CLIMATE CHANGE AUTHORITY

Unlocking Australia's clean energy potential

SUPPLEMENT TO THE 2024 ANNUAL PROGRESS REPORT

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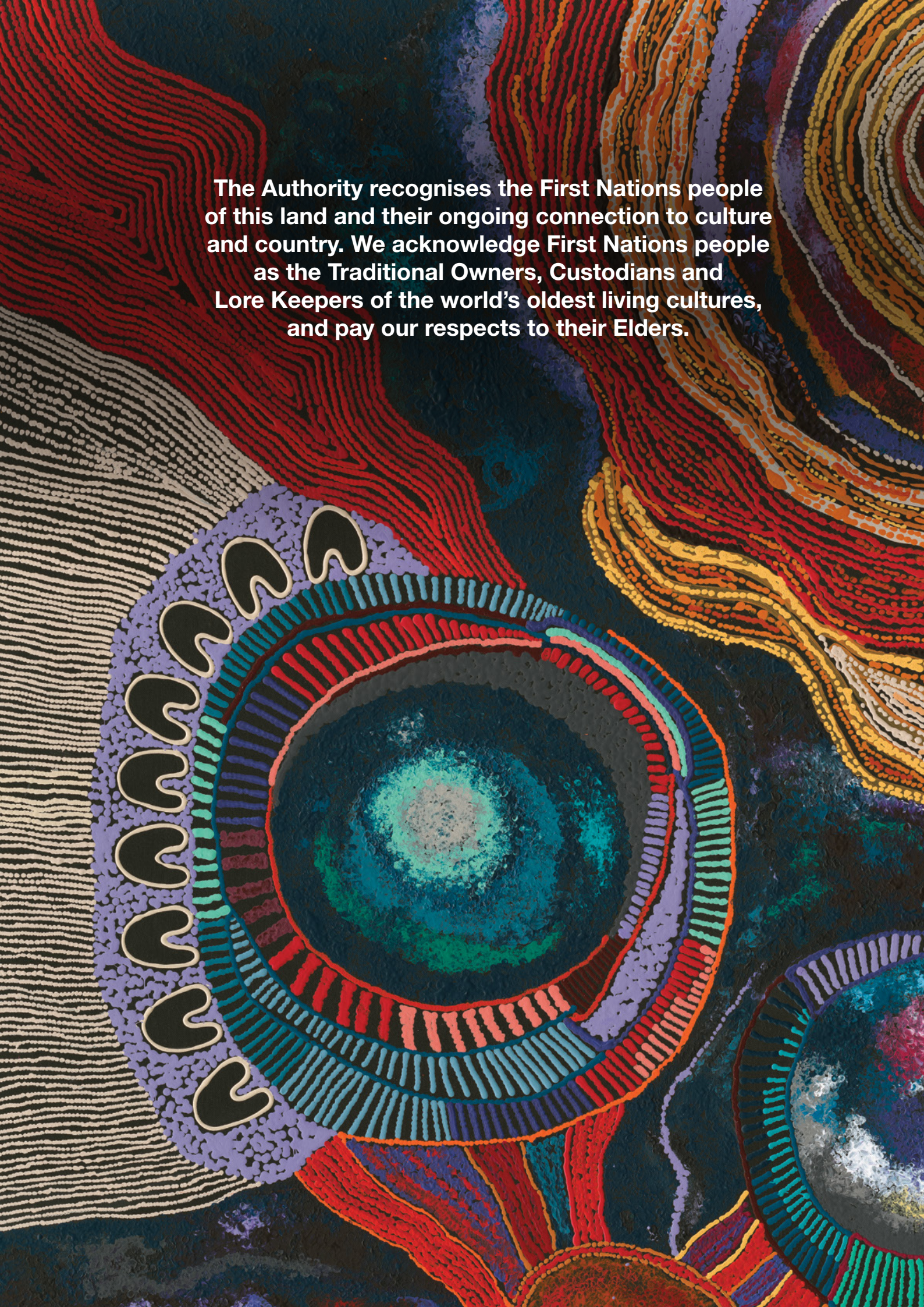

The Authority recognises the First Nations people of this land and their ongoing connection to culture and country. We acknowledge First Nations people as the Traditional Owners, Custodians and Lore Keepers of the world's oldest living cultures, and pay our respects to their Elders.

Acknowledgements

The Climate Change Authority would like to acknowledge and thank the many individuals and organisations who contributed their time and expertise to this report.

Our report is informed by expert consultations accompanied by our analysis, research and other public consultation process. The Authority has spoken to more than 25 expert organisations and individuals since the inception of this report, including the Australian Energy Market Commission, Australian Energy Market Operator, Australian Energy Regulator, Clean Energy Regulator, Department of Climate Change, Energy, the Environment and Water and the National Electricity Market Review Expert Panel, and would like to thank them for being so generous with their time.

We received 221 formal submissions to our 2024 issues paper *Targets, pathways and progress*, as well as many more stakeholder contributions during consultation. Public submissions received in response to our 2024 issues paper are publicly available on the consultation page of our website. These contributions have improved the quality of this report and provided evidence to help inform our analysis and recommendations.

Except where explicitly stated, the views expressed in the report are the Authority's own. They should not be taken as the views or positions of any of the entities mentioned above.

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Acronyms and abbreviations

ACF	Accelerated Connections Fund
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
APR	Annual Progress Report
ARENA	Australian Renewable Energy Agency
BEV	Battery Electric Vehicle
BITRE	Bureau of Infrastructure and Transport Research Economics
C&I	Commercial and Industrial
CCA	Climate Change Authority
CEC	Clean Energy Council
CEFC	Clean Energy Finance Corporation
CER	Clean Energy Regulator
CIS	Capacity Investment Scheme
DAPR	Distribution Annual Planning Report
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DNSP	Distribution Network Service Provider
ECA	Energy Consumers Australia
ENA	Energy Networks Australia
EV	Electric Vehicle
EVC	Electric Vehicle Council
EVSE	Electric Vehicle Supply Equipment
FID	Final Investment Decision
GFI	Grid-Forming Inverter
GW	Gigawatt
GWh	Gigawatt Hour
IEA	International Energy Agency
ISP	Integrated System Plan
kW	Kilowatt
kWh	Kilowatt Hour
LRET	Large-scale Renewable Energy Target
MW	Megawatt
MWh	Megawatt Hour
NEM	National Electricity Market
PV	Photovoltaic
RAB	Regulated (or regulatory) Asset Base
RET	Renewable Energy Target Scheme
RETAs	Renewable Energy Transformation Agreements
RIT-T	Regulatory Investment Test for Transmission
SRES	Small-scale Renewable Energy Scheme
TNSP	Transmission Network Service Provider
V2G	Vehicle to Grid

Legislation

All legislation cited in this report is Commonwealth legislation unless otherwise indicated. Commonwealth legislation can be found on the Federal Register of Legislation: www.legislation.gov.au. The following Commonwealth Acts are cited in this report:

Climate Change Act 2022

Environment Protection and Biodiversity Conservation Act 1999

Executive summary

Executive summary

The rapid transition to renewable electricity will underpin the achievement of Australia's emissions reduction targets and is vital for ensuring sufficient generation capacity is being built to replace ageing, and increasingly unreliable coal-fired power stations. Australia leads the world in household rooftop solar photovoltaics (PV). Renewables continue to make up a greater share of electricity generated in Australia's main electricity grid, accounting for a record 46% in the last quarter of 2024 (AEMO, 2025e; CER, 2025c). However, in our *2024 Annual Progress Report* (2024 APR), the Authority concluded that additional policy measures would be required to ensure the Australian Government's 82% renewable electricity target for 2030 is met (CCA, 2024a).

The renewable build-out will need to continue at pace beyond 2030 as the remaining coal-fired power stations retire and to meet demand as other sectors electrify. The Authority expects that additional policy measures, as are required to achieve the 2030 target, will continue to be needed after 2030 to drive the continued build out.

In the 2024 APR, we made recommendations that addressed the following 4 issues:

1. achieving renewable energy targets
2. maintaining system security and reliability as the share of renewables increases
3. connecting renewables to the grid more quickly
4. unlocking more generation and storage at the local level.

This report provides further advice on those issues, supported by consultation with over 2 dozen expert organisations and individuals.

Chapter 1 discusses expanding investment in new capacity so that it covers any additional renewable capacity that will be needed to meet emissions targets. The Capacity Investment Scheme (CIS) is Australia's main policy for deploying new renewables. It is expected to deliver 23 GW of additional renewable generation capacity by 2030. However, the 2024 APR concluded that Australia will need more than that in Australia's largest grid, the National Electricity Market (NEM), if it is to reach the target of 82% renewable generation. Additional generation capacity is also needed beyond the NEM. Expanding and extending investment in new capacity should ensure the delivery of the renewable capacity needed to decarbonise Australia's electricity grids to 2030 and beyond.

Chapter 2 discusses ways to maintain system stability and a reliable supply of electricity as more renewable energy enters the NEM. Historically, traditional spinning generators, such as coal-fired generators, have provided system security. As these coal-fired generators reach the end of their operational life, Australia will need to replace them with proven solutions in a timely manner. Synchronous condensers are a proven technology that can be accommodated in existing grids to provide security. By adding gas-fired generation capabilities that can be deployed at critical times when zero-emissions and storage options are unavailable, synchronous condensers can also make an important and cost-effective contribution to maintaining a reliable supply of electricity as the system transitions to very high levels of renewables.

Chapter 3 discusses options for speeding up network connections and environmental approvals so that new renewable generation can be added to the grid in a more timely way. Approval processes are limiting how quickly project proponents can connect new renewable generation to the grid. Governments can help speed up grid connections by making approval processes more streamlined and transparent. Recent initiatives to improve connection timelines have shown promise.

Chapter 4 identifies ways local-level generation and storage can contribute to accelerating the roll-out of renewables without the need to wait for transmission infrastructure upgrades. With the support of governments and network service providers, Australians can use existing local infrastructure to speed up the rate at which renewable generation is added to the energy mix.

For the timely and successful transformation of the electricity system there needs to be coordinated investments in significant amounts of new generation, storage, transmission, and system services. Given:

- the necessary speed and magnitude of the transition
- the criticality of electricity supply as an essential service
- market uncertainty over policy and the timing of coal-fired power station exits;

a significant amount of government involvement in planning and coordination, and in taking on some of the financial risk of investing in the sector, is necessary if the transition is to be successful. Nonetheless, policy settings should seek to promote private sector investment and competitive retail and generation markets to ensure the most efficient outcomes.

Summary of recommended actions

Summary of recommended actions

Expanding investment in new capacity to meet targets

- Work with states and territories to reach a shared understanding of how much renewable capacity will be built by 2030 beyond the Government's Capacity Investment Scheme (CIS) target – for example through Renewable Energy Transformation Agreements (RETAs), other state and territory commitments, and private investment.
  - If required, the Government should then expand the renewable capacity target under the current CIS to close any remaining gap to achieving the 82% renewable generation target, taking into account advice from the Australian Energy Market Operator (AEMO) on the size and quality of the investment pipeline and the capability of Australia's grids to accommodate additional projects before 2030.
- With CIS tenders currently scheduled to end in 2027, ensure a capacity mechanism like the CIS continues contracting new projects from 2028 to bring on new capacity at the pace and scale that is required beyond 2030.
  - The post-2027 scheme for stimulating generation and storage investment should take into account lessons from the CIS and the recommendations of the current review of wholesale market settings in the NEM.
  - In considering the form a continuing capacity mechanism should take, the Government should work with states and territories to determine an appropriate allocation of costs.

Maintaining system security and reliability while increasing the share of renewables

- Work with the Energy and Climate Change Ministerial Council to enable the deployment of synchronous condensers with gas-fired generation capability to maintain system strength and support reliability. These assets should be able to run on liquid fuels, biomethane, hydrogen or other renewable fuels, and would only be deployed when zero-emissions options are unavailable.
  - Our assessment is that AEMO would be best placed to plan and procure system services that require the installation of synchronous condensers and related equipment, which would be owned and operated by market participants.
  - The central procurer could also procure any necessary gas infrastructure upgrades to support the condensers, including gas network and storage capacity to ensure an adequate supply of gas for peaking needs.
  - Another body could also be considered for the role of central procurer, such as the body implementing the capacity mechanism, who could procure system services to meet targets determined by AEMO.

Speeding up connection of renewable energy resources

- The Government agreed to our original recommendation on speeding up the connection of new generation capacity in the NEM. While we have provided additional analysis and guidance, we have not recommended any further actions in this report.
- Delays associated with project proponents attaining environmental approvals for clean energy infrastructure remain a concern. The Authority has previously made suggestions intended to assist the Government in addressing this concern, such as introducing broader national interest considerations under federal environment laws.

Unlocking generation and storage at the local level

- Incentivise owners of commercial and industrial buildings (C&I) and rural businesses to install solar photovoltaics (PV) and battery systems. Measures could involve a combination of:
  - expanding and extending the existing Small-Scale Renewable Energy Scheme to deploy larger solar systems and batteries
  - establishing tax deductions on combined systems
  - working with state and territory governments to introduce time-dependent feed-in-tariffs that incentivise electricity exports when the market is undersupplied.
- Through the *National Consumer Energy Resources Roadmap*, prioritise requiring distribution network service providers to:
  - provide information on the best places to add generation, storage and EV chargers
  - standardise application processes
  - streamline C&I system connections
  - streamline and speed up transformer upgrade requests, for example by limiting the allowable timeframes for their completion.
- Request the Australian Energy Regulator (AER) consider extending and establishing ring-fencing waivers for network operators to deploy community-scale battery projects, and kerbside electric vehicle chargers.
- Work with AEMO and network operators to:
  - better coordinate and integrate their planning processes
  - reduce curtailment of the existing rooftop solar fleet
  - accelerate deployment of small- and large-scale renewables.

