Climateworks CENTRE

Level 8, 750 Collins Street,
Docklands VIC 3008
Wurundjeri Country

P: +61 3 9902 0741

info@climateworkscentre.org

climateworkscentre.org

23 June 2025

Australian Energy Market Operator
Submitted via email to isp@aemo.com.au

To whom it may concern,

Climateworks Centre submission to the Draft Electricity Network Options Report consultation

Climateworks Centre welcomes the opportunity to provide a submission to the Australian Energy Market Operator (AEMO) in response to the *Draft Electricity Network Options Report.*

Climateworks bridges the gap between research and climate action, operating as an independent not-for-profit within Monash University. We develop specialist knowledge to accelerate emissions reduction, in line with the global 1.5 degrees Celsius temperature goal, across Australia, Southeast Asia and the Pacific.

Since 2021, AEMO has engaged CSIRO, supported by Climateworks, to conduct multi-sector modelling to quantify the dynamic influences that would shape electricity demand under different emissions reduction scenarios. The recommendations in this submission draw on insights from that process – and other Climateworks research and analysis – and will contribute to a robust and optimised Electricity Network Options Report.

Rapidly decarbonising its electricity and energy system is essential for Australia to meet its obligations under the Paris Agreement. As the largest source of greenhouse gas emissions in Australia, electricity generation represents a critical intervention point. The use of fossil fuels to produce electricity and stationary energy for commercial and industrial purposes accounts for 54.9 per cent of Australia's total emissions (CSIRO 2023). Transitioning to renewable energy will not only reduce these emissions directly but also create powerful ripple effects that drive decarbonisation across other economic sectors.

However, the transformation is complex. It requires forecasting and planning that considers evolving energy generation, transmission and storage technologies, changing market and regulatory conditions, and emerging opportunities in renewable energy and resource exports. The next Integrated System Plan (ISP) will be the first for which AEMO must ensure that the electricity supply supports ambitious jurisdictional emissions reduction targets while remaining reliable, secure and affordable. Our submission aims to assist AEMO to do so more effectively.

The energy system in Climateworks' 1.5°C-aligned decarbonisation scenario

In 2023, Climateworks published least-cost emissions reduction pathways for Australia. Our report shows that to align with the Paris Agreement target of limiting global warming to 1.5°C, Australia reduces emissions by 68 per cent below 2005 levels by 2030 and reaches net zero before 2040 (Climateworks Centre 2023).

In our 1.5°C-aligned scenario, renewables make up 88 per cent of Australia's total electricity generation by 2030 and close to 100 per cent by 2034. Clean electricity generation capacity would expand from 55 GW today to around 151 GW by 2030 and 398 GW by 2050. All coal-fired power generation would cease by 2035, and gas-powered generation would be reduced by 61 per cent by 2030, relative to 2024 levels, and near zero by 2050 (Climateworks

Centre 2023).

Submission summary

The rapid transformation of Australia's electricity system presents both opportunities and complex planning challenges. As electricity demand grows through electrification, while the grid simultaneously transitions to renewables, AEMO's planning and forecasting will need to evolve to capture the full value of demand-side resources.

Climateworks welcomes the increased focus on demand-side measures in the *Draft Electricity Network Options Report* and supports AEMO's efforts to enhance demand-side considerations in the ISP by incorporating Distribution Network Service Provider (DNSP) data and proposing a statement of demand-side factors. These are important first steps in a broader reform process.

We also recognise there remain important opportunities to further enhance demand-side integration. To that end, Climateworks suggests AEMO consider the following recommendations as it develops the final 2025 Electricity Network Options Report and the 2026 ISP. The submission body includes specific details on each point. Climateworks recommends AEMO:

- Increase focus on demand-side aspects within the Draft Electricity Network Options Report through additional analysis, building on the considerable improvements already made to ensure a more effective Integrated System Plan 2026 and successful transition to the future electricity system.
- Call on the Energy and Climate Change Ministerial Council (ECMC) to accelerate effective integration of demand-side energy management and performance improvements, including optimising value from network assets and potentially reducing new network infrastructure. We recommend a comprehensive demand strategy across system planning; market reforms through the National Electricity Market wholesale market settings review (NEM review); more effective governance of demand-side measures and technologies; and alignment of wider policies driving new investment.
- Further clarify how average distribution costs and geographic location of consumer energy resources (CER) are used to create the final *Electricity Network Options Report*. Even allowing for current data limitations, geographic cost variation provided by DNSPs is critical for identifying location-based opportunities and reflecting real-world cost differences.
- Clarify assumptions about where electricity demand growth will occur within each modelled region. This would integrate with DNSP data and support the development of a statement on demand-side factors. Clear locational assumptions are essential for identifying cost-effective network and non-network solutions, especially given the significant expected growth in electricity demand.
- Provide energy users and investors with additional information to help them plan investments to optimise outcomes, including opportunities for cost reductions based on shaping demand activities around time, day, season and location factors. This would extend the demand-side factors statement to a Demand-side Statement of

opportunities.

