2026 Integrated System Plan (ISP) Consumer Panel Submission

February 2025

Draft 2025 Inputs, Assumptions and Scenarios Report – Stage 1

Including: 2025 IASR Scenarios Consultation Summary Report

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Acknowledgement of country

The 2026 Integrated System Plan Consumer Panel acknowledges the Traditional Custodians of the land, seas and waters across Australia. We honour the wisdom of Aboriginal and Torres Strait Islander Elders past and present and embrace future generations.

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

Executive summary

The 2026 ISP Consumer Panel recognises the importance of the Integrated System Plan in seeking to set a pathway to net zero emissions for Australia, focusing on the transition to a renewable energy system, backed up by storage.

The ISP process is heavily data and evidence driven and the draft IASR is central to identifying and developing the data that will be used for the modelling to create the optimal development path that will be the 2026 ISP. We commend the AEMO staff involved in developing the 2026 ISP on their expertise, diligence and commitment to getting the data and settings that lead to the ISP as 'right' as they can be.

The setting for release of the draft IASR is one of considerable uncertainty for the Australian public, both in how the energy transition will occur and impacts for energy consumers. This at a time when a large number of households and businesses are living with difficult and ongoing cost pressures, so higher energy bills is not something that they can contemplate.

Crucial in times of uncertainty and change are for all responsible parties, governments, AEMO and market bodies to be diligent in engaging with customers and their communities and being honest with people at all time, even when this is uncomfortable.

In preparing this response to the 2025 draft IASR, the Panel has sought to focus our thinking through a series of recommendations that are summarised in the table following this summary. We wish to highlight 5 themes that, for us, emerge from the recommendations:

1. Carbon Budgets. These are at least as important as the net zero by 2050 target, yet it tends to be the 2050 target that is most discussed in public settings
2. Purposeful policy is paramount. Clear, stable and coordinated policies are required to achieve the transition as effectively as possible
3. Trust before Tech. Communities are as important as individual customers, with their support for major energy projects crucial and the associated 'social licence essential for successful implementation of ISP projects. Trust lays the foundation for social licence.
4. People are investing themselves. Consumer Energy Resources and Distributed Energy Resources more generally are crucial to achieving the energy transition, which is why much of this submission is presented through a CER/DER prism.
5. Forecasting is Fraught. There are many challenges in forecasting such a long way out in such uncertain times.

Contents

1. Recommendations

Table 1 Draft 2025 IASR Stage 1 consultation recommendations table

#	Topic	Recommendation
1	2.2 Draft 2025 IASR Overview observations	That AEMO explain, in the Final IASR why rates for uptake (of Consumer Energy Resources (CER) and) for coordination have decreased in the 2025 draft IASR, compared with the 2024 ISP. (or) That AEMO increase estimates for CER in the 2025 IASR, to consider behavioural factors that drive uptake of CER, in addition to the financial considerations that have led to lower estimates than in the 2024 ISP.
2	3 Social Licence	The Panel suggests that AEMO explore the potential for project level social licence evaluation factors (Table 3) to be quantified and applied as part of the data included in future IASR's.
3	4.1 Scenario Narratives and Description	That AEMO consider a sensitivity within the scenario parameters where the three sectors (business, consumers and government) do not act in sync with each other, particularly for the Progressive change and Step Change scenarios – to address a plausible situation where consumers invest in Distributed Energy Resources (DER) even in adverse economic and policy conditions (as has occurred historically).
4	4.1 Scenario Narratives and Description	The Panel does not consider either Green Energy scenarios to be likely (eg from viability of hydrogen), of the two options presented we consider GEI to be the least implausible. If the Green Energy Industries scenario is included in the ISP modelling, then we suggest AEMO reduce the forecast demand for hydrogen in this scenario, given the growing concerns with its viability in the NEM over the next decade or so.
5	4.1 Scenario Narratives and Description	That hydrogen expectations are reduced for the final 2025 IAS, particularly regarding blending in the gas distribution network.
6	4.2 Key Scenarios Parameters	That the Progressive Change scenario be renamed "Slow change" to more accurately reflect the settings that this scenario embodies.
7	4.4 Sensitivities	While we propose a range of sensitivity tests, the Panel would welcome further dialogue with AEMO on the proposed tests and priorities, including the upper and/or lower range of these tests.

#	Topic	Recommendation
		From the Panel's current perspective, the most important sensitivities to include in the 2025 ISP relate to CER orchestration forecasts, hydrogen forecast for industrial uses, postponement of coal generation closures on the NEM (greater than 2 years), the input costs of transmission and of generation, discount rates and the forecasts of large industrial and large commercial electricity demand (e.g., data centres) and Investment options in distribution network and non-network. We also recommend using sensitivities to test the outcome of significant policy changes and policies that have important implications for the ISP while not yet qualifying for inclusion under the NEM's strict requirements.
8	5.1 Policy Settings	In order to preserve AEMO's reputation for independence, and with it trust in ISP, the Panel recommends AEMO to maintain a very high standard for what is considered 'policy'. Legislation is policy. Funded programs and international agreements can be considered policy. In and of themselves, media releases, speeches and election promises should not be included in the IASR or ISP based on policy until commensurate inclusion in budget, changes to machinery of government are made, bills are introduced other actions are taken.
9	5.1 Policy Settings	AEMO to apply very high levels of rigour to assessing policy elements in the IASR, ISP and related documents and explain how the application has occurred.
10	5.2 Emissions and Climate Assumptions	AEMO be more explicit around the direct and indirect costs of the forecast temperature rise and the associated climate instability.
11	5.2 Emissions and Climate Assumptions	The Panel encourages AEMO to place more emphasis in the presentation of the ISP process on carbon budgets and the impact of different CDPs/technologies on the carbon budgets and potential temperature outcomes.
12	5.2 Emissions and Climate Assumptions	AEMO further investigate the impact of climate volatility on reliability of supply and the direct and indirect costs to consumers of both enhanced system resilience and increasing damage to the existing energy infrastructure.
13	5.2 Emissions and Climate Assumptions	The Panel supports AEMO's consideration of climate change factors in its demand forecasts and transmission thermal ratings. The Panel recommends AEMO further investigate the impact of climate volatility on reliability of supply and the direct and indirect costs to consumers of both enhanced system resilience and increasing damage to the existing energy infrastructure.

#	Topic	Recommendation
14	5.3 Consumption and Demand	The Panel agrees that using all of the new stations as proposed will deliver better demand modelling by better representing climatic variables across the built environment.
15	5.3 Consumption and Demand	That forecast ONSG rates are increased for the Step Change scenario, due to plausible increased uptake of midscale, non-diesel generation.
16	5.3 Consumption and Demand	That behavioural science is considered as a means to model CER and coordination uptake, alongside economic modelling, to incorporate the influence of values and diverse motivations.
17	5.3 Consumption and Demand	There is an urgency to increase coordination of CER and DER uptake, and to adequately support consumers to do so. As such, we recommend that AEMO encourages the Government to review, expedite and increase the resources to facilitate the early implementation of the National CER Roadmap's recommendation.
18	5.3 Consumption and Demand	That AMEO updates and increases the forecasts for PVNSG, especially for the Progressive change scenario to reflect motivations for mid-scale extend beyond economic considerations and that AEMO will not necessarily have visibility into the planning pipeline for these projects.
19	5.3 Consumption and Demand	AEMO continues to expand its consultation with CER and DER stakeholders more broadly than DNSPs and retailers, to accurately understand the opportunities and barriers to CER and distributed energy. The innovations in energy services, programs and business models that will be required to achieve the desired rates of CER, DER and coordination will need to involve a broader range of actors.
20	5.3 Consumption and Demand	The IASR clearly references the ways that ISP modelling will account for distribution network constraints and the (likely growing) impact of curtailment of CER exports. We note that this also applies to the pending ISP Methodology process and AEMO's System Security Roadmap.
21	5.6 Fuel and Renewable Resource Assumptions	AEMO review the fuel price forecasts prior to completion of the Final IASR. This review should explicitly consider the uncertainties identified above that will impact on the fuel prices in each scenario.

#	Topic	Recommendation
22	5.6 Fuel and Renewable Resource Assumptions	AEMO to consider the use of an explicit feedback loop between supply and demand forecasts and price forecasts, to ensure AEMO's models capture the dynamic nature of these relationships. Noting that this is a topic that is also relevant to the ISP Methodology consultations due soon.
23	5.7 Financial parameters	Our recommendations align with and extend those identified in the OEA report: ○ Extend the survey analysis and stakeholder interviews specific to the technologies where there is limited data from the existing study ○ Greater analysis of the implication on WACC of government support to various technologies under the three ISP scenarios. ○ Conduct an update in 6-12 months (preferably in advance of the Final IASR) given the uncertain national and international environment and related policy uncertainty. ○ Consider varying both the technology-specific WACCs and the single discount rate in line with the different scenario narratives. ○ Consider whether in OEA's macroeconomic analysis of the WACCs and the discount rate should more closely align with the approach adopted by the AER as set out in the AER's Rate of Return Guideline, given the lower bound (3% for the discount rate and regulated assets) is determined by the AER's recent regulated revenue decisions.
24	5.9 REZ's	That AEMO outline upfront what AEMO's role is in identifying REZs and broadly outline what the next phases of the process are (including opportunities for public consultation) and who is responsible for these, ahead of a REZ declaration or a transmission route plan.
25	5.9 REZ's	That the visual representation of REZs be amended to clearly identify the stage of each REZ and, where it is not yet declared, to communicate the imprecise nature of the boundaries, as per the content of our feedback.
26	5.9 REZ's	That AEMO enhances the way that local knowledge and REZ based stakeholders can input into the incorporation of community sentiment in REZ planning.
27	5.13 Employment Factors	Given the importance of labour considerations in ISP project costs, we recommend that the IASR utilise the labour demand forecasts provided by RACE for 2030 and also consider adding a forecast for electricity sector wage price index to the IASP data set.

2. Context

In this section we make some broader contextual comments on three topics that inform our more specific responses:

- Role of the ISP Consumer Panel
- IASR overview observations, in particular the role of Consumer and Distributed Energy Resources (CER and DER)
- Social licence considerations; reflecting that social licence considerations are relevant to many of the more detailed aspects of the IASR, we have aimed to provide some context for our thinking about social license considerations and how they can be applied through the IASR.

2.1. About the Panel

The ISP Consumer Panel is an advisory body set up under the National Electricity Rules (NER) put in place since the 2020 ISP. The role of the ISP Consumer Panel is to bring a consumer-focused perspective to the ISP development process, having regard to the long-term interests of consumers.

AEMO appointed four members to the 2026 ISP Consumer Panel (the Panel) in May 2024:

- Bev Hughson, advocate with a focus on promoting consumers' interests, based on 30+ years working in the gas and electricity industries.
- Craig Memery, advocate with the Justice and Equity Centre's Energy and Water Consumer Advocacy Program.
- Dr Jarra Hicks, a founding Director of Community Power Agency, a not-for-profit that works to foster a fair and fast transition to renewable energy that involves and benefits everyday Australians.
- Mark Henley, long term advocate for vulnerable people and communities, with over 44 years working with community and consumer-based organisation in SA and at national level. Mark is the chair of the Panel.

The 2022 ISP Consumer Panel (the 2022 Panel) described their approach to the long-term interests of consumers[1]:

"…to ensure the ISP adequately accounts for the risks of over- or under-investment when the future, inevitably, doesn't turn out the way it was modelled today. If there is over-investment, consumers will pay more than they need to for electricity, and we know the affordability of electricity is already a major issue for many consumers. If there is under-investment, there will be an increased risk of power outages due to reduced reliability or security of supply, or failure to meet emissions reductions targets due to an inability to connect new renewable generation."

The 2026 Panel endorses this approach.

[1]See p.14 https://aemo.com.au/-/media/files/major-publications/isp/2021/isp-consumer-panel-report-on-2021-iasr.pdf

In addition, we see our role to include helping to achieve a future where electricity contributes to a thriving and equitable society in the context of a healthy and sustainable environment. As part of this, the Panel plays a role in advocating for active consumer participation options and equitable outcomes for all consumers from the increased role of consumer and distributed energy resources. We also see it as our role to take a holistic, long term and systems perspective through consideration of the impacts of possible future energy pathways on consumer wellbeing including social, environmental and economic factors.

Under the Clause 5.22.7 of the NER, the Panel is required to publish two main reports:

- A report on the final IASR by 1 October 2025.
- A report on the draft ISP by 12 February 2026.

AEMO must publish these reports on its website and have regard to them but is not obliged to give effect to any recommendations in these reports.

The ISP Consumer Panel is independent of AEMO or any other body, while appointed and funded by AEMO. We consider and provide input on a range of issues associated with the ISP process and seek to represent a breadth of consumer perspectives. Where we have different views to AEMO, these are discussed and documented, with both the Panel and AEMO providing their reasons. Panel members aim to reach consensus on views expressed.

In addition to these two required reports, the Panel considers it has a role in the ongoing ISP development process and is supported by AEMO in this regard. The Panel engages closely with AEMO through formal and informal submissions and other activities. These submissions are listed on our AEMO webpage[2].

The Panel can be contacted via ISPconsumerPanel@AEMO.com.au.

2.2. Draft 2025 IASR overview observations

The Panel considers that one of the starting points for development of the 2026 ISP and hence consideration for the 2025 IASR is figure 2 from the 2024 ISP, page 11, shown below (as Figure 1).[3]

Significant in this best estimates National Electricity market (NEM) capacity to 2050, by source, are the 'small' consumer focused contributions, in particular the categories, "Rooftop solar and other distributed solar" and "Coordinated Consumer Energy Resources (CER) storage", the latter including batteries and EVs.

The annualised contribution through to 2050 for these two 'capacity' components, using the 2024 'Step Change' scenario is demonstrated in our figure 2. The contribution from both is projected to increase steadily through to 2050, with an indicative combined contribution increasing from 24,000 GW (rounded) in 2024-25 to 123,000 GW (rounded) in 2049-50, from an installed capacity of 295,000 GW, NEM wide in 2049-50. This means that over 40% of NEM capacity will come from rooftop solar and coordinated CER, compared to about a quarter at present, and with a 3-fold increase in demand to 2050, using the step change scenario.

(The Panel notes that there is a significant difference between "NEM capacity" and "dispatchable capacity." An example of this difference is in the 2024 ISP, figure 20 and the comment from AEMO:

[2] https://aemo.com.au/energy-systems/major-publications/integrated-system-plan-isp/2026-integrated-system-plan-isp/2026-isp-consumer-panel

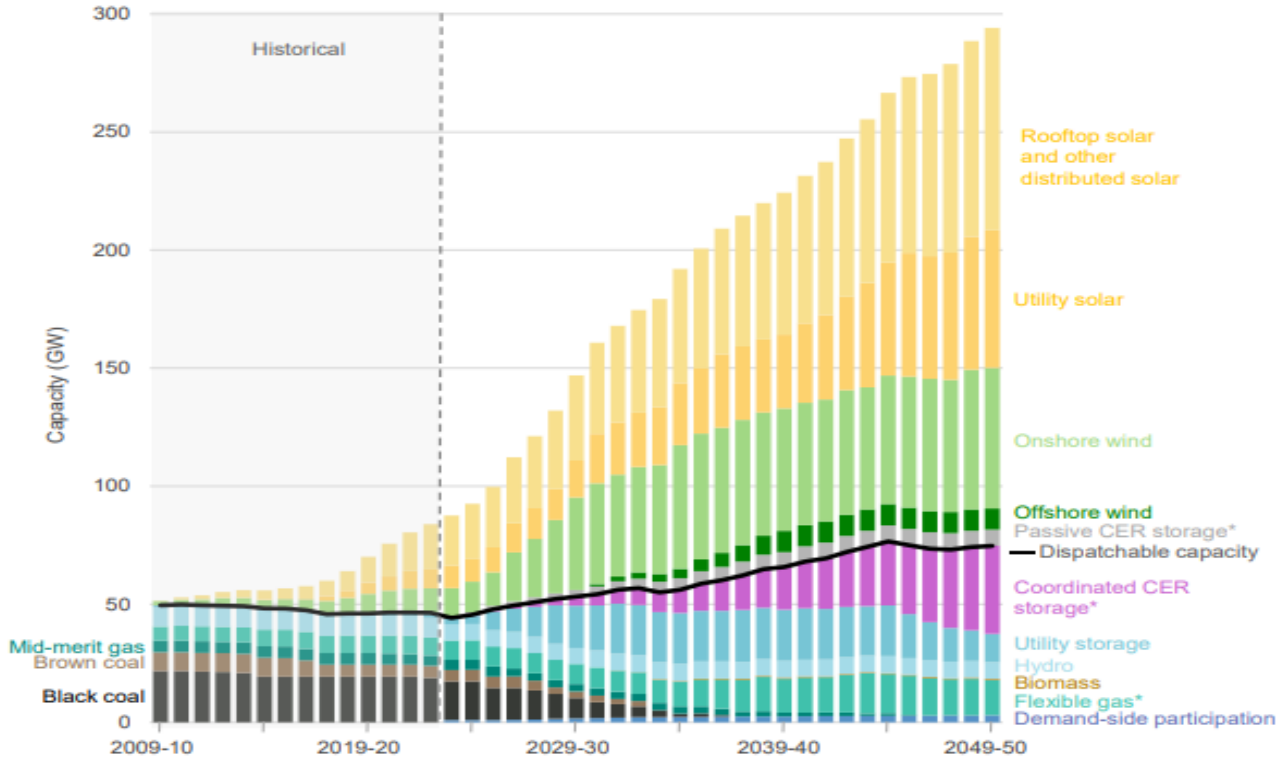
[3] https://aemo.com.au/-/media/files/major-publications/isp/2024/2024-integrated-system-plan-isp.pdf

"While the combined installed capacity of these batteries is large [CER batteries and coordinated batteries] they can only dispatch electricity for about two hours at full discharge, so their energy storage capacity is relatively small, and deeper, utility-scale storage is needed."

The anticipated, updated version of this chart for the 2026 ISP would benefit from further clarification of the differences between "capacity" and "dispatchable capacity" and their interrelationship.)

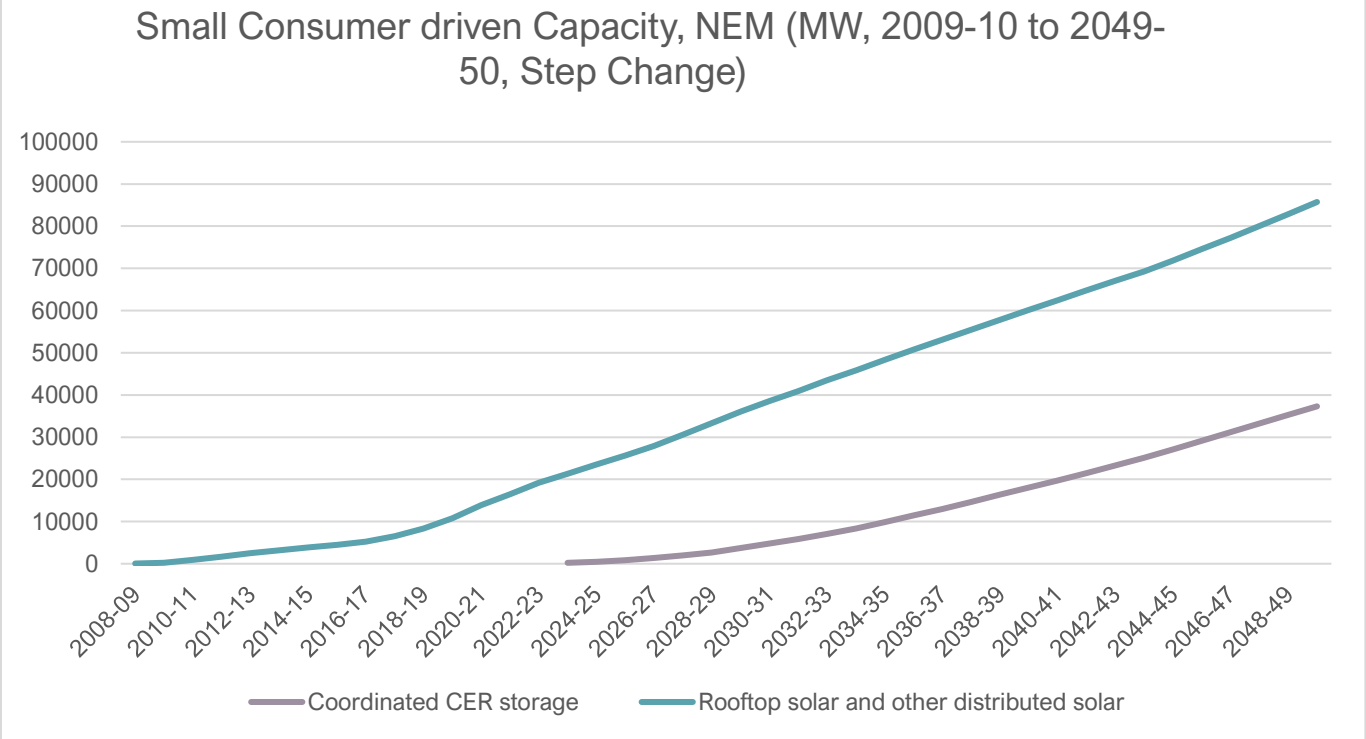
This is a substantial amount of NEM capacity coming from consumer energy investments, CER and assumed CER coordination. Consequently, one of the key questions that the Panel is asking in considering the draft 2025 IASR for the 2026 ISP is how these CER aspects of capacity are modelled and considered. We also maintain a strong interest in the role and potential of distributed energy, i.e. Distributed Energy Resources (DER), which includes storage and generation options beyond rooftop PV – such as mid-scale (100kW-30MW) wind, hydro, solar, bioenergy and batteries. Currently, AEMO has little direct observation of this growing sector of non-scheduled generation, and the Panel is keen to work with AEMO to better understand this sector. It also highlights the importance of AEMO (and Transmission businesses) working closely with the distribution businesses.

Figure 1 NEM Capacity to 2050, AEMO (2024 ISP Figure 2)



Notes: "Flexible gas" includes gas-powered generation and potential hydrogen capacity.
"CER storage" means consumer energy resources such as batteries and electric vehicles.
Projections for "Rooftop solar and other distributed solar" and "CER storage" are forecast based on unit costs, consumer trends and assumptions about payments received to participate in the electricity market.