Chapter 1: Expanding investment in new capacity to meet targets

Chapter 1: Expanding investment in new capacity to meet targets

Australia has a legislated target to reach net zero emissions by 2050 in the *Climate Change Act 2022.* It also has a legislated 2030 emissions reduction target and will soon determine a 2035 target. To meet all 3 targets, Australia's electricity grids must be rapidly decarbonised, and a massive effort will be needed to install renewable capacity, energy storage, peaking generation and poles and wires. The Capacity Investment Scheme (CIS) will be integral to reaching the 2030 target. Continuing to invest in new capacity through a mechanism like the CIS will ensure that emissions reductions can be sustained beyond 2030.

In its *2024 Annual Progress Report* (2024 APR), the Authority recommended that the Government give the CIS a greater role in ensuring renewable and emissions reductions targets can be met (CCA, 2024a). We recommended:

- substantially **expanding the CIS** to help achieve Australia's target of an 82% renewable generation share of on-grid electricity[1] by 2030
- introducing legislation that would **embed the CIS and ensure a capacity mechanism like the CIS continues beyond 2030**
- prioritising projects that do not require extensions of the shared transmission network – in particular, combined solar and battery projects.

This chapter focuses on the 2024 APR recommendations to expand and extend investment in new renewable capacity. The recommendation to expand the CIS relates to the near term need to increase renewable generation and clean dispatchable capacity to meet the 2030 target. The recommendation to continue investment in new capacity relates to the ongoing need to bring in new generation and storage capacity beyond 2030. The current review of wholesale market settings in the NEM[2] (Box 1) will need to make sure longer term market reforms are driving in all the different kinds of generation, storage and system services that are needed for a low-emissions, reliable and secure system. Noting the need in the long term to ensure retiring capacity is replaced, the Authority's view is that there is a need for a continuing mechanism to draw in new assets. Our recommendation to continue investment in new capacity should be considered together with the outcomes of the NEM Review.

Further, the comments made in the chapter focus on renewable generation and clean dispatchable capacity, as these are what the CIS is designed to support. However, as elaborated in further sections of the report, more needs to be done to unlock Australia's clean energy potential, e.g. bringing more gas peaking plants into Australia's networks to provide 'last resort' reliability services (see Chapter 2).

1.1 The CIS

The current CIS targets are now embedded in legislation. In an amendment in force from February 2025, the *Climate Change Act 2022* includes the CIS targets of at least 23 GW of renewable generation capacity and at least 9 GW of clean dispatchable capacity by 2030. The Act requires the Minister's Annual Climate Change Statement to respond to any advice from the Climate Change Authority, provided in its annual progress report, that indicates a material risk to the achievement of the CIS targets. The Act now also requires that any revocation or

1 Our assessment assumes the 82% renewable energy target applies only to on-grid electricity, consistent with the approach taken in *Australia's emissions projections 2024* (DCCEEW, 2024c).

2 The NEM comprises New South Wales, the Australian Capital Territory, Queensland, South Australia, Victoria and Tasmania.

amendment to the legislative authority underpinning the program must be approved by resolution of each house of the Parliament.

Our recommendation to prioritise projects that do not require extensions of the shared transmission network stemmed from our assessment that several transmission projects were being delivered later than their original target dates (CCA, 2024a). We also observed a persistent level of renewable energy curtailment. There is increasing curtailment for grid-scale solar in particular. While solar capacity has grown, a higher proportion of available solar capacity was curtailed in every quarter of 2024 than in 2023. Over 12% of available solar capacity was curtailed in both Q3 and Q4 of 2024 (AEMO, 2025g). These observations prompted us to recommend prioritising support for combined solar and battery projects. Combined, or hybrid, projects help avoid grid issues like congestion and curtailment (Seel et al., 2022). Wind generation is also less likely to be curtailed than solar (AEMO, 2025g), and can complement solar by supplying renewable energy outside of peak solar generation.

We note that grid integration issues are a consideration in the CIS project selection process[3] and that, of the 19 successful projects under Tender 1 of the CIS, 8 combine renewable generation capacity with battery storage (AEMO Services, 2024a).[4] However, a large and early tender round focusing explicitly on these types of projects could further accelerate them.

Our updated advice in this report on the role of the CIS in supporting increased renewable generation may be useful input given the appointment of an expert panel to review wholesale market settings in the National Electricity Market (NEM) (Box 1).

Box 1: NEM wholesale market settings review

In November 2024, an expert panel was appointed to conduct a review of wholesale market settings in the NEM (DCCEEW, 2025h). The terms of reference for the review state 'the expert panel will recommend future market settings to promote investment in firmed, renewable generation and storage capacity in the NEM following the conclusion of CIS tenders in 2027' (DCCEEW, 2024i). We engaged with the expert panel to ensure the advice in this report can inform the broader question of market and policy settings beyond 2030.

The expert panel is expected to deliver its final recommendations in late 2025.

3 Elements of the merit criteria for assessing CIS tenders are intended to favour projects located in strong areas of the network or in areas of the network that are likely to enable the project to contribute to the reduction of unserved energy (AEMO Services, 2024b). Applicants are required to consider risks such as transmission projects not occurring as planned, and possible mitigations (AEMO Services, 2024b).

4 Noting in some cases battery storage located nearby (but not necessarily co-located) that could store generation from multiple plants may be more cost-effective.

While this report focuses on the *supply* of electricity, the Authority also recognises the importance of *demand* for electricity: reducing and shifting the timing of demand will reduce the amount of transmission and generation infrastructure needed. The Government could help manage demand using policies to improve energy efficiency and unlock demand flexibility, particularly in the built environment. This could include uplifting national building energy efficiency by enhancing the National Construction Code, and expanding energy rating and disclosure schemes (CCA, 2024b, 2024a).

1.2 Expanding the CIS

Expanding the current 23 GW CIS generation target or securing state agreements to deliver capacity outside the CIS would provide greater assurance that enough renewable capacity will be built to achieve the 82% renewables target. If some CIS projects are not ultimately delivered, others will need to be built to take their place. A buffer should be built into the scheme target to accommodate this.

According to the Australian Energy Market Operator (AEMO), 33 GW of new large-scale renewable capacity must be installed in Australia's largest grid, the NEM, alone to reach an 82% renewable generation share in 2030 (AEMO, 2024c).[5] Analysis in our 2024 APR showed that approximately 25 GW of the 33 GW needed could be delivered by the current pipeline of committed and probable utility-scale variable renewable projects, combined with renewable generation targeted by the CIS (CCA, 2024a).[6] This means, depending on committed projects and capacity supported by state schemes, the NEM needs up to a further 8 GW of renewable capacity – beyond what is in the pipeline and supported through the CIS – to reach an 82% renewables share by 2030.

For the purposes of this report, we have looked beyond the NEM and found that 42 GW of large-scale renewable capacity needs to be installed across the country to reach the national 82% renewable generation target (Table 1).[7] With up to 4 GW committed or receiving state support before the CIS was announced (CCA, 2024c), and the CIS target of 23 GW, a further 15 GW is required.[8] Accelerating small-scale renewables and storage, as discussed in Chapter 4, could reduce the need for large-scale capacity to meet the 82% target. Much of this additional capacity will likely need to be deployed in the NEM (meaning it may need to deliver more than its proportionate share of the 82% target).[9] The Wholesale Electricity Market in Western Australia, Australia's second largest electricity market, may also need to host a significant amount of the new capacity to contribute to meeting the national target.

Our analysis also identifies for 2030 a 4 GW difference between the new utility-scale battery storage capacity targeted under the CIS and the amount of such capacity that is projected to be in place according to the official emissions projections (Table 1).

Table 1: Growth in capacity between 2025–30, *Australia's emissions projections* versus committed and supported capacity

Technology	Projected additional capacity in 2030 (GW)	Committed or state supported capacity predating the CIS (GW)	Capacity targeted for support under the CIS (GW)	Capacity yet to be committed or targeted for support (GW)
Utility-scale renewables[10]	42	4	23	15
Utility-scale battery storage[11]	13[12]	-	9	4

Sources: Authority analysis based on CCA (2024c) and DCCEEW (2024c, 2025a).

5 The 'Step Change' is the most likely scenario with the lowest long run cost in AEMO's Integrated System Plan (ISP) that models the NEM reaching an 82% share of renewable energy generation in 2030.

6 In our analysis, we considered the project pipeline for the NEM using data from the Clean Energy Regulator and AEMO. We also considered the capacity that the CIS and state mechanisms could deliver, accounting for projects from the current pipeline that would be eligible for, and may seek, support under the CIS.

7 The analysis is based on Australia's emissions projections 2024 (DCCEEW, 2024c), which provide national totals for capacity, and our assumption this is delivered on-grid. However, some capacity may be delivered off-grid.

8 Some projects in the existing pipeline of committed or probable projects (12.6 GW across Australia at the time of writing the 2024 APR (CCA, 2024a)) will likely proceed without CIS support and contribute to filling this gap. We have previously identified approximately 4 GW of projects under this pipeline receiving state support or already committed by the time the CIS was announced we consider will proceed but will be ineligible for CIS support (CCA, 2024c).

9 The NEM supplies around 80% of Australia's electricity (AEMC, 2025b) and to deliver on the national target it may need to achieve more than an 82% renewables share. The Government's own official emissions projections, which assume Australia achieves the 82% target by 2030, have the NEM reaching 84% renewables in 2030 (DCCEEW, 2024c).

10 Under the CIS, utility-scale renewables are referred to as 'renewable generation capacity'.

11 The Authority considers utility-scale battery projects to be the most likely type of 'clean dispatchable capacity' project successful under the CIS, as that is the only technology of this kind likely to be able to meet the requirement that CIS projects be operational by 2030.

12 The Authority estimates that of 20 GW total projected battery capacity growth (DCCEEW, 2024c) approximately 7 GW is likely to be small-scale batteries and the remainder utility-scale, based on the approach taken in *Australia's emissions projections 2024* of using AEMO Step Change scenario ratios of small-scale battery deployment to rooftop solar installations up to 2030 (DCCEEW, 2024j).

Responding to the Authority's 2024 APR, the Government expressed confidence that the CIS, its Renewable Energy Transformation Agreements (RETAs) with the states, and other state and territory commitments, together provide sufficient policy support for Australia to achieve the 82% renewables target (DCCEEW, 2024a). The Commonwealth and state governments use RETAs to allocate responsibility for delivering generation and storage capacity. The Government has not yet finalised RETAs with all states and not all details of RETAs are made public. Finalising RETAs will provide certainty to the Government about the amount of capacity each jurisdiction will contribute to meeting the 82% target. With that knowledge, the Government will be able to determine whether an expansion of the CIS target is necessary.

We consider the CIS to be the predominant mechanism capable of driving new investment in renewable capacity before 2030. It appears to have been well accepted by the market, given completed tender rounds have been oversubscribed (DCCEEW, 2025f). It increases revenue certainty for project proponents by sharing the financial risks and benefits of a project with the Government, dampening the impacts of large variations in electricity prices on generator revenue.

Without the revenue safety net provided by government programs like the CIS, or the *Electricity Infrastructure Roadmap* in NSW, projects face higher financial risks and may not be able to secure financing, making them less likely to proceed. The generation capacity of large-scale renewable projects reaching final investment decision (FID) was relatively low in 2023 (CER, 2025b) until after the first CIS auction in late 2023. This indicates project proponents may have delayed FID until they knew whether they could secure CIS support. Of the 1.3 GW of capacity to reach FID in the last quarter of 2024 (CER, 2025b), one project (0.5 GW) had CIS support and, notably, it reached FID following the announcement of its successful bid under Tender 1 of the CIS (DCCEEW, 2024e; Lightsource bp, 2024). The majority of the remaining capacity that reached FID in the quarter was subject to guaranteed revenue funding under a state auction process or direct state government ownership (CER, 2025b).[13] This suggests most projects require some form of government underwriting to proceed.

The Clean Energy Regulator (CER) suggests that success in CIS tender rounds not only helps projects reach FID, but it helps them to do so more quickly (CER, 2025b). The CER estimates that, given the sizeable capacity of successful bids in Tender 1, total capacity reaching FID in 2025 could be more than 6 GW (CER, 2025b). For the overall project pipeline, the CER estimates approximately 20 GW of committed and probable capacity in Australia (CER, 2025a), an increase on the 12.6 GW noted in the 2024 APR (CCA, 2024a). This change has been driven by a significant increase in probable capacity, and it will be important for these projects to reach FID and become committed.

1.2.1 Recommended actions

Our analysis shows that the Government's 23 GW utility-scale renewable capacity target under the CIS will not be sufficient to meet the target of 82% renewable generation by 2030 without additional capacity delivered by states and territories. RETAs are still being negotiated and there is no public information about commitments states and territories may have made to deliver additional capacity under RETAs.

