connecting micro-embedded generation within a distribution network.

16 The Commission considers that the more preferable draft rule is likely to better achieve the national electricity objective (NEO) than the proposal by AEMO because it:

- establishes technical standards that address the imminent system security threats to the power system
- uses an existing Australian Standard together with AEMO’s short duration undervoltage response testing requirements (both of which are already required by jurisdictional legislation for micro embedded generator connections in South Australia) to provide a cost effective and timely response
- utilises the existing framework for embedded generator connections in Chapter 5A of the NER, including the definitions of micro embedded generators and micro EG connection, which ensures that the draft rule applies to the small scale solar PV generators (who are currently the primary concern for the ESB and AEMO).

17 The scope of the DER Technical Standards is focused on addressing the immediate concerns arising from the growing use of DER. However, this does not prevent more extensive DER technical standards to develop in the future to address other important DER integration issues. The Commission has not placed any time limit on the life of the DER Technical Standards established by the draft rule, enabling the standards to evolve over time as needed.

Governance arrangements

18 The rule change request sought to amend the NER to require AEMO to establish and maintain DER minimum technical standards through an instrument subordinate to the NER.

19 The Commission has considered the merits of creating a new set of DER technical standards in a subordinate instrument against using existing Australian standards that have been produced using a well-recognised framework of stakeholder consultation, industry and

technical knowledge. It has found that establishing a new process may result in duplication and potentially inefficient costs borne by consumers. In addition, confusion and additional compliance costs for industry participants are likely to arise where there are differences between the requirements included in AS 4777.2 and the standards specified in a NER subordinate instrument. Further, creating a subordinate instrument would require a bespoke governance framework to also be created.

- 20 For these reasons, the draft rule has not created a subordinate instrument for AEMO to administer. Instead, the draft rule creates a definition of DER Technical Standards that incorporates the existing AS 4777.2 and the short duration undervoltage response testing requirements in the NER. Consequently, the AEMC will be the responsible body for any changes to the DER Technical Standards if the final rule is in the same form as the draft rule.
- 21 The Commission notes that a rule change request has been submitted by Dr Kerry Schott AO, Chair of the ESB, proposing arrangements for the long term governance of DER technical standards. The governance arrangements included in this draft rule do not limit consideration of other arrangements in the future.

Network connection agreements

- 22 AEMO proposed that the DER minimum technical standards be inserted into the minimum content requirements of connection contracts, negotiation frameworks and model standing offers, and into the model standing terms under Chapters 5 and 5A of the NER. It also suggested that the standard could be recognised in the model terms and conditions for deemed standard connection contracts prescribed in Schedule 2 to the NERR.
- 23 The Commission has determined that DNSPs should be obliged to ensure that connection applicants in relation to micro embedded generators should comply with the DER Technical Standards as defined in the NER. As a result, the draft rule requires DNSPs to include in their connection agreements made under Chapter 5A of the NER a requirement that all connections for micro embedded generation by way of a basic micro EG connection service must comply with the DER Technical Standards.
- 24 The Commission considers that these arrangements are consistent with the key intent of AEMO's proposed approach.

Compliance arrangements

- 25 The rule change request proposed that the initial technical standards be included as a requirement in the connection process to ensure compliance of connected DER. It also proposed that the AER develop a light-touch monitoring and compliance framework.
- 26 The draft rule includes new DER Technical Standards as part of the requirements for the connection of micro embedded generation. In doing so, this places an obligation on DNSPs to be satisfied that the connecting inverter meets the standard. As a result, device manufacturers and installers are obliged to show the DNSP that those requirements are met. These new arrangements are consistent with existing requirements under the NER that enable DNSPs to establish technical requirements for their networks and AEMO's proposed

approach.

- 27 However, the draft rule does not include AEMO's proposed light-touch monitoring and compliance framework for the AER. Instead, the Commission has concluded that the AER's existing compliance processes can be utilised. Placing the standard in the NER places an obligation on DNSPs to ensure the standard is met. This triggers the AER's existing capability to monitor and enforce this obligation.
- 28 In addition, the Commission acknowledges the existing compliance and monitoring systems under the Clean Energy Council and the Clean Energy Regulator, relating to the certification of products and installers of electricity generating systems. It considers these remain suitable and should continue to be used by industry. The Commission considers that this is consistent with achieving the NEO as this avoids imposing inefficient costs of a new, potentially duplicative compliance system on electricity consumers.

Implementation approach

- 29 The Commission recognises that there are a number of actions that must be undertaken by various parties, such as DNSPs and inverter manufacturers, to enable the DER Technical Standards to take effect. It also recognises the intent of the ESB and AEMO to address issues arising from the growth of small solar generation sector as promptly as possible.
- 30 The Commission has concluded that the new DER Technical Standards requirements should come into effect six months from the date the final rule is made. The Commission considers that this timeframe is achievable because it is reasonable to expect that relevant manufacturers are already progressing towards meeting the requirements of AS4777.2:2015 as well as the short duration undervoltage response testing requirements as they are already in place in South Australia.
- 31 The draft rule also includes transitional arrangements to clarify the compliance obligations of parties involved in a connection process at the time the rule comes into effect.

Next steps

- 32 The Commission invites submissions on this draft rule determination, including the more preferable draft rule and transitional arrangements, by 14 January 2021.
- 33 A final rule determination is expected to be published in February 2021.

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1 OVERVIEW OF AEMO'S RULE CHANGE REQUEST

On 5 May 2020, the Australian Energy Market Operator (AEMO) submitted a rule change request to the Australian Energy Market Commission (AEMC or the Commission) to make a rule to implement minimum technical standards for distributed energy resources (DER).

This chapter outlines:

- AEMO's rule change request
- the proposed solution and its expected outcomes
- an outline of other DER related work
- the rule making and consultation processes.

Details and copies of the rule change request may be found on the AEMC website at www.aemc.gov.au.

1.1 Rationale for the rule change request

AEMO's rule change request was prepared in co-operation with the Energy Security Board (ESB) as requested by the COAG Energy Council in March 2020. In the rule change request, AEMO stated that:¹

- There are gaps in current technical standards for DER, which are increasingly driving system risks to unmanageable sizes across the national electricity market (NEM).
- Without establishing minimum technical standards, especially given the exponential growth in DER, NEM system operation may be suboptimal; increasing the reliance on inefficient interventions to manage waning system security parameters such as voltage, thermal capacity, or inertia.
- Particular capabilities in DER minimum standards are critical and need to be brought in line with network connection frameworks, to more efficiently integrate DER into the grid.

According to AEMO, following the rapid growth in DER, particular system impacts at the distribution level are becoming increasingly complex and difficult to manage.² These issues also have the potential to impact on AEMO's core system operating duties, including system balancing, power system stability and recovery and restoration following major system events.³ AEMO recognised that DER does offer critical consumer benefits, both private and for the whole system, yielding rapid change in the generation of electricity toward a two-sided market. Nevertheless, the growing penetration of DER, particularly rooftop solar PV, can create critical system events like over-generation during the midday load profile.

In addition to these observations, AEMO argued that the current arrangements for DER technical standards setting, through voluntary industry, Australian, and International

1 AEMO, Rule change request, pp. 3-4.

2 AEMO, Rule change request, pp. 7-8.

3 AEMO, Rule change request, p. 2.

Standards has lagged in response to DER's uptake.⁴ It also noted that the uptake of these standards may not apply uniformly across the NEM. AEMO considered that this:⁵

current 'patchwork' approach to standards of DER connected to the NEM is not capable of delivering the consumer outcomes needed in the context of the rapid uptake of DER by consumers. It fails to deliver adequate support for power systems at a technical level and will inhibit the future development of markets and services in the NEM to provide benefit to consumers.

AEMO suggested that the minimum technical standard for DER should cover three technical performance capabilities to enable DER to integrate into the NEM and improve consumer value:⁶

- inverter performance and grid responsiveness
- interoperability and communication interfaces
- cyber security measures.

AEMO claimed that its proposed rule change, if made, could provide scope for addressing system operations issues such as minimum operational demand support for systems services through the key performance capabilities noted above. In AEMO's view, if the ability to set DER minimum technical standards is not incorporated into the NER, then growth in DER would necessarily be restrained, daily generation would be inefficiently curtailed, and risks of larger passive shut-downs — and in quite rare cases system black events — would be raised.⁷

In addition, AEMO considered that the creation of a subordinate instrument to establish the required minimum technical standards could address the gaps in current standards setting, provide flexibility and allow for easy updating.⁸ AEMO also proposed that it should be obliged under the National Electricity Rules (NER) to set the minimum technical standards, capabilities, and performance of emerging DER units through a requirement to make, publish and amend this new subordinate instrument. In its view, a rule change to this effect could create a capability for AEMO to monitor and control DER loads, particularly solar PV generation, in order to minimise system impacts to the transmission-distribution interface and maximise efficient integration.⁹

1.2 Solution proposed in the rule change request

AEMO proposed the following key components in its potential solution:

- an obligation on AEMO to make, publish and, if necessary, amend DER minimum technical standards that will be contained in a new subordinate instrument

⁴ AEMO, Rule change request, pp. 6, 11.

⁵ AEMO, Rule change request, p. 11.

⁶ AEMO subsequently indicated that the focus of this rule change process should be on addressing DER capability to withstand power system disturbance.

⁷ AEMO, Rule change request, pp. 7-8.

⁸ AEMO, Rule change request, p. 16.

⁹ AEMO, Rule change request, p. 19.

- that DNSPs ensure, through their connection agreements, that connecting DER meet the DER minimum technical standards
- establishing a high-level definition of DER in the NER.

These are discussed in more detail in this section. As explained below, AEMO has suggested that the new rules should enable the principles of uniformity, adaptivity, and complementarity in technical standards setting in order to minimise DER's negative impacts on system security.

The rule change request did not include a detailed proposed rule. However, it did include a high level description of a proposed amending rule and a high level description of its proposed changes.

1.2.1 **Creation of a subordinate instrument**

The rule change request seeks to amend the NER to require AEMO to establish and maintain DER minimum technical standards through an instrument subordinate to the NER. That is, an obligation on AEMO to create, publish, and amend DER minimum technical standards on an ongoing basis, building on existing state regulatory frameworks in standards and connection setting. In its view, the development of a subordinate instrument would allow for a direct and efficient process for setting standards.¹⁰

To achieve this outcome, AEMO proposed a new rule 3.7G of the NER titled "DER minimum technical standards" which would set out AEMO's obligation to make minimum technical standards. AEMO suggested that this new rule could also specify the purpose and requirements of the standards, and the considerations that it must have regard to when making the DER minimum technical standards.¹¹ In addition, AEMO proposed that new rule 3.7G of the NER also include definitions of relevant terms such as "DER device", "connected DER" and "DER minimum technical standards".¹²

AEMO considered that the amending rules and the creation of a subordinate instrument would allow it to:

- develop and publish an initial technical standard to be available with the new rules, if made.¹³
- introduce other minimum technical standards for DER over time, including the scope to incorporate relevant Australian and International Standards, where applicable
- review and update the standards on a 'needs basis' to allow response by AEMO to technological developments or critical system events, such as a cyber threat.

1.2.2 **Network connection agreements**

AEMO proposed that the NER obligate DNSPs to include the DER minimum technical standards into the terms and conditions of their relevant connection agreements with retail

¹⁰ AEMO, Rule change request, pp. 16, 18.

¹¹ AEMO, Rule change request, pp. 22-23.

¹² AEMO, Rule change request, p. 24.

¹³ AEMO noted in the request that it will undertake concurrent consultation with stakeholders to develop an initial standard focused on adverse under-voltage disconnections. AEMO, Rule change request, p. 17.

customers. This obligation would have a flow-on effect of binding manufacturers and installers of DER and DER devices to the minimum technical standards as compliance with the minimum technical standards would be a condition of connection.¹⁴

AEMO noted that consequential amendments to Chapters 5 and 5A of the NER may be required so that connection contracts entered into under these chapters incorporate the DER minimum technical standards set out in the subordinate instrument. AEMO suggested that such references in the NER refer to the DER minimum technical standards and any subsequent updates so that further AER approval of the connection agreements as a result of any updates would not be triggered.¹⁵ In addition, AEMO suggested that the AEMC consider if changes to the “model terms and conditions for deemed standard connection contracts” set out in Schedule 2 of the NERR would also be required.¹⁶

1.2.3

Definition of DER and connected DER

AEMO proposed that a high-level definition of DER, including its scope, be included in the NER in order to determine the coverage of the minimum technical standards. It suggested the following definition:¹⁷

The types of resources/assets including small and medium scale distributed generation (such as solar PV), energy storage (such as small and medium-scale batteries and electric vehicles that can deliver energy from the vehicle to the power system) and controllable loads (such as air conditioners, electric storage hot water systems, pool pumps, and electric vehicle supply equipment) that connect to the distribution system.

AEMO stated that the definition of DER needed to be general enough to not preclude emerging technologies while providing enough technical detail so the definition can capture current complexities. A DER definition would be included in connection agreement terms and conditions to establish compliance,¹⁸ and according to AEMO:¹⁹

In order to avoid overreach (i.e. inadvertently covering small ‘behind the meter’ appliances etc), AEMO should be required in the standard itself to specify the particular DER being covered

According to AEMO’s proposal the DER must also be newly connected or to be connected within a distribution network, and DER within a distribution network that has recently been upgraded, replaced or otherwise augmented, in order to be “connected DER” to which the standard will apply.²⁰

14 AEMO, Rule change request, p. 16.

15 AEMO, Rule change request, p. 25.

16 No further details were provided by AEMO on this issue. AEMO, Rule change request, p. 22.

17 AEMO, Rule change request, p. 22.

18 AEMO, Rule change request, p. 16.

19 AEMO, Rule change request, p. 23.

20 AEMO, Rule change request, p. 15.

1.2.4 Compliance arrangements

AEMO has also proposed that the NER should also require DNSPs to be responsible for the compliance of “connected DER” with the standards on an ongoing basis. It claimed that monitoring compliance at a distribution network level would create operational efficiencies.

In addition, on the basis that the technical standards be housed in a subordinate instrument, AEMO proposed that the new framework should require the Australian Energy Regulator (AER) to develop a light-touch monitoring and compliance framework, primarily for the purpose of transparency.²¹

1.3 Expected outcomes of the proposed solution

AEMO claimed that implementation of its proposed solution would produce the following outcomes:²²

- Setting minimum technical standards will eventually produce smoother NEM and distribution network operations, which could ultimately lower consumer costs.
- A more consistent performance baseline and predictability of DER could be established, leading to more efficient management of system security. This could include reducing the risk of over-generation in the middle of the day, providing certainty for minimum system service support, fewer disconnections from voltage disturbances, improving reliability, and mitigating the financial losses of consumers.
- Enabling competition by reducing potential consumer or manufacturing barriers to choice, while setting a common baseline of certainty for today’s market participants and future integrative grid developments, such as virtual power plants.

In its view, AEMO’s proposed solution would align DER performance with NEM system needs to maintain system security, balance supply and demand, keep consumer-led DER connected, and optimise the power system.²³

Importantly, AEMO has proposed that any technical standards established as a result of rules made under this rule change process will not apply retrospectively to current DER. Instead, any new requirements should only be applicable to assets that are newly connected, or DER within a distribution system that is newly augmented, upgraded, extended or replaced.²⁴ AEMO asserted that implementation of its proposal will facilitate customer choice and affordability in connecting DER while supporting the operation of the NEM.²⁵

AEMO has also suggested that amendments to the NER, if any, could create a device-level baseline of performance/capability through which market participants, such as DER manufacturers or aggregation services, could derive value from and develop on, essentially setting a consistent technical floor across the market.²⁶

21 AEMO suggested that this could be inserted into Chapter 3 of the NER. AEMO, Rule change request, p. 16.

22 AEMO, Rule change request, pp. 18-19.

23 AEMO, Rule change request, p. 18.

24 AEMO, Rule change request, p. 15.

25 AEMO, Rule change request, p. 18.

26 AEMO, Rule change request, p. 18.

In addition, by creating a subordinate instrument — as opposed to outlining minimum technical standards in the NER itself — the standards could promptly, directly, and efficiently be set and updated to respond to technological and operational necessities of DER, in a more effective and consultative way.²⁷

1.4 Other relevant work

Since receiving AEMO's rule change request on 5 May 2020, other projects and work programs relevant to this rule change process have progressed. These are outlined briefly below. Further details are located in Appendix C.

- Register of DER rule change

On 13 September 2018, the AEMC made a rule that established a process by which AEMO, network service providers and other parties may obtain static data on DER across the NEM. The rule provided that the information on DER would be held in a register established and maintained by AEMO. The purpose of this rule was to improve the visibility of DER to enable network service providers to plan and operate their networks more efficiently.

- Integration of DER rule change requests

In July 2020, the AEMC received three rule change requests that sought to better integrate DER into the NEM. These requests were from the Total Environment Centre and the Australian Council of Social Services; St Vincent de Paul Society of Victoria; and SA Power Networks. These rule change requests are currently being assessed by the Commission. A consultation paper was published on 30 July 2020 with submissions closing on 10 September 2020. The draft rule determination for these requests is expected to be published on 25 March 2021.

- AEMO's consultation on the initial DER technical standard

AEMO published its consultation paper on the content of the initial technical standard on 24 August 2020. In its consultation paper, AEMO focused the initial standard on DER inverter capability to withstand power system disturbances. While AEMO recognised that Standards Australia is currently revising the relevant standard (AS 4777.2) in relation to voltage ride-through, it recommended that its South Australian voltage disturbance ride-through (VDRT) testing procedure be included as an initial DER technical standard for the NEM. On 21 October 2020, AEMO informed stakeholders that it would reschedule the next stage of this process to better align with this current rule change process.

- Rule change request on governance for DER technical standards

On 21 September 2020 the ESB Chair Dr Kerry Schott AO, submitted a rule change request proposing new governance arrangements for DER technical standards under the NER and NERR. The AEMC has not yet initiated the rule change process for this request.

- South Australian regulatory changes for smarter homes.

²⁷ AEMO, Rule change request, p. 16.

From 28 September 2020, a package of regulatory changes to implement new technical standards to support the orderly transition and incentive structures for customers to be rewarded for managing their energy use took effect in South Australia. Relevant to this rule change process in particular, the new technical standard for generating systems connected via low voltage power inverters to the South Australian distribution network requires that the inverters meet ride-through standards as demonstrated by testing in accordance with testing standards in AS/NZS4777.2 and any applicable AEMO testing standard.

- Western Australia's DER roadmap

The DER roadmap set out by the Western Australian Energy Transformation Taskforce has set out the state's plans to transition the South West Interconnected System to optimise renewable, decentralised electricity generation and supply. A number of changes will be worked through over the five-year life of the roadmap, including changes on technical and functional requirements for DER inverters and greater transparency of DER within the electricity system.

1.5 The rule making process

On 25 June 2020, the Commission published a notice advising of its commencement of the rule making process and consultation in respect of the rule change request.²⁸ A consultation paper identifying specific issues of interest to the Commission was also published. Submissions closed on 23 July 2020.

The Commission received 27 submissions in response to the consultation paper. AEMC staff also held a number of meetings with stakeholders during this period. The Commission has considered all issues raised by stakeholders in making this draft rule determination. Issues raised in submissions are discussed and responded to throughout this draft rule determination. The issues that are not addressed in the body of this document are set out and addressed in Appendix A.

Subsequently, on 2 September 2020, the Commission extended the time to make a draft rule determination for this rule change request until 3 December 2020.²⁹ It considered that this extension was necessary due to the complexity of issues arising from stakeholder submissions.

1.6 Consultation on draft rule determination

The Commission invites submissions on this draft rule determination, including the more preferable draft rule and transitional arrangements, by 14 January 2020.

Any person or body may request that the Commission hold a hearing in relation to the draft rule determination. Any request for a hearing must be made in writing and must be received by the Commission no later than 10 December 2020.

²⁸ This notice was published under s. 95 of the National Electricity Law (NEL) and s. 251 of the National Energy Retail Law (NERL).

²⁹ This notice was published under s. 107 of the NEL and s. 266 of the NERL.

Submissions and requests for a hearing should quote project number ERC0301 and are to be lodged online at www.aemc.gov.au.