Figure 2 Small Consumer driven Capacity, NEM (GW, 2009-10 to 2049-50, Step Change), AEMO (2024 ISP data)



We note that overall, the 2025 draft IASR assumes a decrease in rates of CER uptake and coordination compared with the 2024 ISP. This decrease reflected the views of stakeholders that scenarios needed to reflect the current reality, ahead of potential. The observation that current rates of uptake are not delivering the levels predicted for CER and CER coordination in the 2024 ISP leads the Panel to highlight the need to consider the reasons why CER, DER and coordination of these might be lower than forecast in the 2024 ISP and the need to think in a strategic way to understand how to address any current barriers to these. The Panel thinks that AEMO has an obligation to explain why it has decreased the forecasts for CER / DER, in the final IASR. The forecasts are important because the Plexus model solves for the ODP mix of transmission and generation and utility scale storage based on, inter alia, the forecast of these variables.

Recommendation

> That AEMO increase estimates for CER in the 2025 IASR, to consider behavioural factors that drive CER uptake, in addition to the financial considerations that have led to lower estimates than in the 2024 ISP.

A 'key message' from the 2024 ISP was:

*"The 2024 ISP confirms that renewable energy, connected by transmission and distribution, **firmed with storage** and backed up by gas-powered generation, is the lowest cost way to supply electricity to homes and businesses as Australia transitions to a net-zero economy." (Panel emphasis added)*

For the 2026 ISP, "firmed with storage" meaning that storage in general and batteries in particular need to be a clear focus of the IASR. We would also welcome the inclusion of an upfront recognition of the role of energy efficiency in keeping both system and individual costs down by reducing demand.

The Panel also notes that during 2024, the Ministerial Council on Energy and Climate Change released a "National Consumer Energy Resources Roadmap,"[4] (the Roadmap) which has also served as context to inform Panel perspectives. This Roadmap defined CER as follows;

"Consumer Energy resources (CER) are consumers' resources that generate or store electricity as well as flexible loads that can alter demand in response to external signals. CER included rooftop solar, batteries, electric vehicle chargers and controlled loads such as water heaters and air conditioners."

The Panel uses this definition and as such understands CER to be a subset of DER, defined by the Roadmap as:

"A diverse range of small to medium scale energy resources that are directly connected to the distribution system. Examples of distributed energy resources that can be installed include roof top solar, small-scale wind generators and battery storage."

The Panel is clear that distributed energy is different from, though generally connected to, the distribution network. We are also particularly interested in the role of community energy organisations in contributing to DER.

The Panel also observes that in considering CER investment from consumers, AEMO is relying on cost analysis, suggesting that consumers will only invest in CER if this is a cost-effective option. It is important to recognise there are several other motivations for consumers to invest in CER, including a sense of greater longer-term certainty, personal contribution to reducing carbon emissions and other behavioural factors (see further discussion in section 5.3 d). We also recognise there are additional challenges in growing the percentage of CER devices that are coordinated through VPPs and the like. Without additional level of co-ordination, the full potential economic benefits of CER to the whole community will not be realised.

The Panel welcomes the increased attention to CER and DER in the 2025 IASR as informed by the Government's 2024 ISP Methodology Review recommendations. We recognise the complexity of this task and that this first stage of the IASR is only the beginning of the proposed data from AEMO on these aspects of the ISP. We appreciate the additional efforts of an ongoing processes of consultation AEMO is undertaken to deepen the attention to CER and DER in the ISP.

[4] https://www.energy.gov.au/sites/default/files/2024-07/national-consumer-energy-resources-roadmap.pdf

3. Social Licence

In discussions with AEMO, the Panel was asked whether we could lay out broad term social license areas and how they apply to different areas of IASR and ISP, recognising that obtaining Social Licence continues to be crucial for an effective implementation of the ISP. We also note that what is presented here is 'work in progress' rather than finalised thinking. Social licence is directly relevant to the IASR but it also has broader importance, beyond the ISP.

The Panel has talked about two tables that could be part of our response to this request / proposal.

3.1. Social Licence Audiences

The first table suggests a set of 'social license audiences' and then posits a view as to which factors apply broadly to ISP related topics.

Table 2 Social licence Considerations for directly impacted Individuals and Communities

\SL Audiences **IASR topics**	**SL # 1 Directly impacted individuals, e.g. Host Landowners**	**SL# 2 Host Neighbours and communities**	**SL # 3 Community wide acceptance of transition**
Transmission lines	Easement Rent Proactive Associations Better service	Neighbour compensation Grants First Nations heritage Environmentally sig Better Service CEA Connections Local Procurement Local collaboration	Net Zero support Proactive Associations First Nations heritage Environmentally significant
Distribution lines	Better service	Grants Better Service CEA Connections	Net Zero support Proactive Associations First Nations heritage Better Service CEA Connections

REZ	Easement Rent Proactive Associations Better service	Grants First Nations heritage Environmentally sig Better Service Local procurement Local collaboration	Net Zero support Proactive Associations First Nations heritage Environmentally sig
Gas, pipelines	Easement Rent Proactive Associations	Grants First Nations heritage Environmentally sig Better Service Local Procurement Local collaboration	Net Zero support Proactive Associations First Nations heritage Environmentally sig
other			

Our set of Social License Factors which are applied to each cell are given below, recognising that this is not a final list.

- Easement Rent - Direct payments to Landowners
- Neighbour Compensation -Direct payments for neighbours and others with legit amenity impacts
- Grants and other forms of community benefit contributions - for community benefit and positive legacy impacts e.g. community projects
- First Nations heritage programs
- Environmentally Sig - Environmentally significant programs, conservation and regeneration efforts, regional off-setting
- Better service - Problem solving for better local supply of electricity for Transmission hosting communities
- CEA (Community Energy Associations) Connections - Better access to grid for local community energy associations & projects
- Net Zero support - Majority of population / community support transition to net zero projects
- Proactive Associations - Community associations formed or continuing in support of projects to support the transition / climate change responses

- Local procurement – sourcing goods and services from the immediate region where possible, if not the state.
- Local collaboration – developing partnerships in the local area to address areas of concern, impact or opportunity, for example around workforce preparedness, training, workforce housing, regional benefit sharing, environmental initiatives. In particular, collaboration with First Nations organisations and businesses.

From this mapping, we suggest that the audiences requiring greatest attention are host communities and neighbours of compensated landowners.

We also observe that the speed and scale of transition / major energy projects, will also impact on social license considerations. For example, Green Energy scenarios, either version, is likely to have greater or more intense social license implication because it requires quicker processes and more large-scale infrastructure, compared to "Progressive Change" in particular. We assert that populations are generally change adverse, despite early adopters and so quicker the transition, the more resistance there will be, at least in those communities that do not consider themselves as sharing the benefits.

3.2. Potential for Community Acceptance

This next table summarises a number of the main factors that we suggest are significant in gaining social license in a community, for various (ISP and transition) project types. Because social licence is inherently dynamic and contingent on how a project is done, it is important to be able to consider project-specific factors that could build or erode social licence. In particular, this methodology tries to take into account:

- The scale and pace of change – recognising that more change, faster is often harder for communities to feel comfortable and confident in, while simultaneously presenting challenges for doing effective, genuine engagement.
- Procedural fairness – community perceptions and experiences of there being fair and genuine processes of planning and engagement; people feeling respected and heard; investment in trust and relationships.
- Distributional fairness - community perceptions and experiences of the outcomes being fair and overall worthwhile considering the scale and pace of change.

These factors have been well established by research as having a significant bearing on social licence

Note that the final column, probability of 'social license', is not a dependent variable in a mathematical / statistical sense though we suspect that with enough data, regression (or other) modelling is possible and would be useful.

[5].

[5] Hall, N., Ashworth, P., & Shaw, H. (2012). Exploring community acceptance of rural wind farms in Australia: A snapshot. CSIRO; Hall, N. L., Hicks, J., Lane, T., & Wood, E. (2020). Planning to Engage the Community on Renewables: Insights from community engagement plans of the Australian wind industry. Australasian Journal of Environmental Management, 27(2), 123–136; Wolsink, M. (2007). Wind Power Implementation: The nature of public attitudes: Equity and fairness instead of 'backyard motives'. Renewable and Sustainable Energy Reviews, 11(6), 1188–1207.

Table 3 Project level social licence evaluation

Project Type	Project Scale	Scale of local change	Pace of change	Legacy issues, e.g. past experience	Population density	Extent of Social Capital / environment capital	Quality engagement (procedural fairness)	Quality benefit sharing (distributional fairness)	Trust in developer	Probability of community acceptance / social license
Large Solar Wind =2	1-5, small to large	1-5, low to high	Next 24 months – 10 years	1-5, high to low (5)	remote, rural, regional	1-5, low to high	1-5, low to high	1 – 5 Low to high	1-5, low to high	Maybe express as a %
Wind farm (on shore)	1-5, small to large	1-5, low to high	Next 24 months – 10 years	1-5, high to low (5)	remote, rural, regional	1-5, low to high	1-5, low to high	1-5, low to high	1-5, low to high	%
Major transmission line	1-5, small to large	1-5, low to high	Next 24 months – 10 years	1-5, high to low (5)	remote, rural, regional	1-5, low to high	1-5, low to high	1-5, low to high	1-5, low to high	%
REZ	1-5, small to large	1-5, low to high	Next 24 months – 10 years	1-5, high to low (5)	remote, rural, regional	1-5, low to high	1-5, low to high	1-5, low to high	1-5, low to high	%
Community energy Project	1-5, small to large	1-5, low to high	Next 24 months – 10 years	1-5, high to low (5)	remote, rural, regional	1-5, low to high	1-5, low to high	1-5, low to high	1-5, low to high	%

The following table is an indicative example of how this model for social license could be applied:

Table 4 Example of application of Table 3

Project Type	Project Scale	Scale of local change, inc amenity	Pace of change	Legacy issues, e.g. past experience	Population density	Extent of Social Capital / environment capital	Quality engagement (procedural fairness)	Quality benefit sharing (distributional fairness)	Trust in developer	Probability of community acceptance / social license
Large Solar Wind =2	4, large	4, high for some	Next 3years	4, poor prior engagement	rural,	3, moderate	2, low	2, low	2, low	Low, 20-30%
Community energy Project	2, mid scale,	2 low	Next 5 years	4, high	rural,	5, very high	4, high	4, high	5, high	High, 80-90%

This example indicates the factors that have substantial impact on the existence of social license or the alternative: the likelihood of community / sector (e.g. farming, tourism, environment) resistance to a project. The Panel can provide additional information and methodology detail on the above, where appropriate.

It is also worth noting that some companies and consultants have developed means of evaluating and quantifying social licence, which could be of interest for AEMO. For example:

- The commercial renewable energy developer, Windlab, determined that the value of investing proactively in quality community engagement and benefit sharing in order to enjoy social licence came to $5 for every megawatt hour of electricity produced over the life of their wind farms6. They were able to determine this using real-life comparisons between two similar projects in terms of scale and technology, but very different development approaches which led to vastly different outcomes.
- Dr. Keiran Moffatt at Voconiq consultancy has developed a quantification of social license and community sentiment using a longitudinal population survey methodology.

Recommendation

The Panel suggests that AEMO explore the potential for project level social licence evaluation factors (Table 3) to be quantified and applied as part of the data included in future IASR's.

The Panel believes that the incorporation of social licence considerations in the ISP would benefit from being an ongoing and iterative process, given the dynamic and contingent nature of community sentiment. Current methodologies are still being refined and evaluated for their appropriateness and accuracy. In addition, it is inherently difficult to take a complex social phenomenon and turn it into a qualitative metric that can be applied to a wide range of scenarios. However, we do believe there is value in continuing to explore what appropriate means of including social licence considerations that are within the IASR and the ISP and the Panel looks forward to continuing to contribute to this conversation.

We also recognise the inherent tension between the need to progress the implementation of the ISP with some speed as coal fired plants retire, with the challenge of implementing a comprehensive engagement process with the community.

<u>Somewhat related reports</u>

There are several recent and current reports that explore issues associated with obtaining social Licence, the Panel notes some of these, without attempting to synthesise them into this submission.

- AER: Directions Paper Social licence for electricity transmission projects, October 2023[7]
- AER: 2024 Review of the cost benefit analysis and regulatory investment test guidelines, Nov 2024[8]
- ECMC: National Energy Transformation Partnership August 2022[9]

[6] Lane, T., & Hicks, J. (2019). *A Guide To Benefit Sharing Options for Renewable Energy Projects*. Clean Energy Council.

[7] See https://www.aer.gov.au/system/files/2023-10/Directions%20paper_%20Social%20licence%20for%20electricity%20transmission%20infrastructure%2815924469.2%29.pdf

[8] See https://www.aer.gov.au/industry/registers/resources/reviews/2024-review-cost-benefit-analysis-and-regulatory-investment-test-guidelines

[9] See https://www.energy.gov.au/sites/default/files/2022-08/National%20Energy%20Transformation%20Partnership.pdf

4. Draft 2025 IASR Scenarios.

In this section and the next section, we follow the topics in the order presented in the 2025 draft IASR document, referring to the AEMO numbering in each heading, for ease of cross referencing.

4.1. Scenario narratives and descriptions [IASR 2.1]

Matters for consultation

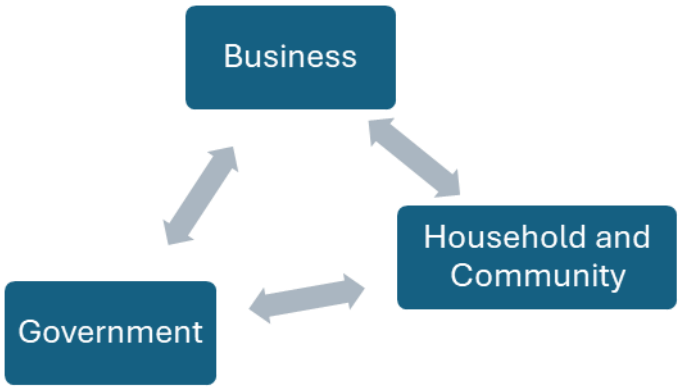
> **Are the scenarios, and the scenario collection, suitable for use in AEMO's planning publications including the 2026 ISP? Does the scenario collection support the exploration of a diverse range of possible futures that could occur over the planning horizon?**

The Panel is appreciative of the prior opportunities to discuss the development of scenarios for the 2025 IASR and recognises the incorporation of some of the suggestions that we made in our response to the 2024 IASR Scenarios Consultation Paper.

In general, the Panel considers the "scenario collection, suitable for use in AEMO's planning …" This is not to say that they are ideal, in part because there is a tension in setting ISP scenarios between consistency in the scenarios over a number of years against adaptability to change and respond to uncertainty. Our view is that staying with existing scenarios into the longer-term future is unhelpful as scenarios will need to change as policy settings and markets change, for 2026 ISP the scenarios are acceptable, notwithstanding the following comments about areas for improvement for 2026.

Since the release of the IASR, the Panel has been thinking about the interactions between sectors of the economy and potential impacts within the various scenarios and possible impacts for the IASR, with our lens on potential CER / DER implications.

We commence with a standard macroeconomics three sector model of the economy, all sectors interrelated:



For purposes of our consideration, we note:

1. Household and Community is defined to include all smaller consumers, households small / medium businesses as well as community, particularly through community- led energy initiatives.

2. Government is understood to be predominantly about energy policy and economic growth policy settings, regulation and practice.
3. Business is larger scale entities, both on demand (C&I) and supply including network service providers, generators and larger scale DER, In the range 100kw – 30Mw

We then 'map' relative movements of these three sectors for each of the three scenarios as presented in the 2025 draft IASR, leading to our economic growth by sector summary as below:

Table 5 Economic growth by sector by draft IASR scenario.

Scenario \ sector	Business	Household and Community	Government
Step Change	↑	↑	↑
Progressive Change	↔	↔	↔
Green Energy	↑↑	↑↑	↑↑

The arrows in each cell are a simple reflection of the degree of economic growth indicated by the description in the draft IASR. They show that the degree of growth is similar for each sector, for each scenario.

The Step Change scenario provides for moderate economic growth with some continuing government fiscal spending to support economic growth particularly if business level activity shows signs of declining.

The Progressive Change scenario is based on slower economic growth both in Australia and globally, a very real situation if a US led 'tariffs war' breaks out. This situation would likely impact Australia severely, risking greater decline across the economy.

Green Energy Industries (as we prefer) we regard as the "all systems go" option.

4.1.1. CER and DER

We then ask, how do these scenarios, as described, play out for CER and DER forecast parameters? We suggest that, in general, the picture is the same as in Table 1.

Table 6 CER / DER growth by sector - draft IASR scenario.

Sector DER/CER Scenario \	Business	Household and Community	Government
Step Change	↑	↑	↑
Progressive Change	↔	↔	↔
Green Energy	↑↑	↑↑	↑↑

[Note, the arrows in the cells are intended to reflect relative 'movement' and so the horizontal arrows in "progressive change" are intended to reflect slower growth (than the other scenarios) and not imply no growth as the scenario allows for some modest growth.]

This summary is drawn from Table 2 in the draft IASR, "Key parameters by scenario, "where the summary has basically the same relativities for the two CER parameters listed: "Coordination of CER" and "CER Investments

with high/higher levels for “Green Energy”, moderate/high for “Step Change” and lower for “Progressive Change. A related parameter, Demand Side participation” is also rated with the same relativities.

The Panel understands the rationale for each of the three sectors in our stylised economy moving ‘in synch’ with each other. We also ask whether there are realistic situations where sectors move counter to each other? As an example, we note that as a general macroeconomic principle, governments provide fiscal stimulus when the private sector is not performing well, and governments should then rein in spending when the private sector is booming.

The Green Energy scenario requires all sectors and actions to be ‘in synch’ and so sectors moving in different directions to each other is unlikely.

However, we suggest, this is not necessarily the case with the other two scenarios, particularly “Progressive Change.”

The Progressive Change scenario is summarised in the draft IASR report as:

“This proposed scenario describes a world that aims to achieve Australia’s current Paris Agreement commitments of 43% emissions reduction by 2030, amid economic circumstances that are more challenging. The scenario features slower and weaker economic growth domestically, and global ambition to address climate change is less ambitious after current commitments.”

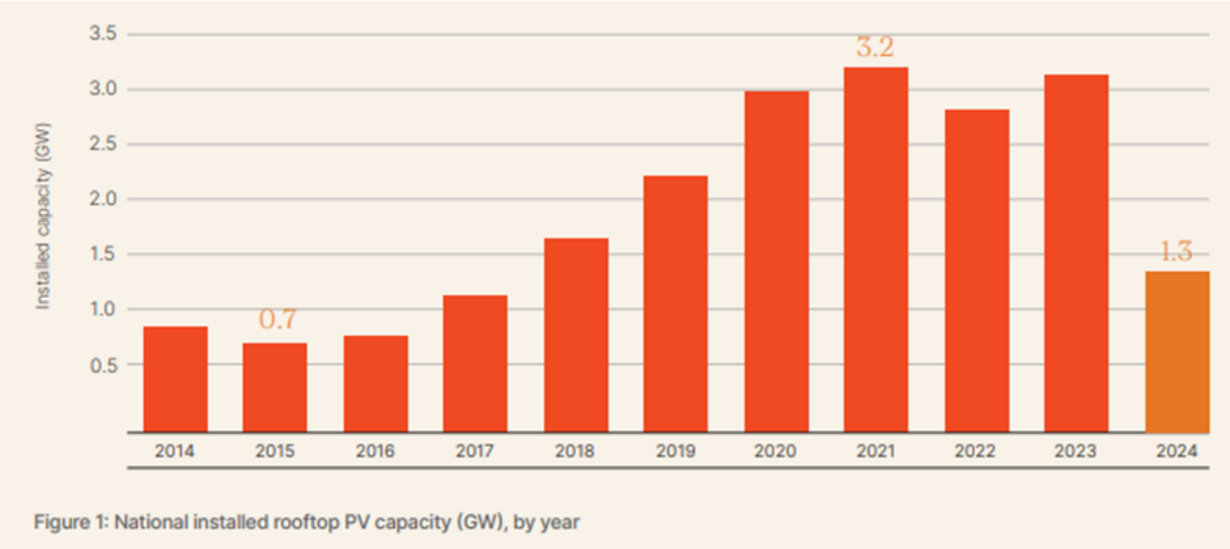
With all three sectors of the economy responding through CER and DER more slowly and weakly than other scenarios.

Globally, and in Australia, it is possible that government policy and action will diminish in terms of CER/DER commitment. However, we do not think that this setting also means the household sector and / or business sectors will follow suit. In addition, if economic conditions deteriorate, we may still see household and community investment in CER and DER as a means to control their electricity prices.

On the household side, we opine that there remains a substantial proportion of the household and community sector who will act to increase investment in CER and DER, despite the vagaries of government policy and economic conditions.

By way of example, this graph from the Clean Energy Council shows solar PV installations in Australia, by year for the last decade:

Figure 3 PV Installations, Australia



(we understand that the 2024 result is a part year result, at least in part explaining the low number of installations)

We suggest that this rapid investment in CER (as PV) occurred during a period when the Australian Government was at various times actively antagonistic to action on climate change, with the Coalition Government in office from 2013 to 2022. There were also times when there was an acceptance of the need for climate change action, with some elected Coalition Government members continuing to oppose climate action, including supporting renewable energy.

We recognize that some jurisdictional governments actively supported climate and renewable energy policies, at odds with the national government, so the actions of governments were not consistent either.

In short, the Household and Community sector invested heavily in CER and DER while national government policy could have been described as 'weaker,' or less supportive of CER investment.

The Panel suggests that over the period of the 2026 ISP, similar Household and Community responses, even to "slower and weaker" government involvement are likely. This could include growing investment in PV (larger systems), even when state- based Feed in Tariff incentives for early adaptors expire (2028 for SA and Queensland) as well as batteries and EV's at household level and with greater community level investment too.

Where there is solid consumer demand, then business will follow as suppliers seek to meet the direct demand of households and their communities. So consumer demand driven intent, despite government policy, can supply impetus for increased business activity in response to consumer lead demand.

Under the Step Change scenario, we can also envisage a setting where business leads with proactive investment in DER, particularly in some sectors, even if not sector wide. For example, there is significant potential for very largescale DER investment in new/expanding mining ventures as well as revamping some existing sites.

This short discussion leads us to state that we believe that here are CER/DER outcomes, for both Step Change and Progressive Change scenarios, that have outcomes that are not inferred by the scenarios as presented. We summarise these as:

Table 7 CER / DER growth by sector, difference from draft IASR scenario.

Sector DER/CER Scenario \	Business	Household and Community	Government
Step Change	↑ ↑	↑	↑
Progressive Change 1	↑	↑ ↑	↔
Progressive Change 2	↔	↑	↔

Note that this table is focused on the level of CER/DER and does not consider the coordination aspects of CER.

The different CER/DER outcome options summarised above are:

Step Change; Business leads a much stronger uptake of DER, in particular) than envisaged.

Progressive Change 1: Households and Community respond very strongly to both perceived government inaction and to high energy costs with no sense that they will ever come down, so many people invest themselves as households or as part of community-led initiatives, in part out of desperation. Business follows the Household and Community sector lead.