We recommend that the Government works with states and territories to reach a shared understanding of how much renewable capacity will be built by 2030 beyond the Government's CIS target – for example through RETAs or other state and territory commitments, and private investment. If required, it could then expand the renewable generation capacity target under the CIS to close any remaining gap to achieving the 82% renewable generation target, taking into account advice from AEMO on the size and quality of the investment pipeline and the capability of Australia's grids to accommodate additional projects before 2030.

Priority should be given to CIS projects that can diversify state generation and storage capacity in the near term into areas not constrained by limitations in transmission capacity. This could include enhancing the capacity of existing transmission lines through the deployment of large utility-scale batteries.

13 Significant projects reaching FID in Q4 2024 are:

- Goulburn River Solar Farm (450 MW) – successful under CIS Tender 1 (AEMO Services, 2024a)
- Wambo Wind Farm Stage 1 (252 MW) and Stage 2 (254 MW) – backed by Queensland Government's Renewable Energy and Hydrogen Jobs Fund (Wambo Wind Farm, 2025)
- Carwarp Solar Farm (150 MW) – was previously supported by the Victorian Renewable Energy Target auction 1 in 2018 (RenewEconomy, 2024), however it is not clear whether this support is still in place (Victorian Government, 2025)
- Horsham Solar Farm (119 MW) – supported by the Victorian Renewable Energy Target auction 2 and now owned by the State Electricity Commission of Victoria (DEECA, 2025)
- Warradarge Wind Farm (180 MW) – the owner Bright Energy Investments is a joint venture between Potentia Energy and Synergy, which is owned by Government of Western Australia (Bright Energy Investments, n.d.).

1.3 Continuing a capacity mechanism like the CIS beyond 2027

Tenders for support under the CIS are scheduled to end in 2027. Proponents must then build and connect these projects by 2030 if their generation is to contribute to achieving the 82% renewable generation target by 2030. However, the 82% target is not where the transition challenge ends. Our *Sector Pathways Review* (CCA, 2024b) shows renewable electricity generation and storage capacity must substantially increase through to 2050 if Australia is to meet its emissions reduction targets. Renewable generation and storage capacity will need to increase even more if Australia is to take full advantage of the potential for clean energy intensive exports in a world transitioning to net zero emissions (CCA, 2024b). Without a clear signal for new investment, there is a risk that momentum will be lost after 2030.

Australia will still need a policy mechanism – in addition to market reforms that come out of the NEM wholesale market settings review (Box 1) – to coordinate and stimulate interdependent investments in generation, storage and firming beyond 2030. The former Energy Security Board (ESB) identified a need to incentivise capacity in the market to 'bridge the gap' between investors' interests and governments' risk appetite. Investors have an incentive to build new capacity when supply gaps arise from power station closures and demand growth (ESB, 2021a). However, the potential for these gaps to cause supply interruptions for consumers is not a risk that governments are likely to accept.

The existing 'energy-only' spot market is very efficient at delivering pricing signals for real-time operation. However, it was never intended on its own to be a pricing signal for investment in long-lived firmed renewable generation and storage. It is the interaction of this market with forward derivatives and policies such as the [Renewable Energy Target], state-based schemes and the CIS that have delivered longer-term pricing signals that allow projects to be banked.

NEM Review 2024 (DCCEEW, 2024g)

Whatever the market will look like, we will need a mechanism to drive capacity. The design is not the most important thing at the moment, it's letting the market know this is coming, and showing there will be continued momentum.

Anonymous, Authority stakeholder consultation, 2025

From a system perspective, achieving a renewable share of 82% by 2030 may be difficult without a capacity scheme or market. Australia is moving to a place where energy costs are low, but capital costs are high, making financing more difficult.

Anonymous, Authority stakeholder consultation, 2025

In our submission to the NEM wholesale market settings review, we offered the view that continuing a capacity mechanism beyond 2030 is the best option for sustaining and accelerating investment in renewable capacity (CCA, 2025). The continuing scheme should incorporate updates to address learnings and any issues with the design of the current scheme. Continuing a capacity mechanism like the CIS would give policy certainty to investors and market participants. Technologies with a longer development timeline, such as offshore wind, could potentially receive support under a continued capacity mechanism. To further provide policy certainty to investors and market participants, a continued capacity mechanism could be embedded in the National Electricity Law or National Electricity Rules, potentially stipulating national targets.

There have been several reviews and policy proposals aimed at addressing market reform of the NEM over the

past decade, with the aim of incorporating the objective of decarbonising the supply of electricity, including:

- *Towards the next generation: delivering affordable, secure and lower emissions power* (AEMC & CCA, 2017)
- *Independent Review into the Future Security of the National Electricity Market – Blueprint for the Future* (DEE, 2017)
- National Energy Guarantee proposal (PM&C, 2017)
- Post-2025 Market Design project (ESB, 2021b).

None of these exercises have resulted in substantial market reform. The last review of NEM arrangements was tasked by the Council of Australian Governments Energy Council to the ESB in 2019, but did not ultimately result in any major reforms (DCCEEW, 2019; Wood, 2024). This all highlights the technical and political challenges of finding an implementable solution. If the NEM wholesale market settings review can find a way forward, the reforms will still take considerable time to be fully designed and implemented. In the meantime, the Government could ensure that continuity and momentum in the build out of renewables is maintained through a continuation of a capacity mechanism like the CIS (Box 1).

The centrally planned and administered elements of the CIS can assist to target investment in a way that fosters orderly and effective project roll-out that will continue to be important beyond 2030 (AEMO Services, 2024c). This level of coordination is unlikely to be achieved through alternative mechanisms like national certificate schemes, as currently designed, or emissions trading schemes, which lack a central body to coordinate the market activities of numerous competing participants. The coordination of investment under the CIS also leverages competition between private sector project proponents, who remain best equipped to develop, finance, build and operate most of the many new assets required.

One argument against extending the CIS in its current form is that it could reduce liquidity in the wholesale contracts market as owners of CIS-supported projects rely more on CIS contracts to manage wholesale electricity price risk instead of selling contracts in the market.[14] Under CIS contracts, the Government pays owners a percentage of the shortfall if revenue falls below a revenue floor (in the event of low average wholesale electricity prices over a year) and receives a percentage of revenue above a ceiling (in the event of high average wholesale prices over a year) (DCCEEW, 2024d). This scheme design reduces, but does not eliminate, electricity price risk when revenue is outside the range or 'collar' set by the revenue floor and ceiling.

This retains some incentive for owners to sell contracts into the wholesale contracts market to manage revenue risk outside the collar, and the full incentive to manage revenue risk within the collar. We have not seen evidence of current issues for liquidity arising from the scheme. However, we accept that this is a risk and therefore take the view that the Government should monitor the market for signs of liquidity constraints.

Another argument against continuing a capacity mechanism could be that it requires the Government to 'pick winners', resulting in a loss of efficiency, and creating the risk of inadvertently 'picking losers'. These risks are mitigated under the CIS through competitive and rules-based processes for allocating contracts to successful tenderers.

Expanding the CIS target and continuing a capacity mechanism will come at an additional cost to government. However, the Authority holds the view that the importance of ensuring a reliable supply of renewable generation to meet emissions reduction targets warrants additional government spending. The Australian Government and states and territories should work together to determine an appropriate allocation of costs.

There are risks and barriers to the roll-out of renewable capacity that a scheme like the CIS does not address. These are set out in our *Sector Pathways Review* (CCA, 2024b) and 2024 APR (CCA, 2024a). As we have previously discussed, the scale, complexity and interdependence of investment and action required by many government bodies and the private sector for decarbonising the electricity system necessitates strong coordination – across the energy market, across levels of government, and across portfolios within governments. A new, senior, full-time role — Energy Transition Coordinator — backed by a small team of experts, could support the Minister and liaise with stakeholders to further help drive Australia towards its energy and emissions targets (see Recommendation 7 of the 2024 APR).

1.3.1 Recommended actions

We recommend that, with CIS tenders currently scheduled to end in 2027, the Government ensure a capacity mechanism like the CIS continues contracting new projects from 2028 to bring on new capacity at the pace and scale that is required beyond 2030.

- The post-2027 scheme for stimulating generation and storage investment should take into account lessons from the CIS and the recommendations of the current review of wholesale market settings in the NEM.
- The effectiveness of and need for the post-2027 scheme should be periodically reviewed.

In considering the form a continuing capacity mechanism should take, the Government should work with states and territories to determine an appropriate allocation of costs.

14 The wholesale contracts market allows buyers (e.g. retailers) to secure the price they pay for electricity over a period of time. The sellers of these contracts are producers of energy and other wholesale market participants. Buying in the wholesale contracts market helps retailers offer stable prices to their customers over a period of time (AEMO Services, 2023).

Chapter 2: Maintaining system security and reliability while increasing the share of renewables

Chapter 2: Maintaining system security and reliability while increasing the share of renewables

2.1 The system security challenge

Historically, in large power systems like the National Electricity Market (NEM), generators such as coal, gas and hydro have provided most security-related essential system services – for example, frequency control, inertia, voltage control and system strength (AEMO, 2024d). With ageing coal-fired generators retiring, the NEM is one of the first power systems of its size in the world to face the challenge of having a large share of inverter-based renewable generation, like wind and solar, while maintaining system security (AEMO, 2024c).

Wind and solar already provide over 30% of NEM generation (Open Electricity, 2025), and by 2035 are expected to provide 91% (see AEMO's ISP Step Change scenario (AEMO, 2024c)).[15] Meanwhile, coal-fired generators such as Northern (South Australia), Hazelwood (Victoria) and Liddell (NSW) have closed in recent years (DISER & DPIE, 2020). The Step Change scenario shows all coal-fired generators exiting the system by 2038 (AEMO, 2024c). Maintaining appropriate levels of system security is critical to support the entry of large amounts of wind and solar generation, and the exit of coal.

Maintaining system security in some parts of the NEM is already an ongoing challenge. In South Australia wind and solar currently provide more than 70% of generation (DCCEEW, 2024b). Despite the support provided by interconnected generators in NSW and Victoria, AEMO has had to regularly direct gas-fired generators in South Australia to keep running to maintain system security. For example, in the last quarter of 2024, system security directions were in place in South Australia 65% of the time at a cost to consumers of nearly $23 million (AEMO, 2025g).

Unless timely action is taken, the system security challenge will continue to grow.[16] Although there is a range of system security issues to be addressed, this chapter focuses on what AEMO has advised is the most pressing challenge: maintaining system strength (AEMO, 2024g). In this chapter we also provide advice on the opportunity to co-optimise system security investments to support the reliability of the system.

15 This includes wind and both distributed and utility solar. Output from storage such as batteries is not included in renewable share calculations.

16 The AEMC has recognised this growing challenge and has worked to provide AEMO with some additional tools to manage it in the immediate and medium term (AEMC, 2024c).

Box 2: What is system strength and who is responsible for it?

The security of an electricity grid is its ability to continue to operate within defined technical limits and to respond quickly and remain stable when unexpected events occur, such as generator outages or transmission lines failing (AEMO, 2020).

A key element of system security is 'system strength', which represents the grid's ability to maintain a steady voltage waveform (AEMO, 2025i). System strength is important for the safe and effective operation of protection systems, generator control systems and other equipment. In a weak system, disturbances are more likely to lead to widespread power outages. According to AEMO, system strength 'is likely to be the most onerous emerging requirement in all regions' (AEMO, 2024g) and is projected to 'decline sharply over the next decade' (AEMO, 2024b).

AEMO identifies 2 types of system strength requirements:

- The 'minimum fault level' requirement ensures 'the correct operation of network protection systems, appropriate operation of voltage control devices and overall system stability' (AEMO, 2025b) following a major disturbance.
- The 'efficient level of system strength' is the level of system strength needed to accommodate and encourage the connection of future wind and solar capacity.

AEMO is responsible for maintaining and improving system security, necessarily including system strength. A 2021 Australian Energy Market Commission (AEMC) rule change requires transmission network service providers to ensure that system strength requirements determined by AEMO are met (AEMC, 2021b).

2.2 Technologies to support system strength and reliability

2.2.1 Synchronous generators, synchronous condensers and grid-forming inverters

There are 2 key technologies that can provide system strength:

- **Synchronous generators, such as coal, gas or hydro generators**
  Hydro generators or gas-fired generators fueled by biomethane, hydrogen or other renewable fuels would be zero-emissions options.
- **Synchronous condensers, which are rotating machines connected to the power system in the same way as synchronous generators but without the ability to feed new power into the grid**
  These typically use a 'pony motor' powered by a small amount of non-renewable fuels to 'spin up' initially to match the grid frequency, but most of the time they draw their power from the grid, so their direct emissions are minimal. By using renewable fuels or other mechanisms[17] to spin up synchronous condensers, they could be made zero-emissions.

Grid-forming inverters (GFIs) are another technology that may play a role providing some system strength services in the future, although they are not currently able to provide all such services. These are inverters that form their own voltage source rather than following the voltage of the grid. GFIs must be supported by an energy source (AEMO, 2022), so they are usually built as part of new battery projects.

Synchronous condensers are needed to meet minimum fault level requirements for system strength and can also be used to meet 'efficient level' requirements (Box 2). There is the potential for emerging technologies, such as GFIs, to also contribute to the latter component of system strength (AEMO, 2024g). Since at least the 1960s, synchronous condensers have been used to provide system strength and inertia in the NEM (AusNet Services, 2015). They have played an increasingly important role in providing these system services as synchronous generators have left the system. For example, 4 large synchronous condensers were installed in South Australia in 2021 (AEMO, 2021). They allow the system to operate with fewer synchronous generators or with reduced output from those that remain (AEMO, 2023a). This results in more generation from renewables, lower costs to consumers (AER, 2019a) and reduced emissions (AEMO, 2025a). Synchronous condensers are also capable of providing frequency control services, particularly if paired with gas-fired generation capabilities.