2 DRAFT RULE DETERMINATION

2.1 The Commission's draft rule determination

The Commission's draft rule determination is to make a more preferable draft rule. The more preferable draft rule addresses the urgent power system security issues identified by AEMO and stakeholders in relation to the increasing penetration of distributed solar PV generation across the NEM. This is achieved by requiring micro-embedded generators connecting to distribution networks to be compliant with the DER Technical Standards (AS 4777.2:2015 and AEMO's short duration undervoltage ride-through testing requirements).³⁰

The draft rule allows for an implementation time frame of six months and will apply to new connections or replacements of distribution network connected micro embedded inverter generating units. The Commission did not consider it necessary to mandate further compliance monitoring functions as sought by AEMO.

A description of the draft rule is provided in section 2.4 below. The Commission's key reasons for making this draft rule determination are set out in section 2.5.

This chapter outlines:

- the rule making test for changes to the NER and the NERR
- the more preferable rule test
- the assessment framework for considering the rule change request
- the Commission's consideration of the more preferable draft rule against the national electricity objective (NEO)
- the Commission's consideration in deciding whether to make a uniform or differential rule in accordance with the Northern Territory legislation adopting the NEL.³¹

Further information on the legal requirements for making this draft rule determination is set out in Appendix B.

2.2 Rule making test

2.2.1 Achieving the NEO and the NERO

Under the NEL the Commission may only make a rule if it is satisfied that the rule will, or is likely to, contribute to the achievement of the NEO.³²

The NEO is:³³

to promote efficient investment in, and efficient operation and use of, electricity services for the long term interests of consumers of electricity with respect to:

30 Should AS 4777.2:2020 be published before the final rule determination is made, the AEMC anticipates that it will update the relevant NER provisions to refer to the new standard without AEMO's short duration undervoltage ride-through testing requirements.

31 *National Electricity (Northern Territory)(National Uniform Legislation) Act 2015.*

32 Section 88 of the NEL.

33 Section 7 of the NEL.

- (a) price, quality, safety, reliability and security of supply of electricity; and
- (b) the reliability, safety and security of the national electricity system.

Under the NERL, the Commission may only make a rule if it is satisfied that the rule will, or is likely to, contribute to the achievement of the national energy retail objective (NERO).³⁴

The NERO is:³⁵

to promote efficient investment in, and efficient operation and use of, energy services for the long term interests of consumers of energy with respect to price, quality, safety, reliability and security of supply of energy.

The Commission must also, where relevant, satisfy itself that the rule is “compatible with the development and application of consumer protections for small customers, including (but not limited to) protections relating to hardship customers” (the “consumer protections test”).³⁶

Where the consumer protections test is relevant in the making of a rule, the Commission must be satisfied that both the NERO test and the consumer protections test have been met.³⁷ If the Commission is satisfied that one test, but not the other, has been met, the rule cannot be made.

There may be some overlap in the application of the two tests. For example, a rule that provides a new protection for small customers may also, but will not necessarily, promote the NERO.

2.2.2 Making a more preferable rule

Under s. 91A of the NEL, the Commission may make a rule that is different (including materially different) to a proposed rule (a more preferable rule) if it is satisfied that, having regard to the issue or issues raised in the rule change request, the more preferable rule will or is likely to better contribute to the achievement of the NEO.

In this instance, the Commission has made a more preferable rule. The reasons for this are outlined below in section 2.5 and in the following chapters.

2.2.3 Making a differential rule

Under the Northern Territory legislation adopting the NEL, the Commission may make a differential rule if, having regard to any relevant Ministerial Council of Energy statement of policy principles, a different rule will, or is likely to, better contribute to the achievement of the NEO than a uniform rule. A differential rule is a rule that:

- varies in its term as between:
 - the national electricity system, and

³⁴ Section 236(1) of the NERL.

³⁵ Section 13 of the NERL.

³⁶ Section 236(2)(b) of the NERL.

³⁷ That is, the legal tests set out in s. 236(1) and (2)(b) of the NERL.

- one or more, or all, of the Northern Territory's local electricity systems, or
 - does not have effect with respect to one or more of those systems
- but is not a jurisdictional derogation, participant derogation or rule that has effect with respect to an adoptive jurisdiction for the purpose of s. 91(8) of the NEL.

As the draft rule relates to parts of the NER that apply in the Northern Territory, the Commission has assessed the draft rule against additional elements required by the Northern Territory legislation.³⁸

In making the draft rule, the Commission has considered whether a uniform or differential rule should apply to the Northern Territory. The draft rule determination is to make a uniform rule because the provisions in the NER which are amended by the draft rule are the same in the Northern Territory version of the NER, and making a differential rule due to the different physical characteristics of the Northern Territory's network would not better achieve the NEO in this instance.

2.2.4 Application to Victoria

As indicated in AEMO's rule change request and the AEMC's consultation paper, amendments made to the NERR must be considered in light of Victoria having not adopted the National Energy Customer Framework in its jurisdiction. This is because amendments made to the NERR may not apply unless Victoria elects to make changes to its own jurisdictional instruments.

As the draft rule does not include amendments to the NERR, and the provisions in Chapter 5A of the NER that are amended by the draft rule apply unamended in Victoria, the draft rule is applicable to all NEM jurisdictions including Victoria.

2.3 Assessment framework

In assessing the rule change request against the NEO and NERO the Commission has considered the following principles:

- Efficient operation of the electricity system, considering if the proposed solution would reduce the probability of system security issues arising from the growing number of DER connections. In the context of minimum DER technical standards, the Commission has considered which issues are the most likely to cause imminent threats to system security.
- Efficient risk allocation, taking account of who is best placed to manage system security and reliability risk arising from an increasing number of DER connections. In general, it is desirable that the party that is allocated a risk has the incentive and ability to manage that risk because there is a clear link between that party's actions on the outcomes of the risk. For DER technical standards, it does not always seem clear that this can be

³⁸ From 1 July 2016, the NER, as amended from time to time, apply in the NT, subject to derogations set out in regulations made under the NT legislation adopting the NEL. Under those regulations, only certain parts of the NER have been adopted in the NT. (See the AEMC website for the NER that applies in the NT.) *National Electricity (Northern Territory) (National Uniform Legislation) Act 2015*.

achieved. For example, while interoperability may provide system security benefits, it is not clear that consumers are best placed to manage this risk.

- Regulatory burden, assessing the proposed additional regulatory burden directly imposed on consumers as well as that on device manufacturers, DNSPs and the AER related to the introduction of a minimum technical standard for DER which may have consequential costs for consumers. For the purpose of minimum DER technical standards, the Commission considered any additional costs, direct and indirect which would be imposed on consumers, manufacturers, installers, DNSPs and the AER.
- Governance, examining if appropriate governance structures are or can be put in place to support AEMO's proposed role in setting an interim minimum technical standard for DER. The Commission considered additional governance requirements if the new standard would be set in a subordinate instrument.

2.4 Outline of the draft rule

AEMO's rule change request proposed that amendments to the NER should be made to Chapters 5 and 5A. It also raised the possibility that amendments to the NERR may also be required to implement its objective.

In making this draft rule determination, the Commission has considered AEMO's proposed approach. It has concluded that to achieve the policy objective of addressing the immediate concerns arising from small scale rooftop solar generators, amendments to Chapter 5A of the NER (with transitional provisions in Chapter 11) are the only amendments to the NER that are required.

Amendments to Chapter 5 are not required because this chapter of the NER does not apply to embedded generators connected by way of a micro EG connection. In addition, the Commission has not found it necessary to make any amendments to the NERR because the model terms and conditions for deemed standard retail connection contracts are broad enough to capture the changes made to Chapter 5A of the NER in the draft rule.

The more preferable draft rule made by the Commission is attached to and published with this draft rule determination. The key features of the more preferable draft rule are:

- the creation of DER Technical Standards which embedded generating units connecting by way of a micro EG connection service must comply with
- DER Technical Standards that include the requirements set out in both AS 4777.2:2015 and a new Schedule 5A.2 of the NER (which incorporates AEMO's short duration undervoltage response test requirements)
- a requirement that model standing offers for basic connection services for embedded generating units include the requirement that the embedded generating units the subject of the basic micro EG connection service must be compliant with the DER Technical Standards
- an obligation on DNSPs that the information to be provided to connection applicants in order for them to negotiate a connection contract must include the requirement that if the connection applicant is proposing to connect an embedded generating unit by way of

- a basic micro EG connection service, that the micro embedded generating unit must be compliant with the requirements of the DER Technical Standards
- a requirement that the minimum content requirements of connection offers under Schedule 5A.1 to the NER must include the requirement that if the connection applicant is proposing to connect an embedded generating unit by way of a basic micro EG connection service, that the embedded generating unit the subject of the connection application is compliant with the DER Technical Standards.
 - the DER Technical Standards will apply only to new connection and replacement inverters and connection alterations (including upgrade, extension, expansion or augmentation)
 - the rule will commence six months after it is made, to allow for the implementation of the new requirements
 - transitional provisions have been included so that if before the commencement date of the rule:
 - a connection applicant in relation to a basic micro EG connection service has made a connection application but not received a connection offer, the new Chapter 5A will apply to that connection offer and connection contract
 - if a connection applicant in relation to a basic micro EG connection service has received a connection offer from the relevant DNSP but has not yet entered into a connection contract, the old Chapter 5A will apply to that connection offer and connection contract.

It should be noted that if Standards Australia releases the updated version of AS 4777.2 (that is, AS 4777.2:2020) before the publication of the final rule determination, then the Commission anticipates that the final rule will refer to AS 4777.2:2020 alone rather than AS 4777.2:2015 and the short duration undervoltage response test testing requirements which are specified in the draft rule. The publication of the final rule determination and the final rule, if made, is currently expected to be in February 2021.

Further detail on the more preferable draft rule can be found in the following chapters of this draft rule determination.

2.5 Summary of reasons

The Commission has considered the rule change request submitted by AEMO which proposed the creation of a subordinate instrument obligating it to set DER minimum technical standards and establishing a high-level definition of DER in the NER. While the focus of the rule change request was to make amendments to the NER, AEMO did suggest that the NERR may also require amending.

In making this draft rule determination, the Commission notes that AEMO has more recently indicated that, in its view, the focus of this rule change process should be on addressing DER capability to withstand power system disturbances.

The Commission has assessed whether AEMO's proposal would, or would be likely to, contribute to the achievement of the NEO and the NERO with regard to the assessment framework outlined above. It has concluded that changes to the NER adequately address the

issues identified by AEMO and stakeholders. In addition, the model terms and conditions for deemed standard connection contracts in Schedule 2 to the NERR are broad enough to capture the changes made to Chapter 5A of the NER. Therefore, the Commission has determined that changes to the NERR, and consideration of the NERO, are not required.

The draft rule represents one component of the ESB's work program to prioritise more effective integration of DER into the NEM.

The following outlines the reasons for the Commission's draft rule determination. Further details are set out in the following chapters.

Scope and duration of the initial standard

AEMO's rule change request proposed that the initial standard should encompass inverter performance and grid responsiveness; interoperability and communication interfaces; and cyber security measures. Of these, the Commission recognises the particular concern of the ESB, AEMO and other stakeholders that small scale solar generation is having a detrimental impact on the operation of some distribution networks and the NEM.

Accordingly, the Commission has focused on addressing these immediate concerns. As a result, the draft rule establishes DER Technical Standards in regard to inverter performance and grid responsiveness. This is consistent with AEMO's recent approach to DER technical standards set out in its consultation paper on the content of the initial standard.

The DER Technical Standards established by the draft rule comprise two components: the current Australian Standard AS 4777.2:2015; and AEMO's short duration undervoltage ride-through testing requirements. These will apply to new connections and replacements of inverters connecting micro-embedded generation within a distribution network.

The Commission considers that the more preferable draft rule is likely to better achieve the NEO than the proposal by AEMO. This is because having considered the nature of the imminent threats to the NEM, and recognising the urgency required in addressing these, it has concluded that it is unlikely to be consistent with the NEO if technical standards over and above what is currently required to address the urgent NEM-wide power system security issues are created. Other important DER integration issues can be addressed in the future.

In addition, using an existing Australian standard with AEMO's short duration undervoltage ride-through testing requirements is likely to be more cost effective and timely than establishing a set of new requirements with bespoke governance arrangements. This is because AS 4777.2:2015 has been produced using a well-recognised framework of stakeholder consultation, industry and technical knowledge. In addition, the short duration undervoltage ride-through testing requirements have already been implemented in South Australia.

The Commission has found that defining the DER Technical Standards as including AS4777.2 in the NER will address the immediate concerns arising from the increasing use of small rooftop solar generators, and that this does not require a broad definition of DER as proposed by AEMO.

Instead, the Commission has used the current NER definition of micro embedded generators. This would mean that in terms of the devices that are within scope of the standard, the draft rule applies the DER Technical Standards to inverters connecting solar PV generation units, as well as potentially batteries and electric vehicles.

The Commission considers that the use of the existing definition of micro embedded generator has benefits that are consistent with achieving the NEO. In particular, industry familiarity of the definition should assist with clarity in the application of the new rules, supporting successful compliance.

The scope of the DER Technical Standards is focused on enabling market participants to address their immediate concerns arising from the growing use of DER. More extensive DER technical standards can be developed in the future to address other issues as they arise.

The Commission has not placed any time limit on the life of the DER Technical Standards. It considers that it is appropriate to allow the standards to evolve over time as needed.

Governance arrangements

The rule change request sought to amend the NER to require AEMO to establish and maintain DER minimum technical standards through an instrument subordinate to the NER.

The Commission has considered the merits of creating a new set of DER technical standards against using existing Australian standards that have been produced using a well-recognised framework of stakeholder consultation, industry and technical knowledge. It has found that establishing a new process to establish technical standards may result in duplication and potentially inefficient costs borne by consumers. The Commission is of the view that this would not be likely to advance the NEO because it may result in technical standards over and above what is required to address NEM-wide power system security issues. In addition, confusion and additional compliance costs for industry participants are likely to arise where there are differences between the requirements included in AS 4777.2 and the standards specified in the NER subordinate instrument.

The Commission received substantial feedback from stakeholders that raised concerns about AEMO's proposal to create a subordinate instrument. The Commission considered that creating a subordinate instrument would require a bespoke governance framework to also be created. In contrast, if the standard is housed within the NER, this could be done quickly and would also establish the AEMC as the responsible body. In addition, the process to update the standards would utilise the existing AEMC rule change processes rather than create new processes.

This more preferable draft rule is likely to better achieve the NEO than the rule change request sought by AEMO because it achieves the overall outcome of creating an initial DER technical standard in a timely manner because no additional work on governance is required at this stage. This will likely result in imminent system security issues caused by DER connections to be addressed in a more timely manner than would otherwise have been possible.

The Commission notes that a rule change request has been submitted by Dr Kerry Schott AO, Chair of the ESB, to proposing arrangements for the long term governance of DER technical standards. The governance arrangements included in the draft rule do not limit consideration of other arrangements in the future.

Network connection agreements

AEMO proposed that the initial DER minimum technical standards be inserted into the minimum content requirements of connection contracts, negotiation frameworks and model standing offers, and into the model standing terms under Chapters 5 and 5A of the NER. It also suggested that the standard could be recognised in the deemed standard connection contracts prescribed in Schedule 2 to the NERR.

Under an approach where the DER Technical Standards are defined in the NER, the Commission has decided that DNSPs should also be obliged to ensure that connection applicants in relation to micro embedded generators should comply with the initial standard. As a result, the draft rule requires DNSPs to include in their connection agreements made under Chapter 5A of the NER a requirement that all connections for micro embedded generation by way of a basic micro EG connection service must comply with the DER technical standards.

As the draft rule only relates to the connection of micro embedded generation, only Chapter 5A and not Chapter 5 of the NER has been amended.

The Commission considers that these arrangements to establish DER Technical Standards in the NER are consistent with the key intent of AEMO's proposed approach. It expects that the draft rule, if made, would be consistent with achieving the NEO as it clearly establishes compliance with the technical standard at the point of connection. This is achieved efficiently through the use of existing processes DNSPs have in place for the connection of embedded generation and applies across all NEM jurisdictions and the Northern Territory.

Compliance arrangements

In its rule change request, AEMO proposed that the initial technical standards be included as a requirement in the connection process to ensure compliance of connected DER. It also proposed that the AER develop a light-touch monitoring and compliance framework, primarily for the purpose of transparency.

The draft rule includes new DER Technical Standards as part of the requirements for the connection of micro embedded generation. In doing so, this places an obligation on DNSPs to be satisfied that the connecting inverter meets the standard. As a result, device manufacturers and installers are obliged to show the DNSP that those requirements are met. These new arrangements are consistent with existing requirements under the NER that enable DNSPs to establish technical requirements for their networks as well as AEMO's proposed approach.

The Commission also considered AEMO's proposal to develop a light-touch monitoring and compliance framework for the AER. However, the draft rule does not include the proposed new framework. Instead, the Commission has concluded that existing compliance processes

can be utilised. Placing the standard in the NER creates an obligation on DNSPs to ensure the standard is met. This triggers the AER's existing capability to monitor and enforce this obligation.

In addition, the Commission acknowledges the existing compliance and monitoring systems under the Clean Energy Council and the Clean Energy Regulator, relating to the certification of products and installers of electricity generating systems. It considers these remain suitable and should continue to be used by industry. The Commission considers that this is consistent with achieving the NEO as this avoids imposing inefficient costs of a new, potentially duplicative compliance system on electricity consumers.

Implementation approach

The Commission recognises that there are a number of actions that must be undertaken by various parties, such as DNSPs and inverter manufacturers, to enable the initial DER Technical Standards to take effect. It also recognises the intent of the ESB and AEMO to address issues arising from the growth of small solar generation segment as promptly as possible.

The Commission has concluded that the requirements should come into effect six months from the date of the final rule is made. It considers that this timeframe is achievable as it is reasonable to expect that relevant manufacturers are already progressing towards meeting the requirements of AS 4777.2:2015 as well as the short duration undervoltage ride-through testing requirements. This is because these requirements are already in place in South Australia.

The draft rule also includes transitional arrangements as discussed in section 2.4 to clarify the compliance obligations of parties involved in a connection process at the time the rule comes into effect.

3 SCOPE AND DURATION OF THE STANDARD

This chapter sets out the problem that was considered by the Commission and its consideration of possible amendments to the NER and NERR to address this problem. In doing so, the Commission has considered the issues raised by AEMO in its rule change request as well as stakeholder submissions on the development of DER in the NEM. This includes consideration of the growth in consumer-led DER to date and how it can contribute to, or sometimes exacerbate, power quality issues in distribution networks.

This chapter also discusses the scope of a technical standard for DER. Specifically, the issues that could be best addressed by a technical standard as well as what particular DER devices or services would benefit from the requirement to comply with a standard. In relation to the technical matters, the Commission has concluded that the draft rule should focus on the current and urgent needs of managing power quality issues as this is the primary focus of AEMO's rule change request. Similarly, the draft rule applies only to micro embedded generating units.

This chapter also discusses the scope of a technical standard in terms of the duration, or term, of the standard. The Commission has determined that the technical standard can be enduring; it does not require an explicit end date but can be updated and amended in the future by amendments to the NER. The Commission does not consider it necessary to have the standard cease at a specific time, or to have a requirement in the NER that the standard be reviewed at some later date.

Finally, this chapter discusses AEMO's and stakeholders' views on the cost of implementing a technical standard for DER. The Commission is satisfied that the draft rule's implementation of the DER Technical Standards achieves the sought after benefits while minimising costs for industry participants and electricity consumers.

3.1 Growth, impact and urgency of DER in the NEM

3.1.1 AEMO's view

As set out in AEMO's rule change request, electricity users have adopted DER at a significant rate across Australia. However, AEMO has observed that this rapid introduction of these new technologies has begun to impact on its ability to operate the power system. AEMO's views on these issues are set out below.