Progressive Change 2: a variation of the situation above where there is still firm support for and active Household and Community response to tardy governments, but at a lower level.

In response to the second part of the question at the beginning of this section: "*Does the scenario collection support the exploration of a diverse range of possible futures that could occur over the planning horizon?"*

The Panel suggests that there is a greater range of likely possible futures that should also be considered in the parameter forecasts, characterised by futures when the three sectors, as we have identified them, do not move in synch with each other, as summarised in table 3 (above).

CER coordination impacts are separate from CER penetration. This, in part explains the difference between CER uptake and coordination, yet coordination is an increasingly key part of how to achieve savings to the system. The Panel is most concerned about the lack of consideration of impacts of coordination. One in every six PV systems now also include investment in batteries, so there is capacity for better outcomes using batteries, eg co-optimisation of demand and supply sides.

(note3.3 (Consumption and Demand) CER coordination section has stuff about market setting not meeting consumer needs at the moment.)

Recommendation

> That AEMO consider a sensitivity within the scenario parameters where the three sectors (business, consumers and government) do not act in sync with each other, particularly for the Progressive change and Step Change scenarios – to address a plausible situation where consumers invest in DER even in adverse economic and policy conditions (as has occurred historically).

4.1.2. Green Energy scenarios

Matters for Consultation

"Which of the two described scenario variants for the Green Energy scenario is the more appropriate variant for application as the scenario in AEMO's 2025 IASR scenario collection (depending on the planning analysis, AEMO may apply the alternate variant in sensitivity analysis)."

The Panel has explored this question in our earlier submission responding to the IASR Scenarios Consultation Paper in August 2024.

The Panel is not convinced that either Green Energy scenario is a realistic option. Given the two options presented to us, however, we consider the "Green Energy Industries" variant to be the more appropriate for the 2026 ISP and for AEMO's broader application of scenarios, the main reasons being:

- Most of the green energy export specific projects are largely exogenous to the NEM as stand-alone projects, e.g. South Australia's Whyalla / Port Bonython 'green steel' project.
- A scenario with a major focus on export markets is inconsistent with other ISP scenarios that are focused on Australia's domestic markets. We are also concerned that an export focused scenario would place the infrastructure costs to facilitate hydrogen exports onto Australian consumers, when this should really be a cost borne by the industries benefitting from the export activity.

We are concerned that both hydrogen assumptions appear to remain biased by the historical over optimism about the scale and scope of potential for hydrogen in the energy system, consumer (?) market and wider economy, and we question whether this is aligned with the 'plausibility' principle.

For example, we note that despite the federal government's seeding fund announced in July 2023 to develop a "Huge Hydrogen Hub to be Housed in the Hunter"[10], Origin Energy has recently announced its exit from the project (October 2024) with an impairment cost of $13m. In making this decision, the Origin Energy CEO noted the company had followed the developments in the global hydrogen market over the last four years and evaluated a range of options across several jurisdictions. He concluded:[11]

"We continue to believe hydrogen could play a role in the future energy mix. However, it has become clear that the hydrogen market is developing more slowly than anticipated and there remain risks and both input costs and technology advancement to overcome. The combination of these factors mean we are unable to see a current pathway to make a final investment decision on the project."

Recommendation

The Panel does not consider either Green Energy scenario to be likely (eg from viability of hydrogen), of the two options presented we consider GEI to be the least implausible. If the Green Energy Industries scenario is included in the ISP modelling, then we suggest AEMO reduce the forecast hydrogen demand in this scenario, given the growing concerns with its viability in the NEM over the next decade or so.

Hydrogen production, storage, transport and use

In its submission to the 2023 draft IASR the 2024 ISP Consumer Panel noted:

*"Hydrogen is likely to play an important **niche** role in emissions reduction, at a global level, in sectors and regions that are otherwise difficult to decarbonise.*

[10] See https://minister.dcceew.gov.au/bowen/media-releases/joint-media-release-huge-hydrogen-hub-be-housed-hunter

[11] See: https://www.originenergy.com.au/about/investors-media/update-on-hunter-valley-hydrogen-hub/ 3 October 2024.

[however]

Producing, storing, transporting and using hydrogen at scale for most potential applications remains far from economic after more than 50 years, and a recent burst of activity, of research and development.

Despite the high hopes of proponents and governments, plans for hydrogen are highly speculative, and rely on major technology and other breakthroughs to becomes feasible."

Since that submission was written, there is growing awareness that ambitions for hydrogen held by some Government, industry and other stakeholders have been unrealistic for some applications, and entirely implausible for others. The draft 2025 IASR begins to reflect this in terms of lower assumed H2 production in the Green Energy scenarios.

The Panel supports the direction AEMO is taking with these changes, however, the reductions applied to some assumptions and inputs remain too modest to bring the scale of hydrogen forecasts in those scenarios to a level that meets the plausibility requirements of the IASR.

Should the ISP have a hydrogen-based scenario at all?

The 2024 ISP Consumer Panel opined that, to be consistent with the long-term interests of consumers and therefore the National Electricity Objective:

The development of scenarios in the 2026 ISP should take a more comprehensive approach to analysing the hydrogen cost assumptions and how they may influence the scenario variables. (page 88)

Transmission investments to support hydrogen production, transport, storage and use are predicated on highly speculative breakthroughs in all parts of a multifaceted supply chain. This supply chain is a long way from existing, in even a precommercial form. Even if a viable hydrogen industry were to emerge in coming decades, it is impossible at this time to predict with any confidence what it will look like and what its specific energy system needs would be.

The risk of overinvestment – a matter AEMO must have regard to according to the ISP rules – is already unacceptably high, and obviously growing. During the first 2 weeks of February 2025 the Queensland government has removed funding for a major hydrogen project and the SA Government appears to be retreating from the Whyalla hydrogen projects, for example ABC news, 5th February 2025[12]. Origin in its half yearly report, published 13th February said:

"In October 2024, Origin announced its intention to exit its potential hydrogen development project in the Hunter Valley, the Hunter Valley Hydrogen Hub. The decision to exit the project is consistent with Origin's strategy and reflects uncertainty around the pace and timing of development of the hydrogen market, and the risks associated with developing capital-intensive projects of this nature."

These very recent examples indicate a declining appetite for investment in large scale hydrogen projects, backing up our view that the 2025 IASR should scale back the level of anticipated investment in hydrogen, notwithstanding the plans and 'commitments' laid out in the Federal Governments 2024 National Hydrogen Strategy.[13]

[12] See https://www.abc.net.au/news/2025-02-05/hydrogen-plant-linked-to-whyalla-steelworks-in-doubt/104899216

[13] See: https://www.dcceew.gov.au/sites/default/files/documents/national-hydrogen-strategy-2024.pdf

The obvious counterpoint to this would be the risk of lost opportunity for hydrogen development in the event we don't build hydrogen assumptions into transmission planning now restricting the development of a future hydrogen industry. The Panel questions the materiality of risk. If the tide of evidence turns to show demonstrable commercial promise for hydrogen being produced here for use in industry or export, it appears there is ample lead time to cross that bridge in the increasingly unlikely event we come to it.

These considerations bring into focus the previous Consumer Panel's question of:

"Whether the ISP should countenance the inclusion of transmission for hydrogen facilities at all, or at least in the absence of reforms (or committed government funding) that avoid imposing the high costs of transmission for future speculative hydrogen on consumers."

The 2024 Consumer Panel recommended

"Either:

Government funding, committed funding by proponents and/or reforms to cost recovery should prevent other consumers funding the portion of shared network infrastructure attributable to hydrogen projects in the ISP,

or

AEMO should minimise the inclusion of hydrogen projects in the ISP to a level where there is no material cost or risk, including the risk of underutilisation of transmission assets, for other consumers."

Of these two options, the latter is the only one within AEMO's direct control. The Panel recommends that AEMO minimises assumed production, transport, storage and use of hydrogen in the 2025 IASR, 2026 ISP until - and only if - the viability and likelihood of both of hydrogen supply chains and markets - for either domestic use or export - can be demonstrated with a sound evidence base. We also note that the Commonwealth Government released a 'National Hydrogen Strategy' in 2024' which provides some further context for this topic.

Hydrogen and distributed gas networks

One key assumption in all scenarios is the limits for blending hydrogen into gas networks. A diminishing number of gas distribution network owners continue to promote R+D of, and even make 'plans' for, blending hydrogen into local gas networks for homes and businesses. There are limited example of viable and cost effective solutions emerging to address the barriers to cost effectively sourcing H2, safely blending H2 with other gases, containing H2 in gas transmission pipelines, pigging and other gas distribution network maintenance practices with H2, metering H2 blends, using H2 in home appliances, dealing with burnt H2 exhaust moisture in the home, and preventing H2 leaks throughout homes.

Given these barriers, the focus for renewable gas for use in distribution networks has largely shifted to biomethane. While sustainable sources of biomethane are limited, it shows promise as a tool to reduce net emissions associated with distributed natural gas use, as it does not require the extensive ancillary changes noted to address the above 'showstopper' issues for hydrogen. Increasingly, natural gas networks are pursuing biomethane as the 'green' future of gas, for example Jemena Gas Networks in NSW has recently lodged its revised Access Arrangement proposal for 2025-30 with the AER and they have maintained a clear focus on the role of 'biogas' throughout the development of this proposal and have included capex proposals to enable biogas connections to occur over the next 5 years.

At the same time, as the 2024 Consumer Panel submission noted:

"…the natural gas distribution and transmission sectors are facing the existential threat of under-utilisation and asset stranding as homes and businesses shift traditional gas loads to electricity.

The prevailing view of independent energy experts is that gas of any type has a diminishing future as a fuel in homes. The question of new gas connections ceasing altogether is one of 'when', not 'if', and it is plausible large portions of gas distribution networks will be decommissioned by 2050."

Since this time, the Victorian Government has acknowledged that neither fossil gas nor renewable gas can compete with electricity for domestic applications in most homes and moved to prevent new gas connections. AEMO's 2024 GSOO assumes approximately about 2/3 of today's residential natural gas loads will be electrified by 2040 (and almost 1/3 by 2030). A rapidly growing number of consumers are electrifying, motivated by improved running cost, performance, safety, emissions output and convenience of electric appliances.

Electrification is vastly more cost effective than any renewable gas for decarbonising the average home, and for most individual non-strata dual-fuel homes in Australia, the additional upfront cost of electrification will be recovered through lower running costs and avoided fixed charges.

The move towards electrification further erodes the business case for renewable gases.

For all these reasons, the 2024 ISP Consumer Panel noted:

"To inject more than a trivial blend of hydrogen blend (averaged across the gas network) does not reflect:

- *consumer interests or preferences*
- *economic feasibility, now or into the future*
- *technical feasibility, now or into the future*
- *decarbonisation needs over any time scale*
- *AEMO's core principles for the IASR."*

Developments since then - and the lack thereof - have affirmed this view.

The 2024 Panel concluded the Draft 2023 IASR assumptions about hydrogen blending in gas networks do not satisfy AEMO's core principle that the scenario be plausible. Based on the situation at the time, the 2023 Panel recommended:

"Noting there are technology trials which will result in some injection of hydrogen into gas networks for the foreseeable future, AEMO's IASR should assume the following levels of hydrogen in reticulated gas networks:

- *a default value of 2% in all scenarios (rather than unlimited as per the Green Exports scenario and <10% as per the other scenarios)*
- *a sensitivity of 10% in the Green Exports scenario (rather than a default value of unlimited as proposed in the Draft 2023 IASR)."*

AEMO agreed in part with the Panel's observations that the 2023 Draft IASR numbers did not satisfy AEMO's core principle that the scenario be plausible and lowered the value for the Green Exports scenario to 10% for blending of hydrogen in the reticulated gas system.

In light of the mounting evidence that 10% is implausible, the 2026 Panel recommends the IASR should assume the following limits of hydrogen in reticulated gas networks:

- a default value of 2% in all scenarios. This acknowledges that, while the most cost effective and viable level of hydrogen in gas pipelines will remain 0%, some trials may continue.
- a sensitivity of 10% in the Green Exports scenario, to respond to stakeholders who remain convinced that this is a viable option.
- Unlimited blending opportunity for biomethane.

In the extremely unlikely event of the multiple breakthroughs (and good fortune) required for hydrogen to be viable for use in existing gas distribution networks occurring in time to provide a viable alternative to the wide scale retirement of the gas network, AEMO could revisit its assumptions IASRs in a future IASR.

In table 2 of the 2025 draft IASR, the cell dealing with Green Energy and "Renewable gas blending in in gas distribution networks says:

"Up to 10% (hydrogen), with unlimited blending opportunity for biomethane and other renewable gases."

The use of the word 'unlimited' is a bit confusing, we think it means an unlimited percentage of ability (up to 100%) to blend natural gas (not hydrogen) with biomethane in the gas distribution network. This could be clarified in the final IASR

Recommendation:

> That hydrogen expectations are reduced for the final 2025 IAS, particularly regarding blending in the gas distribution network.

4.2. Key Scenario Parameters [IASR 2.2]

Matters for consultation

Are the scenarios parameters, and parameter values, clear and suitably aligned with their respective narratives?

Comments about Green Energy scenario considerations are given elsewhere in this submission. The scenario we comment on here is "Progressive Change." We accept the details of the scenario but are not satisfied that "Progressive Change" is an accurate reflection of the detail of this scenario. As the slowest change of the three scenarios, the name is confusing. We propose changing the name of this scenario to "Slow Change" to more accurately reflect the nature of this scenario.

Recommendation:

> That the Progressive Change scenario be renamed "Slow change" to more accurately reflect the settings that this scenario embodies.

4.3. Scenario Likelihoods

(no 'matters for consultation')

The future world is highly uncertain and made even more so by the recent election of President Trump in the US. The impact of his dramatically different orientation to energy and climate change policy, including any continuing

role for aspects of the Inflation Reduction Act, is unknown in terms of its effect on global agreements and trade – as well as the broader socio-political impact.

In this context, it is difficult to determine the likelihoods of the scenarios in the near to medium-term, although over the longer term this extreme shift to one side of politics is likely to even out. Even with heightened uncertainty, the ISP process remains of high importance for Australia. Indeed, we would argue that it becomes more important as it lays out the impact of the broadly defined scenarios facing the Australian governments and people.

4.4. Sensitivities

Matters for consultation

What uncertainties are valuable to explore with sensitivity analysis?

In summary:

Having examined the role of sensitivities in the ISP process set out in the AER's Cost Benefit Analysis guideline (November 2024), the Panel outlines its current view of possible sensitivity tests. However, we regard this as an interim list and propose that these be reviewed in conjunction with AEMO as we progress through the 2026 ISP process.

The Panel has reviewed the sensitivities adopted in the 2024 ISP and noted AEMO has considered sensitivities that directly test the robustness of the selection of the ODP relative to other CDPs to changes in key input forecasts. This includes tests on variations in the forecast of the volume and/or costs of input fuels and transmission.

AEMO also included sensitivity testing to assess the 'value' of, for example, the level of CER coordination n.14 We consider both categories of sensitivity testing are relevant and important to understanding the ISP and the implications of these factors on the mix of transmission, generation and storage, the overall costs and the climate impacts.

The Panel also suggests AEMO include new sensitivity tests on key government 'policies' that might be changed or removed completely such as the removal of interim carbon targets. Such tests will assist the community and stakeholders to better understand the risks and benefits of these policy options.

Recommendation

While we propose a range of sensitivity tests, the Panel would welcome further dialogue with AEMO on the proposed tests and priorities, including the upper and/or lower range of these tests.

From the Panel's current perspective, the most important sensitivities to include in the 2025 ISP relate to CER orchestration forecasts, hydrogen forecast for industrial uses, postponement of coal generation closures on the NEM (greater than 2 years), the input costs of transmission and of generation, discount rates and the forecasts of large industrial and large commercial electricity demand (e.g., data centres) and Investment options in distribution network and non-network. We also recommend using sensitivities to test

[14] See 2024 ISP Appendix 6, pp 107-108.

the outcome of significant policy changes and policies that have important implications for the ISP while not yet qualifying for inclusion under the NEM's strict requirements.

The role of sensitivities in the ISP:

A starting point for any discussion on sensitivities is to clarify their role in the ISP. We start here with consideration of the AER's Cost Benefit Analysis guidelines (CBA guideline), authorised under clause 5.22.5 of the NER.

The Rules state, inter alia, in relation to the preparation of an ISP by AEMO:[15]

"Require AEMO to test the robustness of alternative development paths to future uncertainties through the use of scenarios and sensitivities"

As the Panel highlights throughout this submission, the energy transition process in Australia and the world is happening in the context of considerable economic, social, technological and political uncertainty – Australia is not immune from world events and the future is not at all clear.

The ISP's three scenarios are based around forecasts of high, medium and low economic growth16 and include a range of fixed input forecasts ('parameters)' that are consistent with each of the scenario growth projections. It is important, however, to understand the level of uncertainty in these inputs and the impact of alternative forecasts on the outcome of the ISP's analysis.

Sensitivity tests provide one means of understanding this impact. Properly understood and applied in the ISP, sensitivity tests provide insights into the robustness of the outputs (CDPs/ODP). As AEMO says in the 2024 Draft ISP: [17]

"In developing the ISP, sensitivity analysis is used to test the resilience of the investments, to increase confidence in the robustness of the investment conclusions."

Or as the AER's CBA guideline states:[18]

"Sensitivity testing varies one or multiple inputs to test how robust the output of its CBA is to input assumptions"

As noted, the CBA guideline states sensitivity tests apply to the ODP – as such, they are part of the last step in the ISP process (defined as Step 4 in the CBA guideline):[19]

"Once AEMO has selected an optimal development path, it will undertake sensitivity testing and/or cross checks… AEMO may or may not change its choice of optimal development path base on the sensitivity testing and/or cross checks…"

The AER then provides guidance on key aspects of sensitivity testing, for example:[20]

- Should only vary inputs (or underlying assumptions) that are not already varied through scenario analysis

[15] See AER, *Cost benefit analysis guideline*, November 2024, p 2. Citing NER, clause 5.22.5 (d)

[16] Alternatively, they could be described as high, medium and low global temperature increases. The current approach somewhat conflates economic growth and global temperatures changes.

[17] AEMO, 2025 Draft IASR, p 22.

[18] AER, CBA guideline, p 39.

[19] AER, CBA guideline, p 37.

[20] For details see: AER, CBA guideline, pp 37-38.

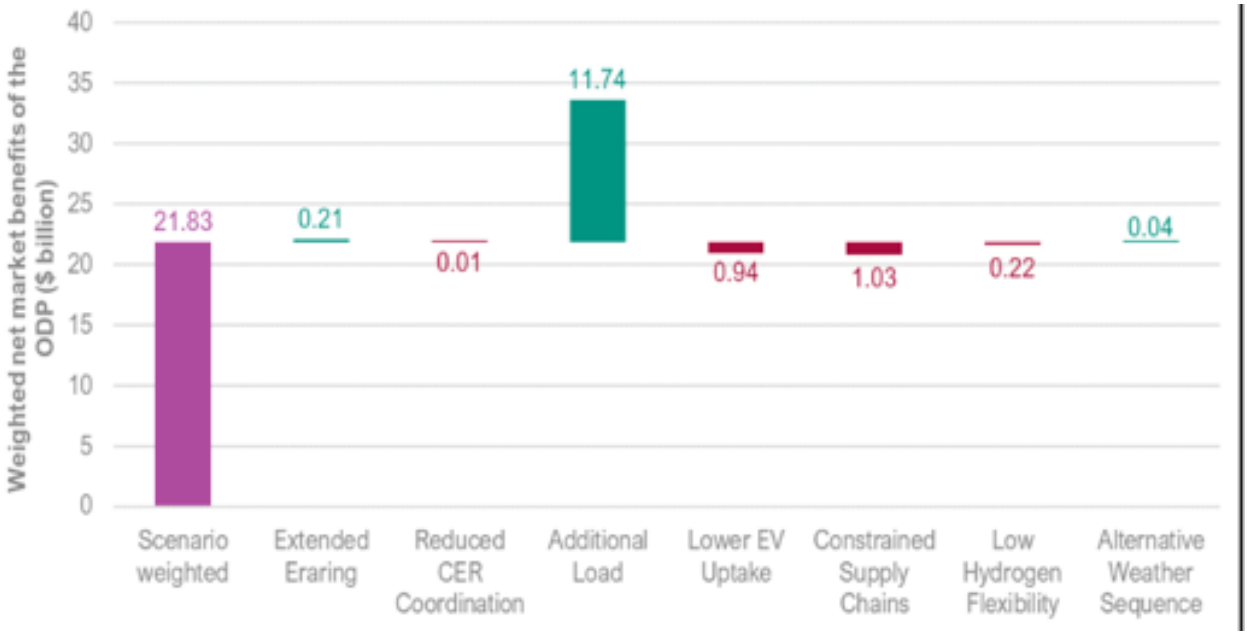
- Should test important inputs such as the discount rate and VCR
- Should test cost estimates against the lower and upper end of their ranges
- Should, in deciding how many sensitivities to test, recognise the risk assessment already undertaken through scenario analysis and the resource cost of additional runs.

The 2024 ISP outlines how AEMO determined the relevant sensitivities to test. It highlighted the importance of defining the upper and lower boundaries of the sensitivity testing. The boundaries need to stress test the CDP/ODP against potential risks but also be realistic.

In the 2024 ISP, AEMO tested sensitivities to more rapid decarbonisation, new industry demand, lower energy efficiency, variable hydrogen demand, variable EV demand, electrification alternatives, constrained supply changes, reduced social licence, impact of pumped hydro projects, lower orchestration of CER, delay in retirement of Eraring power station, higher and lower discount rate and higher cost uncertainties.21

The figure below illustrates the changes in the weighted net benefits from a selection of these sensitivities. It suggests inclusion of at least some of these 2024 ISP sensitivities in the 2026 ISP should be reconsidered as they have little impact on the selection of the ODP. Others may serve the purpose of quantifying the specific value of (for example), lower or higher CER coordination. Alternatively, AEMO might review the high-low range applied to these sensitivities, that is – does the 2024 +/- range sufficiently stress test the central forecast.

Figure 4 Weighted net market benefits in the core scenarios and across all sensitivities, (billion)



Source: https://aemo.com.au/-/media/files/major-publications/isp/2024/appendices/a6-cost-benefit-analysis.pdf

The Panel considers the 2024 ISP scenario list is a reasonable starting point for recommending the sensitivities to test the robustness of the CDP/ODPs in the 2026 ISP, although we note that the three scenarios already build in variation in inputs such as 'additional load' and 'lower EV uptake'. Others we find redundant, including 'extended

[21] https://aemo.com.au/-/media/files/major-publications/isp/2024/appendices/a6-cost-benefit-analysis.pdf

Eraring' as extension of that specific coal generation plant is confirmed and included in the forecasts for the 2026 ISP.

