

7 March 2025

Anthony Lean
Secretary
Department of Climate Change, Energy, the Environment and Water
Online submission

Dear Mr Lean,



NSW Emergency Backstop Mechanism and Consumer Energy Resources Installer Portal Consultation Paper

AEMO welcomes the opportunity to comment on the NSW Emergency Backstop Mechanism and Consumer Energy Resources Install Portal Consultation Paper.

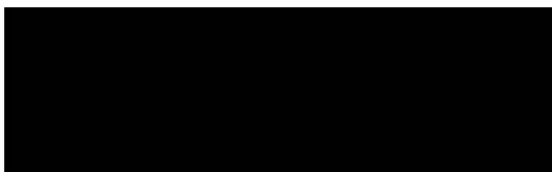
The New South Wales Government's introduction of an emergency backstop mechanism as a last resort operational tool is a critical capability required to manage system security risks and AEMO is very supportive of its introduction. AEMO acknowledges the NSW Government's support in addressing the complex challenges in maintaining a secure power system, and its collaborative approach with AEMO, DNSPs and industry including equipment manufacturers and installers.

If appropriate market mechanisms and incentives are introduced to encourage customers to respond to market signals, the use of emergency backstop mechanisms required should remain infrequent, but essential for maintaining a secure and reliable supply of electricity for customers. There are a number of critical reforms underway to lower barriers for consumers and their agents and facilitate greater participation of Consumer Energy Resources (CER) in market processes. These reforms will enable a diverse range of consumers, from large businesses to households with rooftop solar and storage systems, to benefit from and contribute to the market in line with their preferences and capabilities.

A detailed submission is attached offering AEMO's learnings from the implementation of backstop mechanisms in the context of the NSW Government's proposed approach to the introduction of an emergency backstop and CER Installer.

AEMO looks forward to continuing to work with the NSW Government as it moves toward the implementation of an emergency backstop mechanism and the development of a CER Installer Portal. Should you wish to discuss any of the matters raised in this submission, please contact 


Yours sincerely,



Attachment: Detailed submission

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New South Wales | Queensland | South Australia | Victoria | Australian Capital Territory | Tasmania | Western Australia

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Attachment: Detailed submission

1. Background

Australians continue to invest in distributed photovoltaics (DPV) and other consumer energy resources (CER) at world leading levels. More than one-third of homes across the country now host rooftop solar systems, helping households and businesses reduce their energy bills and directly contributing to the decarbonisation of the energy system.

Rooftop solar, and CER more broadly, has become an indispensable part of Australia's future energy system, offering a range of significant short and long-term benefits for consumers, communities and at a broader systems level.

Given the growing installation of distributed PV, there are increasing periods where there is a significant amount of generation from distributed PV in the daytime. During these periods, there is limited demand being supplied from the main transmission system.

In July 2024, Australia's Energy Ministers agreed to a National CER Roadmap,¹ building on advice from the Energy Security Board (ESB) around critical technical capabilities for ongoing power system security. The CER Roadmap sets out an overarching vision and plan to unlock CER at scale and identifies measures to "unleash the full potential of CER" by establishing the required mechanisms, tools and systems. This includes both:

- Reforms to increase the opportunities for market participation of CER, including through enhanced coordination, allowing customers to respond to market-based incentives which will also help meet the challenges of low operational demand.
- Measures to support ongoing power system security, particularly the requirement for "backstop mechanisms to be in place" by the end of 2025 for "emergency response to ensure operational security when required".

Minimum operational demand in the National Electricity Market (NEM) has been falling on average more than 1.2 gigawatts (GW) per year and is projected to continue on this trajectory. At present, the power system relies on large-scale plant to deliver a range of system security services (system strength, inertia, voltage management and ramping). To deliver these services, these large-scale plant need to operate above minimum safe operating levels. In periods of very low operational demand, it may not be possible to dispatch enough large-scale plant above their minimum safe operating levels to deliver these essential security services.

AEMO published a report in December 2024,² articulating the technical challenges emerging in minimum system load (MSL) periods, and the technical basis of the need for implementation of emergency backstop capabilities. This report highlighted that "emergency backstop" mechanisms, already vital in South Australia, Queensland and Victoria, are now needed in every NEM mainland jurisdiction to allow emergency curtailment of distributed PV when needed to maintain system security.