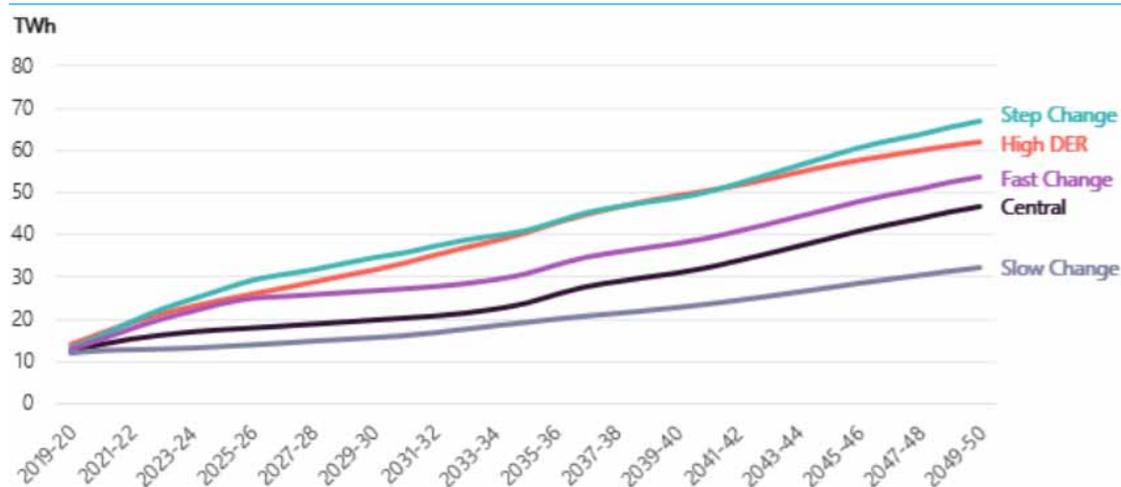
The growth of DER

Across Australia, households and small businesses are increasingly installing devices at their premises (such as rooftop solar generation, batteries and electric vehicles) and adopting behaviours (such as demand response and the use of energy management systems) in response to developments in the electricity market and concerns about climate change.³⁹

³⁹ Each of these, as well as air conditioners, pool pumps, and other behind-the-meter devices, can be described as being a form of DER.

The uptake of each particular form of DER has been growing and is expected to continue to do so for some time. However, it is the growth of rooftop solar generation that is regarded as being at the forefront of impacting the distribution networks and the operation of the broader power system.⁴⁰ This is indicated by the figure below from AEMO.

Figure 3.1: Distributed PV generation, 2019-2020 to 2049-2050



Source: AEMO, *2020 Integrated system plan*, July 2020, p. 41.

Note: Includes PV non-scheduled generation.

The impact of DER

In its rule change request, AEMO stated that DER can cause, or at least in specific instances exacerbate, power quality issues in some distribution networks that may also impact on the operation of the whole system.⁴¹ In terms of addressing these issues, some have been identified as more urgent than others.

AEMO has stated that the performance of these DER assets in aggregate can pose considerable risk to its ability to maintain key power system operational limits, like voltage and inertia, while also needing to operate under increasing uncertainty and variability.⁴² In particular, AEMO stated it can be difficult to balance generation across dispatch intervals in order to cater for uncertain DER performance, which can cause network reliability and security issues.⁴³ This can adversely affect the benefits that consumer-led DER may provide.

According to AEMO, the type of DER that can have the most impact is household distributed solar PV generation. To date, distributed solar generation on the low voltage network has tended to be of a passive nature. That is, it is not very controllable (nor often visible) by the relevant DNSP. As penetration of passive solar generation grows in distribution networks,

⁴⁰ AEMO reports that DER could provide up to 22 per cent of annual NEM electricity consumption in the future with much of this driven by the installation of rooftop solar generation. AEMO, *2020 Integrated system plan*, July 2020, p. 41.

⁴¹ AEMO, Rule change request, pp. 6-8.

⁴² *ibid.*

⁴³ *ibid.*

DNSPs experience greater difficulty in managing voltage in their networks. This in turn can impact on the distribution-transmission interface in the event a system disturbance or contingency event occurs.

Operating the power system with large penetrations of DER in some locations has major implications on the maintenance of system security and the ability for the system to return to a steady state following a contingency event.⁴⁴ Continued growth of passive distributed solar generation will, over time impact on AEMO's ability to manage the power system and balance load and generation.⁴⁵ AEMO has specified particular issues for the NEM arising from the growing proportion of DER generation in the power system that it would like to see addressed:⁴⁶

- **impact on AEMO's core power system operation** — Increased penetration of DER is impacting AEMO's core power system operating duties including system balancing, power system stability and recovery and restoration following major system events. In addition, due to identified risks associated with unmanaged and unnecessary disconnection of DER in response to system disturbances, in some regions the continued connection of rooftop solar PV is forecast to impact planning around contingency size. Without action, the largest contingency sizes will increase due to distributed solar PV generation disconnection following major system disturbances.
- **managing the system load profile** — This can be difficult where aggregate small solar generation depresses operational demand load (often referred to as the 'duck-curve') when demand for electricity is low and solar generation exports are high as it may lead to an underestimation of the evening ramp. It has been noted that this is exacerbated by the "invisibility" and the unpredictability of some DER assets.
- **system strength support through minimum operational demand** — Continued increases in rooftop solar PV generation may result in inefficient system demand in some regions to support the minimum levels of synchronous generation required to deliver power system services, such as inertia, frequency control or system strength, that are required to maintain power system security during normal operation. The limited availability of such services may also lower the resilience and the effectiveness of emergency control mechanisms available to AEMO.
- **responding to disturbance events** — As distributed solar PV generation penetration has continued to rise, in some regions (for example, South Australia, Western Australia and Queensland) limitations have begun to be reached in distribution networks related to managing voltage, thermal capacity and protection co-ordination. While DNSPs have successfully implemented a range of responses to manage this, impacts are beginning to occur at the transmission-distribution interface. During frequency or voltage disturbance, small solar generating units have acted in unison to disconnect from the power system when they should have remained connected. This has exacerbated the contingency

44 A contingency event is an event that affects the power system in a way which would likely involve the failure or sudden and unexpected removal from operational service of a generating unit or transmission element.

45 AEMO, *Renewable integration study stage 1 report, Appendix A: high penetrations of distributed solar PV*, April 2020, p. 14.

46 AEMO, Rule change request, pp. 2, 7-8.

event, and has required AEMO to acquire increased levels of frequency control ancillary services (FCAS) following transmission faults due to the potential for mass disconnection of distributed solar PV generation systems. The aggregate impact of this is significant for the safe and secure management of the power system, and because the size of this event is largely unknown or invisible, this can compound the risk of managing contingency events for AEMO. DER inverter responses to power system disturbances are an increasingly important factor in system recovery.

Urgency of managing DER's impact

Of the impacts on the power system noted above, a key focus for AEMO has been on responding to power system disturbance events, in particular the mass disconnection of small solar generators in response to frequency or voltage disturbances and the consequential exacerbation of the impact of the initial event.⁴⁷

AEMO has indicated that in some jurisdictions, particularly South Australia and Western Australia, managing power quality and system security under increasing uncertainty and variability inclusive of potentially higher fault rates, has reached urgent levels. In particular, it has stated:⁴⁸

AEMO has identified through analysis of recent power system events, that a proportion of distributed PV (DPV) disconnect in response to short duration transmission undervoltage disturbances. In South Australia (SA), possible contingency sizes associated with tripping of DPV following a credible fault is estimated to exceed 500 MW (on average approximately 100,000 residential rooftop PV systems) by the end of the year, and this will grow as more DPV is installed. If this eventuates, AEMO will have very few courses of action available for secure operation of South Australia if separated from the rest of the National Electricity Market (NEM). Load shedding and resulting customer disruption may be inevitable in response to credible faults, and cascading failure may be possible.

AEMO and the South Australian Government have worked together to put in place arrangements to address the issues with small solar PV generation response to undervoltage events in South Australia. However, the issue is also expected to soon apply to other locations in the NEM.⁴⁹ For this reason, AEMO has recommended that an undervoltage disturbance ride-through capability for inverters connecting to distribution networks be enforced across the NEM through a testing procedure. This is the key focus of this current rule change process and AEMO's consultation on the content of an initial technical standard for DER.⁵⁰

⁴⁷ AEMC, *Technical standards for DER*, consultation paper, 25 June 2020, pp. 7-9.

⁴⁸ AEMO, *Short duration undervoltage disturbance ride-through: inverter conformance test procedure for South Australia*, consultation paper, June 2020, p. 3.

⁴⁹ Instantaneous penetration of distributed solar generation was 31 per cent in Victoria and 30 per cent in Queensland in 2019. AEMO, *Renewable integration study: stage 1 report*, April 2020, p. 39.

⁵⁰ AEMO, *Initial distributed energy resource minimum technical standards*, issues paper, 24 August 2020, pp. 4-5.

3.1.2 Stakeholders' views

Stakeholder views on the growth of DER

In general, stakeholders recognised the growth in consumer-led uptake of DER, inclusive of the increasing penetration of generation and load behind-the-meter.⁵¹ In addition, stakeholders appreciated that the growth of DER across the NEM presents a new frontier of two-way energy flows, seldom nationally standardised, which can impact operation and augmentation of the energy system.⁵²

Stakeholder views on the impact of DER

Conversely, stakeholder views on the degree of impact that this growth in DER can cause were more varied. For example, Ausgrid stated that it 'understands' the concerns that AEMO raised that a high variable renewable energy world (that is, DER) can yield specific impacts worth of short-term actions in the immediate future.⁵³ Essential Energy stated that, under current and forecast levels of consumer-led DER, the operation of the system can be exposed to some risks which technical standards could help address.⁵⁴

Energy Queensland raised that these impacts, particularly with regard to voltage, thermal capacity, and protection coordination, rest with jurisdictional legislation that obligates the DNSP to manage them. Energy Queensland demonstrated that Energex and Ergon have effectively managed 3 GW of installed solar PV capacity, through compliance with Standards Australia's current relevant standard in their DNSPs' connection agreements.⁵⁵ Nevertheless, Energy Queensland also commented that:⁵⁶

It is accepted that DPV is beginning to cause issues at a system-wide level during the day time, and it is believed that electric vehicles and batteries may either help or hinder these issues, depending on tariff incentives and how they are controlled.

In addition to this, Dr Martin Gill agreed that there is a problem that 'some' inverters unfavourably disconnect in response minor disturbances in voltage, which can pose a cascading problem of unfavourable disconnections along the local network.⁵⁷

Stakeholder views on the urgency of managing DER

Some stakeholders held views on both the urgency of the impact of DER, and whether the creation of standards now, is the most apt solution. ARENA and Endeavour Energy opined that the growth and impact of DER does require short-term and immediate action, or else DER would be restrained and curtailed, or system security and frequency issues would persist.⁵⁸ However, ARENA also commented that the urgency of standardisation could in fact

51 AGL submission to the consultation paper, p. 1.

52 Intellihub submission to the consultation paper, p. 1.

53 Ausgrid submission to the consultation paper, p. 2.

54 Essential Energy submission to the consultation paper, p. 1.

55 Energy Queensland submission to the consultation paper, p. 3.

56 Energy Queensland submission to the consultation paper, p. 8.

57 Dr Martin Gill submission to the consultation paper, p. 4.

58 Submissions to the consultation paper: ARENA pp. 2-3; Endeavour Energy p. 3.

stunt innovation and growth of DER in the long run — a point similarly raised by ERM Power, who “[were] keen to avoid heavy-handed requirements... thereby inhibiting the uptake of DER among large energy users.”⁵⁹ Furthermore, ERM Power were not certain that heavy-handed or over-reaching standards would likely succeed in managing evening load peaks or utility scale solar’s contribution to the duck curve.⁶⁰

Dr Martin Gill commented that the urgency of managing DER in the proposed way was ‘not essential’ because an unquantified amount of inverters can meet the technical requirements AEMO proposed.⁶¹ Similarly, the Caravan & Camping Industry Association NSW expressed that implementing NEM-wide standards would create a duplication of work seeking to manage these issues, such as localised strategies at the DNSP-level or through the South Australian Smarter Homes policies.⁶² In these cases, some stakeholders found that the proposed solution to the issue was not urgently required, while others saw it as not very appropriate, due to the potential risks it could likely impose to regulatory burden or costs of new DER installations.

3.1.3

Commission’s assessment

The Commission recognises the large growth in consumer-led DER behind-the-meter, with 2020 already recording up to 1.5 GW of rooftop solar PV generation. This will continue to grow as consumers respond to jurisdictional incentives or look to capture the value of distributed energy resources, such as potential bill savings or from consuming less emissions intensive generation. By 2040, AEMO has estimated “that 13% to 22% of total underlying annual NEM energy consumption” could be provided by DER across the NEM.⁶³ The Commission considers that the growing use of solar PV generation does provide a range of benefits, as identified by AEMO and other stakeholders as noted above. This is particularly so if consumers integrate their DER assets with the local low voltage network, including providing benefits to non-DER consumers in the form of lower overall total system costs.

Nevertheless, the Commission also recognises that DER is one potential contributing factor to network security issues in terms of voltage management. As noted by some stakeholders, grid voltage, as a dynamic range, is relatively high regardless of the local DER penetration. As a result, when solar generation connects to a distribution network and subsequently exports at a higher voltage than the receiving line, it can add to the variability of the dynamic range. If overvoltage was to occur on a DNSP’s feeder, for instance at a time of peak generation but lower relative demand, this could lead to curtailment of exporting DER generation. This behaviour indicates that DER, particularly solar PV generators, are contributing to the greater difficulty in managing voltage in the distribution networks that is being experienced in some locations.⁶⁴

59 Submissions to the consultation paper: ARENA pp. 2-3; ERM Power p. 3.

60 ERM Power submission to the consultation paper, p. 2.

61 Dr Martin Gill submission to the consultation paper, p. 6

62 Caravan & Camping Industry Association NSW submission to the consultation paper, p. 2.

63 AEMO, *2020 Integrated system plan*, July 2020, p. 41.

64 AGL submission to the consultation paper, p. 4. Also see: University of New South Wales, *LV Voltage Report*, May 2020.

The Commission also recognises that the growth in DER to date has, or may have, contributed to power quality issues in the aggregate. Most notably, the large growth of passive rooftop solar PV generation to date appears to have exacerbated some operational issues like the 'duck curve'.⁶⁵ Furthermore, faults, for instance short duration undervoltage events, are now being similarly compounded in some locations by passive inverter based DER as they do not respond to such events appropriately.

At the same time, while the volume of DER installed is understood to be significant and growing, there is limited visibility for a number of DNSPs and AEMO due to a low penetration of advanced meters or network devices which capture voltage and current between the meter and substations upstream to the transmission network connection point. In addition, there is a lack of specifications to realise the needed visibility of DER. The Commission considers that this lack of sufficient information about DER operations has created a divergence between realising the significant benefits of DER and the ability to manage its impacts on networks and on the whole power system efficiently.

The Commission recognises that managing the high growth and potential benefits of DER (particularly small scale solar generation) with the potential for negative network and system impacts can be addressed a multitude of ways. Most notably, as stakeholders have commented, the balance between price signals and off-market solutions is crucial for capturing benefits at least possible cost. Stakeholders have provided examples of both market incentives and alternative forms of technical regulation that could be used.

The Commission acknowledges that the growth of DER, particularly small scale solar generation, over recent years has been significant and is still expected to continue at pace. It also notes the benefits that owners of DER have been able to capture as well as benefits that can flow through to other electricity users. Nevertheless, some negative impacts of high DER use have begun to emerge in some locations in the power system as technical difficulties in operating networks become exacerbated under certain conditions. Mandating technical requirements will not always be the most appropriate response to issues relating to the use of DER. However, the Commission has concluded that the specification of certain technical requirements are an appropriate response for the issue of particular concern for this rule change process — that of high penetration of (often passive) small scale solar generators impacting on the ability of DNSPs and AEMO to manage voltage disturbances.

3.2

Technical scope of the standard

3.2.1

AEMO's view

AEMO's rule change request proposed that the content of the initial technical standard should reflect the important and urgent needs of the power system, both currently and what would be reasonably required in the future. This included:

- **Inverter performance and grid responsiveness:** Given the behaviour of individual DER assets, but particularly solar PV generation in the aggregate, AEMO has proposed

⁶⁵ Utility scale inverter based generation, which has begun to displace retiring synchronous generation, may also contribute to these power quality issues at a whole of system level. However, the focus of this rule change request is on DER assets

that select capabilities of Australian specific standards be adopted and nationally mandated. The initial specifications proposed include AS 4777.2:2015 (the current standard), which requires an autonomous response to voltage variations, among a raft of other inverter capabilities. AEMO proposed this requirement because without a baseline or default inverter setting a system disturbance event can be exacerbated if, for example, inverters trip off.⁶⁶

- **Interoperability and communication interfaces:** AEMO proposed that nationally consistent interoperability requirements should also form part of the initial technical standard. It was proposed this would include standards like AS 4755, as well as communication interfaces for data exchange, coordination, and control of DER assets. AEMO considered these requirements necessary to further integrate DER.⁶⁷
- **Cyber security measures:** Noting the increasing digitisation of the energy system, especially of DER and the use of cloud data storage, AEMO claimed that there is a need to prevent threats of cyber attack. Currently, there is no device level cyber security standard for the NEM. This, in AEMO's view, decreases the perceived reliability of the system, as well as the security of DER customers and their data.⁶⁸ Accordingly, AEMO proposed that the initial technical requirements for DER should include cyber security measures to future proof the NEM and protect consumers' data.

In its rule change request, AEMO also commented on the trade off between achieving inverter performance and grid responsiveness, and to a lesser extent interoperability and communications outcomes, through a market services approach compared to using a standard. AEMO stated:⁶⁹

The benefit of minimum standards is that they can provide a uniform technical foundation for DER markets to develop more efficiently and enable full-service offerings to be valued by the market.

In this way, AEMO is of the view that setting minimum technical requirements of DER does not preclude the additional development of market services or innovations. Rather, using a standard creates a technical floor which customers can rely on and make investment decisions around going forward in addition to having a base level of performance and response for DNSPs and AEMO to rely on.⁷⁰

AEMO subsequently commenced a consultation process on the content of the initial technical standard. The consultation paper was published on 24 August 2020; it indicated that AEMO's focus on the content of the initial minimum technical standard had narrowed to inverter performance and grid responsiveness standards. Interoperability and communication interfaces, and cyber security standards would continue to be developed as soon as

66 AEMO, Rule change request, pp. 11-12.

67 AEMO, Rule change request, p. 12.

68 AEMO, Rule change request, p. 13.

69 AEMO, Rule change request, p. 13.

70 AEMO, Rule change request, p. 13.

practicable through a separate process, “as [the standards] are not sufficiently well prepared.”⁷¹

3.2.2

Stakeholder views

The majority of stakeholders considered that the technical outcomes, specifically with regard to the content and subsequent requirements for DER, should be specified by the NER. Stakeholder responses covered the different aspects of technical details proposed by AEMO, including standards of inverter performance and grid responsiveness, interoperability and communication interfaces, and cyber security measures as detailed below.

Inverter performance and grid responsiveness

Firstly, there was broad support for standards to be put in place regarding inverter performance and grid responsiveness from stakeholders as this aspect was recognised as having a significant degree of importance and/or urgency.⁷² Submissions from ENA, SAPN, and Jemena expressed the view that this rule change should be expressly limited to address the immediate shortcomings of the AS 4777.2 ride through capabilities by amendments made to the NER.⁷³

Interoperability and communications interfaces

Secondly, and conversely, stakeholders were generally less supportive of interoperability and communications requirements being part of new minimum technical standards for DER as proposed by AEMO. For example, Dr Martin Gill commented that mandating communications standards was “unnecessarily expensive”, while the AER considered that implementing interoperability standards before system risks had eventuated NEM wide could be unnecessary.⁷⁴

Nevertheless, some stakeholders did recognise the importance of interoperability and communications for the longer term, suggesting that these issues could be considered later.⁷⁵

Energy Queensland stated that DNSPs should still have their own standards which could include interoperability.⁷⁶

Cyber security

Finally, stakeholders were much less supportive of AEMO’s proposal to include cyber security standards in the minimum technical standards for DER. The South Australian Department for Energy and Mining noted the importance of future cyber security provisions in an ever digitising NEM, yet did not support the enforcement of these provisions as proposed.⁷⁷ This

⁷¹ AEMO, *Initial distributed energy resource minimum technical standards*, issues paper, 24 August 2020, p. 7.

⁷² Submissions to the consultation paper: ARENA, p. 4; Ausgrid, p. 7; Endeavour Energy, p. 3; ENA, p. 4. Jemena, p. 2; Red Energy and Lumo Energy, p. 3; Reposit Power, pp. 4-5; SAPN, p. 5; Tesla, p. 3.

⁷³ Submissions to the consultation paper: ENA, p. 4; SAPN, p. 5; Jemena, p. 5.

⁷⁴ Submissions to the consultation paper: Dr Martin Gill, p. 3. AER, p. 2.

⁷⁵ Submissions to the consultation paper: Jemena, p. 5; Ausgrid, p. 8; SAPN, p. 5, CEC, p. 3.