The Panel also recommends conducting sensitivity tests on both changes to existing policy inputs that are fixed across all scenarios, and/or new possible policies that do not yet meet the strict criteria set out in the NER. These tests could provide insight for consumers on the impacts of government energy policy decisions and add to the overall value of the ISP for those consumers.

However, these 'policy' sensitivity test should be limited to testing policies (or the removal of existing policies) that while not certain, are reasonably possible. This might include the following sensitivity tests:[22]

- The impact of delays, cancellation or modification of interim carbon targets
- The impact of postponement of multiple coal generation retirements (through subsidies or other means)
- Cancellation of pumped hydro projects (Burdekin?)/ and/or significant delays of 2 years + to delivery of pumped hydro projects (Snowy 2?)
- Increase or decrease in electrification policies, including but not only EV forecasts.

Other potential sensitivity tests include some of the fixed inputs to the IASR forecasts that currently do not vary with scenarios, including:

- Higher and lower than forecast input costs such as transmission costs and labour costs
- Higher and lower flexible gas supply costs for domestic markets and for gas generation.
- Significant delays in construction of gas pipelines and storage facilities identified in the ISP
- Upper and lower discount rates – see also the Panels' comments in Section 5.7
- Significant delays in completion of key interconnector transmission lines including:
- Committed/anticipated (PEC, VNI)
- Actionable (Hume, QNI)
- Increase and decrease of co-ordinated CER/DER as a % of forecast growth in CER/DER and domestic battery markets.[23]
- More extreme weather events (in addition to the central temperature forecasts) requiring additional reinforcement and/or earlier replacement of transmission (and distribution) assets
- Social licence impact, combining both higher costs and later delivery of large-scale generation and transmission – if these are not already accounted for in the input cost forecasts and/or in the proposed timing of the project.

[22] Note: elsewhere in this submission we recommend AEMO put tighter restrictions on the inclusion of any policies. We consider the option to explore these policies that sit outside the tighter framework can be best addressed through sensitivity testing.

[23] In section 5.3.4 and 5.3.5 of this submission, the Panel raises its concern regarding the forecasts of CER/DER and coordination rates.

If AEMO decides to continue with its current scenario narratives, the Panel would also like to see some sensitivity tests applied as follows:

- A sensitivity test specific to the Progressive and Step Change scenarios and which considers the impact of higher CER/DER and co-ordinated CER than forecast in the current scenario.
- The impact of a slower world and Australian economy, with significant trade disruptions, than is currently forecast in the Step Change scenario over the next decade.

The recommendations below include a list of the Panel's current view on priority sensitivity tests, recognising AEMO is constrained in the number of tests it can usefully run.

However, this list is not conclusive, and the 'ranges' (high and low) are yet to be defined. The Panel, therefore, welcomes the opportunity for further discussions with AEMO on the selection of the key scenarios and the upper/lower range of the chosen sensitivity tests.

From the Panel's current perspective, the most important sensitivities to include in the 2025 ISP relate to CER orchestration forecasts, hydrogen forecast for industrial uses, postponement of coal generation closures on the NEM (greater than 2 years), the input costs of transmission and of generation, discount rate and the forecasts of large industrial demand and large commercial demand (e.g., data centres) for electricity. We also recommend using sensitivities to test the outcome of significant policy changes and policy removals on costs and CO^2-e emissions to 2050.

While we propose a range of sensitivity tests, the Panel would welcome further dialogue with AEMO on the proposed tests and priorities, including the upper and/or lower range of these tests.

5. Draft 2025 IASR - Inputs & Assumptions

5.1. Policy Settings [IASR 3.1]

A perennial challenge for AEMO in the development of the ISP is finding a balance between the inclusion of policy and an evidence-based approach.

The Panel sympathises with the difficult position AEMO is in when the same governments that constitute AEMO's authorising environment make announcements, commitments and decisions that could have material implications for the future energy system.

The Panel observes the sibling issues of trust and social license pose a threat to the ISP. A public perception of AEMO independence is critical to ameliorate that threat. This perception, and with that the acceptance of the ISP, is at risk when AEMO is perceived to prioritise policy over evidence.

While much can change politically in the two-year interval of one ISP to the next, little would be expected to change in terms of long-term predictions and uncertainty. This is evident in the reduction in volumes of hydrogen in AEMO's scenarios since the ISP published less than a year ago. Little if anything has changed in the evidence base – it remains stacked against the ambitions for hydrogen to be a silver bullet for our energy systems - but the government 'policies' and industry hopes are rapidly vanishing as that evidence becomes better understood.

When changes to policies that AEMO applies to one ISP change dramatically for the next, this leaves AEMO - not governments - to do the explaining. It's also not a great look when AEMO is compelled to 'scramble' in the final weeks and days before the release of the ISP (draft or final) or IASR to include 'policy' changes, especially when they have only a media release for evidence.

Looking ahead, it could deeply undermine the ISP's social licence, AEMO's reputation and support of the energy transition at large if one ISP focused on the transmission needs for an 82% renewable target (noting nuclear to be among the most expensive and least viable options) but the next ISP were to plan for a nuclear future supported only by policy and policy-based evidence.

Recommendation

In order to preserve AEMO's reputation for independence, and with it trust in ISP, the Panel recommends AEMO to maintain a very high standard for what is considered 'policy'.

Legislation is policy. Funded programs and international agreements can be considered policy.

In and of themselves, media releases, speeches and election promises should not be included in the IASR or ISP based on policy until commensurate inclusion in budget, changes to machinery of government are made, bills are introduced other actions are taken.

Recommendation

AEMO to apply very high levels of rigour to assessing policy elements in the IASR, ISP and related documents and explain how the application has occurred.

While AEMO would understandably prefer not to point out where policies themselves do not meet the long-term interest of consumers or climate, AEMO should strictly not include policy-based inputs, assumptions or scenarios that do not meet AEMO's principle for plausibility.

We note above that sensitivity analysis provide the opportunities to test newer or less developed ideas and even more controversial propositions.

5.2. Emissions and Climate Assumptions and Climate Factors [IASR 3.2 & 3.8]

(no 'matters for consultation')

5.2.1. Emissions and climate assumptions:

The Draft IASR outlines the process it has adopted for determining the carbon budgets for Australia as a nation and for the NEM, based on Australia's international commitments. Table 26 in the Draft IASR also sets out the new class of benefits in the ISP being the annual values of GHG emissions reductions beginning with 2024-25 ($75.26/tonne of CO2-e) to 2049-50 ($421.99/tonne of CO2-e).[24] The Panel supports this development in the 2026 ISP.

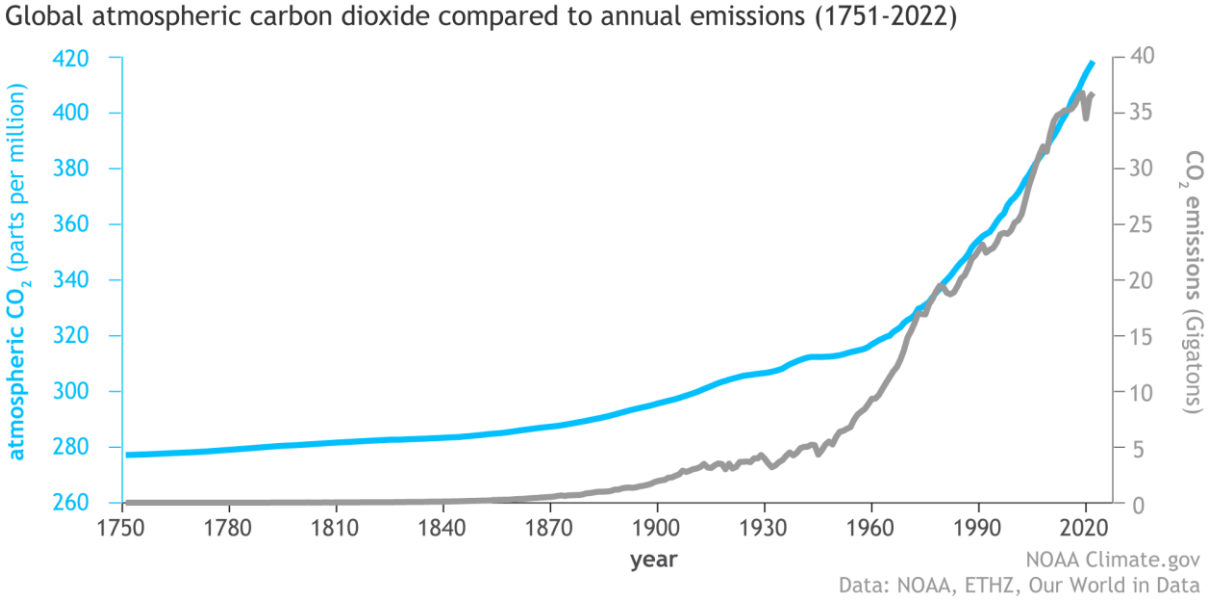
Carbon budgets are a distinct and, arguably, a more important concept in terms of global temperature outcomes than the oft-quoted 'net zero by 2050'. A net zero target tells us about the net carbon emissions we aim to achieve at a specific point in time such as the year 2050.

The carbon budget focuses on the cumulative amount of CO^2-e retained in the atmosphere over a specified period. Carbon dioxide (CO^2) in particular, is a very stable atmospheric gas with an atmospheric life in the order of thousands of years and thus is the main contributor to the accumulation of greenhouse gases in the atmosphere as illustrated in the figure below.

In turn, it is this accumulation of atmospheric CO^2-e that is increasing Australian and global temperatures and climate instability.

[24] See AEMO, 2025 Draft IASR, Table 26, p 120.

Figure 5 Global atmospheric CO2



Source: NOAA https://www.climate.gov/media/14596

Further to this, AEMO states:[25]

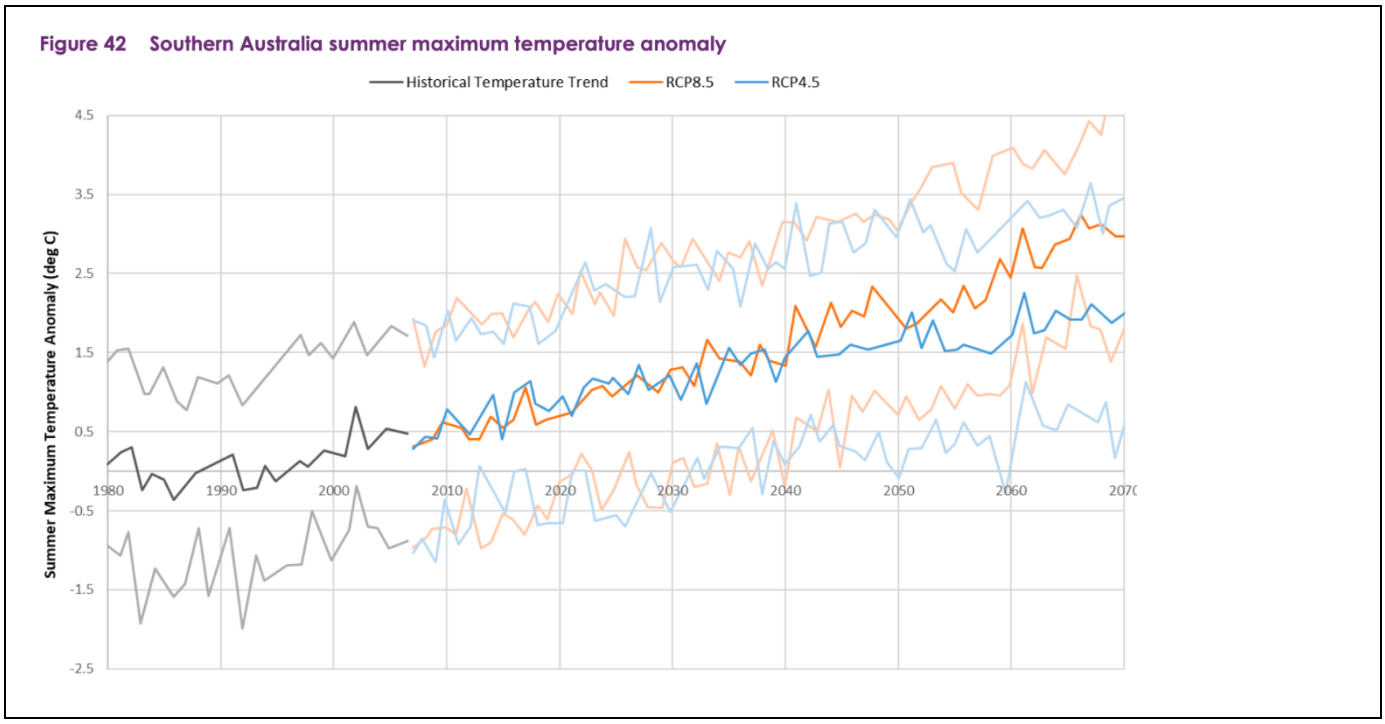
"Climate science considers that warming over the next 20 years or so is largely locked in from historical emissions, so adjustments do not vary substantially between scenarios to 2050"

Reflecting both the 'locked-in' CO^2-e gases and the forecast of future emissions under each scenario, the figure below illustrates the continued upward trend in the observed and forecast summer maximum temperature anomaly for Southern Australia relative to 1980.[26]

[25] AEMO, Draft 2025 IASR, p 121.

[26] The chart refers to RCP8.5 and RCP 4.5 which approximates, respectively, the progressive change and step change scenario outcomes.

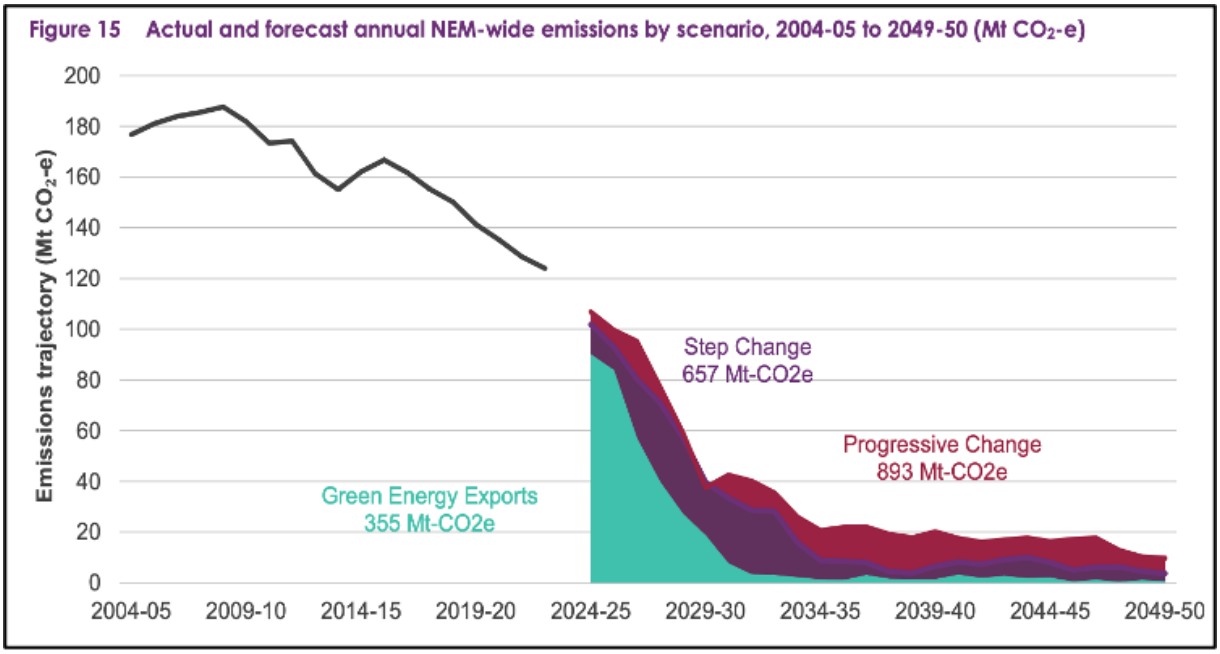
Figure 6 Southern Australia summer maximum temperature anomaly



Source, AEMO Draft 2025 IASR, p 122. RCP references correspond approximately with the Step Change and the Progressive Change scenarios (RCP4.5 and RCP8.5 respectively).

The three ISP scenarios all satisfy the policy objective of 'net zero in (the year) 2050. However, they vary in the pace of the transition to 'net zero' and, therefore, in the total accumulated CO^2-e emissions over the period from 2024-25 to 2049-50. This is illustrated in the figure below from the 2024 ISP.

Figure 7 Actual and forecast annual NEM-wide emissions, by scenario



Source: 2024 ISP, Appendix 2, p 30.

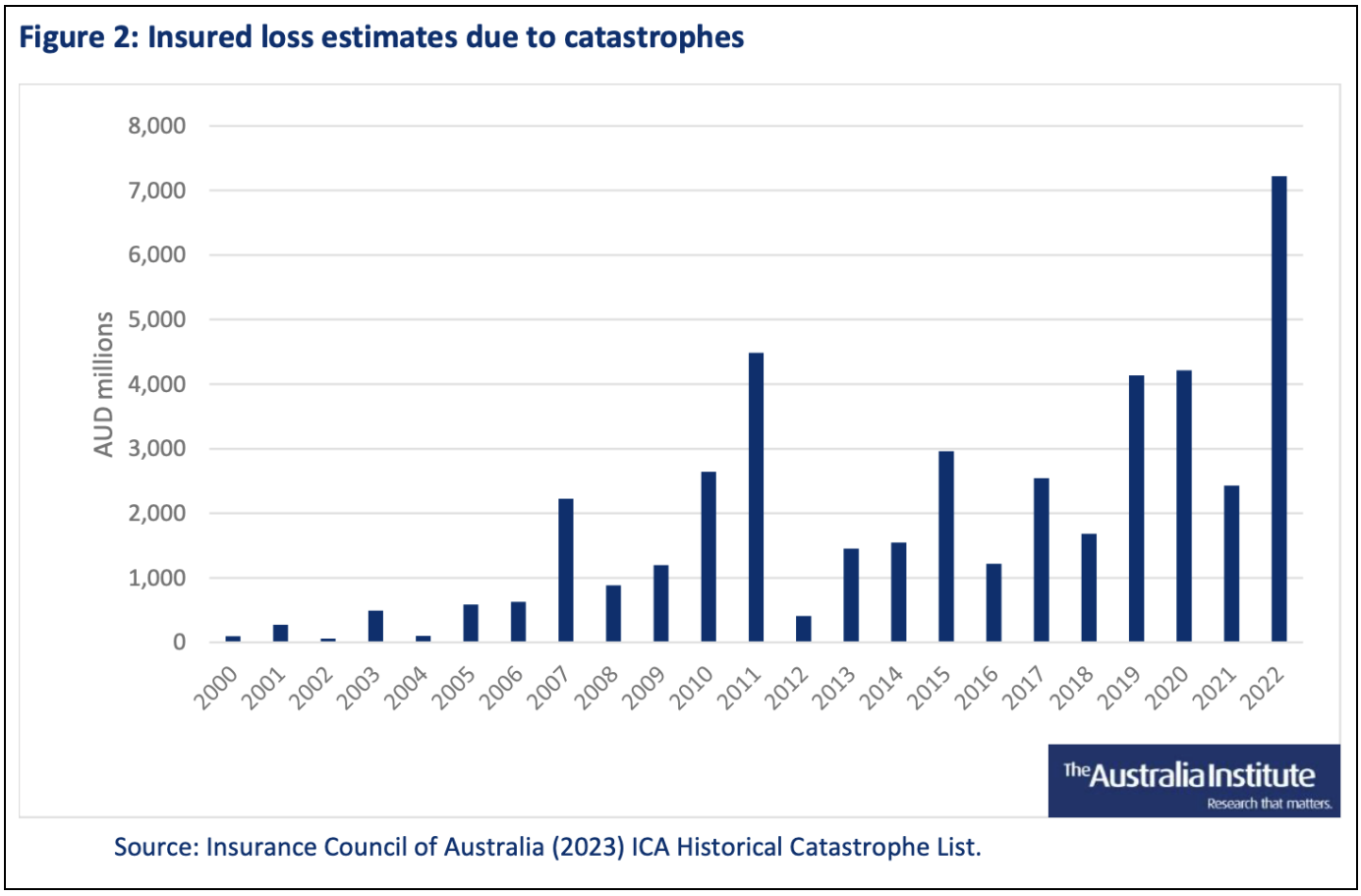
In the 2024 ISP therefore, the Progressive Change scenario met the interim and final 'net-zero' annual targets but overall emitted around 150% more CO^2-e (893 Mt-CO^{2-}e versus 355 Mt-CO^{2-}e) over the period than the Green Energy exports scenario despite the significantly greater electricity demand in the Green Energy scenario.

Similarly, the Progressive Change scenario emitted some 40% more CO^2-e than the step change scenario. Much of the CO^2 accumulates in the atmosphere driving increasing atmospheric temperature and climate instability at huge economic cost to all sectors of the economy.

The following figure shows the increasing trend in insurance losses since 2000. Since 2013, insured losses in each year have exceeded the total combined losses in the first five years of the century. The Actuaries Institute research indicated one in eight households suffer home insurance affordability stress and pay more than four weeks gross income on home insurance premiums.[27]

There is no free lunch. A slow transition to 'net zero' threatens greater climate instability and increasing costs to consumers and the community.

Figure 8 Insured loss estimates due to catastrophes



Source: https://australiainstitute.org.au/wp-content/uploads/2024/11/P1707-Climate-change-and-insurance-Web.pdf

[27] See The Australian Institute, Premium price – The impact of climate change on insurance costs, November 2024.https://australiainstitute.org.au/wp-content/uploads/2024/11/P1707-Climate-change-and-insurance-Web.pdf

The Panel therefore considers it most important that the impact of both the rate of transition and the make-up of the CDP's, will have on annual emissions, the carbon budget and temperature outcomes become an even stronger feature in the presentation of the 2026 ISP. The slower the transition, the greater the economic cost in the long term.

Recommendation

AEMO be more explicit around the direct and indirect costs of the forecast temperature rise and the associated climate instability.

Recommendation

The Panel encourages AEMO to place more emphasis in the presentation of the ISP process on carbon budgets and the impact of different CDPs/technologies on the carbon budgets and potential temperature outcomes.

5.2.2. Climate change factors

The Draft IASR acknowledges that a changing climate has an impact on all aspects of the electricity system including consumer demand, generation and network availability. It will also have broader effects on the environment and economy. One approach already adopted by AEMO is to build in a 'value of emissions reductions', a value which rises over the period to 2050.