If appropriate market mechanisms and incentives are introduced to encourage customers to respond to market signals. The emergency periods where emergency backstop intervention is required should remain infrequent, but essential for maintaining a secure and reliable supply of electricity for customers.

2. Operational demand thresholds and requirements for backstop capability in NSW/ACT

The combined New South Wales and Australia Capital Territory region recorded a new minimum operational demand of 2,718 MW at 12:30pm (AEST) on 16 February 2024, breaking the previous record set in October 2024 by 403 MW.

AEMO's December 2024 report,³ highlighted that projections for minimum operational demand indicate emergency backstop capabilities could be required in the NSW/ACT region from Spring 2025 under certain emergency conditions.

¹ Department of Climate Change, Energy, the Environment and Water (July 2024) National Consumer Energy Resources Roadmap, <https://www.energy.gov.au/sites/default/files/2024-07/national-consumer-energy-resources-roadmap.pdf>.

² AEMO (December 2024), Supporting secure operation with high levels of distributed resources. <https://aemo.com.au/-/media/files/initiatives/der/managing-minimum-system-load/supporting-secure-operation-with-high-levels-of-distributed-resources-q4-2024.pdf?la=en>

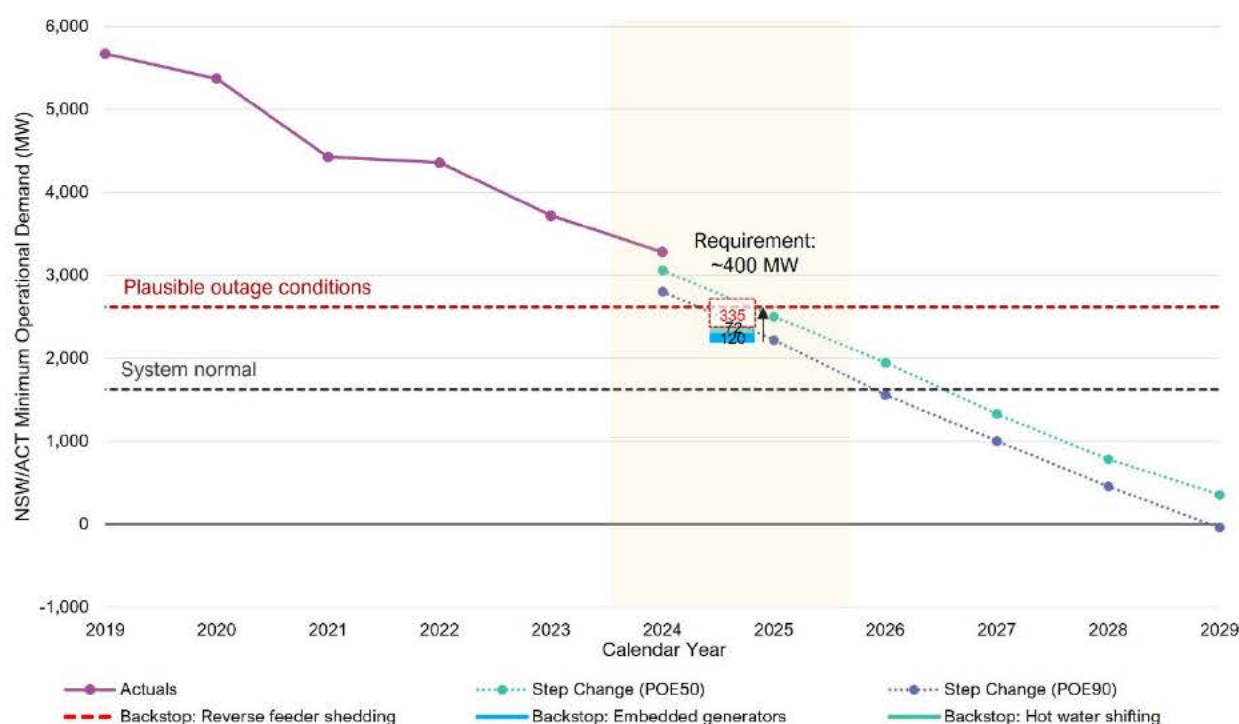
³ AEMO (December 2024), Supporting secure operation with high levels of distributed resources. <https://aemo.com.au/-/media/files/initiatives/der/managing-minimum-system-load/supporting-secure-operation-with-high-levels-of-distributed-resources-q4-2024.pdf?la=en>