⁷⁶ Energy Queensland submission to the consultation paper, p. 9.

⁷⁷ South Australian Department for Energy and Mining submission to the consultation paper, p. 3.

sentiment was expressed by other stakeholders who were concerned about shifting responsibility for determining these standards from existing instruments, like the Cyber Security Centre or the Cybersecurity Capability Maturity Model, for example, to an AEMO instrument.⁷⁸

In contrast, the AER and Wattwatchers, and to a lesser extent EnergyAustralia and the CEC, supported AEMO undertaking and implementing cyber security standards as proposed.⁷⁹

3.2.3

Commission's assessment

With regard to the technical scope of the standard, the Commission has considered the development of DER in the NEM and stakeholders' views, as well as AEMO's position in its consultation paper on the content of the initial minimum technical standard.

The Commission has determined that the DER Technical Standard's scope ought to focus on inverter performance and grid responsiveness only. It is satisfied that this aspect of the proposed technical requirements for DER is urgent and should be addressed promptly. While South Australia has addressed the issue through its own jurisdictional mechanism, the potential for the issue to arise in other jurisdictions in the near future indicates that it is important to take action now. It is also satisfied that an appropriate response is setting the needed technical requirements through a standard to apply across the NEM. The Commission considers this approach is consistent with the NEO as it enables a timely, cost-efficient mechanism suitable to the scope of the issue.

Similar to many stakeholders, the Commission considers that the other technical requirements identified in the rule change request do not require urgent attention in the same way as inverter performance and grid responsiveness. This is consistent with AEMO's current approach as noted above. These issues are important and appropriate responses to concerns about interoperability and communications, and cyber security (including options other than mandating standards across the industry) should be considered by all relevant parties promptly to enable timely implementation to support the integration of DER in the NEM.

The technical scope of the DER Technical Standards will be that set out in Standards Australia's AS 4777.2:2015 *Grid connection of energy systems via inverters — inverter requirements* in its entirety. For the avoidance of doubt, the text and content of AS 4777.2:2015 will not be replicated in the NER or otherwise in a subordinate instrument. Instead, the Commission will create an obligation for compliance with the standard by way of reference in the NER. This approach has the benefit of preventing divergence between the requirements relevant in the NEM and the industry standard set out in AS 4777.2.

The DER Technical Standards will only apply to assets connected after the implementation of the final rule or when the assets themselves are upgraded, extended, or replaced. The Commission acknowledges that not extending the requirements to existing devices does limit the immediate impact of making the rule, as identified by a number of stakeholders.

⁷⁸ Submissions to the consultation paper: Reposit Power, p. 1; Energy Queensland, pp. 9-10.

⁷⁹ Submissions to the consultation paper: AER, p. 2; Wattwatchers, pp. 2-3; EnergyAustralia, pp. 2, 7; CEC, p. 2.

However, the application of new technical requirements on existing devices is significantly more complex and costly.

Standards Australia’s AS 4777.2:2015

The current national standard which establishes the appropriate inverter performance and grid responsiveness capabilities is Standards Australia’s AS 4777.2:2015. This standard describes the technical requirements and associated testing for low voltage inverters to be able to safely and efficiently deliver electrical power to the grid. Of particular interest to this rule change process is clause 7.4 of the standard, which states that an inverter device should automatically disconnect in line with passive anti-islanding specifications of undervoltage and overvoltage protection. The particulars are set out in the table below:

Table 3.1: Passive anti-islanding set-point values

PROTECTIVE FUNCTION	PROTECTIVE LIMIT	TRIP DELAY	MAXIMUM DISCONNECT TIME
undervoltage	180 volts	1 second	2 seconds
overvoltage	260V	1 second	2 seconds
overvoltage	265V	—	0.2 seconds

Source: Standards Australia, *AS 4777.2:2015 Grid connection of energy systems via inverters Inverter requirements*, October 2015. p. 29, Table 13.

However, the current standard does not include a testing procedure for the above protective function, which would be used to certify the compliance of the asset’s behaviour with the standard. As a result of no established testing regime, there is an undefined number of existing inverters in the NEM which can meet this capability.⁸⁰

AEMO’s short duration undervoltage response testing requirements

To meet the omission of a testing procedure required to comply with the current standard, AEMO has sought to develop testing requirements to enable parties to demonstrate compliance with the protective function of the passive anti-islanding set-point values. As outlined in AEMO’s consultation on the content of the initial standard, it proposed to incorporate a NEM wide short duration undervoltage response procedure along with the current standard AS 4777.2:2015 in its initial technical standard.⁸¹ This proposed testing procedure is largely the same as the testing procedure AEMO developed recently for South Australia.⁸² The differences are relatively minor and reflect applying the requirements to the entire NEM rather than only South Australia.

⁸⁰ Importantly, the revised standard AS 4777.2:2020 corrects for the omission of the test procedure and builds on the technical parameters detailed in the current standard.

⁸¹ AEMO, *Initial distributed energy resource minimum technical standard*, issues paper, 24 August 2020, pp. 4-5.

⁸² This was included in the South Australian regulatory changes for smarter homes that took effect on 28 September 2020.

In addition, AEMO made amendments to the testing requirements from the version it first published for consultation on 5 June 2020.⁸³ The amendments have been made in response to stakeholder feedback provided to AEMO as part of that consultation process.

The Commission's draft rule creates a definition of DER Technical Standards which includes the requirements of both AS 4777.2:2015 and the latest version of AEMO's short duration undervoltage response testing requirements as referred to above. For the avoidance of doubt, the short duration undervoltage response requirements, including the mandatory settings tables in new Schedule 5A.2 to the NER, are to be applied during testing of the devices only.

To confirm inverters' compliance with the current standard, as referenced in the NER, the short duration undervoltage response testing requirements set out in the NER should be used to determine the performance of the asset. Satisfying these requirements will be relevant for new inverters that are to be connected to a distribution network or existing devices that undergo part replacement, upgrade, extension, expansion or augmentation.

3.3 Devices to be covered by the standard

3.3.1 AEMO's view

In the rule change request, AEMO proposed that the initial technical standard would apply to the DER devices included in its proposed definition of DER. That is:⁸⁴

The types of resources/assets including small and medium scale distributed generation (such as solar PV), energy storage (such as small and medium-scale batteries and electric vehicles that can deliver energy from vehicle to the power system) and controllable loads (such as air conditioners, electric storage hot water systems, pool pumps, and electric vehicle supply equipment) that connect to the distribution system.

AEMO stated that the scope of this definition is intended to capture minimum requirements for connected DER (new and replacements) and DER devices including the inverters, demand response enabled devices, smart meters, gateway and other equivalent devices that determine or influence DER response to grid conditions and/or control instruction/commands.⁸⁵

In addition, AEMO proposed that only new and replacement devices would be covered, the requirements would not apply retrospectively to existing DER devices.⁸⁶

3.3.2 Stakeholders' views

Stakeholders provided numerous comments in regard to what devices should be covered by the proposed technical standards. These are outlined in the table below.

⁸³ See: <https://aemo.com.au/en/consultations/current-and-closed-consultations/short-duration-undervoltage-disturbance-ride-through-test-procedure>

⁸⁴ AEMO, Rule change request, p. 22.

⁸⁵ *ibid.*

⁸⁶ AEMO, Rule change request, p. 15.

Table 3.2: Stakeholders' views on what devices should be covered by a standard

STAKEHOLDER VIEWS ON OUTCOMES AND SERVICES	STAKEHOLDER VIEWS ON DEVICES
AGL stated that the technical standard should "consider the nature of the services provided" as a means to DER integration, instead of device centric integration (p. 3).	AGL asserted that self-consumption specific DER should not be covered by the DER Technical Standard (p. 3).
ARENA suggested that market-based approaches, inclusive of incentives to contribute to power system security, should not be "lost in the consideration of technical standards" (p. 3).	ARENA suggested that the standard recognise a full range of technologies, such as large scale and small scale generating inverters, especially for these to withstand short-term voltage disturbances. In addition, the definition should align with the DER register (pp. 1, 4).
Plus ES considered that outcomes should be the focus, as well as solution agnostic. In addition, developing a standard on current technical solutions could discourage innovative solutions (p. 3).	Plus ES stated that "[the standard] should apply to any devices which can provide measurement and/or control of electrical power flowing through that device" except where power and control capabilities should be separate (p. 3).
Tesla considered that market interaction with DER and standards should be "fully technology agnostic", more focused on removing barriers to entry (p. 8).	Tesla stated that it did not support a definition of DER that included or excluded systems from different markets and services (p. 7).
Energy Queensland opined that consideration on customers' value of controllable load and giving control of load should be made with price signals (p. 8).	Energy Queensland commented that exempt generation (>200 kW, <5 MW) poses particular risks to power quality and impact the system which could be considered under the technical standard (p. 8).
Intellihub stated that standards should, under best endeavours, specify outcomes at the connection point not technology centric solutions for individual devices, like generator performance standards (p. 4).	Solar Analytics stated that "[the standard] should include all large loads including hot water and air conditioners" (p. 2).
Wattwatchers considered that describing the nature of services rather than describing devices that can provide services would likely better integrate DER with future market services (p. 3).	
The AER did not object to the proposed definition of DER, but noted the risks of	

STAKEHOLDER VIEWS ON OUTCOMES AND SERVICES	STAKEHOLDER VIEWS ON DEVICES
creating a definition when technology is evolving rapidly. It urged that any definition should be capable of extension to new technologies that may become available (p. 3).	
AEMO noted that, while its rule change request could progress without a definition of DER, as technical standards typically set out technical requirements for assets such as electrical equipment, plant and devices, a definition that refers to assets may be more suitable than one that focuses on services (p. 4).	
Vector supported a high-level definition of DER based on service standards of service levels, rather than on minimum technical standards or specifications. This is on the basis that standards may limit the potential for innovation by narrowing the potential outputs that technologies are able to deliver (p. 5).	

Source: Submissions to the consultation paper.

Other stakeholders, while acknowledging it is appropriate to consider the type of service or function that a DER device provides, considered that a definition of DER in the NER was not necessary.⁸⁷

Jemena commented that the standard does not need to apply to all DER but rather the device which controls the DER between the grid.⁸⁸ Ausgrid observed that the NER currently has definitions for small generating units and different classifications of embedded generators in Chapter 5A, including micro embedded generators as defined by the scope of AS 4777. In its view, these definitions could be used to cover the minimum technical standards required for the major area of concern such as the voltage disturbance ride through capability of inverter energy systems.⁸⁹

⁸⁷ Submissions to the consultation paper: Reposit, p. 2; Jemena, p. 2; Ausgrid, p. 4; ENA, p. 4.

⁸⁸ Jemena submission to consultation paper, pp. 4-5.

⁸⁹ Ausgrid submission to consultation paper, p. 7.

3.3.3

Commission's assessment

The Commission's draft rule applies the DER Technical Standards to new connections and replacements of inverters connecting micro-embedded generation within a distribution network. Micro-embedded generation connection as defined in Chapter 5A of the NER includes the connection of an embedded generating unit of the kind contemplated by Australian Standard AS 4777 (Grid connection of energy systems via inverters) currently up to 200kVA and a distribution network.⁹⁰ The DER Technical Standards will not apply to existing installed equipment.

As the intent of the draft rule is primarily to address the potential impacts that household (or small) solar PV generation has on the grid, the Commission considers it appropriate that the requirement to meet the DER Technical Standard should be focused on solar PV systems connected via an inverter to a distribution network. As previously noted, such systems are treated as micro-embedded generating units under existing rules.⁹¹ While the term micro-embedded generation covers solar PV inverters it may also be applicable to other devices such as residential batteries and electric vehicles. As these devices are also capable of generating energy that can be exported to the distribution network, the Commission considers that where batteries and electric vehicles do use a basic micro EG connection service, then there is no reason to exclude these inverters from the requirements of the DER Technical Standards.

The Commission considers that using the term micro embedded generator is appropriate to determine the devices to which the DER Technical Standards will apply. It considers this a more preferable approach than developing a new definition of DER as proposed by AEMO. This is because using micro embedded generators as the basis for the devices that the DER Technical Standards will apply to best addresses the particular immediate issues to be resolved by this rule change process. In addition, it does not unnecessarily confine the development of DER or the future scope of the DER Technical Standards in the Australian electricity system.

Further, the Commission considers that the class of asset that is most relevant to the key issue raised (inverter performance and grid responsiveness) in the rule change request is micro embedded generation.

As a result, the draft rule utilises the existing definitions in the NER, forgoing the need to create a new definition of broader "connected DER". The local definition in Chapter 5A of the NER of *micro embedded generator* is:

means a retail customer who operates, or proposes to operate, an embedded generating unit for which a micro EG connection is appropriate.

Where an *embedded generating unit* is defined in Chapter 10 as:

A generating unit connected within a distribution network and not having direct access

⁹⁰ ENA, *Distributed energy resources grid connection guidelines*, May 2018, p. 2.

⁹¹ NER clause 5A.A.1.

to the *transmission network*.

And where a *micro EG connection* is defined in Chapter 5A as:

a *connection between an embedded generating unit and a distribution network of the kind contemplated by Australian Standard AS 4777 (Grid connection of energy systems via inverters)*

The Commission has determined that these definitions sufficiently cover the DER assets which can contribute to power quality issues on low voltage distribution networks. The already defined term of *micro embedded generator* precludes any generation with a nameplate capacity above 30kVA and an export limit of 10kW per phase. Applying the DER Technical Standard to new connection and replacement devices' inverters and connection alterations (including upgrade, extension, expansion or augmentation) devices is consistent with the purpose of the current Australian Standard for low voltage inverters that deliver electrical power to the grid.

In this way, the Commission finds that utilising an already defined and recognised type of asset best specifies the technical scope of the DER Technical Standards and addresses the issue AEMO proposed to resolve. As well, the draft rule has some flexibility. This is because it does not preclude the future inclusion or exclusion of other assets specifically. It also allows for the inclusion of new devices that fall within the definitions above as they are developed and become available to electricity consumers. Accordingly, the Commission considers the draft rule is fit for purpose, meeting the issues raised by the rule change request and is likely to achieve the NEO.

3.4 Duration of the standard

3.4.1 AEMO's views

Although positioned expressly to create an "initial" technical standard for DER, the AEMO rule change request detailed that there is a need for:

- developing standards in the future — consistent with the COAG Energy Council's direction to the ESB in developing a future governance arrangement
- a flexible framework to enable easy updating of standards when necessary.

As a result, the rule change request proposed a rules-based structure to introduce an initial minimum technical standard for DER, a base-level standard as a starting point, while allowing for subsequent standards over time. Nevertheless, the AEMC's consultation paper did seek stakeholder feedback on whether the role of AEMO in setting DER minimum technical standards (the subordinate instrument) should be limited in time.

3.4.2 Stakeholders' views

There was broad stakeholder support for the notion to review the technical standard, if made, in the future. However, there was no consensus on the detail of the review, for instance, the timing, trigger, or responsible party.

For example, Ausgrid and EnergyAustralia pointed to “a future date”, while Citipower, Powercor and United Energy suggested a date agreed by all stakeholders. ERM Power and Reposit Power suggested a periodic or scheduled review, if one was to be carried out at all.⁹²

Stakeholders also held different views on why the review should be established. For example, Ausgrid considered that a review would provide a back-stop in case future arrangements did not eventuate while Reposit Power suggested regular reviews would manage stakeholders’ investment risk or concerns.⁹³

Furthermore, some stakeholders suggested a review was required due to the intent of the proposed rule, including how relevant participants would be obligated to comply with (potentially) overlapping standards, governance, or clear roles and responsibilities down the supply chain.⁹⁴

Conversely, ARENA questioned the intention of the proposed rule to prescribe standards, not minimum service levels or non-standards-based outcomes, as was argued would make more sense to be limited by the NER or by review.⁹⁵

A common theme in relation to reviewing the scope of the proposed technical standards was the involvement or primacy of a longer-term governance body. Some stakeholders suggested that a review be undertaken by the suggested long-term responsible body. However, others maintained that the decision on whether to carry out a review should be deferred to this body. For example, Energy Queensland stated that a long-term governance body should undertake a review of the standard. However, Wattwatchers suggested that a “considered approach” would be to defer the decision until an appropriate governance structure is established.⁹⁶

In addition to this, there was reasonable consensus across submissions that limiting the proposed standard in the NER would best account for alignment with a future governance mechanism, consistency with the NEO, or to address barriers or challenges imposed by the rule.⁹⁷ A review of the technical standard, as suggested by PIAC, could establish if the standards are, and remain, fit for purpose.⁹⁸

Limiting the life of the standard

The Commission received a wide range of feedback in submissions on whether the proposed standard (located in a subordinate instrument as proposed) should have a limited lifespan.

Some stakeholders commented that, given the impending ESB governance arrangement review process, the decision to limit the standard should be an outcome of the ESB review. Alternatively, the standard should cease to continue when the longer term governance

92 Submissions to the consultation paper: Ausgrid, p. 8; EnergyAustralia, p. 6; CitiPower, Powercor and United Energy, p. 2; ERM Power, p. 2; Reposit Power, pp. 3-4.

93 Submissions to the consultation paper: Ausgrid, p. 8; Reposit Power, pp. 3-4.

94 Submissions to the consultation paper: CEC, p. 4; Tesla, p. 8; AER, p. 2.

95 ARENA submission to the consultation paper, pp. 2-3, 5.

96 Submissions to the consultation paper: Energy Queensland, p. 12; Wattwatchers, p. 3.

97 Submissions to the consultation paper: Intellihub, p. 5; Plus ES, pp. 4-5.

98 PIAC submission to the consultation paper, p. 2.

arrangement comes into effect. For example, AGL suggested a sunset clause, while Jemena suggested establishment of a future governance body would then allow that body to decide on an appropriate time to review the initial standard.⁹⁹

Submissions by ERM Power and Intellihub suggested limiting the role of AEMO to “urgently required standards” and that it “makes sense” to limit the time this role is in effect. In addition, these stakeholders commented that the standards should be periodically reviewed and amended as needed.¹⁰⁰ Further, SAPN explained that limiting the duration of the standard without limiting its scope could lead to perverse outcomes, like rushed standards on minimal consultation.¹⁰¹ Similarly, Ausgrid suggested that a limit on duration could provide cause to limit by other means, such as per jurisdiction.¹⁰²

3.4.3 Commission’s assessment

The Commission acknowledges that stakeholders have considered the issue raised in the consultation paper in the context that AEMO’s proposed initial minimum technical standard would be established through an instrument subordinate to the NER. Broadly, stakeholder views indicate they value a framework that enables the reviewing and updating of technical standards as circumstances change over time. In principle, this is consistent with Standards Australia’s approach to standard setting and updating.

However, the Commission has considered this particular issue in light of its decision to establish DER Technical Standards through the NER. In this context, the DER Technical Standards could evolve over time as Standards Australia updates AS 4777.2.¹⁰³ In addition, the DER Technical Standards could also be amended by amending the new Schedule 5A.2 of the NER through a rule change process.

There has been some concern expressed to the Commission about the use of a rule change process to update requirements like the DER Technical Standards. To this point, it should be noted:

- small, minor amendments which do not have a significant impact on the NEM may satisfy the criteria to be considered as an expedited rule change request, a process which usually takes eight weeks
- that appropriate and relevant public consultation carried out prior to the lodgement of a rule change request may enable the request to be considered through a fast track rule change process (which is usually approximately five months in duration)
- a standard rule change process is carried out over approximately six months.

With these public consultation processes available to any party, the Commission considers that it is not necessary or desirable to create a bespoke change mechanism for the DER Technical Standards at this stage. It is satisfied that the cost and time in creating a bespoke

99 Submissions to the consultation paper: AGL, p. 7; Jemena, p. 6.

100 Submissions to the consultation paper: ERM Power, p. 2; Intellihub, p. 5.

101 SAPN submission to the consultation paper, p. 5.

102 Ausgrid submission to the consultation paper, p. 8.

103 The draft rule refers to AS 4777.2:2015 and the short duration undervoltage response testing requirements in Schedule 5A.2. As noted in this draft rule determination, the final rule, if made, may refer to AS 4777.2:2020.

process for this draft rule would result in duplication of processes and outweigh any potential benefits.

The approach of the draft rule to managing the DER Technical Standards does not pre-empt future governance arrangements that may be put in place. The Commission notes the rule change request lodged by Dr Kerry Schott AO (Chair of the ESB) on the issue of long term governance arrangements for the DER Technical Standards. This rule change process may result in a change to the arrangements set out in this draft rule.