GFIs are a relatively new technology and more testing is needed to determine the role they can play in the system. As of December 2024, there were 7 batteries with GFIs in the NEM with another 34 GFI projects in the connections pipeline (AEMO, 2024d). Batteries with GFIs are currently being trialled for a range of system security services, such as synthetic inertia and system strength (AEMO, 2024d). However, in most cases the main revenue-earning system security service offered by these batteries is 'fast frequency response', along with other frequency control services sold in the Frequency Control Ancillary Services market (AEMC, 2021a; AER, 2025b; Wood Mackenzie, 2024). These are services that all large-scale batteries can provide (AEMC, 2021a; AEMO, 2024d). It is likely GFIs will play a role in meeting broader system strength requirements in the future, but more testing is needed to show they can meet the minimum fault level requirement (Aurecon, 2024).

Based on AEMO's current technical understanding, the only technologies that have demonstrated the capability to meet the minimum fault level requirement are synchronous generating units and synchronous condensers.

AEMO in consultation with the Authority, 2025

17 One alternative to a pony motor is a start-up frequency converter, which can use power from the grid to start a synchronous condenser (Zhu et al., 2024).

2.2.2 Use of synchronous condensers for system strength

The outlook for system strength in the NEM shows a need for synchronous condensers (AEMO, 2024g). In its *Update to the 2023 Electricity Statement of Opportunities*, AEMO stated that 'a need for new system strength services has been identified equivalent to approximately 22 synchronous condensers distributed in optimal locations across the NEM' (AEMO, 2024g). Furthermore, the new synchronous condensers (or equivalent technologies) must meet the minimum fault level requirements for system strength, and much of that investment must be made before 2029–30 (AEMO, 2024g).

AEMO's *2024 System Strength Report* identified shortfalls in achieving the 'efficient level of system strength'. To address these shortfalls, the preferred plans of transmission network service providers (TNSPs) include many new synchronous condensers – 34 new synchronous condensers have been proposed in New South Wales, Victoria and Queensland by 2033–34 (AEMO Victoria Planning, 2025; Powerlink, 2024; Transgrid, 2024).

Currently, only synchronous condensers and synchronous generation can provide all necessary system strength services for the security of the future grid, so they are the only viable technology for deployment at scale within the timeframes needed to maintain the system security of the NEM. This does not mean that other technologies, such as GFIs, could not also to be utilised to support the 'efficient level of system strength'. Therefore, it is important that AEMO and market participants continue to explore the capabilities of GFIs and other new technologies.

Government support, including support through the Australian Renewable Energy Agency (ARENA), could drive more rapid testing of the capabilities of new technologies to provide system security services. AEMO currently has the power to establish contracts to trial new technologies, or new applications of existing technologies, to manage system security (AEMC, 2024d).

2.2.3 Maintaining reliability with new dispatchable capacity

Although rapid projected growth in electricity demand will mainly be met by increased renewable energy, dispatchable capacity is required to 'firm' this energy supply. With coal-fired generators leaving the system, maintaining a reliable electricity supply requires new forms of dispatchable capacity to backup increasing amounts of renewable energy. Much of the dispatchable capacity will likely be in the form of energy storage, such as batteries and pumped hydro, which can help to meet capacity requirements and shift energy over time (with batteries being better suited to address short-term capacity needs and pumped hydro providing the 'deep storage' to shift energy across longer periods of time) (AEMO, 2024c). However, AEMO expects that gas-fired generators will continue to be needed in a last-resort 'firming' role for renewable energy (AEMO, 2024c). Although the capacity from gas-fired generators will be important to firm up electricity supply, in practice they are only expected to be producing electricity infrequently (ideally only where zero-emissions forms of dispatchable capacity are insufficient) and so will only make a minimal contribution to emissions.

The amount of dispatchable capacity needed to maintain reliability in the NEM is projected to grow by around two thirds over the next 2 decades (Table 2). This dispatchable capacity is required to provide firming for the influx of variable renewables that is required to meet an almost doubling in electricity demand under the Step Change scenario. Failure to invest in sufficient dispatchable capacity could compromise reliability in the NEM, leading to a reliance on expensive emergency backup, the extension of the life of coal-fired power stations (resulting in more expensive electricity and higher greenhouse gas emissions), and the risk of more outages from load shedding.

Table 2: Dispatchable capacity in the Step Change scenario

Technology	2025	2030	2035	2040	2045	2050
Energy storage[18] (GW)	4	22	31	40	49	49
Gas (GW)	13	12	14	16	18	15
Hydro (GW)	7	7	7	7	7	7
Coal (GW)	21	11	1	0	0	0
Other[19] (GW)	1	2	3	3	3	3
Total	46	53	56	66	77	75

Source: Authority analysis of AEMO (2024c).
Note: Totals may not sum due to rounding.

2.2.4 Role of gas-fired generators in the energy transition

Gas-fired generators are expected to play an important role in providing firming for renewables through the energy transition, but they will only need to generate occasionally. They will be particularly important during 'renewable droughts' (where wind and solar resources remain low over a large area for long periods of time) and times of extreme peak demand (AEMO, 2024c). As much as possible of the dispatchable capacity to firm renewables will come from zero-emissions sources, such as batteries or pumped hydro, to minimise the need for gas-fired generation. However, it is likely that gas-fired generators will still be needed in a supporting role. AEMO modelling suggests gas-fired generators will only provide around 2–4% of the electricity generated in the NEM between 2035 and 2050 (AEMO, 2024c).

New gas-fired generators are not currently being built to ensure sufficient capacity is in place following the retirement of ageing coal and gas plants. A number of existing gas-fired generators are expected to close in the coming years (AEMO, 2024b). Based on those closures, around 2.8 GW of gas capacity will need to be built by 2035,[20] and a further 9 GW of new gas capacity will need to be built by 2050.[21]

Recent experience suggests the market may not be well placed to drive investment in new gas capacity, with only 2 gas-fired generators built in the NEM since 2022. These were the Hunter Power Project and Tallawarra B (AEMO, 2025f). Each of these projects only occurred with significant Australian Government support (Taylor, 2021, 2022). Our analysis identified several areas of risk and uncertainty likely to be inhibiting investment, including:

- future government policies with respect to gas
- the availability and cost of a reliable fuel supply
- closure dates for coal-fired generators
- expected revenues streams, particularly since gas-fired generators are only expected to operate for a small number of dispatch periods.

In the near term, gas-fired generators will need sufficient natural gas supply and supporting infrastructure, and potentially the capability to use liquid fuels, to ensure they can continue to support reliability. In the longer term, to minimise the emissions of gas-fired generators they should be able to operate on renewable gas, such as green hydrogen or biomethane.

This gas-fired generation will be critical in the limited circumstances when variable renewable generation firmed by storage needs additional support. With a future role based on less frequent and less regular dispatch, these assets are unlikely to attract investment on their own. The following sections explore how to ensure these assets are built through a new procurement process to underwrite their deployment.

18 Includes pumped hydro, utility-scale batteries and coordinated small-scale batteries.

19 Includes other renewable fuels and demand side participation.

20 To replace approximately 1.86 GW of exiting capacity (AEMO, 2025f) plus approximately 0.97 GW of net capacity additions (AEMO, 2024c).

21 To replace approximately 7.48 GW of exiting capacity (AEMO, 2025f) plus approximately 1.48 GW of net capacity additions (AEMO, 2024c).

2.2.5 Equipping synchronous condensers to operate as gas-fired generators

Synchronous condensers are needed to provide system security and gas-fired generation is needed to maintain reliability. There is an opportunity to reduce system costs by combining these services.

One relatively low-cost option would be to upgrade existing gas-fired generators to also operate as synchronous condensers. This would require a clutch to be added to allow the generator to switch to operate as a synchronous condenser, at around 60% of the cost of a new synchronous condenser (DIgSILENT, 2023). It is possible to build new synchronous condensers that can also operate as gas-fired generators, and this could provide another revenue stream to help overcome investment barriers (see Section 2.2.4). According to AEMO, the cost of doing this would be significantly lower than building both a synchronous condenser and a gas-fired generator separately.

Building synchronous condensers with gas-fired generation capability could avoid the electricity consumer having to pay twice – once for the synchronous condenser and again for the gas-fired generator that would need to be built later. Research for ARENA indicates that equipment manufacturers now recommend that every new gas-fired project be installed with a clutch or allow space for a clutch to be fitted in the future (DIgSILENT, 2023).

These types of projects should be located around the network in locations where they best support system strength and where they can access a reliable supply of gas at minimal additional cost. Careful consideration will need to be given to whether it is practical and cost effective for a given synchronous condenser to be equipped with gas-fired generation capability. In particular, proximity to a gas network and the availability of supply through the network will need to be considered. In some cases, it may not be affordable to provide a gas supply to a synchronous condenser location, or liquid fuels such as diesel or biodiesel may be more appropriate, noting there will likely be competition for renewable fuels from other sectors such as transport and industry. If it does not make practical or economic sense for a synchronous condenser to have generating capabilities, it may still be necessary to build one in a given location to provide system services.

Our analysis finds the lowest system cost to meet minimum fault level requirements could be achieved by the right mix of:

- upgrading existing gas-fired generators so they can act as synchronous condensers
- building new synchronous condensers with gas-fired generator capability connected to fuel supply
- building standalone synchronous condensers.

Where possible these facilities should be able to switch to renewable gas in the longer term to minimise emissions. The increased cost of this capability would need to be taken into consideration when identifying the lowest system cost.

More work is needed to determine the most efficient approach and we consider AEMO is best placed to advise on the optimum buildout.

In the following section we address the need we identify in this section for synchronous condensers by recommending changes to the current system strength procurement framework, to enable a central procurer to determine the right mix of technologies and to purchase system services that would be delivered by this equipment (see Section 2.3.3).

2.3 Procurement of synchronous condensers and upgrades to gas networks and storage capacity

2.3.1 Shortcomings of the current system strength framework

As discussed above, to maintain system security through the transition, synchronous condensers are required across the NEM. Our analysis reveals 3 ways the current system strength procurement framework – the Efficient Management of System Strength framework (AEMC, 2021b) – is no longer sufficient to address this rapidly emerging challenge. Specifically, the framework does not co-optimise for system security and reliability, may not deliver the necessary investment in new infrastructure in a timely manner, and leaves little room for flexibility and responsiveness in the face of new developments. Two key changes to the framework could address these shortcomings.

Introduction of a central NEM-wide procurement function for system strength services would create opportunities to co-optimise system security and reliability outcomes by combining, where appropriate across the NEM, synchronous condensers with gas generation capability. This is unlikely to occur through the Regulatory Investment Test for Transmission (RIT-T) process under the current framework. Currently, TNSPs must procure the necessary system strength resources based on the needs identified by AEMO (AEMC, 2021b). One benefit of the current arrangement is that TNSPs can gain efficiencies by carrying out synchronous condenser procurements at the same time as making other improvements to their transmission network that improve system security. However, TNSPs are unlikely to procure synchronous condensers combined with new gas-fired generation because of ring-fencing provisions

that prevent TNSPs from providing services other than transmission services (AER, 2025d).[22]

In addition, employing a streamlined procurement process could address system security concerns more quickly than the current procurement process for system strength. Under current arrangements, generators must provide at least 3.5 years notice ahead of a planned closure (AER, 2019b). This means coal closures could lead to a shortfall in system security and gives insufficient notice for TNSPs to attempt to fill the gap. To do so, TNSPs must go through the lengthy RIT-T process. By way of example, in December 2022 Transgrid published its first report in the RIT-T process to address system strength requirements in New South Wales from 2025 onward (Transgrid, 2022). However, it has still not released its final project assessment conclusions report. After that report is released and the Australian Energy Regulator (AER) approves the investment, Transgrid will still need to go through a procurement process for the synchronous condensers before they can finally be built. It is noted that Transgrid could start the procurement process in parallel to completion of the RIT-T process as AEMO Victoria Planning has proposed to do in its own RIT-T (AEMO Victoria Planning, 2025).

A centralised streamlined procurement process could also be more flexible and dynamic than the current process, with the procurement decisions informed by consultation with the market and TNSPs. The rigid timeframes and structure of the RIT-T process do not appear to be well suited to respond dynamically to rapidly emerging system security issues (AEMO, 2025i). TNSPs use the RIT-T process to identify the credible investment option that 'maximises the present value of the net economic benefit to all those who produce, consume and transport electricity in the market' (AER, 2024b). The process protects consumers by preventing unnecessarily expensive network investments. It also includes rigid minimum consultation timeframes to ensure all interested parties can be heard. However, the RIT-T is best suited to long-term planning for major infrastructure builds. While the proposed streamlined procurement process should not have the same rigidity as the RIT-T process, it should still involve appropriate cost-benefit analysis.

Below we outline how these proposed changes to the system strength procurement framework have the potential to reduce costs for consumers.