With the present operational toolkit, New South Wales/Australian Capital Territory requires at least 1.5-2 GW of operational demand to maintain online the minimum synchronous units required for essential services. However, challenges will arise much earlier than this threshold under conditions of outages. Unplanned network or unit outages can occur at any time, and there needs to be adequate operational tools available for managing these conditions. Extrapolating from studies in Victoria, outages can push thresholds ~1 GW higher.

Figure 1 shows the projections for minimum operational demand for New South Wales/Australian Capital Territory, compared with these thresholds. The potential requirements for backstop capability shown in Figure 1 are based on needing to reach an operational demand threshold of ~2.6 GW under conditions of outages. This indicates possible issues could emerge in New South Wales/Australian Capital Territory as early as 2025 if emergency conditions coincide with demand at the lower range of the minimum demand forecast. The amount of backstop capability required based on studies to date is ~400 MW from October 2025.

As of December 2024, DNSPs in the NSW/ACT region estimated they can curtail some embedded and non-scheduled generators in their network, delivering a total estimated response of ~120 MW. Some Distribution Network Service Providers (DNSPs) estimated that they can also shift hot water loads delivering a total estimated response of ~72 MW. Beyond these options, DNSPs have indicated that at present, they have limited ability to respond to an instruction from AEMO to increase operational demand if necessary.

Figure 1 New South Wales/Australian Capital Territory: Minimum demand thresholds and projections



3. Learnings from implementing emergency backstops

The New South Wales Government's introduction of an emergency backstop mechanism as a last resort operational tool is a critical capability required to manage system security risks and AEMO is very supportive of its introduction. To meet the projected system security requirements outlined above, it is crucial to enable networks to play a clear and well-defined role in delivering an emergency backstop capability. This requires an implementation pathway that support DNSPs also expanding complementary measures that reduces customer impact, such as hot water load shifting,

Emergency backstops are already being implemented in South Australia, Queensland and Victoria. DNSPs have taken a variety of technical approaches to establish emergency backstop capability. These approaches include those listed in the hierarchy of measures that the Consultation Paper outlines including:

- Hot water load shifting
- DPV curtailment and disconnection
- Enhanced voltage management (EVM).

Implementing a new system capability is a complex endeavour. It will be critical for all key parties including government, DNSPs, OEMs and AEMO to collaborate constructively to deliver a fit-for-purpose outcome.

AEMO offers some of the following key learnings from the experiences of other jurisdictions in the context of the proposed approach to the implementation of a New South Wales emergency backstop and CER Installer Portal.

Consider the broad need of backstop capability

The Consultation Paper notes that it is envisaged that the use of an emergency backstop mechanism by DNSPs would result in the temporary curtailment of customer exports to the grid and could also result in customers' roof top solar being switched off. The consultation paper also recognises that there are emerging use cases for the use of emergency distributed PV management. AEMO agrees it is important to consider the broad need for backstop capabilities.

As outlined in AEMO's December 2024 Report,⁴ emergency backstop capabilities are intended to be the last resort measure to allow AEMO to manage power system security in a wide range of circumstances. The most immediate power system security use cases include increasing operational demand to manage MSL conditions and reducing the contingency size related to sympathetic tripping of DPV inverters during grid disturbances. There are many other potential security issues that could arise and require backstop capabilities, such as:

- Management of cybersecurity threats.
- CER control system interactions (which could occur even if systems are curtailed to 0 MW but remain connected to the system).
- Possible use to facilitate a system restart process.

For these reasons, AEMO recommends that backstop capabilities include the ability to completely disconnect the system if required, in addition to the ability to curtail generation to 0 MW.