In light of its decision to create the DER Technical Standards as described in this draft rule determination, the Commission has decided not to limit the life of those standards by specifying an end date. Nor has the Commission included a review mechanism in the draft rule as a rule change request can be submitted at any time to initiate consideration of a change to the standards.

On balance, the Commission considers that the draft rule is appropriate and consistent with achieving the NEO as it enables changes to the DER Technical Standards to occur through a public consultation process without the cost, or potential duplication, of establishing a new bespoke process.

3.5 Cost of establishing the standard

3.5.1

AEMO's view

AEMO, both in the rule change request and its subsequent consultation on the content of the initial standard, noted the costs of establishing technical standards for DER in terms of the revised AS 4777.2, which holds additional functionalities, that manufacturers would bear.

In terms of benefits from technical standards, AEMO focused on the individual benefits, such as enabling access to new markets and benefits, as well as whole-of-system benefits, such as cost mitigation, and the operational efficiencies that a baseline technical capability could provide.¹⁰⁴

3.5.2

Stakeholders' views

The Commission recognises that a majority of stakeholder provided feedback on the potential costs of the initial standard. Some stakeholders identified where additional costs could be likely to occur, such as in implementation and increased testing or more compliance requirements.¹⁰⁵ Moreover, stakeholders provided feedback on the need to balance benefits to power system security and the costs across the supply chain, to prevent against stifling innovation.¹⁰⁶

¹⁰⁴ AEMO, Rule change request, pp. 2, 13; AEMO, *Initial distributed energy resource minimum technical standards*, issues paper, 24 August 2020, p. 18.

¹⁰⁵ Submissions to the consultation paper: Jemena, p. 8; SAPN, p. 6 which also raised that any additional new costs are not covered under the five-year regulatory revenue allowance; Tesla, p. 8 which also raised that additional costs would likely be incurred from overlapping standards or specific standard to jurisdictions or DNSPs; Essential Energy, pp. 1-4; AGL, pp. 2, 8.

¹⁰⁶ Submissions to the consultation paper: Jemena, p. 8; Red Energy and Lumo Energy, p. 2; Vector, pp. 1-2, 7.

The CEC noted that given the very open-ended nature of the AEMO proposal, it was difficult to conceive how the costs and benefits would be rigorously assessed.¹⁰⁷ Ausgrid expressed concern that:¹⁰⁸

The proposal does not appear to have adequately considered the potential cost impacts on all customers... In the short-term, if a rule is to be made, we would prefer a rule that is limited in time, scope and potentially jurisdiction to immediate, short-term system security needs.

Stakeholders also expressed concern for the costs and impact to future DER consumers. These concerns included the ways in which additional costs to devices would impinge on the falling cost curve of household DER, as well as how that compares to DER and non-DER consumers.¹⁰⁹

Energy Queensland also raised concerns on how the costs of compliance would be recovered — whether that is as incurred or smeared across all consumers— as well as whether considerations could be made for consumer losses.¹¹⁰ Furthermore, the AER noted that any significant additional costs to manufacturers or in compliance and monitoring are ultimately borne by consumers, which ought to be ascertained through a regulatory impact statement.¹¹¹

Stakeholders expressed significant concern that AEMO did not provide any cost-benefit analysis on the scope of its proposed technical standards in its rule change request. Vector submitted that it would be consistent with good regulatory practice for AEMO's proposal to be subject to a cost-benefit analysis.¹¹² Red Energy and Lumo Energy raised concerns about the impact of AEMO's proposed scope of the standard on the cost to consumers:¹¹³

Consumers will inevitably bear the cost of the proposed changes (through increased costs for their solar systems and potentially increased network charges owing to new responsibilities for managing ongoing compliance with the standards). Regulation must therefore be fit for purpose and pass an adequate cost benefit analysis to ensure that consumers do not face unnecessary increased costs.

Accordingly, a number of stakeholders indicated an interest in the proposed technical standards being subject to a cost benefit analysis.¹¹⁴ Stakeholders suggested some variables which could be critical in valuing the costs and benefits such as comparing the standard to a non-standard alternative, valuing reductions in wholesale price from additional DER,

107 CEC submission to the consultation paper, p. 6.

108 Ausgrid submission to the consultation paper, p. 3.

109 Submissions to the consultation paper: Dr Martin Gill, p. 1; Energy Australia, p. 1; Solar Analytics, p. 1.

110 Energy Queensland submission to the consultation paper, pp. 5, 11.

111 AER submission to the consultation paper, p. 3.

112 Vector submission to the consultation paper, p. 1.

113 Red Energy and Lumo Energy submission to the consultation paper, p. 3.

114 Submissions to the consultation paper: AER, p. 3; Energy Queensland, p. 11; Vector, p. 7; Tesla, p. 8; SAPN, p. 6; AGL, p. 8; ARENA, p. 4; Ausgrid, pp. 2-4; ENA, p. 6; Solar Analytics, p. 1.

identifying the direct costs to new DER installations and the indirect costs of compliance and monitoring, and importantly the cost impact to consumers.¹¹⁵

Other stakeholders noted the absence of a holistic cost benefit analysis in AEMO's rule change request and attempted to identify stakeholder groups likely to bear the costs of the proposed technical standard. For example, Reposit identified 11 areas of potential costs, both direct and indirect, linked to AEMO's proposed scope of the standard. These included that system strength and inertia should be paid for by the market, rather than categorising some MWh as "overgeneration" and that minimum technical standards for DER may:¹¹⁶

- inhibit revenue generating and cost saving functionality of DER now and into the future
- have the potential to effectively exclude DER from large portions of wholesale market value.

3.5.3

Commission's assessment

Stakeholder submissions have indicated that there could be significant costs in establishing a technical standards framework for DER as outlined in the rule change request. The Commission acknowledges such a framework could be costly. However, while these possible costs are difficult to specify, the Commission has considered the information provided by stakeholders when making the draft rule.

The benefit of the draft rule establishing DER Technical Standards focused on the key issue identified by the rule change request is that it has also narrowed the costs of implementing a standards framework. Similarly, the draft rule has not created bespoke compliance arrangements for the AER nor an additional governance framework to enable the standards to be updated over time.

In brief, the Commission is satisfied that the draft rule achieves the sought-after benefits while minimising the costs of creating an obligation to comply with a technical standard for DER. That is, that the draft rule, would, or is likely to, contribute to the achievement of the NEO because it creates arrangements that enable parties to address and manage the negative impacts of significant levels of small scale solar generation within distribution networks that may arise on occasions. This has been done without extending the draft rule beyond the identified key issues while still enabling the arrangements to develop and update over time as needed while not limiting the possibility of other, market-based solutions to emerge.

3.6

Commission's conclusion on the scope and duration of the standards

The Commission's draft rule determination has considered that DER's development in the NEM to date has grown rapidly as more consumers make investments into these assets. As well, the Commission recognises the growth in the breadth of devices which could be classified as DER. The integration of consumer-led DER is critical to enable consumers to

¹¹⁵ Submissions to the consultation paper: ARENA, p. 4; Ausgrid, pp. 2-4; ENA, p. 6; Solar Analytics, p. 1.

¹¹⁶ Reposit Power submission to the consultation paper, pp. 6-7.

benefit from their investments directly while also providing benefits to electricity consumers more generally as well as the power system.

However, DER can also exacerbate, or in some instances cause, power quality issues in a distribution network which can impact on the efficient integration of DER as well as the operation of distribution networks and the whole power system. As indicated by the ESB, AEMO and stakeholders, of particular importance to this issue is the degree to which DER inverters in the aggregate perform and respond to the grid to standard that manages their response to voltage disturbances.

In this way, the Commission has determined that, proportionate to the impact and urgency of the issue, the technical scope of the DER Technical Standard set out in the draft rule is AS 4777.2, with the voltage disturbance ride through component to be proven in accordance with the short duration undervoltage response testing requirements as set out in the draft rule Schedule 5A.2.

The devices which will be required to meet this technical standard will be micro embedded generating units because this class of asset is recognised as delivering electrical power to the grid via low voltage inverters. The Commission has determined that the DER Technical Standards will not have an explicit end date nor has a predefined review been specified in the draft rule.

4 GOVERNANCE ARRANGEMENTS

This chapter outlines the Commission's decision to establish DER Technical Standards in the NER rather than creating an instrument subordinate to the NER in which to house the standard.

This chapter sets out AEMO's proposed governance arrangements for the DER Technical Standards, stakeholder views and the Commission's assessment.

4.1 AEMO's views

AEMO's rule change request did not include a proposed rule but set out a framework on how initial minimum technical standards could be introduced. It proposed that a new rule be inserted into Chapter 3 of the NER that set an obligation on AEMO to make, publish and, if necessary, amend initial DER minimum technical standards. AEMO would be required to create these initial technical standards in an instrument that was subordinate to the NER.¹¹⁷

AEMO anticipated that it would carry out a consultation process to develop the content of the initial technical standard at the same time that the AEMC would carry out this rule change process. This would enable an initial technical standard to be published at the time the final rule would be made, consistent with the COAG Energy Council's plans.¹¹⁸

AEMO asserted that developing a framework to allow for the implementation of DER minimum technical standards through a subordinate instrument would provide flexibility and allow for the technical standards to be easily updated to reflect the evolution of technology.¹¹⁹ In addition, AEMO considered that establishing a subordinate instrument would enable technical requirements to be introduced over time with consultation.¹²⁰

4.2 Stakeholder views

4.2.1 Proposed introduction of a subordinate instrument

In general, stakeholders did not support establishing a subordinate instrument to enable AEMO to set initial minimum technical standards for DER.¹²¹ In many cases, this was on the basis of in-principle support for the existing Australian Standard's standard development process and a preference to see the finalisation of the ESB's review on governance of DER standards prior to establishing any form of enduring governance arrangement.¹²²

In fact, a number of stakeholders explicitly stated that if the Commission considered that there was merit in establishing technical standards for DER to meet immediate short-term outcomes, then these would be best achieved by setting the initial standards in the NER with

¹¹⁷ AEMO, Rule change request, p. 16.

¹¹⁸ AEMO, Rule change request, p. 17.

¹¹⁹ AEMO, Rule change request, p. 16.

¹²⁰ AEMO, Rule change request, p. 18.

¹²¹ Submissions to the consultation paper: AGL, p. 2; Ausgrid, p. 5; Tesla, p. 7; ENA, p. 2; CEC, p. 2; Vector, p. 3; Dr Martin Gill, p. 1; EnergyAustralia, p. 1; Caravan and Camping Industry Association NSW (CCIA NSW), p. 3; CitiPower, Powercor and United Energy, p. 2; Reposit, p. 3; Energy Queensland, p. 3; Wattwatchers, p. 2.

¹²² ESB, *Governance of DER technical standards*, consultation paper, July 2020, p. i.

a clear end date and by limiting the scope of the initial standards to addressing immediate concerns.¹²³

Wattwatchers, Vector, Energy Australia, Dr Martin Gill, the AER and ARENA urged consideration with regard to the potential market impacts of introducing an initial standard such as, risks and costs to manufacturers and industry, impacts on future opportunities for innovation (that is, new markets for services) and cost to consumers.¹²⁴ In particular, Dr Martin Gill considered that AEMO's proposal may limit the potential for future market services to develop by restricting how solar loads are able respond (for instance, the development of demand response services may be hampered if technical specifications are enforced).¹²⁵ Similarly, ARENA noted that it is important that the need to enhance the underlying incentives for market participants to contribute to power system security is not lost in the consideration of DER Technical Standards.¹²⁶

In contrast to these views, Landis+Gyr and ERM Power expressed support for the introduction of minimum technical standards through a subordinate instrument. They considered that a subordinate instrument would allow for future flexibility in resetting standards as technologies and markets develop.¹²⁷

Jemena also expressed support for the creation of a subordinate instrument in the NER, provided an end date is specified for the initial standard.¹²⁸ The South Australian Department for Energy and Mining supported the development of a subordinate instrument by AEMO in order to support the continued integration of DER.¹²⁹

4.2.2

Appropriate body for the management of the standards

Many stakeholders expressed concern with the proposal for AEMO setting the initial DER technical standard in the absence of any enduring and clear governance arrangements to support comprehensive consultative processes in the development of technical standards.

While AGL supported AEMO's role in contributing towards the development of appropriate technical standards for DER with insights on system security and market operation, it did not consider AEMO to be the appropriate body to manage technical standards for DER. AGL considered Standards Australia, as an independent body skilled in standards setting, continues to be best placed to develop and adopt technical standards that reflect international best practice through broad stakeholder engagement and with the support of relevant industry expertise.¹³⁰

123 Submissions to the consultation paper: Ausgrid, p. 5; ENA, p. 2; CCIA NSW, p. 3; CitiPower, Powercor and United Energy, p. 2; Reposit, p. 3.

124 Submissions to the consultation paper: AER, p. 1; Vector, pp. 4-5; Dr Martin Gill, p. 1; Energy Australia, p. 6; Reposit, p. 3; Wattwatchers, p. 2; ARENA, p. 3.

125 Dr Martin Gill submission to the consultation paper, p.1.

126 ARENA submission to the consultation paper, p.3.

127 Submissions to the consultation paper: Landis+Gyr, p. 1; ERM Power, p. 2.

128 Jemena submission to the consultation paper, p. 1.

129 South Australian Department for Energy and Mining submission to the consultation paper, pp. 1-2.

130 AGL submission to the consultation paper, p. 4.

Reposit Power suggested that a number of other technical regulatory bodies are better placed than AEMO to set technical standards for DER. These included Standards Australia, the Australian Cyber Security Centre (ACSC), DNSPs, the AEMC's Reliability Panel, and state and territory technical regulators.¹³¹

The CEC, EnergyAustralia and ARENA, for example, considered that AEMO should only have responsibilities for technical standards that relate to its specific set of functions relevant to power system security.¹³² Similarly, Intellihub suggested that AEMO's role should be limited to any issues that urgently require new standards to address system security risks before a longer-term governance model is implemented.¹³³

Endeavour Energy suggested that the development of the DER technical standard, AEMO-led or otherwise, should account for the views of network service providers who are well placed to establish (or identify) minimum standards required to support effective network operation.¹³⁴ Solar Analytics considered that the development of a DER technical standard should be guided by a technical reference group.¹³⁵

A number of stakeholders expressed support for improvements to AEMO's proposed governance arrangements for initial minimum DER technical standards to ensure decisions with regard to the standards remain customer-focused, evidence-based and contemplate other crucial matters, including safety, economic efficiency and innovation.¹³⁶ These stakeholders generally considered that the ESB's review of governance arrangements would be the most suitable pathway to establish arrangements for the setting of technical standards, including the relevant body, safeguards and consultative requirements.

4.3 Commission's assessment

4.3.1 Locating the initial standard in the NER

Based on its analysis and consideration of stakeholder feedback, the Commission has concluded that the DER Technical Standards to regulate inverter performance be established in the NER. The draft rule provides a simplified approach to address the immediate issues raised by AEMO compared to the proposal set out in the rule change request. This simpler approach mitigates the system security risks presented by short-duration undervoltage ride-through promptly. It also allows for the long-term governance of the DER Technical Standards to be subject to appropriate consideration in the future.

For the introduction of the DER Technical Standards to be effective, it is important that the appropriate structures are in place to support transparent governance and timely implementation. The Commission does not consider it would be practical or appropriate for DER Technical Standards to be prescribed by AEMO through a subordinate instrument. This is

¹³¹ Reposit Power submission to the consultation paper, p. 1.

¹³² Submissions to the consultation paper: CEC, p. 2; ARENA, p. 1; EnergyAustralia, p. 1; Intellihub, p. 5.

¹³³ Intellihub submission to consultation paper, p. 5.

¹³⁴ Endeavour Energy, submission to the consultation paper, p. 2.

¹³⁵ Solar Analytics submission to the consultation paper, p. 1.

¹³⁶ Submissions to consultation paper: AGL, p. 5; Tesla, p. 4; Ausgrid, p. 4; ARENA, p. 3; Energy Queensland, p. 2; Jemena, p. 1.

largely consistent with the feedback provided by stakeholders in submissions to the consultation paper.

The Commission understands that there is merit in establishing DER Technical Standards to meet the immediate system security concerns. However, it is also important that the approach taken to address the urgent inverter performance issues is proportional and able to be implemented quickly. The draft rule therefore established the DER Technical Standards in the NER. In doing so, the draft rule will not require any additional governance arrangement to be established at this time.¹³⁷ This approach balances feedback from industry in submissions to the consultation paper regarding the potential market impacts and risks of implementing the suite of standards proposed by AEMO with the need for standards to be in place as soon as practicable.

Accordingly, the Commission has concluded that establishing the DER Technical Standard in the NER with a focus on inverter performance is proportional to the scope and urgency of the issues raised by AEMO. It is consistent with the key intent of AEMO's proposed approach.

The Commission considers that the draft rule, if made, is likely to better achieve the NEO than AEMO's proposed approach as it will allow for the efficient and timely implementation of technical standards for DER without the risk of implementing technical standards beyond what is currently required, or with the need to establish additional governance arrangements.

4.3.2 AEMC as the body responsible for the standards

As the draft rule establishes the DER Technical Standards in the NER, the AEMC will be the body responsible for the management of the DER Technical Standards.

This approach will materially reduce the impact of the rule change on industry by allowing existing governance structures to be utilised. The Commission considers it appropriate that the standard is housed in the NER and that it be the responsible body for the initial standard. This is preferable to requiring a new process to establish a subordinate instrument with new governance processes for that new instrument. In addition, the draft rule avoids the potential risk of duplication of standards and processes, the cost of which would likely be borne by consumers.

Nevertheless, it should be noted that the Commission's draft rule to establish the initial DER Technical Standards to meet immediate issues does not limit any future governance structures that may be put in place.

The ESB has undertaken a review to establish a long-term governance framework for DER technical standards.¹³⁸ This review has resulted in a rule change request proposing different governance arrangements to those put forward by AEMO in its rule change request.¹³⁹ The rule change request on enduring governance arrangements proposes that the AEMC, with the assistance of an advisory committee, be the responsible body for setting DER Technical

¹³⁷ Draft NER rule S5A.2.

¹³⁸ ESB, *Governance of DER technical standards*, consultation paper, July 2020.

¹³⁹ Dr Kerry Schott AO, *Governance of distributed energy resources technical standards rule change request*, 21 September 2020.

Standards. When this rule change process is initiated, the Commission will seek stakeholder comment on the proposal.

5 NETWORK CONNECTION AGREEMENTS

This chapter outlines the Commission's more preferable draft rule and the requirements established within the NER to give effect to the initial DER Technical Standards through the relevant to DNSP network connection agreements.

The draft rule requires DNSPs to include in the terms and conditions of their model standing offers, if the service is a basic micro EG connection service, a requirement that all newly connected or replacement micro embedded generators must comply with the DER technical standards.

This requirement also applies to negotiated connection contracts for micro EG connection services and is a mandatory requirement to be included in connection offers.

This chapter provides an overview of the current connection framework in the NER and discusses the treatment of grid connected generation in the NEM. Stakeholders' views on including technical standards in DNSPs' connection agreements and the Commission's assessment in respect of this issue are also provided in this chapter.

5.1 Connection arrangements and technical standards in the NEM

5.1.1 Current connection arrangements in the NEM

Obligation to provide connection services

The current connection framework, governing electricity connections for small and large customers as well as embedded generators (that are not registered participants) in the NEM, consists of components related to (i) offers for new connections and connection alterations and (ii) connection service charges. It is the first of these components that is more directly relevant to establishing initial technical standards for DER — for example, offers for new connections or alterations may impose specific requirements such as safety and technical requirements.

In jurisdictions that have adopted the National Energy Customer Framework (NECF), the obligation to provide connection services is imposed on DNSPs under the NERL.¹⁴⁰ The relationship between DNSPs and retail customers in relation to the provision of connection services is set out in detail in Part 4 of the NERR. Under Part 4, Division 3 of the NERR, a DNSP is obliged to provide a deemed standard connection contract for a new connection or a connection alteration within its distribution network. The connection contract commences on acceptance by the customer of the distributor's connection offer for a new connection or connection alteration in accordance with the requirements under Chapter 5A of the NER. At the same time as the contract for a new connection commences (discussed in the following section), a deemed standard connection contract is also formed. The deemed standard connection contract establishes the terms and conditions upon which the DNSP will provide ongoing connection services once a new connection is established.