2.3.2 A central NEM-wide procurer for system strength infrastructure

Optimising for system security and reliability is a complex task and what follows is our latest thinking on the design of a new framework. As ideas evolve, the Government and Energy and Climate Change Ministerial Council would need to work with market bodies in consultation with market participants to develop the details of the new framework, and to analyse costs and benefits to ensure that a new framework provides an overall net benefit. We have considered the benefits of additional system strength services in the grid, but a full cost-benefit analysis could weigh these alongside the equipment costs, and against the cost of providing system services and meeting reliability standards in the absence of these changes.

Our analysis suggests a system strength procurement framework with a centralised procurer would be the best option to efficiently deliver system security. A single procurer would have greater purchasing power. Furthermore, having a single procurer would simplify the procurement process because suppliers would not need to negotiate with multiple TNSPs. A central NEM-wide procurer could also coordinate procurements to manage the risk of supply chain constraints.[23]

Noting the additional analysis required, our early investigations suggest AEMO would be suited to this new procurement role because it would be consistent with AEMO's existing role in ensuring system reliability and security. Also, AEMO already carries out system security planning, so it is likely to have the necessary technical basis to underpin procurement decisions (AEMO, 2025i). AEMO could respond dynamically to new developments (or new projected outcomes) without the need to wait for updated external technical advice.

Where tenders support a new facility with gas-fired generation capability, this facility would need to have a reliable fuel supply at peak times. Therefore, a central NEM-wide procurer should also be able to procure upgrades to gas networks and storage capacity where needed to support the new facility. Our analysis suggests AEMO would be best placed to identify locations that would most effectively support system security and reliability while minimising the costs for additional gas infrastructure.

22 TNSPs may form contracts for system strength with existing facilities or pay for retrofits of existing gas generators to allow them to operate as synchronous condensers (AEMO Victoria Planning, 2025). These can help to maintain system security but do not represent all options likely needed in the optimal mix to meet future system security needs.

23 Analysis for ARENA found that due to global demand there is a 2–2.5 year lead time for new large synchronous condensers and anticipated that, if many more synchronous condensers were required in the NEM, supply chain pressures would likely increase (DIgSILENT, 2023).

The central procurer could procure these infrastructure upgrades as part of its tender for synchronous condensers with gas-fired generation capability to provide system strength or through a separate procurement process.

We envisage a framework in which AEMO, or another central procurer, would run a streamlined procurement process for system strength upgrades, such as synchronous condensers with gas-fired generation capacity. The plants would be owned by market participants and could be dispatched through the energy market as required. Due to conflicts of interest with its role in operating the market, it would not be possible or appropriate for AEMO to own and operate generators. The plants could alternatively operate as a strategic reserve, running only when required to ensure reliability. AEMO would recover the costs of the upgrades from market participants.

Developing a new system strength procurement framework is a significant reform, and it should not be permitted to delay current procurement processes that are nearing conclusion. TNSPs have nearly completed existing RIT-T process, so it would be best to allow those processes to conclude to deliver much needed system strength upgrades as soon as possible. However, the TNSPs' proposed solutions will likely miss any opportunities to co-optimise for reliability by incorporating gas-fired generation capability with synchronous condensers. For future RIT-T processes, it may be faster and more efficient to procure system strength upgrades through the proposed new framework. Should the Government choose to pursue the establishment of a new procurement framework, it will be important to give clear notice to TNSPs that RIT-T processes currently nearing completion would not be affected.

2.3.3 Recommended actions

We recommend that the Government work with the Energy and Climate Change Ministerial Council to enable the deployment of synchronous condensers with gas-fired generation capability to maintain system strength and support reliability. These assets should be able to run on liquid fuels, biomethane, hydrogen or other renewable fuels, and would only be deployed when zero-emissions options are unavailable. Our assessment is that AEMO would be best placed to plan and procure system services that require the installation of synchronous condensers and related equipment, which would be owned and operated by market participants. Another body could also be considered for the role of central procurer, such as the body implementing the capacity mechanism, who could procure system services to meet targets determined by AEMO.

The central procurer could also procure any necessary gas infrastructure upgrades to support the condensers, including gas network and storage capacity to ensure an adequate supply of gas for peaking needs. AEMO could recover the costs of the investments from market participants on behalf of the central procurer.

Chapter 3: Speeding up connection of renewable energy resources

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3.1 The need for faster connection

In our 2024 APR, we recommended speeding up connection approvals for large-scale renewable generation into the National Electricity Market (NEM) and providing more information about connection timelines (CCA, 2024a). The Government agreed with this recommendation (DCCEEW, 2024a). We have provided some additional analysis and commentary in this chapter, as faster connection approvals will help ensure that new large-scale generation is in place in time to replace retiring coal-fired generators. AEMO's Step Change scenario indicates that 33 GW of large-scale renewables needs to be commissioned in the NEM by 2030 (AEMO, 2024c), an average of 6.6 GW each year. This compares to 3.8 GW of new capacity connected in 2022–23, 2.2 GW in 2023–24, and 2.5 GW in the first 9 months of 2024–25 as shown in Table 3 (AEMO, 2025c).

The legacy of connections is expecting that we have one or two units connecting over a long time, but this is changing. Currently 2 GW of capacity is connected each year, we need to be reaching at least 6 GW.

CEC in consultation with the Authority, 2024

The need to significantly improve the connections process remains a constant driver, given the pace of the energy transition.

Connections reform roadmap V2 (CEC, 2023)

3.2 Resource constraints for processing new transmission network connection applications

Our 2024 APR recommended speeding up approvals for connection to the NEM by addressing resourcing constraints in the Australian Energy Market Operator (AEMO) and transmission network service providers (TNSPs). These organisations need sufficient resources to promptly process the increasing quantity of new connection applications they are receiving. Timely assessment of these applications avoids project delays and maintains the flow of new capacity into the system to replace retiring coal-fired generation.

Recent data from AEMO shows more capacity moving through most stages of connections processes and a decrease in average processing times, particularly in the last 9 months (Table 3).

Table 3: Connections to the NEM

	2022–23	2023–24	2024–25 (Jul–Mar part year)
NEM connections (GW)			
Approved applications	6.8	12	9.2
Approved registrations	2.5	2.4	7.5
Full output achieved	3.8	2.2	2.5
Average processing time (months)			
Approved applications	11	9.7	9.6
Approved registrations	8.7	5.3	5.6
Full output achieved	-	4.9	4.7

Sources: AEMO, 2024c, 2025c.

In agreeing to our recommendation, the Government recognised the need for increased grid connection speeds, outlining programs it has established to improve processes (DCCEEW, 2024a):

- the Summer Readiness Pilot, established in 2023 by the Energy and Climate Change Ministerial Council to accelerate connections ahead of the summer of 2023–24, which brought an additional 3.2 GW of capacity online (DCCEEW, 2023, 2024a)
- the Streamlined Connections Trial run through the AEMO-led Connections Reform Initiative that commenced in 2023 (AEMO, 2023b)
- the $8.9 million Accelerated Connections Fund (ACF), announced in December 2024 (DoF, 2024), which will increase AEMO resources for the 2025–26 financial year, enabling it to work with TNSPs to accelerate connections (DCCEEW, 2025c).

We welcome the announcement of the ACF to support AEMO to continue processing higher numbers of connection applications in 2025–26, and suggest the Government considers – in consultation with AEMO – extending the funding beyond 2025–26. For the national target of 82% renewable electricity by 2030 to be met, AEMO will likely need an ongoing uplift in its capacity to process connection applications.

3.3 Increasing availability of information about project applications

Our 2024 APR recommended that AEMO publish more detailed information on connection application timelines. This should provide project developers with more clarity over the connections process, set realistic expectations for approval times and allow for better tracking of progress. Since our APR, AEMO has indicated it will update its Connection Scorecard, a quarterly report that tracks NEM connections, with application timeline data disaggregated by type of project – for example, wind, solar, battery and hydro. We welcome this development.

AEMO can also speed up connection timeframes by giving clear guidance about what proponents are required to provide when submitting applications. The AEMC completed a rule change in July 2024 to clarify the process and requirements at the R1 phase of the connection application process (between financial commitment and commencement of revenue), which is a key part of the process where stakeholders have highlighted that clearer guidance would be helpful (AEMO, 2024e, 2025h). Among other things, the new rule clarifies the obligations of all parties during the R1 process and requires AEMO to update its guidelines to clarify the data and information requirements. We welcome the AEMC's rule change.

3.4 Speeding up environmental approvals

Environmental approvals at national and state and territory levels also continue to slow the deployment of renewables (CCA, 2024a). Stakeholders described these application processes as opaque, with approvers holding too much discretion around decisions. Approval processes under federal environmental laws could be sped up by incorporating consideration of broader national interests (CCA, 2023). We have previously made recommendations aimed at speeding up approval processes, while maintaining rigorous consideration of environmental impacts. These include:

- implementing and monitoring of planning reforms to address approval delays through relevant ministerial forums (CCA, 2024a)
- appointing an Energy Transition Coordinator to work across governments to drive the delivery of priority renewable energy projects (CCA, 2024a)
- expediting the *Environment Protection and Biodiversity Conservation Act 1999* assessment process for large-scale renewable energy projects (CCA, 2023)
- simplifying, coordinating and expediating approval processes for priority projects within and between jurisdictions (CCA, 2024b).

We welcome the introduction of the National Renewable Energy Priority List to provide coordinated support for regulatory planning and approval processes for priority projects (DCCEEW, 2025e), however we note that more work needs to be done to address delays in environmental approvals processes. Beyond approval processes, other barriers to the deployment of renewable generation, including workforce constraints, will also need to be addressed (CCA, 2024b).

Chapter 4: Unlocking generation and storage at the local level

Chapter 4: Unlocking generation and storage at the local level

Distribution networks carry electricity from transmission networks to homes and businesses and can play an important role in achieving Australia's target of 82% renewable electricity by 2030. Producing and storing electricity locally can reduce the losses and congestion that occur in transmitting electricity over longer distances on higher-voltage transmission networks (AEMC, 2025c; CEFC, 2019). Renewable deployment can proceed on distribution networks without waiting for large transmission network extension projects that are underway (ENA, 2024b).

This recommendation is the most important in terms of reaching near-term climate goals. Households with rooftop solar produce excess electricity that they can feed into the grid for the majority of the year, and there is largely unused valuable generation space locally, including on rooftops. Distributed energy resources can be rolled out quickly using the distribution network, allowing for larger projects that need to connect to a transmission network to come online later.

Rewiring Australia in consultation with the Authority, 2025

In our 2024 APR, we recommended the Government pursue options to incentivise and rapidly connect much higher levels of renewables in distribution networks. The Government agreed to this recommendation in principle (DCCEEW, 2024a).

4.1 Incentivising investment in solar PV and battery storage in commercial buildings

Commercial and Industrial (C&I) properties have significant underutilised roof space for local generation on distribution networks (ENA, 2024b; Roberts et al., 2019). Installation rates have been slow compared with residential solar photovoltaics (PV), and C&I solar systems are generally small relative to the amount of available roof space. Residential solar capacity had grown to over 21 GW in 2024, but C&I systems only reached a quarter of this capacity (Table 4).[24] The reported median size of C&I systems is 15 kW (ENA, 2024b). However, C&I rooftop systems can reach capacities up to 5 MW, and sometimes even larger, depending on roof size, structural robustness and other factors such as shading (CER, 2024b; Nidras et al., 2024).[25]

C&I customers might have enormous roof spaces but only have a small PV array in order to meet their own load as they are not currently incentivised to think of their system playing a role in the benefits of solar to the broader system.

Energy Networks Australia in consultation with the Authority, 2025

24 C&I systems include systems from 15 kW to 2 MW in Table 4.
25 CCA analysis of CER accredited power stations data.

Table 4: RET scheme total installations to Dec 2024 (as at 31 Jan 2025)

	Verified installations	Capacity (GW)	Capacity share of Small-scale Renewable Energy Scheme (SRES)
Residential (less than 15 kW)	3,908,850	21.2	83%
Commercial (15 kW to 100 kW)	131,977	4.4	17%
Power stations (100 kW to 2 MW)	2,446	1.0[26]	-[27]

Source: CER, 2025 (unpublished).

There is significant potential to install rooftop solar on C&I buildings, along with storage. A study for the Clean Energy Finance Corporation (CEFC) estimated that planning zones denoted as C&I could provide enough rooftop space for over 28 GW of solar capacity (Roberts et al., 2019). Although rooftops present an opportunity in urban locations, ground mounted solar PV may be an option for regional and rural business properties where sufficient land is available. The right incentives could unlock the potential for C&I solar and batteries to not just meet the needs of C&I energy consumers, but export excess electricity to the network, particularly at times when the market is undersupplied.

Small-scale battery installation numbers remain low across both residential and commercial premises. Only 10%[28] of solar systems registered with the Clean Energy Regulator (CER) in 2024 reported that a battery was installed at the same time (CER, 2024c).

Barriers to greater uptake of rooftop solar and batteries on C&I premises include:

- high capital costs
- buildings not being owned by the occupants (leading to the 'split incentives' problem)[29]
- feed-in tariffs being too low to provide a benefit to businesses to export to the grid
- the complexity of ongoing compliance for larger systems under the Large-scale Renewable Energy Target (LRET), compared with upfront discounts for smaller systems under the SRES
- difficult and costly connection and regulatory requirements, particularly for businesses without energy expertise (CEFC, 2019; ENA, 2024b; Evans, 2024; Nexa Advisory, 2024; Nidras et al., 2024).