To appropriately manage customer impacts, a first tier of response could involve curtailment of site exports to 0 MW, but it is also important that the full ability to curtail all generation on site to 0 MW is also available and tested (potentially reserved to a later tier of response), to ensure a sufficient suite of tools available to manage plausible emergency conditions.

Harmonisation

The Consultation Paper outlines the New South Wales Government's approach to require DNSPs to set up and operate Common Smart Inverter Profile - Australia (CSIP-AUS) servers to curtail solar exports to the grid and use a consistent test protocol across all three DNSP servers. The Consultation Paper indicates that the New South Wales government also intends to require DNSPs to harmonise their approach in the use of utility servers for the backstop mechanism.

AEMO notes that there is work under the CER Roadmap underway to develop nationally consistent CER technical standards and the establishment of a CER Technical Regulator to enforce standards. Until nationally consistent standards and a CER Technical Regulator has been put in place, AEMO supports pursuing consistency of approach across jurisdictions and DNSPs where possible (leveraging work done to date on standards such as IEEE 2030.5 CSIP-AUS and leveraging prior experience and existing systems where feasible). This should simplify implementation for DNSPs and equipment manufacturers and minimise the challenges experienced in other jurisdictions due to differences in the implementation of CSIP-Aus.

Suitable mechanisms and frameworks for managing compliance

The Consultation Paper identifies roles and responsibilities for DNSPs with respect to conformance monitoring, conformance assessment and rectification of non-conformance at the time of installation, and ongoing over time. The

⁴ AEMO (December 2024), Supporting secure operation with high levels of distributed resources. <https://aemo.com.au/-/media/files/initiatives/der/managing-minimum-system-load/supporting-secure-operation-with-high-levels-of-distributed-resources-q4-2024.pdf?la=en>

Consultation Paper also acknowledges the importance of allowing for the ability to periodically test and confirm the aggregate response of the entire mechanism and the ability to test individual device capability on site.

The consultation paper highlights challenges previously reported by AEMO in April 2023 regarding compliance with AS4777.2 requirements.⁵ Following concerted effort between AEMO, DNSPs, OEMs and others, AEMO reported an increase in compliance for newly installed systems to 75-80% in December 2023.⁶ Subsequent analysis suggests the rates today are even higher. This experience highlights that adequate compliance can be achieved with significant effort. However better compliance governance is needed to ensure this process is efficient and the outcomes enduring.

AEMO's December 2024 report⁷ highlighted the challenges experienced in other jurisdictions to achieve emergency backstop compliance. Ensuring suitable mechanisms and frameworks for managing backstop compliance, both during initial commissioning and maintained over time is critical for an operationally effective emergency backstop. Significant resourcing efforts are also required to achieve the levels of compliance with backstop capabilities necessary for operational effectiveness.

Approaches to compliance and testing, utilising feedback loops, were outlined in the AEMO's December 2024 Report⁸, including:

- Capability testing: a test triggered by installers at the time of commissioning to check that a site is set up and responding to emergency backstop triggers correctly.
- Increased incentives – requirements for capability test response in order to enable export, and potential penalties for installers that consistently fail to install systems with compliant backstop capabilities.
- Periodic testing – in development of regulatory frameworks, jurisdictions should make explicit allowance for periodic testing of the mechanism in aggregate, so that compliance can be assessed and enforced.

In addition, the New South Wales Government and DNSPs should consider the type of compensatory controls that would be appropriate to manage non-conformance.

Use of enhanced voltage management

Some DNSPs have enhanced voltage management (EVM) capability. This is a sophisticated voltage management system used to dynamically regulate voltages in the distribution network. Under normal circumstances, this capability better supports network voltages and therefore maximises the amount of energy that DPV systems can generate, increasing hosting capacity of the network. EVM capability is also available to assist with managing MSL periods in South Australia and Victoria.

AEMO considers EVM a higher-impact backstop method than controlled curtailment of DPV generation, and recommends it is used only in events where controlled curtailment is insufficient to meet system security needs, and for purposes of testing. Where an investigation and necessary safety and technical analysis by DNSPs confirms voltage management for emergency distributed PV curtailment (also known as emergency voltage management, or EVM) would be an effective and appropriate backstop method in NSW, any regulatory barriers should be identified and removed including barriers to testing.