¹⁴⁰ NERL ss. 66(1) and (2). No consumers in Victoria are covered by the NECF. However, they are covered by protections under the Victorian Energy Retail Code which applies protections similar to many of those in the NECF.

Types of connection offers

Connection offers set out both the applicant's and DNSP's obligations and form the basis of the connection contract once accepted by the applicant. The types of connection services for new and altered connections for NEM retailer customers are specified in Chapter 5A of the NER. These are:

Basic connection services: apply where the provision of connection services between a distribution network and a retail customer's premises involves minimal or no augmentation to the distribution network, and a model standing offer has been approved by the AER for providing that service as a basic connection service.¹⁴¹ In general, these services cover the majority of simple connections by NEM retailer customers, including those customers that are micro embedded generator connections (for example, residential rooftop solar systems).

A DNSP must submit to the AER for approval and publish a model standing offer for basic connection services. A DNSP can publish different model standing offers for different subclasses of basic connections, for example, one offer for a basic connection with only load and one offer for a basic connection including micro embedded generation.¹⁴² A DNSP's model standing offer must specify terms and conditions, such as a description of the connection, including a statement of its maximum capacity, or if the service is connection of a micro embedded generator, the particular requirements regarding the export of electricity into the distribution network.¹⁴³ The terms and conditions may also refer to jurisdictional or other legislation and statutory instruments that impose specific requirements (such as qualifications of the service provider, and safety and technical requirements) to be complied with by the provider of a contestable service, in jurisdictions where contestability in connection services exists.

Standard connection services: apply where the provision of connection services involves augmentation of the distribution network. Offers for standard connection services typically apply to larger developments and embedded generators (including non-registered embedded generators) that are not micro-embedded generators.¹⁴⁴

Negotiated connection services: apply where a connection service sought by a connection applicant is neither a basic nor a standard connection service, or the connection applicant elects to negotiate the terms and conditions on which the connection service is to be provided. The negotiations between a DNSP and a connection applicant are governed by the rules set out in Part C of Chapter 5A of the NER.

Chapter 5A also applies to embedded generator proponents seeking to connect a generating system of less than the standing exemption from the requirement to register as a Registered

141 Part B, Division 1 of Chapter 5A of the NER.

142 A micro-embedded generator is defined in cl. 5A.A.1 as a retail customer who operates, or proposes to operate, an embedded generating unit for which a micro embedded generator connection (of the kind contemplated by AS 4777: Grid connection of energy systems via inverters) is appropriate. In essence, a micro-embedded generator is a retail customer who has small, inverter-based generating equipment, such as a rooftop solar PV system.

143 NER clause 5A.B.2(b).

144 A non-registered embedded generator is an embedded generator who is neither a micro-embedded generator or a Registered Participant. Non-registered embedded generators that fall under the NER Chapter 5A connection process can elect to use the connection process under Chapter 5, which applies to registered embedded generators and represents a more detailed process.

Participant with AEMO (currently 5 MW), or who hold an exemption from the requirement to register with AEMO. These are known as:

- micro embedded generators (embedded generator connections that comply with Australian Standard AS 4777)
- non-registered embedded generators (a system of less than 5 MW but larger than a micro-embedded generator, or a system of 5 MW or greater that holds an exemption from the requirement to register with AEMO).

5.1.2

NEM technical standards and the treatment of grid-connected generation devices

DNSPs are required to meet a range of technical regulations and design and performance standards when supplying customers and designing their networks. These are imposed at both national and jurisdictional levels. Technical standards applicable in the NEM are set out in Schedules 5.1a to 5.3a of the NER. These schedules define the level of performance required of the equipment that makes up, and is connected to, the power system. The overall power system is operated to these standards and this allows the power system operator, AEMO, to effectively manage power system security. These system standards are also important as the level of technical performance standards that are provided by DNSPs to customers have implications for the power quality, reliability and safety outcomes received by these customers. Therefore, they are also important tools for managing power quality, reliability and safety obligations for distribution networks.

In order to manage a customer's impact on network power quality, reliability and safety, a DNSP can impose conditions on entities and individuals connecting to its network through connection agreements. These operate in tandem with jurisdictional requirements, such as the Service and Installation Rules (or similar) established in and by each jurisdiction.¹⁴⁵ Service and Installation Rules are primarily designed to define and co-ordinate the relationship between a licensed distributor and its customers.

5.2

AEMO's views

AEMO's rule change request did not include a proposed rule but set out a framework on how minimum technical standards could be introduced. It proposed that a new rule be inserted into Chapter 3 of the NER that sets two key obligations. Firstly, an obligation on AEMO to make, publish and, if necessary, amend DER minimum technical standards. Secondly, an obligation on DNSPs to ensure that connected DER, either by its own means or by way of a DER device, meet the DER minimum technical standards (including without limitation, through the inclusion of appropriate provisions in connection agreements).

AEMO proposed that initial DER minimum technical standards be inserted into the minimum content requirements of connection contracts, negotiation frameworks and model standing offers, and into the model standing terms under Chapters 5 and 5A of the NER.¹⁴⁶ It also

¹⁴⁵ For example, the Service and Installation Rules of New South Wales is the recognised industry code in NSW outlining the requirements of electrical distributors when connecting a customer to the distribution systems of NSW. They reflect the requirements outlined in the *Electricity Supply Act 1995* and Chapter 5A of the NER.

¹⁴⁶ AEMO, Rule change request, p. 25.

suggested that the standard could be recognised in the deemed standard connection contracts prescribed in Schedule 2 to the NERR. AEMO suggested that if these changes were put in place in the NER and NERR, they should allow for:¹⁴⁷

- the introduction of an initial standard to be published alongside the proposed new rule
- the introduction of subsequent standards over time
- the ability to call up in the standards any relevant Australian and International Standards, or parts thereof
- review, and update of the standards to occur, on an as needs basis in response to developments in technology or, for example, new cyber threats.

AEMO proposed that the minimum technical standards apply to newly connected DER devices (and replacements) for which the DNSP has visibility (and not existing connections).¹⁴⁸

5.3 Stakeholder views

The majority of stakeholders conditionally supported including the minimum technical standards in DNSPs' minimum content requirements of connection contracts, negotiation frameworks and model standing offers.

Jemena considered this could be achieved through supplementing obligations in Chapters 5 and 5A of the NER for connection of embedded generators to ensure DER meet minimum technical standards.¹⁴⁹ Reposit Power suggested that placing minimum standards in connection contracts would be suitable and noted that in present arrangements AS 4777 is often referenced in inverter energy system connection contracts.¹⁵⁰

Energy Queensland expressed concern that requirements for customers' technical standards to be maintained via the network connection agreement with the relevant DNSP may create conflict with jurisdictional obligations.¹⁵¹

However, a number of stakeholders did not support the approach to including minimum standards in connection agreements. For example, Wattwatchers considered minimum standards should be published in the NER to improve the accessibility and transparency of the minimum standards.¹⁵²

Similarly, Ausgrid considered that minimum standards are more appropriately set out in either the NER or AS 4777.2 to ensure transparency and accessibility.¹⁵³ While SAPN agreed that minimum technical standards should be reflected in DNSPs' connection contracts, it suggested that this reference should be based on the applicable Australian Standards.¹⁵⁴

147 AEMO, Rule change request, pp. 16-17.

148 AEMO, Rule change request, p. 15.

149 Jemena submission to the consultation paper, p. 2.

150 Reposit Power submission to the consultation paper, p. 4.

151 Energy Queensland submission to the consultation paper, p. 3.

152 Wattwatchers submission to the consultation paper, p. 2.

153 Ausgrid submission to the consultation paper, p. 5.

154 SAPN submission to the consultation paper, p. 4.

Some stakeholders supported the proposal that any initial standards should only apply to new or replacement devices, noting that applying the standards to installed devices would be challenging and costly.¹⁵⁵

5.4 Commission's assessment

Under an approach where the DER Technical Standards are defined in the NER, the Commission has decided that DNSPs should also be obliged to ensure that connection applicants in relation to micro embedded generators should comply with the DER Technical Standards. The draft rule requires DNSPs to include in their connection agreements made under Chapter 5A of the NER a requirement that all connections for micro embedded generation by way of a basic micro EG connection service must comply with the DER Technical Standards.

To give effect to the policy intent, the draft rule requires DNSPs to:

- include in model standing offers for basic connection services for retail customers who are seeking to connect micro embedded generators by way of a basic micro EG connection service the requirement that the relevant embedded generating unit complies with the DER Technical Standard¹⁵⁶
- include in the information that the applicant requires in order to negotiate a connection contract on an informed basis, the requirement that if the connection applicant is proposing to connect an embedded generating unit by way of a basic micro EG connection service, that the micro embedded generating unit must be compliant with the requirements of the DER Technical Standards¹⁵⁷
- include in the minimum content requirements of connection offers under Schedule 5A.1 to the NER a requirement that if the connection applicant is proposing to connect an embedded generating unit by way of a basic micro EG connection service, that the embedded generating unit that is subject of the connection application is compliant with the DER Technical Standards.¹⁵⁸

This approach will materially reduce the impact of introducing technical standards by utilising the existing contractual arrangements for connection contracts. The Commission considers that DNSPs have the necessary skills, resources and processes in place to meet the obligations set out in the draft rule and arising from increasing numbers of embedded generator connections.

In addition, the Commission considers that it is practical and appropriate for DNSPs to incorporate the DER Technical Standards into model standing offers, negotiation frameworks and minimum content requirements for connection offers applying to new or replacement micro embedded generation. Importantly, this obligation to ensure compliance at the point of

155 Submissions to the consultation paper: CEC, p. 3; Wattwatchers, p. 2; AGL, p. 2; Plus ES, p. 2; Solar Analytics, p. 2; Essential Energy, p. 3.

156 Draft NER clause 5A.B.2.

157 Draft NER clause 5A.C.3.

158 Draft NER clause S5A.B(a)(7a).

connection approval relies on the processes DNSPs have in place for the connection of embedded generation, including the requirements of Chapter 5A of the NER.¹⁵⁹ The Commission considers that in general, these arrangements to establish technical standards in the NER are consistent with the key intent of AEMO's proposed approach.

Consistent with the current provisions of Chapter 5A of the NER, under the draft rule the AER will continue to approve model standing offers for connection contracts and assess that they are reasonable and comply with the requirements of the NER.

The Commission notes that as the draft rule only relates to the connection of micro embedded generation, only Chapter 5A and not Chapter 5 of the NER has been amended. The Commission has considered how changes to the clauses in Chapter 5A of the NER may have implications for the application of the rule in the Northern Territory. It has concluded that the clauses in Chapter 5A of the NER that are modified will not affect the application of the rule in the Northern Territory. Accordingly, the draft rule is applicable as a uniform rule in the Northern Territory.

Further, the Commission notes that as no draft rule is being made for the NERR (the reasons for the Commission's decision are set out in section 2.5 of Chapter 2) there is no need to consider the implications for Victorian customers that may arise because the NECF does not apply in that jurisdiction. The draft rule, because it only involves changes to the NER, applies in the same manner in Victoria as it does in other NEM jurisdictions.

Having regard to the issues raised in the rule change request, the Commission is satisfied that the implementation of the DER Technical Standards through DNSPs' connection agreements is a necessary and proportionate response because it allows for identified system security issues caused by increasing small scale solar generation connections to be addressed in an efficient and timely manner.

¹⁵⁹ The compliance arrangements for the initial standard are discussed further in Chapter 6.

6 COMPLIANCE ARRANGEMENTS

This chapter sets out the Commission’s draft rule determination in relation to the compliance arrangements for the DER Technical Standards. Specifically, that the management of compliance through DNSPs’ connection agreements will meet the need for effective compliance on the required inverter functionality.

In addition, the Commission considers that the existing compliance and monitoring systems under the Clean Energy Council (CEC) and the Clean Energy Regulator (CER), relating to the certification of products and installers of inverter-based electricity generating systems, are suitable and can and should continue to be used by industry.

This chapter sets out the current arrangements in place for technical requirements of DER, stakeholder comments on AEMO’s proposed approach and then the Commission’s draft determination and reasons. This chapter also describes the interactions in a compliance arrangement managed through connection agreements, product testing to meet AS 4777.2, and the certification and monitoring of inverter products and installers via the CEC and CER processes.

6.1 Existing technical requirements and compliance and monitoring arrangements

6.1.1 Network connection requirements

DNSPs determine the technical requirements for basic, standard and negotiated connection services for connection of embedded generation to the distribution networks.¹⁶⁰ Chapter 5A of the NER sets out terms and conditions which are to be included by DNSPs in their contracts with retail customers for the connection of small scale generation to the distribution networks. Relevantly, for both basic and standard connection services, the NER requires that DNSPs must set the “safety and technical requirements (including jurisdictional and other legislation and statutory instruments under which the requirements are imposed)”.¹⁶¹ For negotiated connections, DNSPs are required to determine the technical requirements for a proposed new connection or alteration.¹⁶² Through the use of customer connection contracts, the NER requires DNSPs to establish technical obligations for networks which device manufacturers and installers of connected embedded generation are required to meet.

DNSPs are also bound by legal obligations set out in state electricity and electrical safety legislation and codes, and the conditions of their distribution licenses.¹⁶³ In determining technical requirements for a connection contract, DNSPs are to consider these regulatory obligations and the operating needs of their network.¹⁶⁴

¹⁶⁰ See Chapter 5 of this draft rule determination for a detailed discussion of DNSPs’ obligations to provide connection services and the types of connection offers.

¹⁶¹ For connection requirements set out in the NER, see clause 5A.B.2(4) in relation to basic connection services, clause 5A.B.4(4) for standard connection services and 5A.C.3(5) for negotiated connection services.

¹⁶² *ibid.*

¹⁶³ For example, in Queensland jurisdictional legislation, including the *Electricity Act 1994* and *Electricity Regulation 2006*, places network performance obligations on DNSPs Energex and Ergon Energy.

¹⁶⁴ For example, under Ausgrid’s model standing offer, the electrical installation and the premises’ connection assets must comply

6.1.2 Australian Standard AS 4777 performance testing

Australian and international standards are voluntary until called up in a legal instrument. In the NER, AS 4777 is referenced in Chapter 5A in the definition of micro embedded generation connection to refer to a type of inverter-based generation.¹⁶⁵ In doing so, this reference to the standard has the effect of requiring that all micro embedded generating units connected to a network are of the kind contemplated by AS 4777. However, managing adherence to the standard remains a challenge.

At the product level, the existing process for achieving compliance with AS 4777.2 relies on devices undergoing relevant testing from a Standards Australia recognised testing facility. If the device has demonstrated the appropriate capabilities and receives a testing certificate of approval, the device is deemed to meet the standard. This is characteristic of a performance-based approach to standard setting which requires the devices of manufacturers to undergo an initial testing process and treats the behaviour of the tested sample devices as indicative of the function of all devices of that type once installed. An outcome of this approach is that devices not meeting AS 4777.2 in the field (for example, due to malfunction or installation fault) are difficult to detect.

6.1.3 Compliance and monitoring arrangements for the production and installation of inverters

Currently, inverter compliance with AS 4777.2 is governed at the product testing level and also at the installation level by random inspections. Solar energy system suppliers, inverter suppliers and electrical contractors are required to supply and install only AS 4777.2 compliant inverters.

Compliance through the connection approval process relies on the processes DNSPs have in place for the connection of embedded generation, including the requirements of Chapter 5A of the NER. Various DNSPs also validate inverter energy system applications against the CEC's list of compliant inverters and power conversion equipment that are approved under the Small-Scale Renewable Energy Scheme (SRES).¹⁶⁶ A number of state government programs also require installed products to be approved by the CEC in order to participate.¹⁶⁷

The equipment listed by the CEC is equipment that has demonstrated sufficient evidence that it meets the required safety standards for use in Australia. In order to be approved by the CEC, the inverter must be independently certified by a Joint Accreditation System of Australia and New Zealand (JAS-NZ) accredited certification agency, or by a state electrical safety regulator. Test reports must be submitted to the CEC along with the certificate and a fee. The process of application for inclusion in the CEC's approved product list is outlined in Box 1.

with the requirements of (as applicable) the *NSW Service and Installation Rules*, any requirements specified by Ausgrid under the *Electricity Supply Act 1995*, the *Electricity Supply (General) Regulation 2014*, the *Electricity Supply (Safety and Network Management) Regulation 2014*, the *Electricity (Consumer Safety) Act 2004* or the *Electricity (Consumer Safety) Regulation 2015*.

165 NER clause 5A.A.1.

166 <https://www.cleanenergycouncil.org.au/industry/products/inverters/approved-inverters>

167 For example, the Victorian Solar Homes Program and the NSW Empowering Homes Program both establish the use equipment on the CEC approved lists as a conditional requirement for the installation of solar system under the respective programs.

BOX 1: CEC APPROVED PRODUCT LIST APPLICATION PROCESS

To apply for inclusion on the CEC's approved products list, applicants are required to:

- Ensure product is tested to the Australian and/or IEC standards by an accredited testing laboratory
- Ensure product is independently certified by a Joint Accreditation System of Australia and New Zealand (JAS-ANZ) accredited certifying bodies or state electrical regulators
- Ensure all importers or manufacturers of the product register with the Electrical Regulatory Authorities Council (ERAC) (this is a product identification record)
- Application fees associated with applying to have an inverter listed with the CEC cost \$5000 + GST.

Source: <https://www.cleanenergycouncil.org.au/industry/products>, viewed 23 November 2020.

In conjunction with the product approval lists, the CEC also carries out a testing and compliance program. This involves CEC internal audits of inverters included in its database of approved products and their relevant certifications and targeted product testing. The CEC purchases selected devices from the Australian market (either based on risk-based profiling or random selection) and has them tested at multiple certified testing laboratories. The CEC can reject an application to list a product and to de-list a product that ceases to comply with the relevant terms and conditions of listing.

DNSPs do not have a direct ability to manage the installation of inverters.¹⁶⁸ As a result, DNSPs rely on the CER administered schemes for the certification of installers and the monitoring of installed generating units under the SRES. As part of the scheme, the CER is required to conduct random inspections of small scale generation units which have had small-scale technology certificates created against them. Inspections are conducted to confirm that the selected systems meet all the installation requirements of the SRES. This includes the system including components that are listed on the CEC's list of approved products.¹⁶⁹ As a result of such inspections, the CER can identify installations that do not meet the electrical and building standards of Australia, and installers that have breached the CEC accreditation guidelines. The CER has also recently indicated its intention for an additional component to its inspection program that focuses on inverter settings.

6.2

AEMO's views

Managing compliance through connection agreements

AEMO's rule change request proposes that DNSPs ensure that connected DER, either by its own means or by way of a DER device, meets the minimum technical standards (including without limitation, through the inclusion of appropriate provisions in connection agreements).

¹⁶⁸ Note that individual DNSPs may have additional requirements above and beyond the CEC's list requirements.

¹⁶⁹ To be eligible to create small scale technology certificates, the small generation unit's solar panels and inverter must be on the CEC's list of approved components, and the system must be installed by a CEC accredited electrician.

It has proposed that this be achieved by including minimum technical standards into the minimum content requirements of connection contracts, negotiation frameworks and model standing offers, and into the model standing terms under Chapters 5 and 5A of the NER. AEMO also suggested that the standard could be recognised in the deemed standard connection contracts prescribed in Schedule 2 to the NERR.

It is anticipated by AEMO that such obligations for DNSP contracts would have a flow-on effect of binding manufacturers and installers of DER devices to the minimum technical standards.¹⁷⁰

Light-touch monitoring and compliance framework

To support the obligations on DNSPs, AEMO proposed that the AER develop a light-touch monitoring and compliance framework, primarily for the purpose of transparency around adherence to the standards. It suggested that this could be achieved through a minimalist periodic reporting framework (possibly a light touch version of the AER's Electricity Distribution Ring Fencing reporting framework).¹⁷¹

While AEMO has suggested that the AER monitor DER device compliance with the new technical standards, it has not suggested that the standards be enforced through penalties (by civil penalty or conduct provisions in the NER or NERR).