- Outline contingency pathways that offer alternate responses where there is low confidence in the pace or characteristics of change within modelled scenarios.
- Consider how the Electricity Network Options Report could be used as part of a broader effort to design an energy system that will enable Australia to become a 'renewable energy superpower', including strengthening analysis that could enable 'regional ISPs' and improve understanding of distribution network opportunities.

Recommendations for the final 2025 Electricity Network Options Report

Recommendation 1: Increase focus on demand-side aspects within the *Draft Electricity Network Options Report* through additional analysis, building on the considerable improvements already made to ensure a more effective Integrated System Plan 2026 and successful transition to the future electricity system.

Climateworks notes the complexity of factors that can increase or reduce demand - either overall or at specific times. These include changes in energy efficiency, changes in demand-response/load following to reduce peak loads, increases in electricity demand from electrification of existing industries, transport and buildings, and increases in electricity demand due to new industries and products as part of a shift to green exports (noting that potential demand increases are very substantial and highly geographically localised).

The *Draft Electricity Network Options Report* shows progress through its focus on Consumer Energy Resources (CER) and integration of Distribution Network Service Provider data. Nonetheless, current energy system planning and forecasting tools continue to lack sufficient focus on evolving energy use patterns and optimisation opportunities, while relying on inadequate energy use data.

The Australian Energy Market Commission's recent reforms to better integrate demand-side factors into the ISP provide important foundations, but these reforms alone will not be sufficient to capture all demand-management opportunities. Climateworks recommends additional analysis on potential opportunities from demand-side factors to more effectively incorporate how demand-side management can change system requirements.

Recommendation 2: Call on the Energy and Climate Change Ministerial Council (ECMC) to accelerate effective integration of demand-side energy management and performance improvements, including optimising value from network assets and potentially reducing new network infrastructure. We recommend a comprehensive demand strategy across system planning; market reforms through the National Electricity Market wholesale market settings review (NEM review); more effective governance of demand-side measures and technologies; and alignment of wider policies driving new investment.

Climateworks recommends AEMO call on the ECMC to accelerate effective integration of demand-side energy management and performance improvements across Australia's electricity and energy system. Demand management supports a low-cost transition to renewables and

help manage rapid demand growth required for decarbonisation. It will help optimise existing network assets and reduce the need for new infrastructure investment.

Currently, demand-side measures – including energy efficiency, electrification, energy management, demand response, demand flexibility and load shifting – are not coordinated to the degree required for expected rates of demand growth and Future Made in Australia ambition. Without coordination, they will not align energy demand with renewable energy supply, nor support sufficient investment in new energy infrastructure that could capitalise on low-cost renewable energy.

Responsibility for demand-side measures remains fragmented across multiple government departments and agencies covering buildings, industry, transport and energy markets. Additionally, states and territories bear primary accountability for many energy performance measures and employ different approaches. While this decentralised approach suits state and territory-level delivery, it can be a barrier to coordinated NEM-wide improvements.

This fragmented governance means that neither system planners nor energy-users or investors receive effective information and aligned incentives to optimise overall energy outcomes. This prevents Australia from fully realising the performance improvements and cost savings that effective demand-side integration can deliver. It remains a key barrier to Australia's net zero and renewable energy superpower ambition.

A comprehensive strategy spanning multiple reform areas can effectively integrate demand-side measures:

- Enhanced planning processes to provide greater transparency around the impacts and opportunities of changing demand patterns, ensuring both supply-side and demand-side investors have the information needed for informed decision-making.
- NEM review reforms to establish mechanisms to unlock and monetise demand-side value, creating proper price signals and participation pathways for demand-response resources.
- Clear objectives and governance frameworks to coordinate demand measures and incentives across sectors and jurisdictions. We see particular value in better alignment between demand management considerations and broader policy initiatives, including decarbonisation investments through Clean Energy Finance Corporation and National Reconstruction Fund, electric vehicle uptake under the National Electric Vehicle Strategy, green industrial development through Future Made in Australia policies, and energy efficiency measures under the National Energy Performance Strategy. We highlight the importance of equity considerations for local communities and vulnerable groups during implementation.