In the context of the challenges experienced in other jurisdictions in achieving high compliance with DPV emergency backstop measures, EVM has the potential to assist filling an anticipated shortfall in backstop capacity in the near term, and to provide a backup to other preferred mechanisms in the longer term. During high DPV periods in South Australia during November 2022, EVM was a critical last resort tool in supporting secure management of South Australia's island power system during very difficult operational conditions. EVM capability may also reduce potential reliance on shedding reverse flowing feeders.

⁵ AEMO (April 2023) C Compliance of Distributed Energy Resources with Technical Settings, <https://aemo.com.au/-/media/files/initiatives/der/2023/compliance-of-der-with-technical-settings.pdf?la=en>

⁶ AEMO (December 2023) Compliance of Distributed Energy Resources with Technical Settings: Update, https://aemo.com.au/-/media/files/initiatives/der/2023/oem_compliance_report_2023.pdf?la=en&hash=E6BEA93263DE58C64FCC957405808CA6

⁷ AEMO (December 2024), Supporting secure operation with high levels of distributed resources, <https://aemo.com.au/-/media/files/initiatives/der/managing-minimum-system-load/supporting-secure-operation-with-high-levels-of-distributed-resources-q4-2024.pdf?la=en>

⁸ Ibid.

Cyber security needs

A key factor in designing a backstop mechanism that was highlighted in AEMO's December 2024 report was the consideration of cyber-security frameworks and obligations, for internet connected devices.

AEMO considers that the principles of cyber informed engineering⁹ would provide important options to mitigate cyber security risk and should be applied to the NSW backstop and conformance monitoring design.

Communication

AEMO commends the New South Wales Government's proposed approach to work with DNSPs and engage OEMs and CER installers in the development of the CER Installer Portal. Experience in other jurisdictions has demonstrated the benefits of extensive and ongoing industry engagement starting as early as possible in the design stage. SAPN, for example, engaged via webinars, CEC training courses, 1-1 solar retailer engagements, surveys, industry reference groups, outbound phone calls and events with the Smart Energy Council.

4. CER Installer Portal

The introduction of a single CER installer portal that integrates with each DNSPs utility server can provide consistency for equipment manufacturers and installers. It is worth noting that developing a single portal which interfaces with the DNSP CSIP-AUS servers may be a complex endeavour, hence beginning development and industry engagement as early as possible will support implementation and compliance outcomes. This includes technology development, OEM collaboration, user testing, small-scale trials and installer education.

Once implemented, a CER installer portal can also improve compliance as conformance tests can be conducted prior to energisation of the CER. This means non-conformance can be corrected during installation. As discussed above, high compliance at installation reduces and removes the need to embark on costly identification and rectification of non-compliant sites.

5. Risks if there is insufficient backstop capability

Where backstop capability, including EVM capability, has been exhausted DNSPs will need to resort to shedding of reverse flowing feeders. This involves shedding whole distribution feeders (tripping all the distributed PV on the 11 kilovolts (kV) or 22 kV circuit, as well as all the customer load on the circuit). Tripping distribution circuits that are operating in reverse flows contributes to an overall increase in operational demand. Customers that are connected to feeders that are shed will have no electricity supply during these periods. This approach requires shedding large amounts of customer load to achieve a small increase in regional operational demand, so has a very high impact on households and businesses.

If there is insufficient backstop capability, and the use of these higher impact tools are exhausted, this could mean the NEM is operating insecurely for extended periods, outside the permissible range specified in the National Electricity Rules. A credible disturbance at such times could lead to cascading failures and reliance on emergency control schemes to prevent system collapse. This places customers at an elevated risk of system collapse. The ability to restore the system following a black system event may also be compromised at times of very high distributed PV generation.

6. Conclusion

The NSW Government's decision to implement an emergency backstop mechanism to ensure consumers have a secure power system should be commended.

AEMO looks forward to supporting the government and department during both this high-level and then detailed design process, towards ensuring an effective operationalisation of the mechanism.

⁹ See US Department of Energy Security and Response, Cyber Informed Engineering, <https://www.energy.gov/ceser/cyber-informed-engineering>