Industrial property, such as big warehouses and logistics centres, could have more solar. Other than physical constraints, the main reasons solar uptake isn't higher on these buildings is that the load within the building isn't large enough to offtake the solar production, existing market structures don't allow landlords to on-sell the energy production at-scale, and limitations within the local grid.

Property Council of Australia in consultation with the Authority, 2025

Commercial and industrial property owners are not provided with any investment signals which would cause them to invest in solar above self-consumption needs.

The Time is Now: Getting smarter with the grid (Energy Networks Australia, 2024b)

26 Power stations accredited under the LRET include all forms of renewable generation. However, 83% of installed capacity in this size category was from solar.

27 Under the Renewable Energy Target scheme, power stations above 100 kW are accredited through the LRET, rather than the SRES. Systems accredited under the LRET that are smaller than 2 MW are indicative of larger commercial and industrial systems.

28 Battery installation numbers are provided to CER voluntarily and may undercount installations.

29 Split incentives occur when an entity that will benefit from an investment is not the same as the entity that needs to fund the investment. For example, a landlord may invest in solar and a battery, but the business that rents the building will receive the benefit of reduced power bills. Split incentives are also an ongoing issue in residential rental markets (DCCEEW, 2025g; Wood et al., 2023).

The slower rate of installation of commercial-sized solar PV systems indicates that the SRES, LRET and incentives provided by state and territory governments have not overcome these barriers. The incentive provided by the SRES will decrease as the 2030 RET end date approaches (CER, 2024a). This could result in decreasing deployment of solar PV on C&I properties.

Under the 'Step Change' scenario for the National Electricity Market (NEM) developed by AEMO, distributed batteries with capacity totalling around 15 GW are installed by 2034–35 (AEMO, 2024c). The Government's Community Batteries for Household Solar program will support approximately 0.1 GW of storage capacity nationally (ARENA, 2024). The Australian Government has more recently announced the Cheaper Home Batteries Program, to begin from 1 July 2025, which will provide households and small businesses with a 30% discount on installed battery costs (DCCEEW, 2025b). The program will support installation of batteries up to 100 kWh, which will benefit small commercial consumers (AEMO, 2024f). Modelling for AEMO assumes an average capacity for large commercial batteries of 150 kWh, though commercial sector batteries can be much larger, reaching a capacity of over half a megawatt-hour (AEMO, 2024f; Smart Commercial Solar, 2021).There have been some incremental rule changes to allow owners to unlock more revenue from their solar systems. In August 2024, the Australian Energy Market Commission (AEMC) completed rule changes aimed at enabling greater uptake of consumer energy resources by residents and businesses (AEMC, 2024e). These changes aim to provide greater value for flexible resources through the wholesale and ancillary services markets. However, these changes alone are unlikely to address the larger barriers for C&I uptake. For example, they do not address the split incentives or high upfront cost barriers.

4.1.1 Recommended actions

We recommend that the Government enhance the incentives for owners of C&I buildings (and rural businesses) to install solar PV and battery systems, through one or more of the following:

- **Expanding and extending the SRES**
  Increase the generation system capacity threshold to 1 MW to reduce upfront costs for larger systems, and the storage size beyond 100 kWh to reduce costs for larger batteries. Reducing these costs may drive greater participation (CEC, 2024; Evans, 2024).
- **Offering a tax incentive**
  Make a tax deduction available for property managers or building owners for the full capital cost of combined C&I rooftop solar and battery systems, similar to those suggested by the Grattan Institute for electrification of residential buildings (Wood et al., 2023; Wood & Reeve, 2023). We recommend the incentive covers batteries alongside solar to help absorb excess solar generation in the middle of the day. This will reduce the upfront cost to the property manager or building owner and allow them to generate revenue through energy exports.
- **Providing targeted time-dependent feed-in tariffs**
  Work with state and territory governments to introduce appropriately calibrated time-dependent feed-in tariffs to incentivise C&I rooftop solar and battery systems that export electricity at times that the electricity market is undersupplied (Mountain, 2024).[30]

30 Victoria has introduced time-dependent feed-in tariffs, but these may not be set at the levels required to incentivise rooftop solar and batteries (ESC, 2025; Mountain, 2024).

4.2 Faster connection of commercial rooftop solar and battery storage

Commercial solar and battery systems should be connected more quickly to distribution networks to take advantage of the available capacity in these networks (ENA, 2024b). Faster connections should include solar-only systems where there is available network capacity or where generation above grid capacity can be stored in a battery (see Section 4.3).

Feedback from stakeholders suggests that application processes for connecting C&I systems typically take 6 months and sometimes up to 18 months. For new buildings, if a connection application is not approved in time to incorporate the installation with building construction work, a system may not be installed at all. For well-established areas of the grid, local distribution network constraints are often cited as the reason applications are declined.

Barriers to quickly connecting C&I systems to distribution networks include:

- Connection application processes can be slow, unpredictable, inefficient, opaque, inconsistent and costly (DCCEEW, 2024h).
- The scale of these systems means they have the potential to negatively impact the operation of a distribution network. Evaluating these impacts makes connection applications more complex and time-consuming to assess, particularly for solar-only installations and systems over 5 MW.
- Potential developers are unable to readily access information about available local distribution network capacity to connect rooftop PV and ideal network locations for batteries.

The Government's response to our recommendation on timely connections for C&I systems highlighted work being done through the *National Consumer Energy Resources Roadmap* (DCCEEW, 2024f), aimed at unlocking consumer energy resources. The Roadmap's early priorities include faster and harmonised connection processes (DCCEEW, 2024f).

The Roadmap presents draft recommendations aimed at streamlining C&I connections, that include (DCCEEW, 2024h):

1. requiring distribution network service providers (DNSPs) to publish consumer energy resources connection data, including current application timeframes
1. requiring DNSPs to provide information about available capacity at prospective sites
2. incentivising DNSPs to connect and energise large consumer energy resources faster
3. requiring DNSPs to provide clear requirements that an application for a second connection at a site must meet.

The draft recommendations are yet to be finalised or implemented.

4.2.1 Recommended actions

We recommend that, through the *National Consumer Energy Resources Roadmap*, the Government prioritise delivering policy programs that:

- **Require DNSPs to provide network information**
  We support the Roadmap's draft recommendation to require DNSPs to provide information to project developers about available capacity at prospective sites. We propose this could include publicly available, up-to-date and comprehensive network maps that are consistent across DNSPs. This should include information on locations where there is capacity to connect more solar generation, and areas that would benefit from storage. We support the requirements for DNSPs to publish this information as outlined in the rule change request that Energy Consumers Australia submitted to AEMC (AEMC, 2025a; ECA, 2025a). The Australian Energy Regulator (AER) also recently stated it will support this rule change request (AER, 2025a).
- **Require DNSPs to standardise application processes**
  Connection application processes should be simplified and standardised across DNSPs, with harmonised minimum requirements that applications must meet (ENA, 2024b).
- **Streamline C&I system connections**
  We recommend incentives be put in place for DNSPs to perform minor upgrades to alleviate network congestion to enable C&I connections, and rule changes adopted that limit timeframes for connection approvals. As application processes are more complicated for systems over 5 MW, some project proponents and manufacturers are sizing or downsizing projects to stay below this limit (AEMC, 2014; Arowana, 2020; Fimer, 2022). We propose that the Government request the AEMC consider whether a higher threshold might be appropriate.

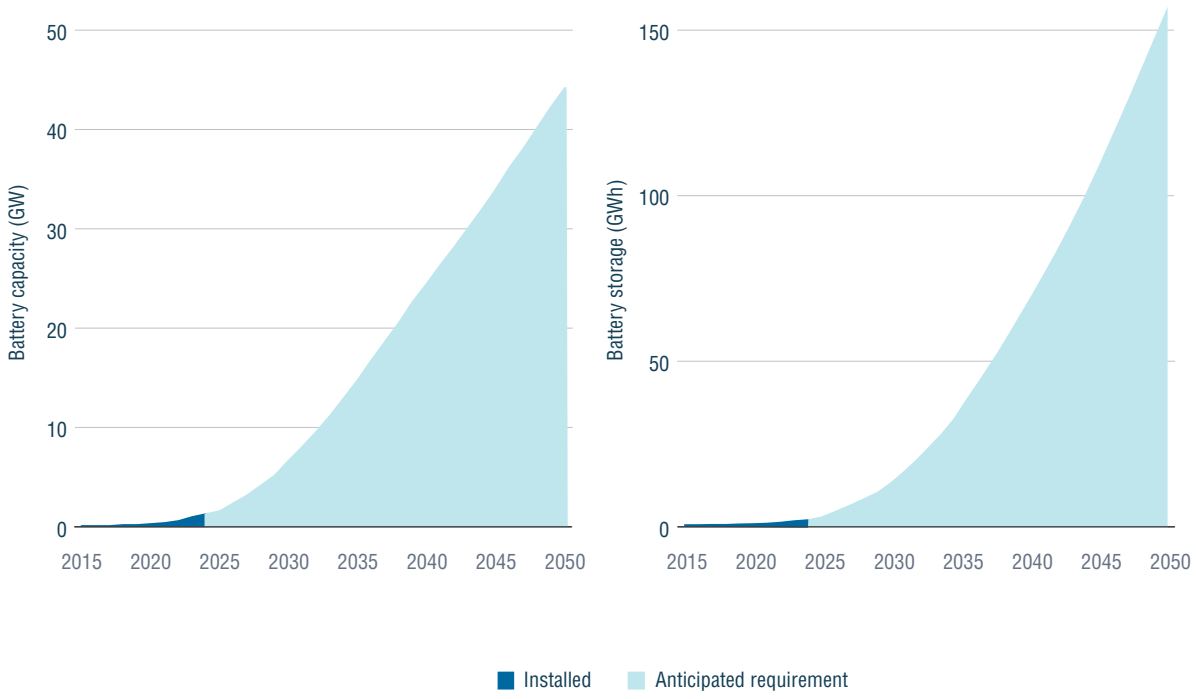
4.3 Installing batteries in the distribution network

Installing more distributed batteries[31] in distribution networks will enable more rooftop solar to be connected and used locally. Batteries can store excess solar generation for later use, reducing curtailment of the existing solar fleet and allowing more solar to be installed in a distribution network (ARENA, 2024; Shaw et al., 2024). The very fast responsiveness of batteries to stabilise the grid can also help to avoid blackouts (RMI, 2024; ARENA, 2025a).

AEMO estimates that, if distributed batteries (residential and commercial) can be coordinated effectively, they can support the power system and lower costs for all consumers by offsetting the need for an additional $4.1 billion in net grid-scale investment by 2050 (AEMO, 2024a).[32] Without coordination, the full benefits of distributed generation and storage will not be realised. There was 1.2 GW (2.0 GWh) of total distributed storage capacity in the NEM in 2024 (AEMO, 2025d). In its Step Change scenario, AEMO projects that 44 GW (157 GWh) will be connected by 2050 as illustrated in Figure 1 (AEMO, 2024c).[33]

Rapid deployment of community-scale batteries could bring more storage capacity to distribution networks more quickly due to their larger size compared to household batteries[34]. They can add storage to the network for the benefit of all users, including those who are not able to access or install home batteries. The current level of government support for community-scale battery capacity is not resulting in the rate of installation required to support the future electricity network. Our 2024 APR recommended that DNSPs be empowered to plan and install community-scale batteries in their networks (CCA, 2024a). The Government's response to our 2024 APR referred to the Community Batteries for Household Solar program (DCCEEW, 2024a). As noted in Section 4.1, this will support approximately 0.1 GW of storage.

Figure 1: National Electricity Market (NEM) historical distributed battery installations and AEMO's anticipated requirements, 2015–50



Sources: AEMO, 2024c, 2025d.
Note: NEM Step Change Scenario. Historical data over calendar years, anticipated data over financial years.

31 Distributed batteries are connected to the distribution network, and installed in a central location within the community (community-scale batteries) or at the consumer end in homes and other buildings (Mehigan et al., 2018).

32 Community-scale batteries can be installed either front-of-meter or behind-the-meter. While AEMO currently defines distributed energy resources as behind-the-meter (ARENA, 2024c), community-scale batteries are also connected to the distribution network (ARENA, 2020a).

33 Vehicle to grid (V2G) technology allows electric vehicles (EVs) to act as household batteries, and these batteries are larger than typical household batteries (for example 60–80 kWh compared to 11–12 kWh; Ali, 2024). The uptake of V2G technology will add battery capacity to distribution networks when connected (ARENA, 2025b).

34 Community-scale batteries are typically rated between 0.1 and 5 MW (Shaw et al., 2024). Household batteries are typically between 2 and 5 kW (CEC, n.d.).

Community-scale batteries can play a larger role in providing more distributed storage, however there are challenges to their deployment, including:

- high capital costs
- less established supply chains than household or transmission scale batteries (ECA, 2024)
- limited public information on the best distribution network locations for installation
- tariffs that do not value battery services (ECA, 2024; ENA, 2024b)
- network charges that are levied twice – for each charge and discharge (ARENA, 2020a)
- requirements for DNSP owners to seek waivers from ring-fencing rules if they lease battery capacity to third parties (Box 3)
- logistical challenges for community ownership, including managing service contracts and balancing services between energy users and the network (ARENA, 2020b).