Climateworks encourages AEMO to acknowledge that while these ISP reforms are necessary, they alone will not be sufficient to capture all demand-management opportunities. We urge AEMO to support ECMC in developing a comprehensive approach that aligns demand with Australia's renewable energy transition, maximising the opportunities this shift presents.

Recommendation 3: Further clarify how average distribution costs and geographic location of consumer energy resources (CER) are used to create the final *Electricity Network Options Report*. Even allowing for current data limitations, geographic cost variation provided by Distribution Network Service Providers is critical for identifying location-based opportunities and reflecting real-world cost differences.

Climateworks commends AEMO's significant progress in incorporating Distribution Network Service Provider (DNSP) data into the *Draft Electricity Network Options Report*. Collecting data from over 500,000 low-voltage distribution assets represents a substantial step forward in understanding the distribution network's role in supporting CER. However, the current approach of averaging distribution costs across regions may obscure important locational variations that are critical for efficient network planning.

The *Draft Electricity Network Options Report* acknowledges substantial cost variations between DNSPs, with voltage management optimisation costs ranging from $100,000 to $919,000 per MW across different networks and network augmentation costs ranging from $960,000 to $4.6 million per MW (AEMO 2025). These variations reflect differences in network characteristics, terrain, population density, existing infrastructure and local regulatory environments that significantly impact the cost-effectiveness of different network solutions.

AEMO applies a standardised methodology using average costs of $400,000 per MW for voltage management optimisation and $2.4 million per MW for network augmentations; however, this approach may not adequately capture the location specificity needed to optimise investment decisions (AEMO 2025). Geographic distribution of CER growth is highly uneven – some areas have experienced rapid uptake while others lag behind. Without understanding how these location patterns interact with varying network costs, the ISP may not identify the most cost-effective solutions for integrating CER.

Furthermore, the current approach limits visibility into location-specific opportunities where targeted investments could unlock disproportionate value. For example, areas with lower augmentation costs but high CER potential may represent priority investment locations, while regions with prohibitively high network upgrade costs might be better served through alternative solutions such as community batteries or demand management.

The location cost variations provided by DNSPs represent valuable information that can be utilised, rather than averaged away. Greater transparency about how these variations are applied in modelling, including how CER distribution interacts with network costs, would support more informed decision-making by network planners, investors and policy-makers.

Recommendation 4: Clarify assumptions about where electricity demand growth is expected to occur within each modelled region. This would integrate with DNSP data and support the development of a statement on demand-side factors. Clear locational assumptions are essential for identifying cost-effective network and non-network solutions, especially given the significant expected growth in electricity demand.

Climateworks recommends that AEMO provide greater granularity and transparency regarding the spatial distribution of electricity demand growth within each modelled region. While the *Draft*

Electricity Network Options Report represents significant progress in incorporating distribution network data, the current approach lacks sufficient locational specificity to optimise network planning.

By integrating DNSP data into the final Electricity Network Options Report and ISP, AEMO can move beyond regional demand forecasting toward more granular, location-specific planning. However, the current methodology does not adequately show how demand growth is spatially distributed within regions, particularly for large-scale electrification loads such as hydrogen production facilities, data centres and industrial processes that will drive much of the anticipated demand increase.

This spatial uncertainty creates significant planning risks. Network augmentation costs can vary depending on whether new demand clusters are near existing transmission infrastructure or require new network development. Similarly, the value proposition of CER and distributed storage varies based on local network constraints and utilisation of existing capacity through innovations such as load orchestration, virtual power plants and vehicle-to-grid.

The scale of this challenge is substantial. Climateworks recently conducted an analysis showing that even the 'Green Energy Exports' scenario may fall short of the electricity capacity needed to rapidly decarbonise existing industries and establish new low-emissions export sectors in the Gladstone region. Our analysis estimates demand for the Gladstone region alone could reach 74 TWh/year by 2040 (Climateworks Centre 2025). In contrast, the industrial forecast for all of Queensland under the 'Step Change' scenario is only 44 TWh/year (AEMO 2024). This disparity highlights the critical importance of detailed place-based energy system planning to provide industry and investors the confidence they need for the transition.

The *Draft Electricity Network Options Report* acknowledges that distribution networks will play an increasingly important role in connecting consumers with energy resources. However, without clear understanding about where demand growth will occur within regions, it becomes difficult to assess whether proposed transmission augmentations represent the most cost-effective solution compared to targeted distribution network investments, deployment of distributed resources or other forms of demand side energy management.

The lack of spatial specificity limits AEMO's ability to identify synergies between demand-side measures and network planning. For example, demand response programs or time-of-use pricing mechanisms may be more effective in specific locations where they can defer network augmentations, but this requires understanding where constraints are most likely to emerge.