6.3 Stakeholder views

Although generally supportive of an obligation on the DNSPs to achieve compliance of "connected DER" with technical standards through the connection process, stakeholders suggested that it was not clear what additional compliance expectations should be. This stakeholder uncertainty was on the basis that at the time of writing submissions AEMO had not yet published its proposed content for the initial minimum technical standard for consultation. In addition to these concerns expressed by industry participants, the AER noted a lack of detail provided by AEMO about its proposed compliance role.¹⁷²

Generally, stakeholders acknowledged that compliance, monitoring and enforcement arrangements for minimum DER technical standards would be likely to be within scope of the ESB's DER standards governance review.¹⁷³ In particular, SAPN advocated for any ongoing compliance arrangements to be considered, consulted on and implemented through the ESB's review.¹⁷⁴ The CEC also stated that it was important for the development of device requirements to include consideration of the compliance and enforcement approach in the ESB's review.¹⁷⁵

AGL expressed the view that AEMO's proposed compliance framework would create additional complexity for industry by duplicating the current compliance framework for technical

¹⁷⁰ AEMO, Rule change request, p.16.

¹⁷¹ AEMO, Rule change request, p. 25.

¹⁷² AER submission to the consultation paper, p. 3.

¹⁷³ ESB, *Governance of DER technical standards*, consultation paper, July 2020.

¹⁷⁴ SAPN submission to the consultation paper, p. 6.

¹⁷⁵ CEC submission to the consultation paper, p. 1.

standards that is largely enforced through state-based legislative technical and safety requirements. To avoid this overlap, AGL recommended leveraging the existing compliance framework, including state-based legislative technical and safety requirements to deliver improved compliance.¹⁷⁶

Tesla and the CEC noted that there is a significant risk of redundancy in establishing additional testing and compliance requirements, raising the concern that the outcomes may lead to multiple and overlapping compliance requirement for the new-technology sector.¹⁷⁷

Endeavour Energy noted that DNSP-led enforcement is particularly an issue in New South Wales due to the Accredited Service Provider (ASP) scheme. Endeavour Energy commented that while ASPs provide connection services in NSW direct to customers with oversight and monitoring from networks, ASPs may not necessarily be involved in DER device installation. For this reason, Endeavour Energy suggested consideration be given to a compliance approach based on the existing CEC and CER processes to certify products and installers of PV systems.¹⁷⁸

Plus ES advocated for a light-touch compliance monitoring approach during the initial implementation of the standard, subject to market evolution, before applying more stringent compliance monitoring program.¹⁷⁹

However, Reposit expressed the view that “given that the majority of DER is a consumer or small/medium enterprise product, compliance should be enforced under Australian Consumer Law”. It considered that if the standard exists and is mandatory and a device is non-compliant then the consumer is protected by the warranties in that Act [*Competition and Consumer Act 2010*].¹⁸⁰

Ausgrid suggested that the level of compliance monitoring should be proportional to the risk being faced and that any potential obligation requiring inspection regimes will need to be rigorously tested to ensure that the benefits outweigh the expected costs.¹⁸¹

Energy Queensland, Essential Energy, CEC and Endeavour Energy all noted that DNSPs are not currently funded or resourced to perform compliance on system security issues, and it is unclear what implications the introduction of such activities would have on customers and costs.¹⁸²

Nevertheless, other stakeholders indicated some support for compliance activity on DER technical standards. For example, CitiPower, Powercor and United Energy considered that installers need to have greater accountability and the CEC should have greater involvement with a wider group of stakeholders to facilitate training to installers.¹⁸³

176 AGL submission to the consultation paper, pp. 6-7.

177 Submissions to the consultation paper: Telsa, p.1; CEC, p. 4.

178 Endeavour Energy submission to the consultation paper, pp. 2-3.

179 Plus ES submission to the consultation paper, p. 5.

180 Reposit submission to the consultation paper, p. 5.

181 Ausgrid submission to the consultation paper, p. 9.

182 Submissions to the consultation paper: Energy Queensland, p. 10; Essential Energy, p. 4; CEC, p. 5; Endeavour Energy, p. 2.

183 CitiPower, Powercor and United Energy submission to the consultation paper, p. 1.

6.4 Commission's assessment

Having considered stakeholder feedback and the scope of the standard implemented by the draft rule, the Commission considers that existing compliance and monitoring arrangements can be leveraged to support the initial standard. The Commission notes:

- The requirement for newly connected rooftop solar inverters to comply with the initial technical standard (AS 4777.2) will arise by the NER requiring DNSPs to include such a requirement in the relevant connection contracts.
- The need for DNSPs to be satisfied that the relevant connecting inverters are compliant with the standard will enable them to enquire and seek confirmation of this from installers and/or manufacturers. This can leverage off the existing compliance programs on the certification of products and installers carried out by the CEC and CER.

In addition, the obligation on DNSPs to be responsible for connecting compliant inverters triggers the ability of the AER to enquire as to the DNSPs' approach and actions to satisfy this requirement as part of its DNSP performance reporting program.

6.4.1 DNSPs to ensure connecting equipment meets technical standards

The key to the Commission's compliance approach relates to a requirement for the initial technical standards to be included in DNSPs' connection contracts for new connections or replacements for solar PV less than 5 MW in distribution networks.¹⁸⁴

The Commission's draft rule requires DNSPs to be satisfied that the equipment connected to their networks operates in a manner that complies with the applicable initial standard. To support this, the Commission considers it is a necessary condition to ensure compliance with technical standard at the time of connection.

An outcome of including this requirement in the NER is that this places an obligation on DNSPs to confirm that the standard is met. This is consistent with DNSPs' existing obligations under the NER which allows DNSPs to establish technical obligations for their networks based on operating needs. As a result of the obligation on DNSPs, device manufacturers and installers of connected inverter-based embedded generation are then obliged to satisfy the DNSP that those requirements are met.

In addition, the compliance arrangements outlined above are supported by the AER's ability to enforce DNSPs' compliance with the above requirement. This may include confirming that DNSPs comply with the initial performance standards¹⁸⁵ through use of its compliance monitoring and enforcement role.¹⁸⁶

The Commission considers that placing the responsibility for connecting inverters to comply with AS 4777.2 on DNSPs is consistent with the NEO because DNSPs are best placed to deal with this additional responsibility through their existing processes.

¹⁸⁴ See Chapter 5 for a more detailed discussion of connection arrangements under the draft rule.

¹⁸⁵ AEMO, *Initial distributed energy resource minimum technical standards*, issues paper, August 2020.

¹⁸⁶ NEL s. 15.

6.4.2 Establishing testing requirements for the initial standard in the NER

Under the Commission's draft rule, mandatory test requirements will be introduced in the NER. Equipment manufacturers can test against the test requirements and ensure compliance with the provisions in AS 4777.2:2015 that require all inverters to have under voltage disturbance ride-through capability. The test requirements will test for inverter performance that is already captured in AS 4777.2:2015, but is not already explicitly tested for.

These test requirements have already been introduced into South Australia through the Electricity (General) Regulations 2012. The requirements included in the draft rule will apply to the whole NEM. The testing requirements are the same as that used in South Australia with the only significant difference between the two being the conformance provisions.¹⁸⁷

The test requirements have been developed by AEMO. Their purpose is to determine whether an inverter can meet the short duration undervoltage ride-through requirements set out in AS 4777.2:2015.¹⁸⁸ That is, whether an inverter will remain connected and in sustained, continuous operation for a short duration, transmission undervoltage step reduction.¹⁸⁹

As noted previously, the existing process for devices to achieve compliance with AS 4777.2:2015 relies on relevant testing from a recognised testing facility. AEMO had proposed that such an approach would be appropriate. The Commission has considered this approach and concluded that the applicable testing bodies and accreditation and conformance processes set out in AEMO's test procedure are suitable for meeting the objective of the draft rule and addressing the most pressing concerns on the impact of rooftop solar generation on the power system.

To be able to test inverters for short duration under voltage disturbance ride-through capability the testing facility must have the technical competence to undertake the test and be accredited by either:

- The Australian National Association of Testing Authorities (NATA),
- the International Accreditation New Zealand (IANZ), or
- by accreditation bodies that are signatories to the International Laboratory Accreditation Cooperation Mutual Recognition Arrangements (ILAC MRA).

Under this approach to product testing and conformance, the Commission considers inverter manufacturers will have adequate on-going access to accredited testing facilities. This should provide installers (and consumers) with choice in compliant inverters available for connection.

Once the testing is complete, the test report is to be provided to the CEC for approval and listing on the CEC Approved Inverter Listing Register.¹⁹⁰ This is consistent with the current arrangements. To the extent that inverter manufacturers will need to lab test and relist

¹⁸⁷ The South Australian conformance requirements give certain responsibilities to the Office of the Technical Regulator of South Australia. This includes maintaining a publicly available register of designated inverters and processing test reports from inverter manufacturers to ensure they meet the appropriate requirements.

¹⁸⁸ AEMO, *Short duration undervoltage disturbance ride-through: Inverter conformance test procedure for South Australia*, 2020.

¹⁸⁹ The values selected are outlined in AEMO, *Initial distributed energy resource minimum technical standards*, issues paper, August 2020, pp. 32-35 and are also discussed in Chapter 3 of this draft rule determination.

¹⁹⁰ <https://www.cleanenergycouncil.org.au/industry/products/inverters/approved-inverters>

inverters with the CEC, industry will be provided with adequate lead-time to meet the new testing requirements and listing timelines. The Commission's draft rule includes implementation timelines. These are discussed further in Chapter 8.

6.4.3

Suitability of existing compliance and monitoring arrangements

The Commission has also considered the arrangements for the ongoing monitoring and oversight of the initial standard to ensure inverters for embedded generators support and operate with the desired short duration under voltage disturbance ride-through functionality.

Based on analysis and stakeholder feedback, the Commission has concluded that revisions to existing compliance arrangements as proposed by AEMO would be overly complex.¹⁹¹ In addition, the creation of a new compliance approach for an initial standard in the NER would create duplicative compliance regimes at a time when the broader enduring governance arrangements for technical standards in the NEM are yet to be finalised.¹⁹²

While the Commission considers it is reasonable for DNSPs to manage compliance with the initial standard through the application of connection policies, it recognises that there are established compliance and monitoring processes in place that also support compliance with AS 4477.2. The Commission's view on why existing processes should continue to apply is discussed below.

Application of CEC inverter listing, compliance processes and CER monitoring processes

As discussed in section 7.2.3, the CEC's Inverter Product Listing Register operates to provide independent validation of testing requirements for inverters. It is the Commission's view that the CEC's approval and listing processes should be undertaken once manufacturers have completed testing. This is necessary to demonstrate that their inverters can meet the prescribed short duration voltage disturbance ride-through provisions as expressed in AS 4777.2:2015. Inverters that meet the requirements for inclusion on the CEC's product listing register will be included in an additional field on the CEC's existing inverter product listing register. Importantly, this register can be referenced by DNSPs when establishing requirements for connecting equipment to their networks.

In order to be included on the product listing register by the CEC, the inverter must be independently certified by an accredited certification agency, or state electrical safety regulator. Test reports must be submitted along with the certificate, for detailed reference and for dealings with electrical safety bodies. The CEC also examines the customer documentation provided by applicants for potentially misleading information or misrepresentations. In addition, the CEC's terms and conditions require applicants to name their importer or local manufacturer, who must be a legal entity holding an Australian

191 AEMO, Rule change request, p. 25.

192 See ESB, *Governance of DER technical standards*, consultation paper, July 2020; Governance arrangements for DER technical standards rule change request at: <https://www.aemc.gov.au/rule-changes/governance-distributed-energy-resources-technical-standards>

Business Number (ABN). This is to ensure there is a point of contact responsible for meeting manufacturer warranty obligations under Australian Consumer Law.¹⁹³

Under this general approach to inverter compliance and monitoring, inverters will continue to be subject to the CEC's targeted inverter testing program, with inverter selection based on risk analysis and on a log of failure reports from the market under the draft rule.¹⁹⁴

In addition to the work carried out by the CEC, the CER's inspection program to ensure that inverter and solar systems meet all the installation requirements of the SRES—including compliance with AS/NZS4777.2—would also continue to apply under the draft rule.

Having considered the systems put in place by the CEC and CER, as well as comments from industry participants, the Commission considers that the application of existing compliance and monitoring arrangements remains appropriate. The Commission expects that the arrangements will be effective and are consistent with the draft rule. It also considers the arrangements are likely to contribute to limiting the regulatory burden placed on industry and the AER, as well as not unnecessarily increasing costs to electricity consumers.

193 <https://www.cleanenergycouncil.org.au/industry/products>

194 <https://www.cleanenergycouncil.org.au/industry/products/product-faults-and-testing>

7 IMPLEMENTATION APPROACH

In developing the draft rule, the Commission has given consideration to the appropriate measures required for the implementation of the DER Technical Standards in the NEM.

The Commission recognises that there are a number of actions that must be undertaken by various parties, such as DNSPs and inverter manufacturers, to enable the DER Technical Standards to take effect. It also recognises the intent of the ESB and AEMO to address issues arising from the growth of the small solar generation segment as promptly as possible. On balance, the Commission has concluded that the requirements should come into effect six months from the date of the final rule is made.

This chapter sets out the steps that the Commission considers will need to be undertaken by DNSPs, market institutions, inverter manufacturers and suppliers before the DER Technical Standards commence. The chapter outlines AEMO's proposed implementation plan, the views expressed by stakeholders in response to the consultation paper, and the Commission's implementation approach in the draft rule.

7.1 AEMO's views

On 20 March 2020, the ESB recommended to the COAG Energy Council that the ESB and AEMO work together to deliver a rule change proposal to put in place initial minimum DER technical standards by October 2020. This was agreed by the COAG Energy Council.

In terms of implementation, AEMO noted that interoperability and cyber security standards may not be sufficiently developed to be considered in time to develop a minimum DER technical standard by the proposed implementation date of October 2020. As a result, AEMO noted that the initial standard will be likely to focus on addressing adverse under-voltage disconnections.¹⁹⁵

AEMO considered that the publication and application dates for the new rules and initial standard should take into account appropriate transitional arrangements to accommodate:

- A reasonable timeframe for DNSPs to update relevant connection contracts or agreements to comply with the new rule. AEMO considered three months from the date the rule is made would be appropriate.¹⁹⁶
- The practical steps that need to occur before DER owners can reasonably be expected to comply with the initial standard.
- The extent to which implementation of particular capabilities in the minimum DER technical standard may be dependent on specific network requirements, and whether such capability is required on specific networks at that specific point in time.

AEMO also proposed that DER technical standards would be developed and published with their own application dates and bespoke transition arrangements, following appropriate consultation with relevant parties.

¹⁹⁵ AEMO, Rule change request, p. 17.

¹⁹⁶ AEMO, Rule change request, p. 17.

7.2 Stakeholder views

7.2.1 Time required for industry to meet the proposed specifications

Broadly, stakeholders considered that any application of an initial technical standard for DER should take into consideration implementation lead times required for industry to meet the proposed specifications. No stakeholders supported AEMO's proposed three month implementation timeframe.

AGL considered that adequate notice for industry would be needed to make the necessary changes and mitigate any impact to consumers who have already contracted for the installation of new DER. Further, AGL noted that for the development of technical standards, manufacturers may require between 15 and 24 months to achieve compliance through appropriate testing.¹⁹⁷

Given the potential impacts on manufacturers and suppliers, Plus ES suggested that the commencement date and the implementation dates need to allow for a minimum period of six months.¹⁹⁸ Ausgrid considered that as long a timeframe as possible is required in order to allow for appropriate design, specification, testing, manufacturing, distribution and sales processes to occur, while ERM Power noted the importance of certainty across industry and the allowance of appropriate lead times for the introduction of new standards.¹⁹⁹

Tesla raised concerns that AEMO's proposed timeframes for industry compliance with the initial standard were unrealistic. It noted that industry participants will be required to seek internal approvals, undertake the relevant tests and go through the CEC's product re-listing approach. Tesla also noted that there are limited JAS-ANZ testing facilities in Australia, making it practically challenging for industry participants to meet the proposed timeframes. Instead, it suggested a minimum of six to 12 months would be a more realistic period for the introduction and testing of new performance standards.²⁰⁰

7.2.2 Specifying a date

A number of stakeholders commented on AEMO's proposal that each specific requirement in the standard could have its own start date.

Both EnergyAustralia and Jemena agreed with AEMO. They stated that the overall technical standards could have an implementation date specified in the NER and then individual requirements within the standard could be set in the standard itself.²⁰¹ Vector also expressed this view.²⁰²

Reposit suggested that in considering the start dates for standards, the standards needed to resolve the most urgent issues should be commenced earlier.²⁰³

197 AGL submission to the consultation paper, p. 6.

198 Plus ES submission to the consultation paper, p. 5.

199 Submissions to the consultation paper: Ausgrid, p. 9; ERM Power, p. 2.

200 Tesla submission to the consultation paper, p. 4.

201 Submissions to the consultation paper: EnergyAustralia, p. 7; Jemena, p. 6.

202 Vector submission to the consultation paper, p. 7.

203 Reposit submission to the consultation paper, p. 5.

While not making a specific suggestion on the implementation date, the CEC noted that the key to setting a date should be that it is achievable and practical.²⁰⁴

Energy Queensland commented that without knowing the contents of the technical standard, it could not assess what the commencement date of the standard should be.²⁰⁵

7.3 Commission’s assessment

7.3.1 Implementation and key dates

The draft rule sets out the key dates for the implementation of the DER Technical Standards.

The Commission has determined that the DER Technical Standards will come into effect six months from the date the rule is made. AEMO, DNSPs, the AER and inverter manufacturers and suppliers will need to begin the development and consultation on the proposed changes in order to give them effect. The Commission considers that a commencement date of six months after the rule is made is sufficient time to make the required changes. An overview of the approach to implementation of the initial minimum standard is set out in Figure 7.1. Additional information on this approach is set out below.

Figure 7.1: Implementation approach



Source: AEMC

7.3.2 Key changes to implement the initial standard

This section outlines how the Commission anticipates the new requirements of the DER Technical Standards would be implemented if a final rule is made in a form like the draft rule.

²⁰⁴ CEC submission to the consultation paper, p. 5.

²⁰⁵ Energy Queensland submission to the consultation paper, p. 10.

DNSP amendments to model standing offers and minimum content requirements

In conjunction with the rule changes, DNSPs will need to make amendments to their model standing offers and minimum content requirements for connection offers under Chapter 5A of the NER. These changes to model standing offers will need to be approved by the AER.

Under Chapter 5A of the NER, the AER currently approves the model standing offers for basic connection services between DNSPs and customers if the AER is satisfied that these are fair and reasonable and comply with the requirements of the section.²⁰⁶ The AER may also approve amendments to model standing offers under clause 5A.B.6 of the NER. This is an established activity for the AER that has been effective in confirming that model standing offers meet the appropriate standards.

As a result of the Commission making a rule to implement DER Technical Standards in the NER in the manner described in this draft rule determination, DNSPs would be required to resubmit model standing offers to the AER that include the requirement for embedded generating units connecting by way of a basic micro embedded generation connection service to comply with the DER Technical Standards. This would utilise an established AER process to assess a minor change to the model standing offer requirements. The AER has indicated its support for this approach. It has noted it would be an effective, low-cost option to ensure that DNSPs require that connecting parties are complying with the standards.²⁰⁷

The Commission acknowledges that in setting a date for the DER Technical Standards to take effect, there will always be some parties that are partly through a connection process. To provide clarity to these parties, the Commission has provided further guidance on when the new requirements apply to connection agreements that are still in the process of being entered into on the commencement date of the rule. These transitional provisions specify that if at the commencement date of the rule (six months from the date the rule is made):

- a connection applicant in relation to a basic micro EG connection service has made a connection application but not received a connection offer, the new Chapter 5A will apply to that connection offer and connection contract (draft rule clause 11.[XXX].2)
- if a connection applicant in relation to a basic micro EG connection service has received a connection offer from the relevant DNSP but has not yet entered into a connection contract, the old Chapter 5A will apply to that connection offer and connection contract (draft rule clause 11.[XXX].2).

The new rules do not apply to existing connection contracts unless there is a connection alteration (that is, the connection is amended, augmented or upgraded) (clause 11.109.4 of the NER).

Inverter compliance through testing and certification

To meet the specifications set out in the DER Technical Standards, manufacturers will be required to demonstrate inverter compliance through testing at a recognised testing facility and certification through the CEC's list of compliant inverters.

²⁰⁶ NER clause 5A.B.3.

²⁰⁷ AER submission to the consultation paper, p. 4.

It is the Commission's expectation that once product manufacturers have achieved product testing and conformance with the DER Technical Standards with an accredited testing body,²⁰⁸ the test report will be provided to the CEC for approval and listing on the CEC Approved Inverter Listing Register.²⁰⁹

The Commission suggests that any changes required to inverters to meet the DER Technical Standards and achieve CEC certification be implemented by the effective date of the standard (that is, six months after the rule is made).