The challenge is how to incorporate these factors into the 2026 ISP modelling, beyond the implied additional costs built into the 'value' of emissions reductions. AEMO indicates that it will incorporate the following factors in the forecast of temperature (see figure above): consumer demand, and transmission line thermal ratings.[28]

This is a start. However, it envisages a world of predictable trends. The challenge is to consider a system operating under conditions of more extreme variability, where the droughts are longer and the floods more frequent and damaging, where coincident periods of low wind and low water for hydro generation occur more frequently – where the 1 in 100-year event becomes the 1 in 10-year event.

For example, AEMO states:[29]

"…it is possible that weather extremes will still impact the resilience of a renewable energy system and increase the magnitude of extreme demand conditions as well, beyond that which is already considered in AEMO's forecasting approach which passes through average temperature rise over time."

What are the costs of building greater resilience into the network and how does this feed into the three scenarios with three different temperature outcomes? How do we capture the value or the supply resilience captured in geographic and technological diversity of sources of generation. when assessing the CDPs?

We can already see the impact of stalled weather systems and coincident periods of drought and low wind on the level and volatility of prices in the electricity wholesale market, particularly when combined with constraints on the existing transmission system. And we can already see the impact of these coincident (but not random) events on consumer prices, including but not only insurance premiums as discussed above.

[28] AEMO, 2025 Draft IASR, p 121.
[29] AEMO, 2025 Draft IASR, p 121.

The Panel believes that AEMO should further explore trends in climate volatility and the impact of climate factors on reliability of supply and costs to consumers when optimising the transition plan.

Recommendation

AEMO further investigate the impact of climate volatility on reliability of supply and the direct and indirect costs to consumers of both enhanced system resilience and increasing damage to the existing energy infrastructure.

Recommendation

The Panel supports AEMO's consideration of climate change factors in its demand forecasts and transmission thermal ratings. The Panel recommends AEMO further investigate the impact of climate volatility on reliability of supply and the direct and indirect costs to consumers of both enhanced system resilience and increasing damage to the existing energy infrastructure.

5.3. Consumption and demand: historical and forecasting components [IASR 3.3]

5.3.1. Historical weather data [IASR 3.3.2]

Matters for consultation:

Will these weather stations provide appropriate weather information to apply to the NEM sub-regions when forecasting consumers' electricity use, including annual aggregate electricity consumption and importantly the peak maximum, and minimum, demand conditions?

Recommendation

The Panel agrees that using all of the new stations as proposed will deliver better demand modelling by better representing climatic variables across the built environment.

5.3.2. Historical and forecast other non-scheduled generators (ONSG) [IASR 3.3.3]

Other non-scheduled generation (ONSG) includes all generation at a scale of 100KW – 30 MW other than solar PV. Notably this includes diesel generators, of which many are scheduled to retire over coming years – and hence the projected decrease in ONSG in the Progressive Change scenario.

As greater attention is given to understanding the opportunities present in the distribution network (e.g. for additional small and mid-scale generation and storage projects connected via the distribution network), and assuming barriers to mid-scale connections and market participation are addressed at some future point, we can realistically expect ONSG to increase over time rather than decrease, particularly from renewable sources.

This could include mid-scale wind farms and bioenergy plants such as community-owned projects like Hepburn Energy. We are aware of an increasing number of Local Governments installing bioenergy generation on site as part of their waste management strategies, for example see Latrobe City Council. We also note that three 24-30MW wind farms were built by Zenith Energy in 2023[30]. Because such generation is connected to the distribution

[30] Clean Energy Council (2024) *Clean Energy Australia*. Melbourne: Clean Energy Council.

network and often at least partially used to meet on-site electricity demand, it is understandable that AEMO would find it difficult to get accurate data on such projects – especially those in planning phases.

The Panel is of the view that forecasts for ONSG for Step Change are low, currently only projecting a very minor increase out to 2055. We think the forecast should be increased for this scenario.

Recommendation

> That forecast ONSG rates are increased for the Step Change scenario, due to plausible increased uptake of midscale, non-diesel generation.

5.3.3. Multi-sectoral modelling influences to demand forecasts [IASR 3.3.4]

The Panel is supportive of the four pillars used to model decarbonisation and we look forward to the release of further detail in stage 2 of the IASR. We are particularly keen to see the role of energy efficiency as a continued focus, as we view this as an area of keen interest to consumers, given the comfort, health and cost savings benefits it can bring.

5.3.4. Consumer energy resources [IASR 3.3.7]

Matters for consultation: Are the CER forecasts suitable for their respective scenarios? What strategic factors do you consider may influence CER projections?

The Panel welcomes the increased attention to CER and DER in the 2026 ISP methodology and understands the IASR is part of this process. We recognise the complexity of this task and that 2026 will, no doubt, be the beginning of an ongoing process to understand how to best source and integrate the data required for high quality visibility into CER/ DER issues.

The Panel believes it is of upmost importance to acknowledge consumers as a significant, active cohort contributing to the energy system and to communicate the value this creates for themselves, for all energy consumers, and for the system. We also understand that to really experience the benefit of CER and DER requires additional coordination, which will involve innovation, support and changes to regulation, policy and operations at different levels within the system to reach optimal levels participation.

We must remember to keep consumers at the centre of planning for the future of the energy system – to do this, we need to be aware of what people's actual understanding is of the energy system and their actual experiences of the energy transition. To meet optimal CER and coordination, and to achieve social licence for the transition at large, we need to make sure customers understand, benefit and have opportunities to participate in the energy transition.

In part this is about ensuring conditions that are conducive to CER, DER and coordination, and in part is about AEMO playing an active role in communicating the transition in common language – to give everyday 'mum and dad' consumers confidence in the plan and trust in AEMO's role as an independent, science based planner and operator of the energy system. As part of this, it is integral to see consumers not as passive, but to recognise them as proactive participation and partners in this change process.

As one consumer advocate stated in our recent consultation: “A lot of the time we get hung up on the tech, but it's actually going to be the community engagement, the relationships and the trust that make it happen”, to get to the high uptake of coordination that we need. Consumer participation and agency is a key pathway to building trust.

It was very useful in the last ISP to have the figure included for the additional costs to the energy system if CER and coordination are not optimised. Consumer stakeholders would like to see this type of analysis extended, including ISP communicating clearly that rooftop solar is the cheapest form of electricity – helping people to understand the basics of the energy transition.

For example, to include measures that will help to achieve this and the imperatives for doing so.

To answer the question regarding strategic factors that may influence CER projections, the Panel draws on our own knowledge and experience, as well as the insights received during a consultation session with DER stakeholders on 4 February. We have broken this into two sections below, coordination s and mid-scale generation, and for each we address the implications for forecasts after some reflections on the current context and considerations.

First, to clarify the use of terms, the Panel understands Distributed Energy Resources (DER) to be all modular, energy generation and storage technologies that provide electricity where (or close to) it is needed, as well as efforts to coordinate, or orchestrate, electricity supply and demand - such as via Virtual Power Plants and aggregated demand response mechanisms. Within this Consumer Energy Resources (CER) refers to consumer energy resources that are generally rooftop systems co-located with homes and businesses (under 100kW). Larger systems (100kw-30MW) such as small wind, solar PV, hydro and bioenergy facilities as well as community or neighbourhood scale batteries which are still below norms of utility scale projects are referred to as ’mid-scale’, and are operated as ‘non-scheduled generation’ (NSG) in the NEM. By coordination, we refer to all efforts made by CER proponents to respond constructively to energy system needs, whether through aggregation and orchestration (as with VPPs) or via (individual) responses to market needs.

5.3.5. Coordination

For coordination of CER to be taken up at optimal levels (for the energy system, for future energy cost minimisation and for consumer benefit), there are several current challenges that need to be understood and addressed. These things are currently limiting the uptake of aggregation programs (e.g. Virtual Power Plants).

From the perspective of consumers, some of the barriers currently inhibiting greater coordination include:

- There is a lot of consumer interest in community batteries and VPPs, but conditions are not such that this is a straightforward undertaking or an obvious business case
- Network operations and pricing are not currently able to reflect value to the network as well as the consumer. In addition, VPPs struggle to balance differences between consumer and network drivers. For example, personal use of batteries for household energy security versus network, or wholesale market benefits.
- A lack of transparency around what current operating guidelines are and who will benefit in what ways
- Lack of consumer protections for VPP participants and ensuring complaints are addressed and systems improved in response to consumer issues.

- Clarity around data access for VPP participants and who owns this data and how it can be used
- Addressing trust issues through having the right proponents driving VPP initiatives and investing in participant consumer awareness raising, education and mentoring to support people to understand and participate in the VPP in a way that meets their needs and expectations. This requires building real, on-the-ground relationships with people. There is a role here for intermediaries like local government and community-based organisations (such as community energy groups). People are not very trusting of energy retailers and (state and federal) government.31
- The lack of dynamic and cost reflective pricing is still a barrier, and something which could unlock more value for consumers participating in VPPs (which would act as an incentive for greater participation). Long run marginal cost based pricing is critical for efficiency, but alone is not enough to fully capture value where energy flows are more complex, such as in VPPs.

Some opportunities include:

- Being informed by behaviour science to consider how to best communicate the benefits of coordination through values-based messaging. Remember that consumers are motivated by many factors including energy resilience, environmental and community outcomes, health benefits, ease, as well as economics.
- Market and tariff reforms that can help to remove or reduce transactions costs for people wishing to store or trade electricity within defined areas of the distribution network. As one stakeholder said: “the way we are collecting tariffs is inhibiting the way we move energy around efficiently”.
- There is real potential in app and smart appliance opportunities for households to do load shifting, if paired with the right price signals and education support.
- As battery costs decrease people may become more willing to participate in VPPs, as they may feel less concerned about sharing the benefit of their expensive equipment with the grid.

We also posit if there an approach to managing CER in the grid that is less about coordination and more about the ability for CER to behave in responsive and dynamic ways (individually) though the right market and technical settings, for example via time of use tariffs, the way EV integration is done. This could circumvent issues of trust and undesirable benefit allocation that prevent some consumers being willing to sign up to VPPs. We also wonder to what extent will coordination be aided or abetted by increased EVs, and how to model this? For example, households may not buy batteries, but invest in EVs instead and then operate in a largely off-grid manner.

AEMO should be aware of opportunities now for households to sell electricity (solar stored in EVs and batteries) at peak times via innovative retailers such as Amber and Flow Power. These retailers are selling energy management / cost management services to enable households to gain economic benefit from the wholesale electricity market. These models are gaining increasing traction in the retail market, as they address a current market failing for consumers where retail feed-in tariffs are not currently able to reflect the value of feeding in at key times. For AEMO, this trend may come to represent a form of coordination of CER that is worth monitoring. For consumers, the risks of being exposed to wholesale market prices will need to be carefully managed. For some consumers,

[31] Essential Research (2024) *Strengthening Regional Transition Narratives.* Commissioned by RE-Alliance.

this will be an appropriate level of risk and enable them to access price benefits. However, there remains a gap between market incentives for feed-in at strategic times for the grid and consumer reward for this coordinated behavior that is not currently addressed by available retail tariffs, and which needs to be if we are to reach optimal levels of CER coordination is going to take place.

Regardless of current barriers, the Panel believes that over the timeline of IASR projection, the barriers will be addressed and appropriate incentives enabled to facilitate CER, DER and coordination. To expediate this, the Panel advocates for much better resourcing of the CER Roadmap and broader actions to realise CER, DER and coordination. This is also why, overall, we recommend increasing CER and orchestration trends in the scenarios.

There is a sentiment among CER and DER stakeholders that the ISP (as part of its system planning role) should be able to understand and communicate the barriers to CER, DER and coordination and what needs to happen to address them. For the purposes of the IASR, the above information can add context for future projections, whereas for the ISP as a whole the above information could inform other planning and recommendations. In addition, we see AEMO as having an important role in communicating, collaborating and advocating with other relevant stakeholder to address barriers – for example in their role in the CER Roadmap and in rule change submissions.

Recommendation

> That behavioural science is considered as a means to model CER and coordination uptake, alongside economic modelling, to incorporate the influence of values and diverse motivations.

Recommendation

> There is an urgency to increase coordination of CER and DER uptake, and to adequately support consumers to do so. As such, we recommend that AEMO encourages the Government to review, expedite and increase the resources to facilitate the early implementation of the National CER Roadmap's recommendation.

5.3.6. Mid-scale generation and storage

We welcome the inclusion of non-scheduled generation (both PV and other) and the explicit reference to mid-scale generation and storage in the assessment of CER and DER. Mid-scale (100kW-30MW) renewable generation (solar, micro hydro and wind) and storage ('neighbourhood' and 'community' batteries) is an area that has often been overlooked in Australian energy system policy and planning. However, with the increased focus on distribution networks, we recommend an explicit effort is made to understand and include the assessment of the contribution that projects at this mid-scale can make to the future electricity system. Projects at this scale are of particular interest to consumers for the following reasons:

- Consumers are often the proponents of projects at the lower end of this scale (farms, high energy using businesses, community-led renewable energy businesses, and small-scale Australian owned businesses)
- These projects connect into the distribution network and can reduce the need for line upgrades, and thereby overall system cost
- These projects can contribute to achieving target levels of CER/ DER without some of the limiting factors that rooftop solar faces

- These projects can increase energy equity by opening up ownership and benefit in solar PV and renewables more generally to people currently locked out from rooftop solar (e.g. renters, apartment dwellers)
- Smaller scale projects that are initiated by and involve local actors, as many mid-scale projects do, are far more likely to enjoy social licence, and consequent easing of development timelines and cost risk.

From the perspective of consumers and community-based organisations pursuing mid-scale generation and storage projects, some significant the barriers to such projects currently exist. These barriers include:

- Challenge of 'community' batteries not actually being owned by or even directly benefiting community members. It would be better to only call batteries owned and/or operated by or for community 'community batteries' and refer to others as distribution or mid scale batteries.
- Navigating regulatory and market technicalities is a barrier for many projects as it is costly, time intensive and often not obvious from the outset
- Tariff options and power purchase prices vary widely for both mid scale batteries and generation, which makes business cases difficult to stack up. Lack of options for peer to peer or local network trading make this particularly difficult.
- It is difficult to access detailed data on the status of the distribution network and the places where investment in mid-scale generation or storage would be possible and useful for the grid.
- Distribution loss factor methodology is not fit-for-purpose to identify (or incentivise) the best scale and location for network and/or non-network solutions.
- varying jurisdictional requirements regarding grid connection for different scales of projects are inconsistent and difficult to understand, and not tailored to the unique need and role of mid scale generation and storage
- Community batteries are finding it impossible to get insurance

Some of the opportunities uniquely presented by mid-scale projects include:

- More ability to directly involve and benefit consumers as participants, co-investors, or co-owners of the generation and storage.
- There is evidence of community-based energy CER and DER projects contributing to social licence for the energy transition at large due to increasing people's understanding of, benefit from and sense of agency in the transition.
- There are potential distribution network benefits of mid-scale generation and storage being owned and operated by third parties (not DNSPs).
- Midscale projects potentially much easier to coordinate than an equivalent MWs of CER.
- Co-benefits in terms of grid services and benefit to communities/ consumers if mid-scale generation and storage are co-located and ideally also service some behind the meter load as well.

- These projects are quick and nimble compared with large solar farms and so can more easily be responsive to consumer and network needs.

Given the above, we are wondering on the extent to which AEMO's work with the DNSPs could help to understand how distribution network augmentation options could enable CER and DER, and the opposite: what kinds of restrictions to connection and export will there be if there isn't the right kinds of investment in network and non-network solutions? Could this involve testing for a sensitivity or TEOR option where there are more/ less batteries and coordination at a distribution level – would this negate the need for augmentation? Could it decrease overall costs and increase system resilience? In this way, the ISP could help to identify areas where more CER is needed and the ways that it can be incentivised, and potentially what the other co-benefits of such an approach could be e.g. to building social licence for the transition

We note that the IASR CER forecasts include both small-scale rooftop solar PV (up to 100kW) as well as larger, often ground-mounted non-scheduled generation (above 100kW and up to 30MW) and batteries. The Clean Energy Council reports that five solar farms between 5MW and 30MW in size were commissioned in 2023[32]. There are now over 120 operating community-based energy enterprises in Australia, who together have completed over 730 projects[33]. A majority of these projects are CER, but also include a number of MW scale wind and solar farms. 12MW of community-owned generation was installed in 2023[34]. The Panel are aware of many mid-scale solar projects being planned by community enterprises, farmers, businesses and small commercial developers, especially in the range of 1-5MW. A report by Jacobs for the Clean Energy Regulator in 2022[35] found that:

- 1,604 mid-scale PV installations in Australia to date, representing a total capacity of 1,490 megawatts (MW) as of September 2022. More than 90% of installations have occurred since 2014.
- The top five sectors installing mid-scale solar PV are: commercial, electricity supply, retail, education, and industrial.
- For the period 2017 to (September) 2022, across all sectors the annual average: the number of new installations was 233; installed capacity was 219 MW; installed capacity per site was 0.9 MW.

They project that installed capacity of mid-scale systems will increase from 1,810 MW in 2022 to 2,817 MW by 2027. This is inline with figures presented in the IASR up to 2027

The Panel view is that the PVNSG forecast included in Figure 7 page 59 for the long-term progressive change scenario is underestimated and too low. From our perspective and the experience of the stakeholders we work with, it is increasingly common for businesses, farms and communities to pursue solar PV projects over 100kW.

Recommendation

[32] Clean Energy Council (2024) *Clean Energy Australia.* Melbourne, Clean Energy Council.

[33] Buckley, E., Walters, K. Marshall, J.P. & Ford, A. (2023) Australian Community Energy Collective Impact Assessment 2023, Community Power Agency, Sydney.

[34] ibid.

[35] Jacobs Group (2022) Mid-scale solar PV system projections.

That AMEO updates and increases the forecasts for PVNSG, especially for the Progressive change scenario to reflect motivations for mid-scale extend beyond economic considerations and that AEMO will not necessarily have visibility into the planning pipeline for these projects.

Recommendation

AEMO continues to expand its consultation with CER and DER stakeholders more broadly than DNSPs and retailers, to accurately understand the opportunities and barriers to CER and distributed energy. The innovations in energy services, programs and business models that will be required to achieve the desired rates of CER, DER and coordination will need to involve a broader range of actors.

5.3.7. Distribution network constraints

Page 57 of IASR A reads the consultant's approaches to CER modelling "does not explicitly consider distribution network constraints", and later on the same page that "AEMO considers that the forecasting approach that does not consider distribution constraints, coupled with the ISP Methodology, will appropriately capture opportunities for distribution investments and other distributed resources in each scenario's development opportunities in the ISP". Assuming unconstrained export and generation conditions for CER (as was the case in the previous ISP methodology) is very misleading, as this downplays the impact of curtailment. Correcting this will be useful for accurately modelling future contributions CER can make.

As we approach a 100% renewable energy system, the efficient level of curtailment – that being portion of otherwise-generated energy that can't be transported in the energy system, taking into account the efficient use of storage – could increases significantly. When the NEM reaches 90% generation from renewables there will likely be months where 50% of renewable generation is curtailed. This will be the case for all scales of generation, from behind the meter solar PV to Gigawatt scale wind farms, and to avoid it would involve over-investing in batteries or other energy storage that would only be discharged for a few hours or year.

Note that the Panel is not assigning any value judgement to curtailment, just noting that it is a reality.

Not considering distribution network constraints in the IASR is at odds to the Panel's understanding that AEMO is in fact modeling the impact of distribution network constraints within the methodology somewhere. It would be good to clarify this and make it clear in this section how AEMO plans to do this.

Recommendation

The IASR clearly references the ways that ISP modelling will account for distribution network constraints and the (likely growing) impact of curtailment of CER exports. We note that this also applies to the pending ISP Methodology process and AEMO's System Security Roadmap.

5.4. Existing generator and storage assumptions [IASR 3.4]

Matters for consultation

Are the retirement cost assumptions detailed in the accompanying Draft 2025 Inputs and Assumptions Workbook appropriate?

The Panel is well aware of AEMO's expertise in modelling energy demand and supply and recognises this to be on ongoing process both through the annual ESOO (Electricity Statement of Opportunities) reports and the ISP process. High quality expertise is also utilised from BoM, CSIRO and other experts for relevant data sets.

Consequently the Panel is satisfied that the estimates for existing generator and storage assumptions, as presented in the 2025 draft IASR are reasonable, and will be updated before the final 2026 ISP is finalised.

We note the following quote from the Draft IASR (pages 85, 86):

"For ISP purposes, the forced outage rate assumptions, which incorporate long duration outages, are held constant past the first 10 years. Although reliability may degrade as a plant ages and nears retirement, it is difficult to predict this trend with any accuracy beyond 10 years, particularly when timing of generation withdrawal may be dynamic. It is a level of complexity that AEMO does not consider warranted as it is not expected to introduce a material difference to ISP outcomes. More information on treatment of outage rates across AEMO's modelling is provided in the ISP Methodology"

The Panel's attitude to long duration unplanned outages is to recognize that as plant ages, the past is of diminishing value in predicting future outages. We therefore suggest that this topic may be an appropriate focus for sensitivity analysis, but have not included it in our 'priority sensitivities,'

The relevance of this topic to the soon to released ISP Methodology is also noted.

5.5. New Entrant Generator Assumptions [IASR 3.5]

Matters for consultation

Do you support the implementation of first-of-a-kind premiums for technologies that have not been deployed in Australia and with the underlying assumptions appropriate?

The Panel supports this implementation. This will be particularly important to capture where multiple complex new supply chains are required to integrate new technologies into the Australians context, as would be required for nuclear energy.

Do you have any comments regarding the draft build cost projections?

The Panel supports the correction of current and projected costs for floating wind turbines to be materially higher than previously thought. While fixed offshore wind turbines are on track to be a game changer for wind energy globally, floating turbines are unlikely to achieve commercial viability, particularly in Australia where terrestrial renewable energy options are mature and cost effective and our distance from markets in Europe, China and the US means higher installation costs (and first-of-a-kind premiums).

We question the magnitude of the predicted changes to the cost of fixed offshore wind turbines in the longer term. The current cost of this technology has dropped materially since the last IASR, improving its financial viability in the nearer term, however our understanding is that improvement is the result of cost reductions being achieved sooner, rather than a likely change to the long-term cost. In a visual sense, compared to the 2023 IASR, the cost curve has been moved 'down', when is the Panel's view it possibly should instead have been moved 'left'.

5.6. Fuel and renewable resource assumptions [IASR 3.6]

(No 'matters for consultation')

Background: Prices for Natural Gas and Diesel in an uncertain future

Input fuel prices are a significant component of the costs of electricity generation and allow AEMO to optimise different generation and storage options in the ISP. Stage 1 of the Draft IASR includes fuel price forecasts for natural gas, coal and diesel. Price forecasts for biomethane and hydrogen may be included in Stage 2 of the Draft IASR.