Recommendation 5: Provide energy users and investors with additional information to help them plan investments to optimise outcomes, including opportunities for cost reductions based on shaping demand activities around time, day, season and location factors. This would extend the demand-side factors statement to a Demand-side Statement of Opportunities.

AEMO's planning and forecasting tools have primarily guided supply-side investments, with recent reforms seeking to begin to address an additional focus on the demand-side. However, significant planning gaps remain regarding efficient demand-side investment decisions and

modelling responsive demand.

Demand growth uncertainty has become a source of planning risk in the energy transition. Large-scale energy-intensive investments – including hydrogen production, data centres and new low-carbon industries – are being considered, alongside widespread electrification of building and transport systems. Additionally, there is ongoing growth in CER, which continues to present coordination challenges. Under the ISP 'Step Change' scenario, the NEM's 'optimal development path' would deliver 213 GW of renewable generation capacity, 75 GW of firming capacity and an additional 10,000 km of transmission. In contrast, high demand requirements under the 'Green Energy Exports' scenario would require 461 GW of renewable generation capacity, 117 GW of firming capacity and an additional 26,000 km of transmission – more than double the infrastructure requirements. AEMO faces a monumental challenge not only with regard to the scale of demand but also its location and how it will respond to changing market signals.

The focus on CER in the *Draft Electricity Network Options Report* and the new demand-side factors statement introduce, for the first time, a focus on optimising distribution-level augmentations alongside related CER and demand activities. This represents a significant step toward creating a more comprehensive approach to considering demand factors. However, at this stage, it is unclear whether the demand-side factors statement, alongside the final Electricity Network Options Report and ISP, will address key gaps in guiding efficient demand-side investment decisions or include modelling responsive demand scenarios.

Future energy costs in Australia, and its economic productivity and competitiveness, will be greatly influenced by the extent to which industry can effectively pursue a renewable-energy future. This includes the ability to capture Australia's strategic advantage of frequently low-cost excess solar generation during daylight hours; minimise exposure to increasing winter gas firming costs when renewable generation is lessened; take advantage of strategic locations to reduce network costs; and respond effectively to increasingly volatile weather-driven price signals. These factors will significantly impact investors' costs as well as costs for all consumers and the overall competitiveness of the Australian economy.

The window for demand-infrastructure investors to capitalise on these opportunities is narrow. Many exist only during early planning phases when decisions about a new facility's location are made, systems are scaled around expected operating hours and utilisation rates (rather than 24/7), or choices are made around operating technologies and designs incorporating smarter, flexible approaches. Furthermore, differences between sectors and energy uses, such as those that exist between large- and small-scale energy infrastructure, create further complexity.

Currently, the *Draft Electricity Network Options Report* and ISP provide minimal insight into these trends, omitting any modelling of price patterns, their underlying drivers, demand-side opportunities for cost reduction or differences between regions. This has resulted in investors having insufficient visibility and insights into demand-side opportunities.

South Australia exemplifies this challenge. Concern has been raised about potential undershooting of demand forecasts, with ElectraNet CEO Simon Emms noting at Australia Energy Week: "We're now seeing that AEMO's forecasts are not keeping up with the customer demand we are seeing in South Australia. The big risk we are seeing is under investment, not

over investment" (Parkinson 2025).

Climateworks welcomes the changes in the *Draft Electricity Network Options Report* that will provide improved modelling of how distribution planning impacts CER uptake, though these improvements are limited in how they model dynamic feedback of price pressures on demand response. While recognising these as important first steps toward improved demand-side consideration, Climateworks recommends AEMO continue investing in these capabilities to address the sector's rapid rate of change and provide more comprehensive information for demand-side investors, potentially in a Demand Side Statement of Opportunity. This would include transparency regarding cost drivers and patterns, trends across seasons, times of day and locations, as well as identify opportunities to reduce costs, for both the energy system and individual energy users, through demand-side actions. Improving the ability of demand-side investors and energy users to make informed decisions will have a material impact on both energy costs and the level of investment needed in grid-scale infrastructure.

Recommendation 6: Outline contingency pathways that offer alternate responses where there is low confidence in the pace or characteristics of change within modelled scenarios.

AEMO has to plan an energy system in an environment of acute uncertainty. However, by modelling sensitivity analyses and a range of assumptions, it is possible to pinpoint the areas of greatest uncertainty and create scenarios for different conditions. This presents an opportunity for AEMO to better navigate unknowns and adopt a more active role in energy system planning.