Energy Networks Australia (ENA) has suggested that allowing DNSPs to lease a portion of battery capacity to third parties for non-network market services would enable them to deploy community-scale batteries on their networks, increasing the number of batteries in the system and reducing overall system costs (ENA, 2023, 2024b). Leasing a portion of battery capacity to third party vendors would generate revenue for DNSPs, and provide access to batteries for third parties, who can make money on market-facing activities (for example by trading or selling the battery capacity). This would require the AER to grant a waiver of current ring-fencing provisions (Box 3). Market-facing activities must still be undertaken through third parties after the AER grants a waiver (ENA, 2024b).

We need a lot more storage in all forms, including behind the meter, utility scale, and at the distribution level. The community battery program is good, but not enough to get the storage needed at the distribution level. DNSPs can deploy and own distribution-connected batteries, including 5–10 MW batteries in substations, in partnerships with third parties, so customers can benefit from the full value stack. A class waiver is needed to get things mobilised, as applying for waivers one-by-one is too slow.

Energy Networks Australia in consultation with the Authority, 2025

Box 3: Ring-fencing and implications for distributed assets

Ring-fencing separates regulated monopoly services from competitive services to support competitive markets (AER, 2016, 2023b). DNSPs are monopoly providers of distribution services, which are regulated. Ring-fencing prevents DNSPs from using their regulated revenue to subsidise competitive services, or from favouring themselves over other market participants in providing competitive services.

The value of the assets that DNSPs use to operate their networks, and on which they are allowed to earn a regulated rate of return, is referred to as the regulated (or regulatory) asset base (RAB). When DNSPs own and use batteries only for network support functions such as stabilising voltage, they can be included in the RAB and do not require ring-fencing waivers.

If DNSPs want to provide unregulated contestable services, they must apply to the AER for a waiver from ring-fencing requirements (AER, 2025c). Unregulated contestable services are services offered on a competitive basis. Examples include providing electric vehicle (EV) charging services and leasing a portion of the capacity of their batteries to third parties.

In 2023, the AER issued a ring-fencing class waiver for recipients of the Government's Community Batteries for Household Solar program (AER, 2023b). AER expected that DNSPs that received funding through the program would seek to lease spare battery capacity to third parties to generate revenue from non-network services (AER, 2023b). This class waiver covers all batteries supported by the program. The waiver allows DNSPs to provide non-distribution services, including leasing battery capacity to third parties, but it does not allow them to directly participate in market-facing activities.

DNSPs are well placed to deploy community-scale batteries in their networks. They have existing skilled workforces, and own land throughout their networks. Battery capacity could be added to these locations reasonably quickly given no negotiations with landholders would be needed (ENA, 2024a). The benefits of these batteries would be shared by the customers in these networks (ENA, 2024b). By deploying larger numbers of community-scale batteries, the costs of purchasing and deploying these batteries in Australia would be reduced. Origin highlighted that networks have economies of scale and therefore have opportunities to provide cost savings in the short term. However, they also have the potential to displace competition in the long term (AER, 2023b).

Stakeholders have raised concerns about issuing class waivers to DNSPs. In issuing the class waiver for the Government's Community Batteries for Household Solar program (Box 3), the AER stated that the provision of these non-network battery services by DNSPs could create a risk that electricity users would bear excess costs (AER, 2023b), should DNSPs overinvest in these batteries as part of their RAB. The AER was also concerned that DNSPs could use their position as the monopoly operator of a network to crowd out or hinder the ability for behind-the-meter storage[35] to provide these services. They cited stakeholder concerns of information asymmetry on network knowledge and data, and tariff discrimination against third-party developers (AER, 2023b).

DNSPs have access to information on the best locations to connect batteries to the distribution network that other prospective installers do not. ECA is not supportive of expanding the waiver unless DNSPs are required to provide much more useful network information.

Energy Consumers Australia in consultation with the Authority, 2025

Waiving ring-fencing requirements can provide advantages to DNSPs over other market participants, as they have information about the networks that may not be public. This could stifle innovation and competition. Public tenders to find least cost options for network services should be run as a first option, with DNSPs ring fenced entities only being permitted ownership after this has gone to market. Any waivers issued should not be for longer than 5 years.

CEC in consultation with the Authority, 2025

This form of activity, by DNSPs, did have the potential to hinder competition in the growing market for battery services, and created a risk that regulated network customers could be required to bear costs in excess of the prudent and efficient cost of providing network services.

Decision: Distribution ring-fencing class waiver for DNSP-led projects funded under the Australian Government's Community Batteries for Household Solar Program (AER, 2023b)

The network data that DNSPs currently provide is not detailed, comprehensive or timely enough to be useful for prospective community-scale battery project proponents to select ideal locations. The location of community-scale batteries is important, as local distribution network conditions can limit the operation of batteries and their ability to generate income (AER, 2024a). These issues were highlighted in a community-scale battery trial, run through the AER's Network Visibility project (AER, 2024a). The trial's project proponents were not able to access the data they needed consistently, or found it was not sufficiently up-to-date for their needs.

35 Residential or commercial battery storage where electricity is managed on the customer's side of the meter.

4.3.1 Recommended actions

We recommend the Government requests the AER consider extending a ring-fencing waiver to DNSPs for all community-scale battery projects. This could help to increase the rate of battery installations, bring down costs for these installations, allow more solar to be connected to the distribution network, and build a local industry for wider deployment. The AER could consider applying the waiver for a limited number of years, and for a limited portion of battery capacity to address competition concerns. The AER should then assess whether the outcomes of granting the waiver enabled the faster deployment of community-scale batteries, and determine whether an extension is warranted. This waiver should uphold the transparency requirements included in the waiver issued by AER for the Community Batteries for Household Solar program. These require DNSPs to provide key information to AER on the contracting arrangements for leasing battery capacity, to ensure there is no potential for discrimination in leasing (AER, 2023b).

Our recommended action in Section 4.2 will help address concerns on information asymmetry between DNSPs and other battery project proponents. This data-sharing requirement should include accurate information on capacity constraints and network opportunities for community-scale batteries (AER, 2023b).

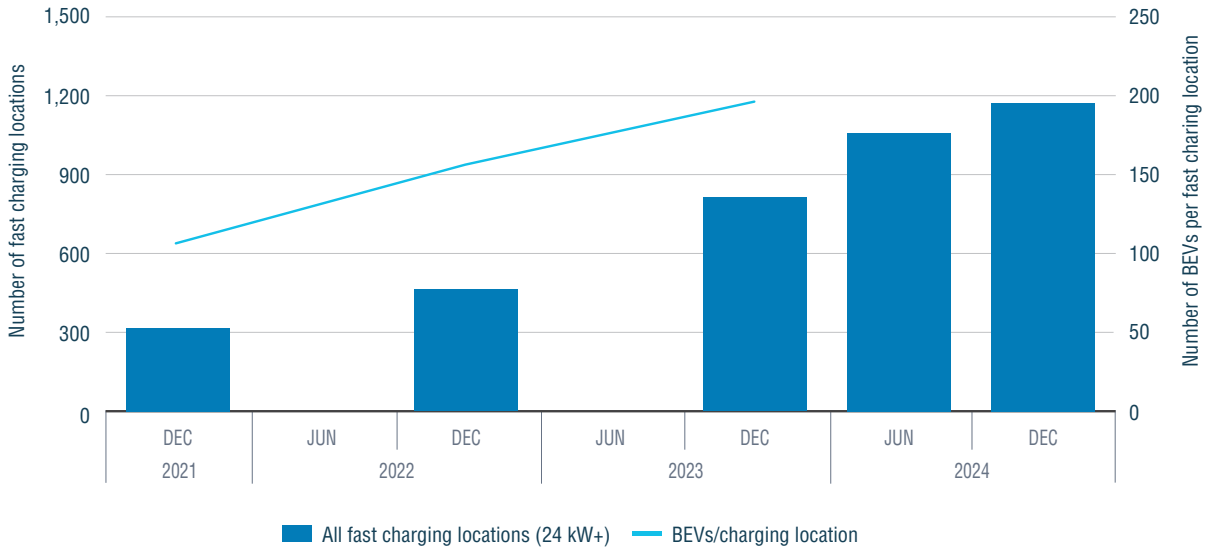
4.4 Accelerating the rollout of EV charging infrastructure

Ensuring that the rollout of public charging infrastructure keeps pace with EV sales is crucial for enabling rapid, large-scale EV uptake (IEA, 2024). Many Australian drivers are unlikely to buy EVs unless they are confident in their ability to access charging (Dawes, 2024). The buildout of a comprehensive public charging network is necessary to support the growth of the EV market.

However, the rollout of fast charging locations in Australia continues to fall behind EV uptake (Figure 2). Inadequate charging infrastructure is cited as a reason why some Australian drivers are opting to purchase hybrids and plug-in hybrids over EVs (Pogrebna Ganna, 2025).

A key barrier to a faster rollout of public charging is the period of time it takes to obtain a connection to the distribution network, which is often more than a year (CCA, 2024b; EVC, 2024b; Evie Networks, 2023; Jolt Charge, 2022). Connection processes can be further delayed by constraints in distribution network capacity (ARENA, 2022), requiring transformer upgrades that also take time to complete (CCA, 2024b). To avoid waiting for upgrades, charge point operators can choose locations with sufficient network capacity. However, many DNSPs do not publish sufficient information on network capacity (EVC, 2024b).

Figure 2: Number of fast charging locations and number of BEVs per fast charging location, 2021–24



Sources: Authority analysis based on data from EVC (2023, 2024a), BITRE (2024a, 2024b) and unpublished DCCEEW (2024).
Note: Data for December 2024 is approximate.

Public charging availability could be improved by rolling out low-cost, kerbside chargers. These chargers are cheaper to roll out, less likely to need network upgrades, and provide charging for residents who park on the street (Ausgrid, 2023; NSW Government 2024b). Kerbside chargers are not yet commercially viable and current deployment is supported by state and federal funding programs (DCCEEW, 2025d; NSW Government, 2024b). ENA has suggested another way to address commercial viability is by allowing DNSPs to roll out EV chargers. ENA says DNSPs can deliver kerbside chargers faster, at a lower cost, and support charger reliability more effectively, than charge point operators because they already own and maintain the assets on which the chargers would be mounted (ENA, 2024b). One DNSP, SA Power Networks, has previously suggested it could deliver charging in more limited circumstances where there is no interest from a commercial operator, acting as a 'charger of last resort' (SA Power Networks, 2023).

Allowing DNSPs to roll out EV chargers would require the AER to either issue ring-fencing waivers (Box 3) or change its guidelines to classify EV charging as a distribution service (Rule 6.2 in the National Electricity Rules). The guideline change would extend DNSP monopoly service provision, particularly if EV charging is classified as a standard control service[36]. This would allow DNSPs to add EV charging assets to the RAB and enable DNSPs to recover asset, installation and maintenance costs of chargers from all electricity network customers, including those not using the chargers. The guideline change raises similar concerns to issuing class waivers for batteries in Section 4.3. There are risks that DNSPs will overinvest in chargers and use their monopoly position to crowd out competition. For example, DNSPs could push charge point operators out of the market by setting high prices for operators to access the DNSP's network, otherwise known as facility access agreements. The AEC pointed out that classifying a competitive product as a monopoly service is not good regulatory practice and that loss of healthy competition, which would normally drive innovation and efficiency, would lead to higher prices (AEC, 2025). The AEC suggested the speed and benefits of DNSP-led kerbside charger roll-out could be tested in a sandboxing trial.

4.4.1 Recommended actions

We recommend the Government requests the AER consider issuing a ring-fencing class waiver to allow DNSPs to deploy EV chargers to increase the rate of deployment and coverage of kerbside charging. A class waiver should include measures to address competition risks, balance benefits and costs for consumers and ensure maximum access to EV chargers. To support the waiver, we suggest the Government sets targets on the number of EVs per charger and public charger uptake.

The AER may consider some of the following measures when balancing the necessary speed of deployment against competition concerns:

- the recommended actions in Section 4.2.1 on providing network information and speeding up connections
- standardised costs to access DNSP networks for other charger proponents, to ensure DNSPs do not use their monopoly position to crowd out competition
- a class waiver applying for a limited number of years
- a class waiver applying for a limited number of assets
- require DNSPs to report against public charger uptake targets to demonstrate overinvestment is not occurring.

The AER could then assess whether the outcomes of granting the waiver enabled the faster deployment of kerbside chargers and determine whether an extension is warranted. We recommend that the Government review the adequacy of coverage in regional and rural areas at the end of the waiver period to determine if incentives are needed to address gaps.

To further accelerate the roll-out of EV chargers, we recommend implementation of the *National Consumer Energy Resources Roadmap* prioritise streamlining and speeding up transformer upgrade requests, for example by limiting the allowable timeframes for their completion.

4.5 Integrated planning framework for transmission and distribution networks

Transmission and distribution network upgrades can unlock renewable capacity without the need to deliver major transmission projects. To maximise the benefits of network upgrades, more integrated planning between transmission and distributed networks is required. Currently, AEMO's Integrated System Plan (ISP) provides an integrated roadmap for transmission networks in the NEM (AEMC, n.d.). However, for distribution network planning, each DNSP must undertake Distribution Annual Planning Reports (DAPRs), which cover a minimum forward planning period of 5 years (AEMC, n.d.). There is no national plan that incorporates detail on network infrastructure below the transmission level as part of a single consistent exercise (C4NET, n.d.).

36 Distribution services are classified further as a standard control service or alternative control service. Standard control services 'form the basic charges for use of the distribution system. Alternative control services are only used or requested by certain customers' (AER, 2022b).