In responding to Stage 1 of the Draft IASR, the Panel's focus is on the forecasts of natural gas and diesel prices.

AEMO's principal source for forecasts of fuel prices in Stage 1 of the IASR is the 2024 ACIL Allen Consulting (ACIL Allen) report published in December 2024[36]. The price forecasts build on trends observed up to mid 2024.

The Panel has reviewed the price forecasts for natural gas and diesel and finds them reasonable given AEMO's forecasts of fuel demand. However, we note ACIL Allen has relied on the 2024 GSOO published in March 2024 as input into its pricing models. We assume the pricing forecasts will be reviewed following the publication of 2025 GSOO.

At this stage, we have not reviewed the pricing forecasts for other current or future fuels. We will consider the forecasts for the price of hydrogen in our response to Stage 2.

Significant uncertainties that will have an impact on fuel prices have emerged since the 2024 GSOO. We list some of these uncertainties below.

- Following the US election, there is considerable uncertainty around the direction of prices for natural gas (and LNG), diesel and other input fuel prices. The US is already largely self-sufficient in gas and oil supply, and there is a view that expansion of US production will have a chilling effect on future international prices, affecting both import and export prices for Australian producers, retailers and generators.
- There is also a risk of policy changes by Australian governments (state and federal), and changes in investors' perceptions over the next few years. For example, the proposed 2025 review of the Gas Market Code by the ACCC[37] could lead to changes in the existing 'price cap' for wholesale gas.
- ACIL Allen's gas price forecasts include the costs of transporting gas through gas transmission pipelines to the specified demand centres. From recent discussions that some Panel members have had with electricity transmission business, we understand that there are significant increases proposed in the costs of new electricity transmission. The final IASR will need to consider whether these significant increases also apply to the cost of gas pipelines and storage.
- The future of the hydrogen market will have an impact on the demand/supply of natural gas and diesel over the next 20 years. For example, ACIL Allen forecasts a continued drop in the price of natural gas in the 'green

[36] ACIL Allen, *Gas, liquid fuel, coal and renewable gas projections, Final report,* December 2024. https://aemo.com.au/-/media/files/major-publications/isp/2025/acil-allen-2024-fuel-price-forecast-report.pdf?la=en

[37] For details of the Gas Market Code, see https://www.dcceew.gov.au/energy/markets/gas-markets/gas-market-code, The Code extends to 2033, but the price cap will be reviewed in mid 2025.

energy export' scenario because of competition from lower carbon sources such as hydrogen/ammonia. In contrast, over the medium-long term, the forecast price of gas grows in both the step change and progressive change scenario (particularly the latter) reflecting supply constraints.

It is important that the fuel price forecasts in the final IASR carefully consider the impact of the changes and uncertainties listed above.

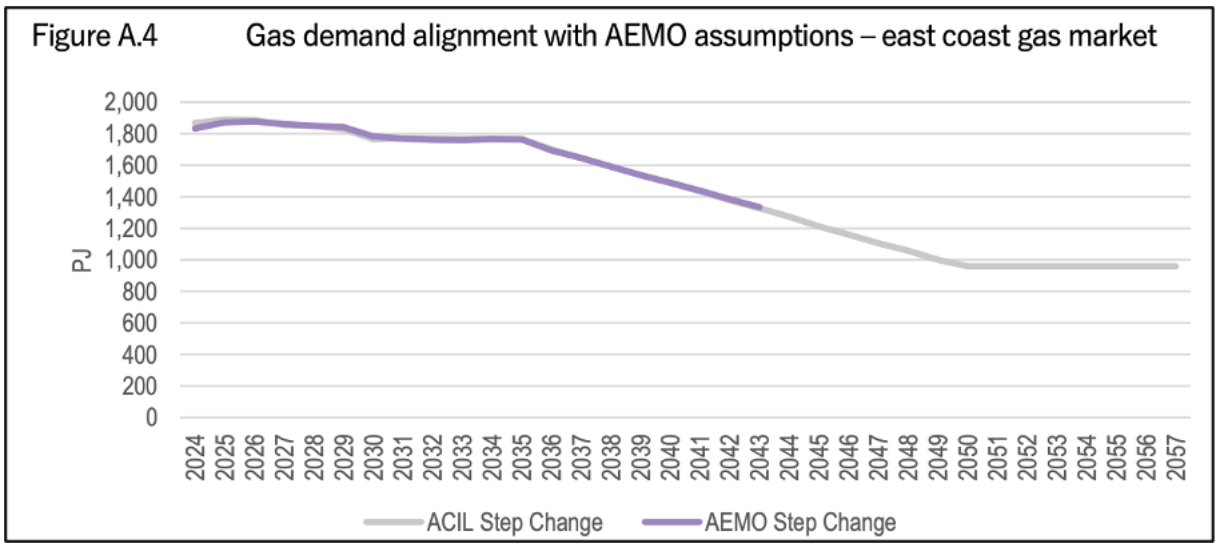
Regarding forecasts for solar and wind resources, the Panel view is that AEMO's proposed methodology is sound.

Feedback on forecast natural gas prices:

In the following section, the Panel outlines the key features of the gas price forecasts that underpin our recommendations.

ACIL Allen's natural gas demand forecasts underpin ACIL Allen's price forecasts. They are largely aligned with AEMO's most recent GSOO forecast of demand and gas supply[38]. For example, see the chart below that illustrates the alignment between ACIL Allen's demand forecast and AEMO's 2024 GSOO.

Figure 9 Gas Demand alignment with AEMO assumptions – east coast gas market



Source: ACIL Allen, A 3.2, p A-5

ACIL Allen uses its proprietary GasMark models to then forecast natural gas prices out to 2050 given the demand and supply forecasts. Importantly, GasMark models hypothetical spot prices rather than gas contract prices[39].

AEMO indicates that the natural gas price forecasts consider inputs such as[40]:

- Gas production costs from existing and upcoming fields, reserves, infrastructure and pipelines.
- International oil and gas prices and their influence on east coast gas prices through LNG netback pricing
- Level of local competition

[38] AEMO, 2024 Gas Statement of Opportunities, March 2024. For a full list of ACIL Allen's data sources for the east coast gas market see ACIL Allen report, Figure A.2, p A-5.

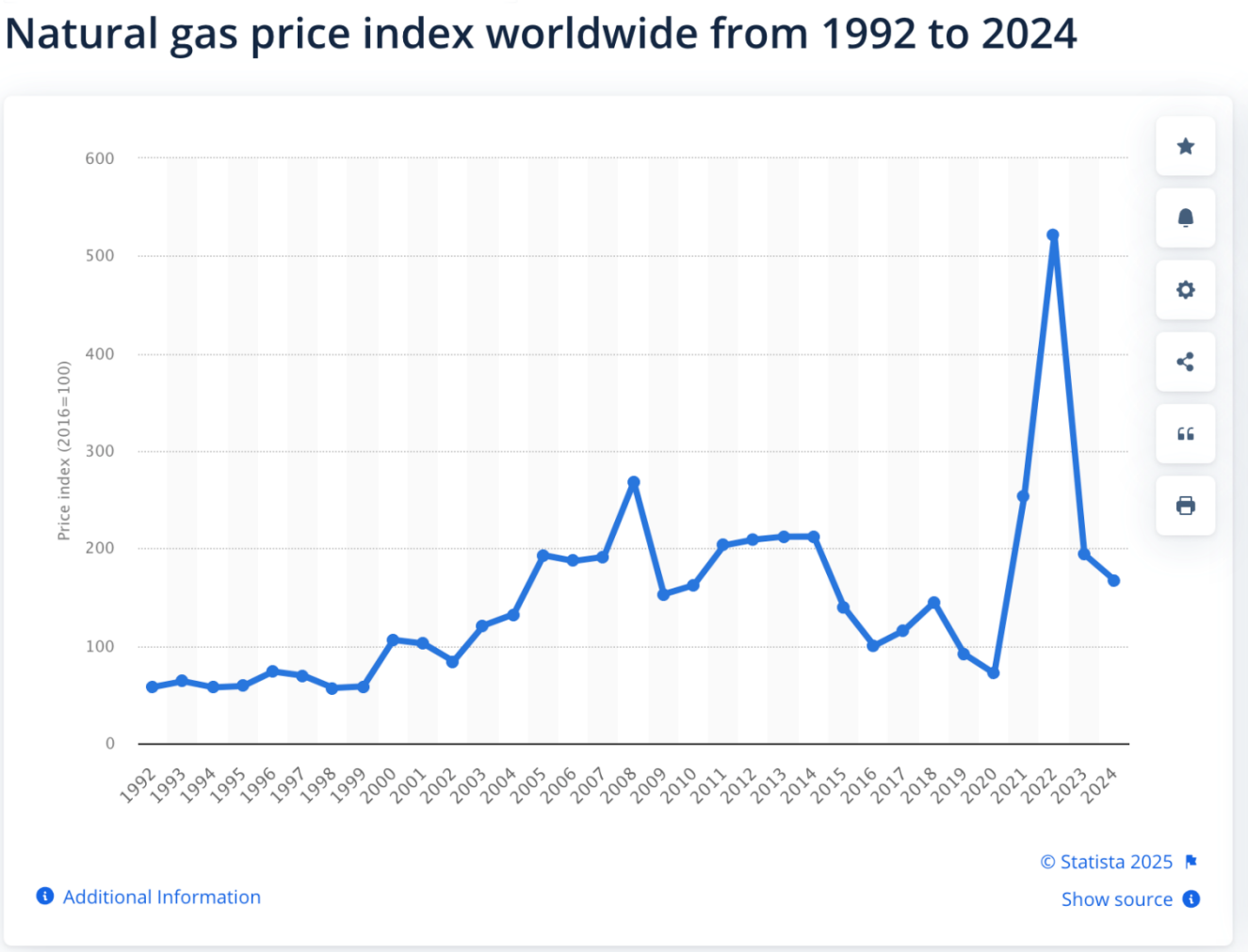
[39] ACIL Allen, p A-2.

[40] AEMO, Draft IASR, p 108.

- Domestic economy
- Regulatory changes, including the Australian Gas Supply Mechanism, Federal Government's mandatory Gas Market Code with a $12/GJ price cap for wholesale contracts and other pricing rules.

Against this background, ACIL Allen has provided forecasts of natural gas prices out to 2056/7, in line with AEMO's supply/demand forecasts (by end-use and state) and consistent with AEMO's three scenario narratives. The figure below illustrates the dramatic impact of geopolitical events on the price of gas in 2022-23 and the subsequent 'recovery' of prices to more normal levels.

Figure 10 Natural gas price index world-wide from 1992 to 2024 (Statista 2025)



Source: https://www.statista.com/statistics/1303056/natural-gas-price-index-worldwide/

Following the dramatic increase in gas prices in 2022/23, the Federal Government introduced the Gas Market Code (Gas Code) was introduced by the Federal Government in response to these high prices and domestic

supply shortages. The Gas Code introduced a $12/GJ price anchor (exclusive of transport costs)[41]. ACIL Allen's final forecast prices then add on transport costs to deliver to city gates[42].

While the Code served its purpose of capping wholesale gas prices and ensuring adequate domestic supply in 2022/23, arguably the cap has acted as a proxy 'floor' to wholesale gas prices in the Australian market in 2023/24. This somewhat perverse outcome can be seen in the domestic wholesale gas market which did not see the dramatic price falls that were observed in the international market.

However, it is possible that the cap price may be reduced in 2025/26 following the ACCC's 2025 review of the Code in July 2025, and subject to their being adequate supply into the domestic gas market[43].

ACIL Allen sees natural gas prices declining from 2024 across all state hubs, and end-uses before rising again from the early 2030, with some differences emerging between the states as a function of the changing sources of supply. Brisbane gas prices, for instance, become **relatively** cheaper over time as southern gas supply sources run down. Sydney delivered gas prices may benefit from any development of the Port Kembla LNG terminal.

The natural gas prices also vary across AEMO's three scenarios, with the Green Energy Export scenario showing the lowest prices because of competition from hydrogen for large scale industrial processing.

ACIL Allen provides a separate gas price for gas powered generation (GPG) reflecting the interplay between the gas and electricity markets and the assumptions associated with both. The GPG demand forecast was provided by AEMO.

The wholesale price reflects the location of the generator, the expected dispatch profile and the mix of contract and spot market prices for each generator type (CCGT or OCGT). For example, a premium was added to the OCGT price to account for the additional costs to supply gas at short notice and at potentially high volumes (ACIL Allen, p 11). This reflects OCGT's primary role as a reliability 'back-up' for the electricity wholesale market.

Overall, the GPG gas prices follow a similar trajectory to the other domestic gas sectors, reaching a high of around $18/GJ in 2025/26, declining through to around 2033 and then slowly rising in the later years.

The Panel finds the price forecasts from ACIL Allen under the three scenarios reasonable given the forecasts of natural gas demand and supply options provided by AEMO and the scenario narratives. However, we see substantial risks to the underlying domestic and international supply/demand forecasts, particularly the risk of oversupply, which could have a significant impact on future prices.

Similarly, as ACIL Allen's forecasts indicate, to the extent there is substitution of natural gas by renewable hydrogen/ammonia in both the domestic and export energy markets, the demand for natural gas may decline more rapidly than forecast, putting downward pressure on natural gas prices.

Recommendation

AEMO review the fuel price forecasts prior to completion of the Final IASR. This review should explicitly consider the uncertainties identified above that will impact on the fuel prices in each scenario.

[41] ACIL Allen (2024)

[42] ACIL Allen states (p A-3): "*The output of this process* [the GasMark model*] is a series of gas prices by region that broadly reflect the wholesale price, including transmission charges, in each region. Contract prices should be expected to be slightly higher than this price to take account of contract terms such as take or pay, interruptible and other services provided*."

[43] ACIL Allen, however, argues they expect prices to remain anchored around $12/GJ for the period up to 2030. (ACIL Allen, p 22)

Recommendation

AEMO to consider the use of an explicit feedback loop between supply and demand forecasts and price forecasts, to ensure AEMO's models capture the dynamic nature of these relationships. Noting that this is a topic that is also relevant to the ISP Methodology consultations due soon.

Feedback on forecast diesel prices:

AEMO sourced diesel price forecasts from ACIL Allen. The forecast prices relate to the use of diesel at power stations that can, or could, use liquid fuels. The projected prices are Terminal Gate prices for automative diesel oil, with a distributors' margin and a transport charge added to the cost.

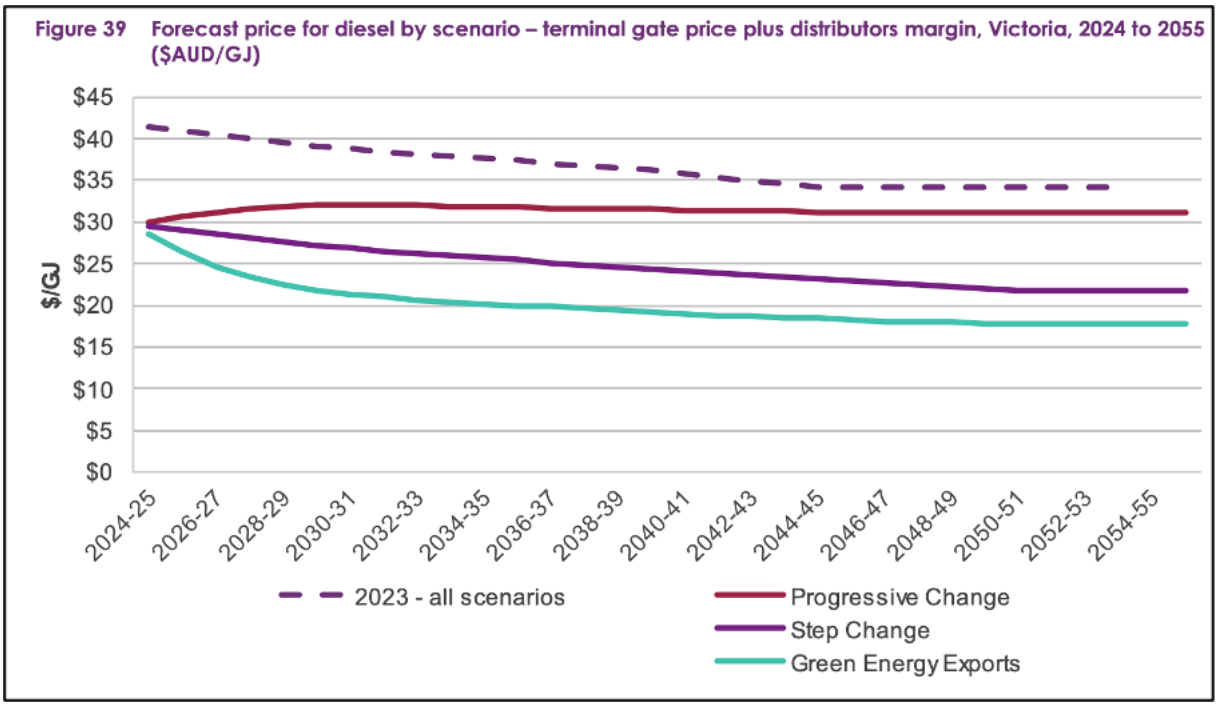
The starting point for the forecast diesel price is the forecast of international prices of Brent crude oil. There is a significant level of uncertainty around the short-, medium- and long-term future of international oil prices. AEMO states that the following uncertainties were considered in the diesel fuel price forecasts[44]:

- Outlook for economic growth in advanced, emerging market and developing economies
- Rates of adoption of EVs, PHEVs and Hybrid light passenger vehicles
- Improved efficiency in all modes of transport
- Fuel switching to biofuels, hydrogen in the longer term and oil to gas switching in the power sector in Middle Eastern Countries over the medium to longer term
- Strategies of produces in the Middle East to shore up their national budgets over the medium term.

ACIL Allens's 2024 forecast sees a reduction in oil price that is well below the 2023 forecast prices. This is demonstrated in the figure below from AEMO's draft IASR.

[44] AEMO 2025 IASR, p 112.

Figure 11 Forecast price for diesel by scenario



Source: AEMO, 2025 Draft IASR, p 113

The Panel would add to AEMO's list of uncertainties - political instability internationally, changing attitudes to climate threats and energy policy changes such as those occurring in the US under the new 'dig baby dig' administration.

The recent report by the US Energy Information Administration (EIA) published in January 2025 stated the following[45]:

"We forecast benchmark Brent crude oil prices will fall from an average of $81 per barrel (b) in 2024 to $74/b in 2025 and $66/b in 2026 as strong global growth in production of petroleum and other liquids [outside OPEC+] and slower demand growth put downward pressure on prices and help offset heightened geopolitical risks and voluntary production restraint from OPEC+ members."

The EIA also notes their 2026 price forecast assumes that the US will reduce production levels in response to the low prices seen in 2025. They conclude that:

"Uncertainty in our price forecast implies uncertainty in our outlook for US crude oil production".

The EIA also cautions that China is moving rapidly to expand its fleet of electric vehicles and alternative fueled trucks, even as demand in other Asian and African countries may expand.

The Panel acknowledges these uncertainties. While the new US administration is encouraging further development of oil wells and greater production, market forces may slow the pace of production and price declines. Nevertheless, the Panel considers that AEMO's current short-medium forecasts of oil prices may be too high under all scenarios given the trends in both the supply and demand side noted above.

[45] See: https://www.eia.gov/todayinenergy/detail.php?id=64305

Recommendation

AEMO review its oil price forecasts given the rapid rebalancing of supply and demand fundamentals in the international oil markets that has emerged over the last six months.

5.7. Financial parameters [IASR 3.7]

Matters for consultation:

Is the proposed application of technology-specific WACC's for different technology types appropriate and reasonable for the ISP?

Is the discount rate, including its upper and lower bounds, reasonable?

In summary:

- The Panel supports the use of technology-specific WACCs for different technologies. Oxford Economics Australia (OEA) provides sufficient evidence in their 2023 and 2024 studies that investors and other relevant stakeholders recognise different technologies pose different technical, construction and merchant risks.
- We support AEMO incorporating these different costs of capital into the assessment of the overall cost base for each technology, despite some gaps in the supporting data for some technologies.
- The Panel has some concerns about the estimation of the central, lower and upper bounds of the single discount rate (7%, 3% and 9.5% respectively), which is used to assess the net benefits of the different CDPs against the counterfactual DP.

Given the analysis of OEA, and the current methodology, these figures are reasonable. However, we also argue that the current methodology is an oversimplification:

(a) the AER's 2024 Cost Benefit Guideline provides some flexibility to AEMO to use different discount rates and;

(b) it seems incongruous for AEMO to apply the same discount rate to different CDPs irrespective of their mix of transmission, generation and storage, and including to the counterfactual DP that has minimal new transmission.

(c) AEMO uses the same discount rate (7%) across all three scenarios despite the scenarios having very different assumptions around economic growth, inflation expectations, interest rates and consumer demand. OEA has provided an analysis of the discount rate for each scenario. The Panel suggests AEMO consider using this additional information in order that the discount rate(s) are consistent with each scenario narrative.

Similarly, AEMO proposes to use the same WACC across all scenarios for each specific technology. OEA has provided data to vary the WACC for each technology in line with the scenario narratives on economic growth, inflation expectations, interest rates and consumer demand. Again, we suggest AEMO consider using this additional information to ensure the industry specific WACCs are consistent with the scenario narratives.

The reasons for our views above are expanded in the sections below.

Background

In responding to the two consultation questions, AEMO's approach must be consistent with the AER's 2024 Cost-Benefit Guidelines (CBA Guideline)[46]. The AER's Guideline specifies three distinct categories on setting the discount rate in its guidance to AEMO. The categories of guidance are: 'mandatory', 'consideration' and 'discretionary' guidance.

The mandatory and 'consideration' categories are binding on AEMO in the context of the ISP. In contrast, guidance listed as 'discretionary' is not binding on AEMO.[47] The CBA Guideline also notes that the discretionary guidance allows some 'flexibility' to AEMO when selecting discount rate(s) for the ISP development path as follows:[48]

"Outside of this requirement [the mandatory requirement], AEMO has flexibility in selecting the discount rate(s) for ISP development paths. We recommend AEMO consider the following ***discretionary guidance...****"* [emphasis added]

The key elements of the CBA guidance are summarised below:[49]

Mandatory requirements:

- The ISP is required to be appropriate for the analysis of private enterprise investment in the electricity sector across the NEM
- The discount rate is required to be consistent with the cash flows that the ISP is discounting.

Discretionary guidance:

- AEMO to set a discount rate(s) that reflects the systematic risk associated with the expected costs and market benefits cash flow streams over the life of the development path
- A common discount rate should be applied across all benefit classes and costs
- Lower boundary should be the regulated cost of capital based on the AER's most recent regulatory determination at the time of the ISP
- The choice of the discount rate(s) should promote competitive neutrality between network and non-network options in a development path.