The Commission notes a six month time frame for manufacturers is less than the 12 month period often provided by Standards Australia when implementing new requirements. It also notes concern by some stakeholders that the limited number of testing facilities may impact on the ability of manufacturers to complete testing quickly. However, the Commission considers that it is reasonable to expect that the relevant manufacturers are already progressing towards meeting the requirements of AS 4777.2:2015 as well as the short duration under voltage disturbance ride-through requirement because:

- these requirements are already in place and compliance may already be required in some jurisdictions
- the development of AS 4777.2:2020, which incorporates requirements for short duration under voltage disturbance ride-through, has been underway since September 2019 and so industry participants are aware of the changes that will come into effect through Standards Australia
- the recent South Australian regulatory changes for smarter homes also require compliance with these requirements and so to participate in South Australia, industry participants must satisfy the South Australian Office of the Technical Regulator, through the same short duration under voltage disturbance ride-through testing requirements as included in the draft rule, that they meet the requirements.

²⁰⁸ See Chapter 6, section 6.5.2.

²⁰⁹ The CEC list can be found at: <https://www.cleanenergycouncil.org.au/industry/products/inverters/approved-inverters>

ABBREVIATIONS

ABN	Australian Business Number
ACSC	Australian Cyber Security Centre
AEMC (or Commission)	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AS	Australian Standard
ASP	Accredited service provider
COAG	Council of Australian Governments
CEC	Clean Energy Council
CER	Clean Energy Regulator
DER	Distributed energy resources
DNISP	Distribution network service provider
DVP	Distributed photovoltaic
ENA	Energy Networks Australia
ENSP	Embedded network service provider
ERAC	Electrical Regulatory Authorities Council
ESB	Energy Security Board
EV(s)	Electric vehicle(s)
IANZ	The International Accreditation New Zealand
ILAC MRA	International Laboratory Accreditation Cooperation Mutual Recognition Arrangements
JAS-ANZ	Joint Accreditation System of Australia and New Zealand
MCE	Ministerial Council on Energy
NATA	The Australian National Association of Testing Authorities
NECF	National Energy Customer Framework
NEL	National Electricity Law
NEM	National electricity market
NEO	National electricity objective
NER	National Electricity Rules
NERL	National Energy Retail Law
NERO	National energy retail objective
NERR	National Energy Retail Rules
PV	Photovoltaic
SAPN	South Australian Power Networks
VDRT	Voltage disturbance ride-through

A SUMMARY OF OTHER ISSUES RAISED IN SUBMISSIONS

This appendix sets out the issues raised in the first round of consultation on this rule change request and the AEMC’s response to each issue. If an issue raised in a submission has been discussed in the main body of this document, it has not been included in this table.

Table A.1: Summary of other issues raised in submissions

STAKEHOLDER(S)	ISSUE	AEMC RESPONSE
The Caravan, Camping & Tourism Industry & Manufactured Housing Industry Association of NSW Ltd., pp. 3-4.	The AEMC should consider the effect of the DER technical standards on assets located in embedded networks, particularly those residential customers living within residential land lease communities.	<p>The AEMC’s <i>Updating the frameworks for embedded networks review</i> recommended an obligation that embedded network service providers (ENSPs) be required to notify the DNSP of the relevant network about any generation or load being connected under Chapter 5A. This is intended to provide DNSPs with the relevant information necessary for managing network security issues that may arise as a result of small scale generation and larger load connecting to an embedded network. The recommendations are currently under consideration by the Senior Committee of Official’s Embedded Network and Stand-alone Power System working group.</p> <p>With regard to the existing framework, DNSPs may impose requirements through their connection agreements with ENSPs.</p>
Red Energy and Lumo Energy, p. 1.	It is necessary to place clear limitations on the application of the DER technical standards, and the standard should not include standalone generation sites connected directly to the network or transmission system.	As noted in section 3.3 of the draft determination, the draft rule sets out that the DER Technical Standards will only apply to devices categorised as micro-embedded generation units.
Reposit Power, pp. 2-3.	Implementing a technical standard for new and replacement devices ignores the existing 4 GW of existing capacity and potentially disadvantages	The AEMC notes stakeholder concerns regarding the application of DER Technical Standards to new and replacement devices only. However, there are significant issues in requiring existing DER to

STAKEHOLDER(S)	ISSUE	AEMC RESPONSE
	<p>new buyers of DER when compared to owners of existing DER. A price signal is a fairer and more efficient means of operating the system than a technical standard for new and replacement devices.</p>	<p>comply with new technical requirements. While the draft rule will impact some customers more than others, the AEMC considers there are overall benefits to customers in addressing the immediate system security concerns presented by VDRT.</p> <p>In the longer term, both technical standards and price signals will play an important role in the operation of the grid as DER continues to be integrated.</p>
<p>Tesla, p. 3; Wattwatchers, pp. 1-2; Reposit Power, p. 4.</p>	<p>Consideration is required with regard to the relationship between technical standards, tariff reform and market development. Standards shape market behaviour and the potential for ongoing innovation needs to be protected. Engagement with “new energy” sector participants is encouraged.</p>	<p>The AEMC’s 2019 <i>Economic regulatory framework review</i> identified there is a significant risk that the regulatory framework will not continue to promote efficient investment in, and operation and use of, energy services without reforms to accommodate the changes in the industry. The AEMC is cognisant of the links between the development of DER technical standards and the broader program of work underway on distribution access and pricing reforms. It has been working to expand its engagement of all parts of industry when considering reforms to integrate DER.</p>
<p>Solar Analytics, pp. 1-2.</p>	<p>Include in relation to DER technical standards, the requirement for AEMO to value greenhouse gas emissions and implement standards consistent with Australia’s commitments under the Paris accords</p>	<p>In order to make decisions that promote the NEO and NERO, the AEMC considers whether its decisions are robust to any impacts of climate change, or climate change mitigation or adaptation measures, on the price, quality, safety, reliability and security of supply of energy or energy services.</p>
<p>Energy Australia, p.3; Vector, pp.4-5.</p>	<p>An alternate option for the control of DER is through the customers meter. Additional capabilities could be set to enable or disable DER technology through the meter. This would require barriers to the accelerated deployment of meters</p>	<p>The application of DER Technical Standards to micro embedded generation focuses on the capability of voltage ride-through. Any additional capabilities, including those that relate to interoperability or the control of DER devices, are not dealt with in this rule change process.</p>

STAKEHOLDER(S)	ISSUE	AEMC RESPONSE
	to be addressed.	The scope of the forthcoming <i>Review of the regulatory framework for metering services</i> will include enabling services through the meter.
ARENA, pp. 1 and 4.	In the case of EV and charging infrastructure (acting as a generator or a load) it is important that any requirement of EVs providing vehicle-to-grid services need to be internationally consistent where possible to ensure that it does not disrupt EV market development.	Connections to which the DER Technical Standards will apply include new connections in relation to micro EG systems or modifications to existing basic micro EG services, where the basic micro EG system consists of inverter energy system, energy storage system or a combination of both. This includes EVs where the on-board battery storage system is capable of exporting to the network. The introduction of the DER Technical Standards is intended as an interim measure until an updated AS 4777.2 is published. This updated version is anticipated to include updates specifically to incorporate EVs. Additionally, AS4777.2 maintains international consistency through reference to International Electrotechnical Commission (IEC) standards.

B LEGAL REQUIREMENTS UNDER THE NEL

This appendix sets out the relevant legal requirements under the NEL for the AEMC to make this draft rule determination.

B.1 Draft rule determination

In accordance with s. 99 of the NEL the Commission has made this draft rule determination in relation to the rule proposed by AEMO.

The Commission's reasons for making this draft rule determination are set out in section 2.5.

A copy of the more preferable draft rule is attached to and published with this draft rule determination. Its key features are described in section 2.4.

B.2 Power to make the rule

The Commission is satisfied that the more preferable draft rule falls within the subject matter about which the Commission may make rules. The more preferable draft rule falls within s. 34 of the NEL as it relates to:

- the operation of the national electricity system for the purposes of the safety, security and reliability of that system²¹⁰
- the provision of connection services to retail customers.²¹¹

Further, the more preferable draft rule falls within the matters set out in Schedule 1 to the NEL as it relates to the operation of generating systems, transmission systems, distribution systems or other facilities.²¹²

B.3 Commission's considerations

In assessing the rule change request the Commission considered:

- its powers under the NEL to make the rule
- the rule change request
- submissions and other information received during consultation
- the Commission's analysis as to the ways in which the proposed rule will or is likely to, contribute to the NEO.

There is no relevant Ministerial Council on Energy (MCE) statement of policy principles for this rule change request.²¹³

210 Section 34(1)(a)(ii) of the NEL.

211 Section 34(1)(a)(iv) of the NEL.

212 Clause 11 of Schedule 1 to the NEL.

213 Under s. 33 of the NEL the AEMC must have regard to any relevant MCE statement of policy principles in making a rule. The MCE is referenced in the AEMC's governing legislation and is a legally enduring body comprising the Federal, State and Territory Ministers responsible for energy. On 1 July 2011, the MCE was amalgamated with the Ministerial Council on Mineral and Petroleum Resources. The amalgamated council is now called the COAG Energy Council.

The Commission may only make a rule that has effect with respect to an adoptive jurisdiction if satisfied that the proposed rule is compatible with the proper performance of the Australian Energy Market Operator's (AEMO) declared system functions.²¹⁴ The more preferable draft rule is compatible with AEMO's declared system functions because it does not affect AEMO's performance of those functions.

B.4 Civil penalties

The Commission cannot create new civil penalty provisions. However, it may recommend to the COAG Energy Council that new or existing provisions of the NEL be classified as civil penalty provisions.

The draft rule does not amend any clauses that are currently classified as civil penalty provisions under the NEL or National Electricity (South Australia) Regulations. The Commission does not propose to recommend to the COAG Energy Council that any of the proposed amendments made by the draft rule be classified as civil penalty provisions.

B.5 Conduct provisions

The Commission cannot create new conduct provisions. However, it may recommend to the COAG Energy Council that new or existing provisions of the NEL be classified as conduct provisions.

The draft rule does not amend any rules that are currently classified as conduct provisions under the NEL or National Electricity (South Australia) Regulations. The Commission does not propose to recommend to the COAG Energy Council that any of the proposed amendments made by the draft rule be classified as conduct provisions.

²¹⁴ Section 91(8) of the NEL.

C OTHER DER REFORMS

This appendix outlines reforms and projects, carried out by the AEMC and others, relevant to the introduction of a minimum technical standard for DER.

The ESB plays an important role in coordinating reforms undertaken by all parts of the electricity industry to make reforms to successfully integrate DER into the sector. Its objective is to “optimise the benefits of DER for all electricity system users, regardless of whether they own DER or not”.²¹⁵ Part of the ESB’s work plan to meet this objective is the technical integration of DER. This includes technical standards, governance of those standards, and improving DNSPs’ systems to integrate DER into their networks. The current rule change process is one project in this work stream. Other relevant projects are outlined below and include:

- register of DER rule change
- long term governance arrangements of DER technical standards
- rule change processes on the integration of DER into the NEM
- AEMO’s consultation on the content of the initial DER technical standard
- South Australia’s regulatory changes for smarter homes
- Western Australia’s DER roadmap.

C.1 Register of DER rule change

On 13 September 2018, the AEMC made a rule that established a process by which AEMO, networks service providers and other parties may obtain static data on DER across the NEM.²¹⁶ The rule provided that the information on DER would be held in a register established and maintained by AEMO. It also required network service providers to provide information about DER within their network to AEMO for the register.

In addition, AEMO is required to provide disaggregated data on the location and technical characteristics of DER devices to network service providers. The new rules also require AEMO to publish aggregated data periodically and publish, at least annually, information on its use of the DER information it has received under this rule.

The purpose of this rule was to improve the visibility of DER to enable network service providers to plan, invest in, and operate their networks for efficiently. In making this rule, the AEMC also anticipated that greater visibility of DER would assist AEMO in improving its load forecasting and modelling as well as its operations.

C.2 Long term governance of DER technical standards

In 16 July 2020, the ESB commenced a consultative process to determine the long term governance arrangements that could be implemented for DER technical standards.

²¹⁵ ESB, *DER integration roadmap and workplan*, September 2020, p. 4.

²¹⁶ AEMC, *Register of distributed energy resources*, rule determination, 13 September 2018.

The ESB's consultation paper was based on a review carried out by consultant firms Sapere and CutlerMerz on the current standards setting arrangements. The ESB reported that the consultants had highlighted:²¹⁷

... to date the governance of DER technical standards has been fragmented and uncoordinated. The pace of change in the governance area is slower than needed and more resources need to be dedicated to the setting of standards given the rapid deployment of DER, across the National Electricity Market (NEM) and the Wholesale Electricity Market (WEM) in Western Australia.

The ESB consultation paper put forward a governance arrangement that featured a new governance committee that would oversee the development of DER technical standards that are coordinated to meet electrical system security requirements and support DNSPs in managing their networks. In addition, it was recommended that the new committee be convened by the AEMC, who would provide a secretariat to the committee and appoint members.

Following a round of consultation, on 21 September 2020 the ESB Chair Dr Kerry Schott AO, submitted a rule change request with the AEMC proposing new governance arrangements for DER technical standards under the NER and NERR.

The rule change request proposed:²¹⁸

...changes to create 'DER Technical Standards' in the Rules or subordinate instrument, provide for the compliance enforcement of those standards and establish the Australian Energy Market Commission (AEMC) as the responsible decision maker for creating DER technical standards.

The AEMC has not yet initiated the rule change process for this request.

C.3 Integration of DER rule change requests

In July 2020, the AEMC received three rule change requests that sought to better integrate DER into the NEM. These requests were:

- The Total Environment Centre and the Australian Council of Social Services together submitted a rule change request to the AEMC on 7 July 2020. This request seeks to enable DNSPs to efficiently manage the integration of DER and meet consumer needs by: requiring DNSPs to offer export services and support efficient investment; and establishing principles to guide DNSP decisions on the allocation of DER hosting capacity within a distribution network.²¹⁹
- St Vincent de Paul Society of Victoria submitted a rule change request seeking to remove impediments in the NER that prevent DNSPs from recovering the costs incurred in

²¹⁷ ESB, *Governance of DER technical standards*, consultation paper, July 2020, p. 1.

²¹⁸ Dr Kerry Schott AO, *Governance of DER technical standards rule change request*, 21 September 2020, p. 1.

²¹⁹ Total Environment Centre and Australian Council of Social Services, *Network planning and access for DER rule change request*, 7 July 2020.

supporting the export of electricity from those users of the network that export electricity.²²⁰

- SA Power Networks submitted a rule change request to enable DNSPs to efficiently manage DER integration and meet consumer preferences. This is to be achieved by: updating the regulatory framework to recognise export services; encouraging efficient DNSP investment in DER to provide the services sought by customers; and enable DNSPs to propose tariffs for export services.²²¹

The three rule change requests listed above are being assessed concurrently by the Commission. A consultation paper was published on 30 July 2020 with submissions closing on 10 September 2020. A draft rule determination for these requests is expected to be published on 25 March 2021.

Further information is available from the AEMC website under the project codes ERC0309, ERC0310 and ERC0311 respectively.

C.4 AEMO consultation on the initial standard

AEMO published its consultation paper on the content of the initial technical standard on 24 August 2020. The submission period to this paper closed on 29 September 2020. In its consultation paper, AEMO focused the initial standard on DER inverter capability to withstand power system disturbances.²²² It noted that:²²³

AS/NZS has a provision requiring that all inverters have VDRT capability. However, the current standard does not have a test procedure which equipment manufacturers can test against and ensure compliance.

AEMO stated that it had drafted a voltage disturbance ride-through (VDRT) test procedure for the South Australian Government in relation to its DER action plan. While AEMO recognised that Standards Australia is currently revising the relevant standard (AS/NZS 4777.2) in relation to voltage ride-through, it recommended that its VDRT testing procedure be included as an initial DER technical standard for the NEM. AEMO also commented that:²²⁴

Improvements to VDRT and other disturbance ride-through requirements are also proposed in the current revision to AS/NZ 4777.2... This revision will not be finalised until early 2021 with manufacturers provided a 12-month transitional period before inverters must be compliant to the new standard.

220 St Vincent de Paul Society of Victoria, Allowing DNSPs to charge for exports to the network rule change request, 2 July 2020.

221 SAPN, Access, pricing and incentive arrangements for DER rule change request, 7 July 2020.

222 AEMO also noted the importance of interoperability capabilities for DER and sought feedback in the consultation paper from stakeholders for future development. AEMO, *Initial distributed energy resource minimum technical standard*, issues paper, August 2020, p. 7.

223 AEMO, *Initial distributed energy resource minimum technical standard*, issues paper, August 2020, p. 4.

224 AEMO, *Initial distributed energy resource minimum technical standard*, issues paper, August 2020, p. 5.

AEMO recommended that AS/NZ 4777.2:2015 be included as an initial technical standard for DER with an accelerated implementation time frame for the VDRT test procedure of six, rather than 12 months.²²⁵

Following consideration of submissions to its consultation paper, AEMO announced on 21 October 2020, that it would schedule the next stage of work on this project to better align with the AEMC's draft rule determination on this current rule change request.²²⁶

C.5 South Australian regulatory changes for smarter homes

In June 2020, the Department for Energy and Mining, South Australia consulted on a proposed package of regulatory changes to seek to implement new technical standards to support the orderly transition and incentive structures for customers to be rewarded for managing their energy use.

This consultation resulted in a number of new technical standards and requirements for new and replacement smaller generating systems, such as rooftop solar, effective from 28 September 2020. These included:

- voltage ride-through standards for generating systems connected via an inverter
- remote disconnection and reconnection requirements
- export limit requirements
- smart meter minimum technical standards
- tariffs to incentivise energy use in low demand periods.

Of relevance to this current rule change process, the new technical standard for generating systems connected by low voltage power inverters to the South Australian distribution network specifies that the inverters meet Australian Standards ride-through requirements set out in AS 4777.2:2015. Satisfying this requirement is to be demonstrated by successful completion of the test specified in the testing procedure developed by AEMO for this purpose.²²⁷ This requirement has been designed to mitigate the impacts of large scale disconnection of DER inverters on the South Australian power system that may otherwise occur during disturbances.²²⁸ An up to date list of approved inverters is maintained on the department's website.

C.6 Western Australia's DER roadmap

The Western Australian Energy Transformation Taskforce was established in 2019 to implement the government's strategy to transition the South West Interconnected System (SWIS) to one that optimises renewable, decentralised electricity generation and supply. One

²²⁵ AEMO, *Initial distributed energy resource minimum technical standard*, issues paper, August 2020, p. 5.

²²⁶ AEMO, email notice to stakeholders from AEMO DER program — standards and connections team, 21 October 2020.

²²⁷ AEMO, *Short duration undervoltage response test*, 28 July 2020.

²²⁸ See https://www.energymining.sa.gov.au/energy_and_technical_regulation/energy_resources_and_supply/regulatory_changes_for_smarter_homes, viewed 1 October 2020.

aspect of this is making improvements to inverters to enable more successful management of the distribution network.²²⁹ The DER roadmap is to be implemented over 2020-2024.

Relevant to the technical requirements of DER inverters, in August 2019 Western Power updated its guideline for inverter-based embedded generators to specify new requirements consistent with AS 4777.2:2015. Following this, further changes are to be made to improve the autonomous functions of inverters as set out in the Australian standard. It is also anticipated that AEMO and Western Power will work on the development of inverter communication functions with the aim of further enhancing the ability of the DNSP to manage its network.²³⁰

More recently, on 1 July 2020, rules governing the wholesale electricity market (WEM) were amended to implement a register of DER devices. AEMO and Western Power are working to establish the register.²³¹

The Energy Transformation Taskforce also recently carried out consultation on the work to implement the DER roadmap. The work consulted upon included the development of the new roles of distribution system operator and distribution market operator, the creation of DER aggregators, and the impact of DER on customers.²³²

229 WA Energy Transformation Taskforce, *DER roadmap*, December 2019, p. 4.

230 WA Energy Transformation Taskforce, *DER roadmap*, December 2019, p. 54.

231 WA Energy Transformation Taskforce, *A brighter energy future*, newsletter issue 8, August 2020, p. 4.

232 WA Energy Transformation Taskforce, *Issues paper DER roadmap: Distributed energy resources orchestration role and responsibilities*, 14 August 2020.