Following the 2024 Review of the ISP, the Energy and Climate Change Ministerial Council agreed that AEMO should enhance demand forecasting in the 2026 ISP (ECMC, 2024). As a result, a rule change has been put in place by the AEMC aimed at improving AEMO's consideration of demand-side factors in the ISP, including a requirement for AEMO to identify opportunities for distribution network developments consistent with the efficient development of the power system (AEMC, 2024b). The rule change also places an obligation on DNSPs to provide relevant information to AEMO (AEMC, 2024b). Following this rule change, AEMO published the *Draft 2025 Electricity Network Options Report*, an input to the 2026 ISP, which for the first time identifies distribution network augmentation options (AEMO, 2025j). The Authority welcomes these changes, but barriers remain on the path to more integrated planning.

Barriers to more integrated planning between the transmission and distribution levels include:

- different timelines and publications for the planning processes for transmission and distribution networks (C4NET, n.d.)
- inconsistent parameters and assumptions used by DNSPs when modelling and planning at the distribution network level, which makes it difficult to bring together DNSP plans and integrate them with the ISP (C4NET, n.d.)
- the absence of information on hosting capacity for consumer energy resources in DAPRs, the inability for DNSPs to account for large shifts in these resources in the longer term due to a lack of requirement to include this in their DAPRs (ECA, 2025b).

Misalignment of transmission and distribution planning could create situations where proponents are not able to plan connections most appropriately due to reduced visibility regarding what network changes will actually occur. While DNSPs are planning for incorporating growth in consumer energy resources in their networks (United Energy, 2025), this planning may not be consistent across DNSPs or integrated with TNSP planning (C4NET, n.d.). Distribution network costs typically account for around a third of electricity retail prices (AER, 2022a), and transmission network costs account for approximately 5–10% (AER, 2023a). Improving the coordination of planning should enable better investment decisions, through providing more information for network users.

There are currently prescribed instances where TNSPs and DNSPs plan together, with joint planning arrangements outlined under the National Electricity Rules (AEMC, n.d.).

The benefit of more of this kind of work would be more integrated and efficient transmission and distribution network upgrades resulting in lower costs for consumers, reduced curtailment of existing solar, and the faster deployment of renewables and storage (C4NET, n.d.).

The NSW Government is looking to improve transmission planning at the state-level (NSW DCCEEW, 2025). It has commissioned a review of planning processes, which has identified issues that are consistent with the barriers noted above. The review has highlighted the need for planning to include system strength services and other system security services and information from the growing amount of consumer energy resources at the distribution network-level. The outcome of this review will likely provide insights useful for reforming transmission planning in other jurisdictions.

4.5.1 Recommended actions

As in our 2024 APR, we recommended that the Government work with AEMO, TNSPs and DNSPs to better coordinate and integrate their planning processes to accelerate deployment of renewables and system security services. Efficiencies could be gained through putting distribution planning on the same schedule and process as the ISP. A framework to support more integrated planning may also:

- give assurance to investors around the timeliness of network connections
- reduce curtailment of the existing rooftop solar fleet
- accelerate deployment of small- and large-scale renewables and storage.

We have highlighted improving the visibility of the distribution network to project proponents as a key opportunity for speeding up the installation of C&I solar and batteries (see Section 4.2). Requiring this information to be published and integrated within a broader planning framework that includes transmission-level data, should enable better planning and use of the networks for all participants.

4.6 Deployment of smart meters

We welcome the AEMC's recent rule changes to deliver an accelerated rollout of smart meters to all NEM customers by 2030 (AEMC, 2024a). Smart meters provide real-time energy use data to enable DNSPs to manage their systems efficiently and to help households and businesses make better decisions about their electricity use.

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Appendix

Appendix A: 2024 APR recommendations relating to decarbonising electricity

Recommendation 1: Strengthen, broaden, lengthen and embed the Capacity Investment Scheme

To realise the 82% renewable electricity by 2030 target and meet Australia's increasing electricity demands, the Capacity Investment Scheme should be enhanced by:

- substantially accelerating and broadening the scheme to:
  - close the gap to the 82% renewable electricity target
  - make an ambitious 2035 abatement target achievable, consistent with Australia's international obligations, and support the clean energy transition required across the economy for Australia to achieve net zero by 2050
- as the Authority suggested in the Sector Pathways Review, embedding the scheme in legislation and, subject to the outcomes of the post-2030 future market design review commissioned by energy Ministers, either extend the scheme or replace it with an alternative mechanism beyond 2030 to increase confidence that subsequent emission reduction targets will be met
- prioritising projects that do not require extensions of the shared transmission network, in particular combined solar and battery projects.

Government response to Recommendation 1 – Note

Building on the existing pipeline of renewables projects, the Government is working closely with jurisdictions to increase the amount of renewable generation in our grid by 2030. The CIS, plus state and territory commitments, such as formal RETAs are expected to result in Australia achieving 82% renewable electricity on-grid by the end of this decade. Accelerating the deployment of renewable energy is critical to emission reduction goals, and the Government is therefore front-loading early CIS tenders to maximise early delivery of new generation and storage projects.

The post-2030 future market review will recommend future market settings to promote investment in firmed, renewable generation and storage capacity in the National Energy Market following the conclusion of CIS tenders in 2027. The review will make actionable recommendations to support the development and staged implementation of reforms to the NEM wholesale market. The reforms will support the achievement of the National Electricity Objectives – including affordability, reliability and emission reduction in the longterm interests of consumers and prosperity of Australia's economy. The Government will consider the appropriate legislative response considering those recommendations.

The CIS tender assessment considers the amount of curtailment of renewable projects to prioritise good locations for projects on the transmission network. The Government is also exploring the expansion of the eligibility of Virtual Power Plants to utilise the existing distribution network for CIS supported projects.

Recommendation 2: Enable the rapid and large-scale deployment of combined synchronous condenser functionality with back-up generation capability, to provide the system security and reliability services needed for the accelerated deployment of renewables and timely coal power station closures, through analysis and tenders run by the Australian Energy Market Operator (AEMO)

As identified in the 2024 Integrated System Plan, synchronous condensers will be needed to provide essential security services (inertia and system strength) to enable the rapid growth of wind and solar, and the timely closure of coal-fired generation. Limited gas-fired generation peaking capacity will also be needed to maintain reliability as a back-up for wind, solar, batteries and pumped hydro at times of low renewable output and/or high demand.

To ensure the delivery of these services is efficient and timely, the Authority recommends that AEMO be authorised to assess the efficient level of these services and conduct periodic tenders to accelerate their provision by market participants through deployment of synchronous condensers which can be operated as generators. AEMO would tender for this capacity with sufficient lead time to meet any forecast shortfall that has not stimulated a sufficient industry response. Funding would come from market sources, and AEMO would not own the plant.

The power generation capability of these installations should be able to operate on natural gas and renewable gases, and if gas network and storage constraints require, liquid fuels including fuels derived from renewable sources (such as hydrogen).

AEMO's assessment and procurement role should include the upgrade of gas network and storage capacity to ensure an adequate supply of gas for peaking needs.

Government response to Recommendation 2 – Note

The Government recognises the important role that technologies such as synchronous condensers will play in the security and reliability of our electricity system and will continue to use existing processes to address the issues raised by the CCA.

The National Electricity Rules provide the framework for achieving and maintaining a secure power system. The AEMO is required to publish annually a System Strength Report in which it must indicate the requirements for system strength at nodes throughout the NEM and identify any forecast shortfalls. The System Strength Service Provider in each region (in most cases, the Transmission Network Service Provider) is then required to procure sufficient services (including through installation of synchronous condensers where appropriate) to maintain adequate system strength at each node in its region. This is done through a transparent process, overseen by the Australian Energy Regulator (AER), to ensure the most efficient solution is found. This ensures that both technical and economic aspects of the solution are considered in a technology neutral environment.

The separation of responsibility between the system operator and planner (AEMO) and those responsible for the provision of services (Transmission Network Service Providers with regulatory oversight from the AER) is a characteristic of the current regulatory framework that reduces the risk of conflict of interest in the choice of solution.

AEMO's Electricity Statement of Opportunities (ESOO) provides technical and market data for the NEM over a 10 year period from 2024–25 to 2033–34. The ESOO is a signal for investment and highlights the opportunities for market participants, investors, governments and other jurisdictional bodies to invest in new assets and systems to maintain a reliable and secure supply of electricity in the NEM.

The Government will continue to monitor issues relating to system strength, including through the Energy and Climate Ministerial Council, and is committed to continuing engagement with market bodies, market participants and jurisdictions to address supply chain constraints in relation to synchronous condensers.

Recommendation 3: Speed up connection approval processes for large-scale generators in the National Electricity Market, while enhancing the transparency of those processes

With an unprecedented roll-out of renewables, storage and firming needed to deliver 82% renewable electricity by 2030, an unprecedented volume of capacity will seek connection.

However, AEMO and transmission network service providers (TNSPs) appear to lack sufficient capacity to handle the quantity of new connection applications that will need to be assessed, and it is not clear how long different types of projects are currently taking to obtain connections. Improving this information could set realistic expectations for project proponents, and better support progress tracking. Better information about connection times will also enable more informed consideration of resourcing needs for AEMO and TNSPs.

Government response to Recommendation 3 – Agree

The Government recognises expediting grid connections is integral to achieving its climate goals. In 2023, the Government established the Capacity and Connections Committee to oversee the Summer Readiness Pilot, which brought an additional 3.2 GW of capacity online ahead summer and reduced commissioning timeframes by 53%. The Government continues to work with jurisdictions through the Streamlined Connections Trial which is trialling initiatives from the AEMO-led Connections Reform Initiative.

The Government will also be providing funding for the Accelerated Connections Fund, which will expedite the connection process of generation and storage projects across the NEM. Non-competitive grants will be provided to AEMO and TNSPs for additional resourcing, which has been proven to reduce connections timeframes. This will help to reduce wholesale prices, lower inflationary pressure, and provide consumer cost of living relief while driving progress toward the 2030 renewable energy target.

Recommendation 4: Make full use of the potential contribution of electricity distribution networks, and commercial and industrial customers' premises, to host renewable electricity generation and storage

Australia's electricity distribution networks and Commercial and Industrial (C&I) customers should be empowered to play a much greater role in the deployment of renewable electricity generation and storage.

This would complement the vital contribution of transmission-connected and household generation and storage.

Key initial actions are:

- develop and implement a scheme to incentivise C&I electricity customers to invest in large rooftop solar PV and battery storage installations (to add capacity without worsening the 'duck curve' phenomenon – high solar energy production during the middle of the day when grid demand is relatively low)
- require distribution network service providers (DNSPs) to plan and deliver timely and efficient connections for C&I rooftop solar and battery storage
- empower DNSPs to plan and install batteries in their networks, including in partnership with market participants, to complement and not crowd out behind-the-meter storage, and allow their efficient costs to be recovered through DNSPs' regulated network charges
- establish a framework for the integrated planning by DNSPs and TNSPs of major network asset and service upgrades, and create a complementary mechanism for DNSPs and TNSPs to invest in minor network upgrades that will accelerate deployment of renewables and storage
- accelerate the mandatory, regulated deployment of smart meters by distributors, and require them to provide leading-edge data services to their customers and retailers.

Government response to Recommendation 4 – Agree in principle

The Government, with the state and territory governments and market bodies, is working to improve the ability of electricity distribution networks to support higher levels of renewable energy and 2-way energy flows. The *National Consumer Energy Resources Roadmap* agreed by Energy and Climate Change Ministers in July 2024 sets out a series of actions to unlock the full benefits of consumer energy resources for consumers and the electricity system. Early priorities include streamlining network connection processes for commercial-scale consumer energy resources, such as community batteries, and supporting higher solar energy exports.

The Government supports the deployment of small-scale renewable energy systems through the SRES. The SRES supports households and businesses that install rooftop PV and solar water heaters. Larger solar PV systems installed by the commercial and industrial sector may be eligible for support under Large-scale Renewable Energy Target scheme. The Government is supporting increased storage in the distribution network through the Community Batteries for Household Solar program – $200 million in grant funding to support over 400 community batteries. The AER has approved a class waiver for batteries receiving funding under this program, enabling distribution network service providers to lease battery capacity to market participants. The program is in early deployment stages and its outcomes will inform future government support or enabling actions to support further distribution-level storage.

Incentive schemes established in the National Electricity Law form an important part of our approach to regulating national monopoly electricity and gas networks in Australia. In 2023, the AER reviewed and refined its incentive schemes and guidelines that apply to regulated electricity and gas networks to ensure they remain relevant and fit-for-purpose. A targeted review of the Service Target Performance Incentive Scheme is now underway as part of the AER's commitment to improve its approach to regulation by being more efficient and focusing on outcomes that matter most to consumers.

Smart meters are an essential enabling technology to provide consumers access to the electricity services and market offers of the future. Under current rules, it is electricity retailers' responsibility to ensure that all new and replacement meters are a smart meter. On 28 November 2024, the Australian Energy Market Commission (AEMC) is due to make a final determination on the accelerated roll-out of smart meters by electricity retailers. The AEMC has previously indicated it will seek 100% rollout across the NEM by 2030. Some jurisdictions have moved independently to accelerate smart meter rollout ahead of 2030, such as Western Australia. In addition, on 10 October 2024, the AEMC published a consultation paper to seek feedback on a rule change request submitted by Energy Consumers Australia that seeks to improve consumers' access to real-time data from smart meters.