AEMO's approach to the discount rate in the 2022 and 2024 ISPs did not distinguish between:

- the WACC and the discount rate, and
- the cost of capital for investments in different assets/technologies.

In the 2024 ISP, stakeholders challenged the AER's approach, claiming that it relied too heavily on theoretical analysis rather than market feedback. The Panel was also concerned by AEMO's use of a single figure for the

[46] AER, Cost Benefit Analysis guidelines, November 2024. https://www.aer.gov.au/system/files/2024-11/AER%20-%20Cost%20Benefit%20Analysis%20guideline%20%28clean%29%20-%2021%20November%202024.pdf

[47] See AER, CBA Guideline, Appendix A for a full list of the mandatory, consideration, and discretionary clauses.

[48] AER, CBA Guideline, p 11.

[49] For a full list of AER's discretionary guidance, see AER, CBA Guideline, pp 11-12.

discount rate/WACC. The Panel noted that the CBA Guideline provided flexibility for AEMO to consider multiple WACCs to reflect different investment risks.

In mid-2023 AEMO commissioned Oxford Economics Australia (OEA) to conduct a market study of investor/industry expectations on discount rates/WACCs.[50] The study demonstrated that stakeholders considered different technologies had different risks and this was reflected in different costs of capital. For various reasons, including its understanding of the AER's CBA, AEMO did not progress this finding and continued with a single discount rate for all technologies under all scenarios in the 2024 ISP.

Proposed conceptual framework for the 2026 ISP:

In the Draft IASR, AEMO distinguishes between the WACC and the discount rate. AEMO proposes to allocate different WACCs to different technologies but will apply a common discount rate to assess the relative net benefits of the CDPs. The Draft IASR proposes the following:

- The WACC represents the cost of capital to investors in specific asset classes and will vary across those asset classes. As such, it is part of the annualised 'cost stack' for each asset class and is an input to the ISP modelling.
- This new approach correctly recognises that investors in the various asset classes are generally investing for different purposes and face different financial and/or business risks.
- In contrast, the discount rate will be used to assess the net benefits (relative to a counterfactual) at specific points of time for each candidate development path (CDP). In AEMO's view, the CBA Guideline requires AEMO to use a single discount rate when analysing the net benefits of all CDPs.

Estimating the WACC and discount rate - the updated 2024 OEA study:[51]

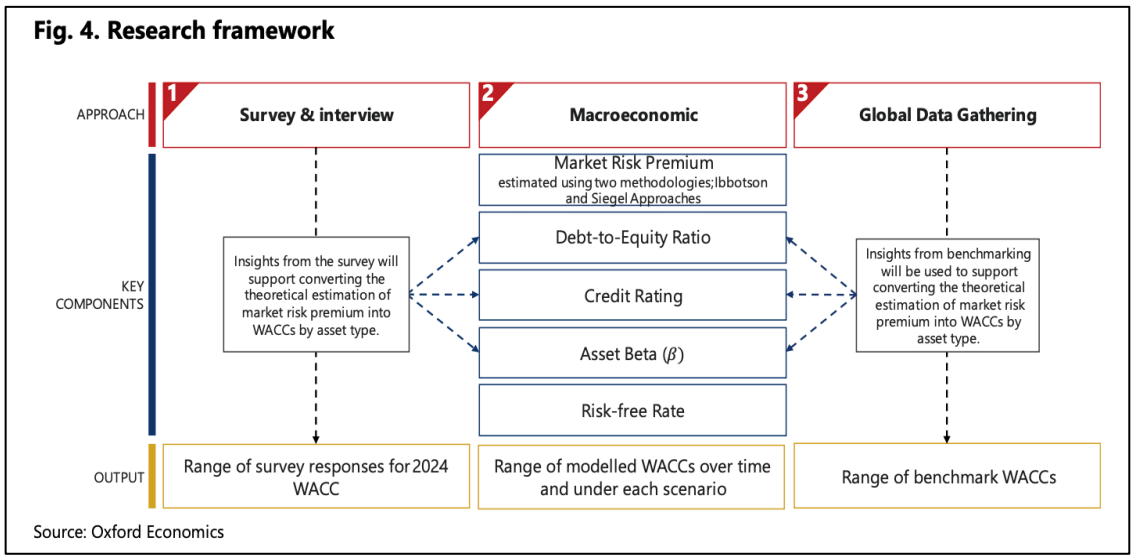
As noted above, AEMO's Draft IASR proposes adopting different WACCs for different technologies that are included in the various CDPs.

AEMO is basing the technology-specific WACCs, and the single discount rate, on OEA's 2024 expanded research study. The 2024 study adopted a three-pronged approach, as illustrated in the figure below:

[50] Oxford Economics Australia, Cost of Capital Survey 2023, July 2023. https://aemo.com.au/-/media/files/major-publications/isp/2023/iasr-supporting-material/cost-of-capital-survey-2023-for-aemo---oxford-economics---final-report.pdf?la=en

[51] Oxford Economics Australia, Discount rates for energy infrastructure, December 2024.

Figure 12 Research Framework used by Oxford Economics for discount rates



Source OEA 2024, p 11.

This 3-stage approach provides the Panel with greater confidence in both the technology-specific WACCs used in the cost build up, and the single discount rate (referred to as the 'technology-neutral' rate) used in the calculation of the net benefit of each CDP. Nevertheless, the sample of respondents remains quite small. In some important categories, such as for the estimate of the WACC for gas generation and storage, there was no response from the gas industry participants.

Given this, the Panel appreciates OEA providing guidance on their level of 'confidence' in the 'central' technology-specific WACCs, reflecting the quality of the data available to them for each technology. For example, the central estimates of WACC ranged from 'high confidence' in the 3% for regulated electricity and gas transmission to 'medium confidence' in the 8.0% for BESS and 'treat with caution' the 10.5% for CCGT with CCS.

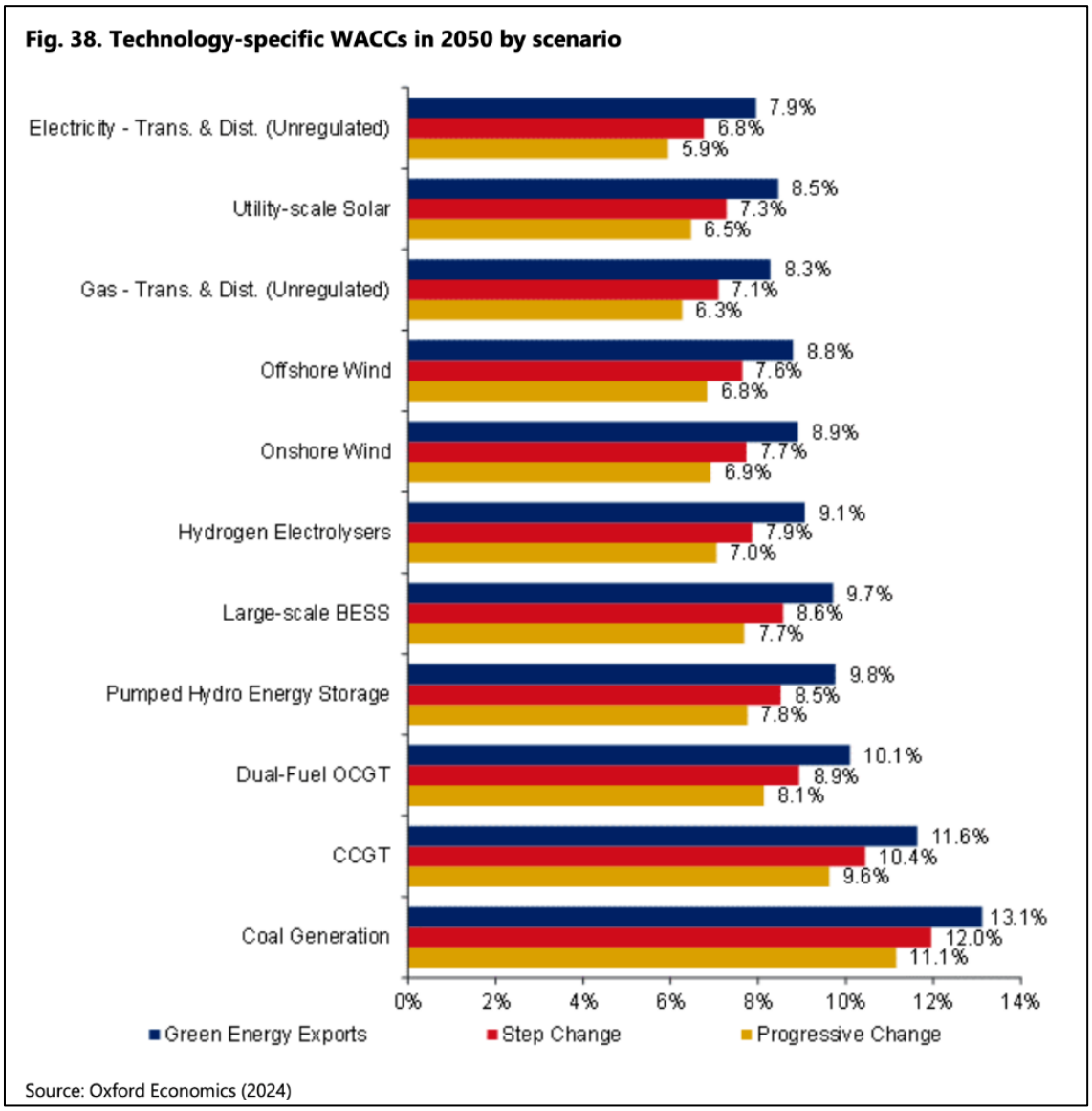
OEA also explains that other than for the regulated electricity and gas transmission which were anchored to the AER's most recent regulated revenue decisions, the lower and central WACCs were largely determined by the macroeconomic modelling whilst being informed by the survey and benchmarking.

This approach allowed OEA to also vary the technology-specific WACCs to match each of the three scenario narratives. For example, OEA was able to vary the model inputs through changes in the level of systematic risk, expected inflation and interest rates in line with the macroeconomic descriptions in each scenario.

The figure below illustrates the outcomes of the OEA analyses of the technology-specific WACCs. For each scenario. The WACCs vary not only by the technology, but also across the three scenarios, with the highest WACCs in the green energy scenario and the lowest in the progressive scenario.

These results are not surprising because they are consistent with the scenario narratives of higher economic growth versus lower economic growth for the Green Energy and Progressive Change scenario respectively.

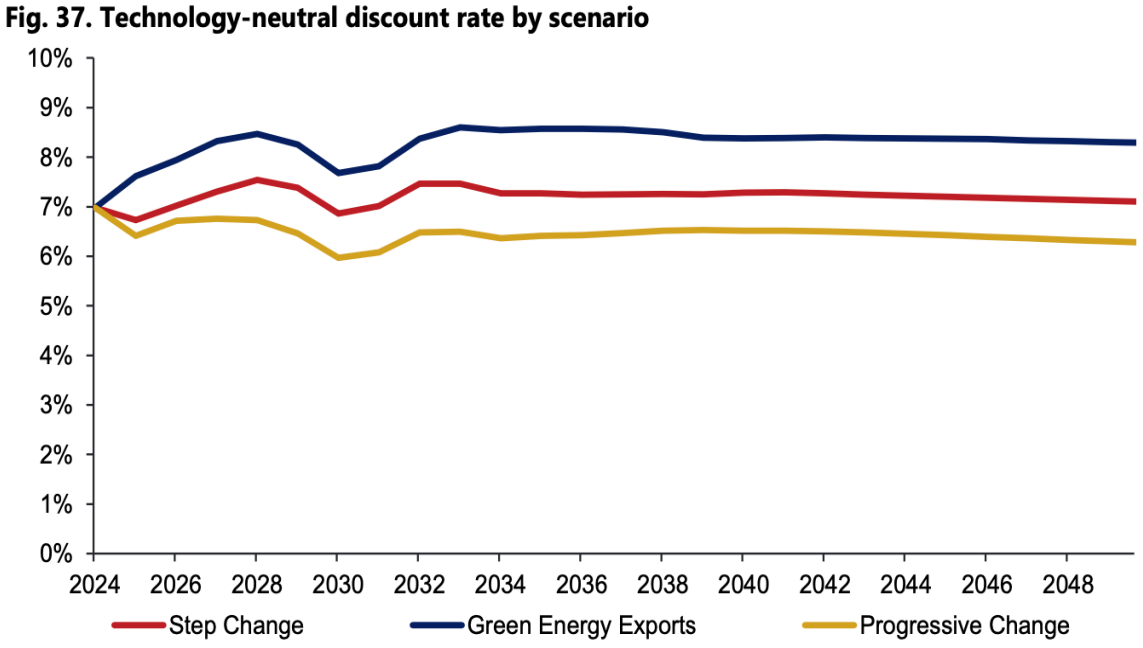
Figure 13 Technology specific WACC's in 2050, by scenario



Source: OEA, 2024, p 46.

OEA's analysis of the single discount rate also varied across the three scenarios. The chart below illustrates this outcome indicating a spread in the discount rate between the green energy and the progressive scenarios of around 2% (200 basis points).

Figure 14 Technology neutral discount rates, by scenario.



Source: Oxford Economics (2024)

Source: OEA, p 45.

Review of the proposed technology-specific WACC results:

The Panel strongly supports AEMO's revised approach which recognises that the cost of capital will vary across different technologies/asset classes. The comments below therefore point to some specific areas which may require some further investigation before the final IASR.

- Off-shore wind:

OEA has provided the same WACC for offshore wind projects and onshore wind projects (7.5%). This is a surprising conclusion given the relatively greater technology and cost risks for offshore wind projects in the Australian context. OEA explains its decision was based on:

- Anticipating governments will provide substantial financial support to offshore wind to 'de-risk' the projects including off-take agreements; and

International data from countries that have installed both off- and onshore wind.

The first reason poses a problem in terms of the WACC estimates. Certainly, long term off-take agreements backed by governments reduce the merchant risks of a project. However significant construction risks remain being 'first-of-a-kind' in Australia. Second, while the cost of capital for onshore wind developments may be like onshore wind developments in countries with a long history of both technologies, the overseas data is mixed and the Australian market if very immature.

More generally, we are not convinced, on principle, that the WACC should include assumptions about government support for some technologies.

- BESS storage projects (WACC of 8%):

Survey respondents were concerned with the 'merchant risk' of large-scale BESS projects, particularly given the large number of projects in the pipeline. Contracted off-take agreements were seen as 'critical' in providing greater certainty of future cash flows and therefore a lower WACC. This raises the same issue as discussed above.

- Pumped hydro (WACC of 8.5%):

Construction costs and access to water were seen as critical risks for investors, and again a lower WACC would require both backing by governments and long-term off-take agreements for the project.

While overall, the Panel agrees with OEA's approach other commentary on the proposed technology-specific WACCs, we are concerned with the assumption that government support should influence the WACC in the manner described above.

In our view, the WACC adopted in the ISP should be based on the intrinsic risks facing a private-sector investor independent of any assumptions about government support for a particular project, particularly as government policies and plans can change. Adjusting the WACC of some technologies in response to assumptions on ongoing government support also appears to be contrary to the AER's guidance on technology neutrality.

We also note the paucity of information on the cost of capital for gas generation and storage. We contend that this will become an important matter for AEMO to address this as part of its Stage 2 plan to better integrate gas/hydrogen generation and storage in the IASR.

Given the above, we agree with OEA's final suggestions for further research, namely:[52]

- Extend the survey analysis and stakeholder interviews with a specific focus on coal generation, dual fuel OCGT and CCGT with CCS, hydrogen electrolysis, and gas plant and unregulated gas pipelines.
- Analysis of the implication for the WACC of government support provision to various technologies under the three scenarios
- Update the inputs to the WACCs in 6-12 months to consider the market response to the new US President's plans, the federal election in Australia and changes to state government policies.

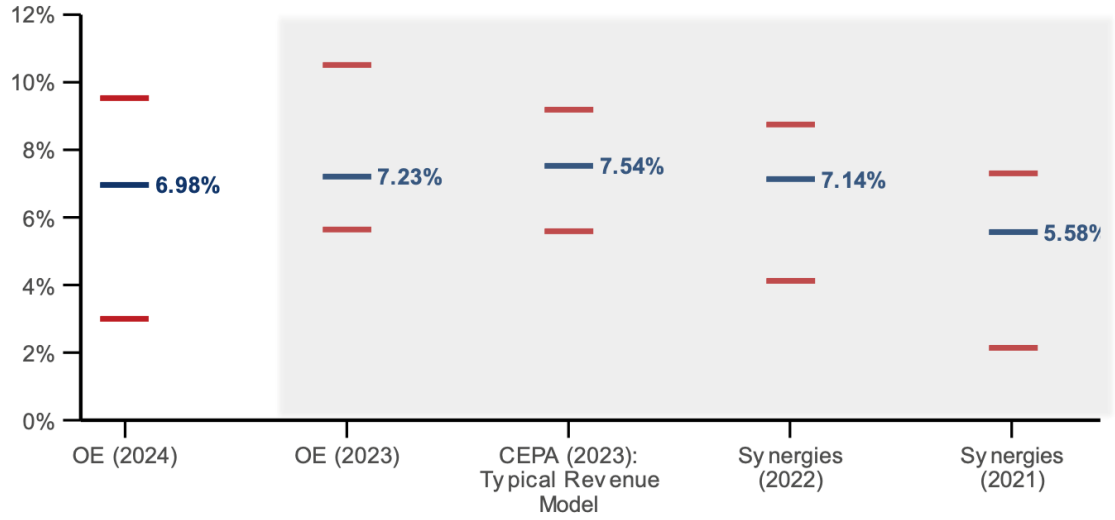
Review of the Technology-Neutral discount rate

As noted above OEA recommended a technology neutral discount rate of 7.0%. This is similar to the overall discount rate AEMO adopted in the 2023 IASR following several earlier studies. The 7% central value was derived using macroeconomic modelling. The figure below illustrates some consistency in the observed measures back to 2022, noting that interest rates have remained reasonably stable since that time, albeit at a higher level than pre-2022.

[52] OEA 2024, p 11.

Figure 15 Technology neutral discount rate estimates and benchmarks

Fig. 6. Technology neutral discount rate estimates & benchmarks



Note: The blue line represents the central estimate, red lines indicate the upper and lower bounds, and the shaded grey area are the benchmark comparisons.
Source: Oxford Economics (2024); Synergies (2021 & 2022)[14], CEPA (2023)[15] and Oxford Economics (2023)[16]

Source: OEA 2024, p 17.

The lower and upper bounds of the discount rate were deemed to be 3% and 9.5% respectively. OEA states:[53]

"The upper bound is 9.5% and is a simple average of the upper bounds reported by survey respondents applied to the recommended discount rate", and

"This estimate broadly aligns with infrastructure Australia's upper sensitivity of 10%."

- While OEA's approach seems reasonable in the circumstances, we query the logic behind having a single discount rate applying across all CDPs and all scenarios. We ask AEMO to consider the following:
- The AER's CBA Guideline does not 'require' AEMO to use a single discount rate, rather it is listed in the 'discretionary' sections of the Guideline. In addition, the Guideline refers to 'rate(s)' not 'rate'. AEMO has the flexibility therefore to vary this single discount rate approach if it believes it would contribute to a more appropriate analysis of the net benefits of the CDPs.
- The Panel considers it would contribute to an improved analysis of the net benefits for the reasons described below.
- Each CDP has a mix of technologies, the proportions of which vary across CDPs. Some CDPs have proportionally more transmission assets, others more generation assets in their mix.
- The net benefit of a CDP is assessed against the 'counterfactual' DP. The counterfactual DP has minimal additional transmission build, so must rely on a greater mix of new generation assets, batteries and the like

[53] OEA 2024, p 18.

to meet the same targets.[54] We would expect that in the real world, the counterfactual project would, therefore have a higher discount rate.

- There is no reason for the same discount rate to apply to all scenarios. The reasons for OEA providing different technology-specific WACCs for different scenarios are also relevant to the discount rate.

Response to AEMO questions:

- Overall, we support the adoption of technology specific WACCs to provide more accurate estimates of the cost of capital for each technology as input into the modelling of the net benefits CDPs and ODP. However, we recommend further investigation into some of the WACC estimates in line with the OEA's recommendations above.
- Based on the data provided by OEA, we accept that the central, upper and lower bands of the discount rate are reasonable, although we expect that the central estimated may need to be modified in the final IASR given the expected changes in the macro-economic and political environment over the next 12 months. The lower band will change automatically over time in line with the AER's regulatory determinations. Changing the upper band may not be required unless there is a significant alteration in the macro-economic and political and international environments.

Recommendations

Our recommendations align with and extend those identified in the OEA report:

- Extend the survey analysis and stakeholder interviews specific to the technologies where there is limited data from the existing study
- Greater analysis of the implication on WACC of government support to various technologies under the three ISP scenarios.
- Conduct an update in 6-12 months (preferably in advance of the Final IASR) given the uncertain national and international environment and related policy uncertainty.
- Consider varying both the technology-specific WACCs and the single discount rate in line with the different scenario narratives.
- Consider whether in OEA's macroeconomic analysis of the WACCs and the discount rate should more closely align with the approach adopted by the AER as set out in the AER's Rate of Return Guideline, given the lower bound (3% for the discount rate and regulated assets) is determined by the AER's recent regulated revenue decisions.

5.8. Climate change factors [IASR 3.8]

(no 'matters for consultation')

[54] In passing, we note the very limited quantitative information on the mix of assets provided for the counterfactual DP.

Please see content in Section 5.2 above.

5.9. Renewable energy zones [ISAR 3.9]

General feedback:

For clarity, it would be good to outline upfront what AEMO's role is in identifying REZs. At present the introduction to section 3.9 describes what a REZ is and then jumps straight into the possible RES Design Report role that AEMO can play, if triggered. This is a little confusing as it is not currently preceded by a description of AEMO's standard role in REZ. It would be good to outline AEMO's (limited) role in REZ declaration and planning.

It would also be good to assist people to understand that the nature of the proposed boundaries (as rough drafts, rather than firm lines) and to outline the next phases of a process (including opportunities for public consultation), ahead of a REZ declaration or a transmission route planning. This may help to allay the fears that can emerge among local stakeholders when they first see a REZ proposed for their area, they deem it to be a 'hard and fast' declaration and are concerned (quite legitimately) that there may not have been any consultation with local stakeholders up to that point.

Similarly in the section on GIS data, dot point three, should include that the maps should not be used to determine if a property (as well as a project) is within or outside a candidate REZ.

It would be useful to provide an overview of the other factors considered in identifying appropriate REZ, such as land use, environmental and social considerations. The list of included considerations outlined on page 122 does not currently reference these elements, although the Panel is aware that they do form part of the candidate REZ analysis. We believe it is important for people to know these things are taken into consideration to the extent enabled by the data available to AEMO for this purpose.