Climateworks recommends that AEMO identify key uncertainties in its electricity network infrastructure analysis and undertake sensitivity testing to explore how different assumptions affect system requirements. The anticipated pathway, and alternate responses where change is not consistent with expectations, could be transparently detailed in the Electricity Network Options Report and subsequent planning and forecasting material, including the ISP. Having alternate responses would enable governments and energy system stakeholders to plan and allocate resources in alignment with the expected pathway or alternative responses. This would provide a clearer basis for decision-making under uncertainty.

For example, Climateworks' modelling indicates that CER will play a crucial role in achieving a 1.5°C-aligned energy system. However, uncertainties remain regarding the pace and scale of adoption and the behaviour of actors within the system. AEMO’s forecasting and planning materials could trigger alternative actions if changes are not in line with expectations, such as increased investment in grid-scale generation and storage.

This alternative pathway approach offers two key benefits. First, it enables AEMO to plan confidently for a 1.5°C-aligned future, while preparing for deviation. Second, it empowers governments and stakeholders to understand and shape unfolding trends, allocating resources accordingly. Transparent contingency planning is essential for managing risks and maximising opportunities in a dynamic transition.

Recommendation 7: Consider how the Electricity Network Options Report could be used as part of a broader effort to design an energy system that will enable Australia to become a 'renewable energy superpower', including strengthening analysis that could enable 'regional ISPs' and improve understanding of distribution network opportunities.

Climateworks supports the establishment of net zero industrial precincts across Australia. Precinct-scale planning for industrial regions will provide long-term guidance for industry and assurance to communities transitioning to net zero emissions. Precinct effectiveness could be enhanced if each major industrial region had a 'regional ISP' or equivalent to show how much renewable energy is needed to support ambitious decarbonisation. This place-based planning approach will make it easier for industrial actors to integrate and share resources, workforces and clean energy alternatives. Through a place-based approach, policy-makers can leverage a region's comparative advantages and unique characteristics and support Australia's ambition to establish itself as a 'renewable energy superpower'.

While large-scale renewable electricity generation is crucial for Australia's future energy mix, distribution networks will play a critical role in enabling the integration of consumer energy resources (CER) and other distributed resources. The distribution network opportunities analysis in the *Draft Electricity Network Options Report* provides an important foundation for designing integrated energy systems at the regional level by forecasting distribution network capabilities and augmentation requirements that will fully enable renewable energy development.

The Draft 2025 Electricity Network Options Report represents a significant step forward in incorporating distribution network considerations into transmission planning for the first time. However, this analysis could be strengthened to better support regional industrial decarbonisation by:

- Developing more granular analysis of distribution network capabilities in major industrial regions, including assessment of network augmentation opportunities specifically for industrial load electrification
- Enhancing the methodology for calculating opportunities for CER to better capture the unique requirements of industrial precincts
- Providing clearer guidance on how distribution network investment (particularly the proposed $0.4 million per MW for voltage management and $2.4 million per MW for network augmentations) will support industrial electrification pathways
- Strengthening coordination between transmission and distribution planning to ensure that Renewable Energy Zone development aligns with distribution network capabilities in industrial regions.

By improving the distribution network opportunities analysis and considering how it can support regional industrial decarbonisation strategies, the Electricity Network Options Report could better enable policy-makers to understand the infrastructure requirements for establishing net zero industrial precincts and supporting Australia's renewable energy superpower ambitions.

Thank you for taking the time to consider our submission. We welcome any opportunity to brief your team to provide further insights from our work.

Yours sincerely,

Matthew Benetti
Policy Manager – Energy, Climateworks Centre
matthew.benetti@climateworkscentre.org

REFERENCES

AEMO (Australian Energy Market Operator) (2025) *Draft Electricity Network Options Report*, AEMO, accessed 16 June 2025.

AEMO (Australian Energy Market Operator) (2024) *2024 Integrated System Plan*, AEMO, accessed 16 June 2025.

AEMC (Australian Energy Market Commission) (2024) *Emissions targets statement under national energy laws*, Australian Energy Market Commission, accessed 16 June 2025.

Climateworks Centre (2023) *Climateworks Centre decarbonisation scenarios 2023: Australia can still meet the Paris Agreement*, Climateworks Centre, accessed 16 June 2025.

CSIRO (Commonwealth Scientific and Industrial Research Organisation) (2023) *What are the sources of carbon dioxide in the atmosphere?*, CSIRO, accessed 16 June 2025.

Parkinson, Giles (2025) *"Our largest load is now our largest generator:" The path to world's first 100 pct variable renewable grid* Renew Economy, accessed 22 June 2025.