Recommendation

> That AEMO outline upfront what AEMO's role is in identifying REZs and broadly outline what the next phases of the process are (including opportunities for public consultation) and who is responsible for these, ahead of a REZ declaration or a transmission route plan.

Matters for consultation

Do you have any specific feedback on the proposed updates to the candidate REZs?

The Panel has an interest in making sure the visual representation of candidate REZ is as clear as possible.

To visually convey the points made above regarding the unprecise nature of REZ candidate areas, rather than outlining them in a dark green line around the light green area, we would recommend just using the light green shaded area, possibly with fuzzy edges rather than a hard line. We are aware that the REZ map can be misinterpreted by community stakeholders in a way that causes angst regarding a perceived lack of consultation around placement and boundaries. While we know this is due to the high-level and limited remit of the ISP in REZ planning, others may not be aware of the staged nature of REZ planning and declaration processes.

Within Figure 43 on page 127 it would be useful to have a means of visually representing the planning status of each REZ: Which have been declared? Which are in planning and consultation? Which remain conceptual?

Regarding changes to planned REZ, and the removal of Leigh Creek in particular, we are pleased to see that there are avenues for AEMO to reconsider REZ where new and pertinent information comes to light that would render an area inappropriate for a REZ for environmental and cultural reasons. The Panel believes it is important to demonstrate openness to local knowledge and information to ensure that energy planning is responsive and appropriately located. It is considered an important element of social licence for communities to view the planning process as fair and legitimate through evidence of responsiveness to stakeholder feedback. (refer to Table 3 in Section 3.2)

Recommendation

> That the visual representation of REZs be amended to clearly identify the stage of each REZ and, where it is not yet declared, to communicate the imprecise nature of the boundaries, as per the content of our feedback.

Matters for consultation

Is the maximum land use assumption of 5% for the REZ hard limits appropriate?

Yes, we think it is appropriate as a guide. However, there will be instances where communities are happy to accept more than this, and instances of exceedance should be something determined in consultation with local communities and stakeholders. The 5% assumption will also be impacted by a range of local factors, including population density and other land use options. (refer to Table 3 in Section 3.2)

Matters for consultation

Do you have specific feedback on the incorporation of community sentiment in the development of REZs?

Community sentiment towards REZ is very important, but also highly complex, contingent and dynamic to try to understand and then incorporate into the ISP. The Panel would like to see AEMO continue to engage on this topic, both with the Panel and more broadly, in response to the fact that it is such a dynamic space. Some REZ specific thoughts are offered here, and more general content on community sentiment is offered in our social licence content above.

We support the layered approach taken in the 2024 ISP (described in the dot points on page 132), and agree they are useful to evaluate and to consider how this range of means of incorporating community sentiment can be enhanced for the 2026 ISP.

We would like to see further detail to understand what is meant by “when appropriate evidence becomes available from localised consultation and studies” and to include a summary of what kind of engagement has taken place with which groups of stakeholders (p.128).

One difficulty is that, at present, the GIS and other mapping data used does not adequately capture social and cultural information and is often very out of date or incomplete regarding environmental data. To fill this gap, we suggest AEMO enhances its ability to gain localised evidence and information. To address this, AEMO and relevant partners could:

- Meet with local government representatives to understand broad demographics and sentiments in a region, and to locate areas of cultural and environmental significance (sense checking GIS data). This would benefit from involving staff in community development, strategic planning and environmental roles.

- Meet with local Registered Aboriginal Parties in a region to sense check location of culturally significant.
- Consider a role for participatory mapping processes with a select group of informed stakeholders in candidate REZ, including local government, Registered Aboriginal Parties, land care & conservation groups to ground-truth and enhance other GIS data sets. The outcomes from this process could become a layer within the current GIS multi-criteria analysis.

Another avenue for gaining localised knowledge on community sentiment would be for AEMO to consult with the community reference groups already established for progressed REZ and transmission projects.

The Panel thinks it is important for AEMO to continue to seek to understand the multidimensional effect of community sentiment on the ISP and to consider how it can best be factored in throughout the ISP process. In the content on social licence at the beginning of this document are some possible methodologies to consider that may be applicable, for example as part of a sensitivity analysis. We believe it is important and appropriate for AEMO to factor in social licence considerations and impacts on transmission planning, including costs and development timelines, and conversely that cost savings should be awarded to options (e.g. augmentation of the distribution network) and do not face these same potential costs.

Recommendation

That AEMO enhances the way that local knowledge and REZ based stakeholders can input into the incorporation of community sentiment in REZ planning.

Matters for Consultation

Do stakeholders have any other suggestions for representation of REZ transmission limit constraints and the secondary REZ transmission limits?

Do stakeholders have any other suggestions for representation of inter-related constraints across multiple REZs and/or REZs and flow paths?

The Panel does not have comments on these two matters

Matters for Consultation

Do stakeholders agree with the proposed approach to allocate system strength remediation costs to REZ connection costs, consistent with the updated System Strength Impact Assessment Guidelines?

The primary beneficiaries of system strength remediation in REZes, and transmission costs more broadly, are the generators for whom these investments enable access to the market. Regardless how costs are allocated within the ISP from a system design perspective, they should be recovered on a beneficiary-pays basis from generators.

5.10. Network modelling [IASR 3.10]

Matters for consultation

Does the proposed sub-regional model reasonably represent the network?

The Panel supports the increase in the number of sub-regions to be used for network modelling as the greater granularity enhances applications of modelling. We note that the proposed sub regions do not correspond with

distribution network business (DNSP) areas. For example Victoria has 5 DNSPs and 3 proposed subregions, South Australia has 1 DNSP and 3 proposed regions. Noting that a recommendation from the DEECCW ISP review was for greater involvement of DNSP's in ISP development, we ask whether there are situations where greater alignment between ISP sub regions and DNSP areas would be useful? We assume that this could be undertaken by mapping sub-region reference nodes to align with DNSP areas, if and when required, but we are not sure about this.

Matters for consultation

> **Do you have any specific feedback on the existing and proposed flow path transfer capabilities?**
>
> **Do you have any feedback on the uplift factors applied to flow paths as a result of committed and anticipated projects?**

The Panel is not appointed with the technical expertise to respond to these questions.

Matters for consultation

> **Is there any information on non-network technologies or proponents regarding opportunities for competitive non-network investment?**

Regarding non-network technologies, we note the discussions elsewhere in this submission regarding the role and potential for community based energy associations to play in providing non-network options. The Panel will continue to explore these options and their future potential with AEMO and seek to enhance engagement with the community energy sector.

Matters for consultation

> **Given that non-network investments generally involve commercial arrangements with plant with multiple revenue streams, how should AEMO estimate their cost transparently?**

As a matter of principle, the Panel contends that AEMO's ability to obtain the data it needs for planning is a priority over full transparency, where commercial in confidence data is involved. This said, transparency remains a high priority and where AEMO utilises data that is commercial in confidence, this needs to be transparent and every reasonable effort should be made to publish cost transparent data, deidentified where this is practical.

5.11. Power system security [IASR 3.11]

The Panel is not offering comment on this topic

5.12. Gas infrastructure [IASR 3.12]

The Panel notes that consultation on costs for production of both hydrogen, using electrolysis, also known as "green hydrogen" and for natural gas and bio-methane production will be considered in 2025 IASR – part B. The Panel will provide further comments in response to this report.

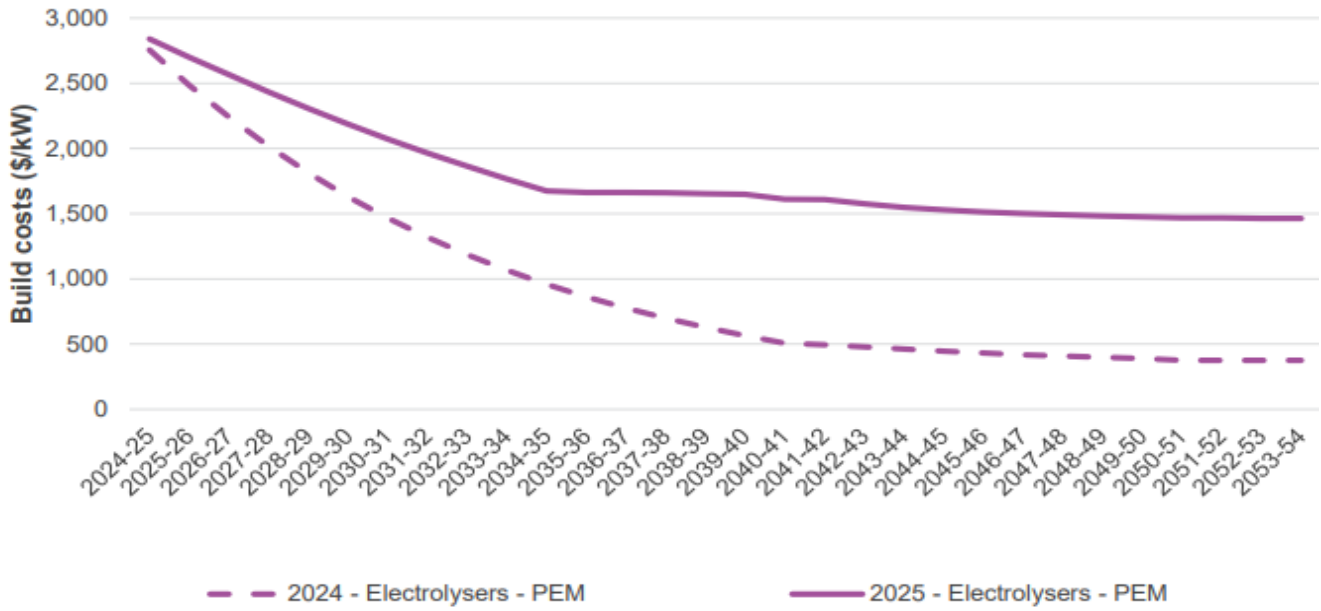
IASR part A asks:

"Do you have any alternative views on the electrolyser cost curve?"

This question is driven by the data presented as figure 48: where PEM is “Proton Exchange Membrane” the electrolyser technology considered by AEMO.

Figure 16 Forecast build cost trajectories for electrolysers (PEM)

Figure 48 Forecast build cost trajectories for electrolysers (PEM), 2023 vs 2025 Global NZE post 2050 scenario ($/kW)



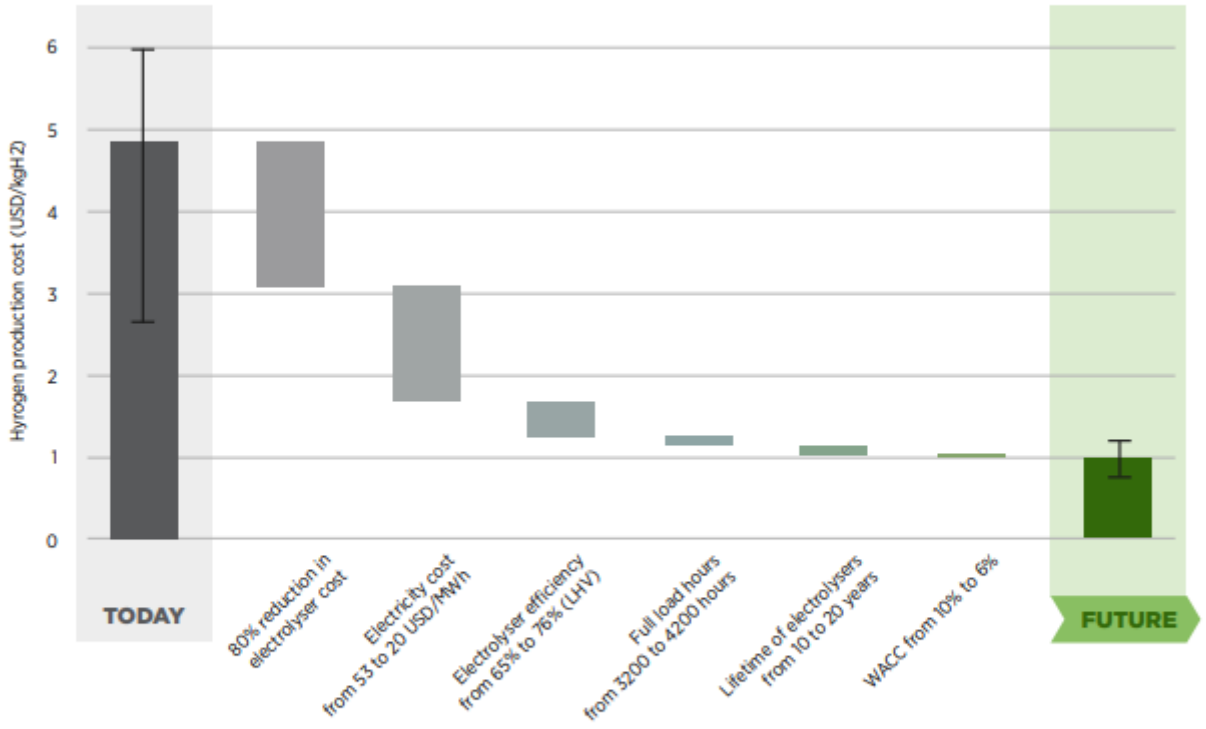
- The Panel observes the obvious that the forecast build cost trajectories for electrolysers have changed
- dramatically between 2024 and 2025 projections, reflecting the Panel’s continuing wariness about the
- extent to which hydrogen can be a cost effective energy source.
- We would expect the cost of electrolysers to fall as demand rises and production costs fall, in line with
- standard declining cost curves.
- Relatively recently (in the last 5 years) there has been considerable optimism about the likelihood and
- potential of hydrogen production costs to fall. For example, the following table from the International

Renewable Energy Agency (IRENA) from 2020 – “Green Hydrogen Cost Reduction Scaling Up Electrolysers To Meet The 1.5°C H Climate Goal”[55] identified the potential for 80% reductions in hydrogen costs.

[55] Green hydrogen cost reduction: Scaling up electrolysers to meet the 1.5C climate goal

Figure 17 Potential for reductions in hydrogen costs

Figure ES1. A combination of cost reductions in electricity and electrolysers, combined with increased efficiency and operating lifetime, can deliver 80% reduction in hydrogen cost.



Note: 'Today' captures best and average conditions. 'Average' signifies an investment of USD 770/kilowatt (kW), efficiency of 65% (lower heating value – LHV), an electricity price of USD 53/MWh, full load hours of 3200 (onshore wind), and a weighted average cost of capital (WACC) of 10% (relatively high risk). 'Best' signifies investment of USD 130/kW, efficiency of 76% (LHV), electricity price of USD 20/MWh, full load hours of 4200 (onshore wind), and a WACC of 6% (similar to renewable electricity today).

Based on IRENA analysis

This moderately recent analysis makes the rapid increase in electrolyser costs over a one year period, 2024 to 2025 seem unlikely. Yet currently, most of the areas where cost reductions seemed likely have not eventuated, dramatically reducing the cost reductions from economies of scale in electrolyser cost curves.

Consequently, the Panel's view is that the updated 2025 PEM electrolyser build costs are reasonable. We recognise that the flattening out of the cost curve is projected from the mid 2030's with no more significant savings from scale. There is always the possibility for technological breakthroughs but at this stage we are not aware of any probable breakthroughs.

We do not have any alternative views for electrolyser cost curves.

5.13. Employment factors [IASR 3.13]

Employment / Labour Market factors

Section 3.13 of the draft IASR commences with:

"Electricity sector employment is forecast to increase by 74% by 2050 (from 33,300 full time workers in 2024 to 57,900 in 2050), in the Step Change scenario from the 2024 ISP."

This is significant compared to a projected population of 32.5 million in Australia in 2050, ABS central projection[56], compared the 26.24m in 2024, a 24% population increase compared to 74% increase in employment in the electricity sector.

The Australian Electricity Workforce for the 2024 Integrated System Plan[57] report was prepared for AEMO by a team of researchers from "RACE for 2030" and provided detailed analysis if likely employment demand, including by skill area for the electricity sector to 2050.

The report writers observe:

"Our recommendations focus on two important areas not addressed in these reports: workforce volatility and the information and research priorities to address gaps in understanding. Despite the welcome attention on workforce and skills, governments are still struggling to understand workforce and the detailed occupations and skills needed across the energy sector, particularly for the demand-side workforce."

The Panel observes that this is a thorough report, covering both areas of job growth and areas of decline and building in volatility, what is not considered in much detail, but we think also relevant, is wage growth associated with the growing demand for electricity sector jobs with potentially greater skill scarcity and this built on a sector that is already renumerated more generously than other employment sectors.

Oxford economics was tasked by SA Power Networks to update the Wage Price Index[58] for the electricity sector as input to the SA Power Network 2025-30 regulatory determination.

Noting that Oxford was commissioned by an SA business, there is some SA specific references, with the national situation also being well presented. Oxford said:

"Over the forecast period, the Australian and SA EGWWS WPI growth is expected to remain higher than the All Industries WPI average, with the national All Industries WPI forecast to average 3.4% over the five years to FY30. This means that the Australian EGWWS WPI is expected to be 0.3% higher than the All Industries average, which is slightly lower than the 0.4% historical difference of the decade to FY21.

"Utilities wages are forecast to increase by more than the national average over the forecast period because of the following factors:

the electricity, gas and water sector is a largely capital intensive industry whose employees have higher skill, productivity and commensurately higher wage levels than most other sectors.

strong union presence in the utilities sector will ensure outcomes for collective agreements, which cover 62% of the workforce, remain above the wage increases for the national 'all industry' average. In addition, with the higher proportion of employees on EBAs, compared to the national average (35%), and EBAs wage rises normally higher than individual agreements, this means higher overall wage rises in the EGWWS sector.

increases in individual agreements (or non-EBA wages) are expected to remain elevated as the labour market remains tight, with the unemployment rate now around 4.1% and expected to SA Power Networks: Labour Cost

[56] Population Projections, Australia, 2022 (base) - 2071 | Australian Bureau of Statistics

[57] Rutovitz, J., Gerrard, E., Lara, H., and Briggs, C. (2024). The Australian Electricity Workforce for the 2024 Integrated System Plan: Projections to 2050. Prepared by RACE for 2030.

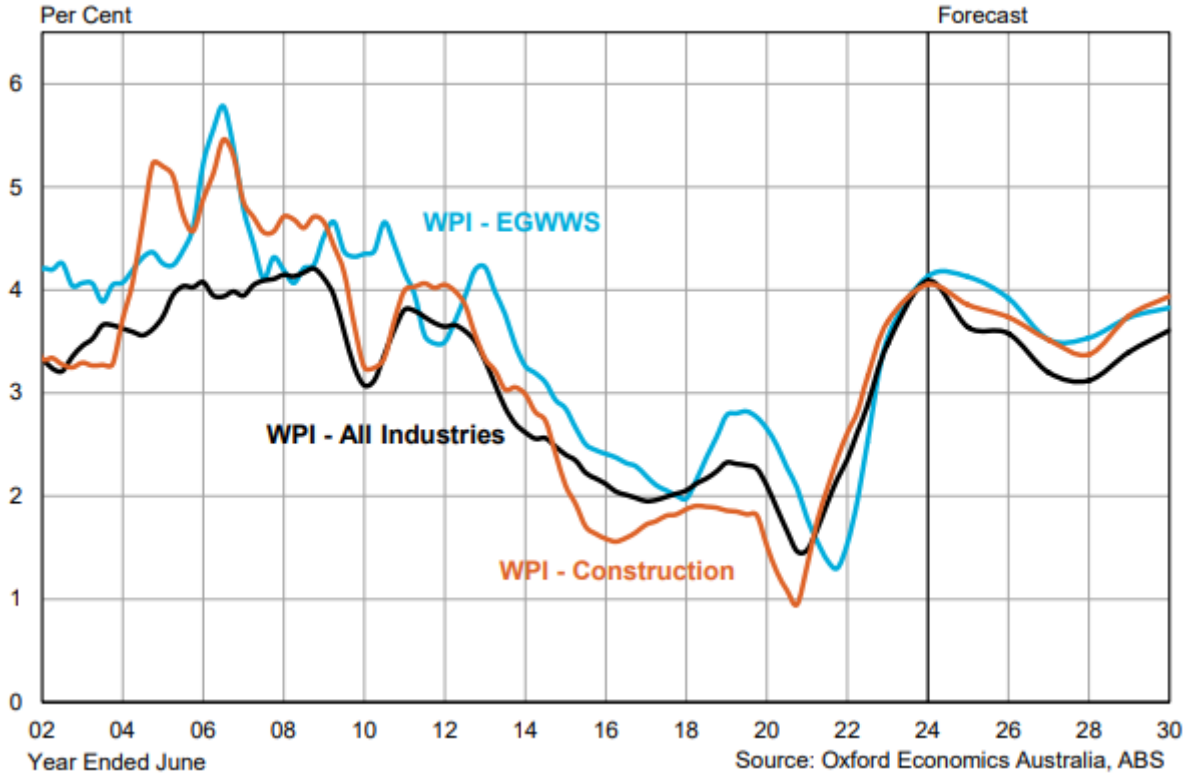
[58] SAPN - 6.2 - Oxford Economics - Labour cost esclalation Forecasts to 2029-30 - December 2024 | Australian Energy Regulator (AER)

Escalation Forecasts to 2029/30 4 remain around 4% over the next year and only rise to a peak of around 4.5% in FY26, before again tightening over the FY27 to FY30 period.

the overall national average tends to be dragged down by the lower wage and lower skilled sectors such as the Retail Trade, Wholesale Trade, Accommodation, Cafés and Restaurants, and, in some periods, also Manufacturing and Construction."

The following graph is part of the report and shows recent history and projections in Wage Price Index for Electricity, Gas, Water and Waste water services compared to "all industries.

Figure 18 Wage Price Index - Australia All Industries and Electricity, Gas, Water & Waste Services



Recommendation

Given the importance of labour considerations in ISP project costs, we recommend that the IASR utilise the labour demand forecasts provided by RACE for2030 and also consider adding a forecast for electricity sector wage price index to the IASP data set.

Matters for consultation

Do you have any feedback on the proportion of manufacturing that is assumed to be onshore, and how it may vary over time in response to state policies?

Another unknown now that there has been a change of government in the US is the extent to which the IRA measures of the previous government and other renewable energy projects in the US will be wound back? If there is material US reduction in renewable energy related manufacturing and infrastructure development, there may be some shift to increase production in Australia and there may be less pressure than now on components, reducing

costs for imported component for Australian application. A change in Australian Government to one that follows more of the new US Government approaches would also impact on investment in the energy transition. Political decisions both internationally and domestically will likely impact Australian manufacturing to a greater extent that diversity in approached by Australian jurisdictions.

End of Submission