August 2023

Transparency review report – Inputs Assumptions and Scenarios Report for the Integrated System Plan

Integrated System Plan

The Australian Energy Market Operator (AEMO) is responsible for publishing the Integrated System Plan (ISP) every two years. The ISP is a forward-looking roadmap for eastern Australia's power system that seeks to optimise consumer benefits from future investment as the national electricity market (NEM) transitions to a low carbon environment.

The ISP identifies the transmission network solutions or equivalent non-network solutions that are most likely to optimise net market benefits through the electricity system's transition to a low carbon future. AEMO identifies these investments across future NEM development scenarios over the planning horizon as the optimal development path (ODP) for the NEM, taking into account uncertainty regarding the development of the NEM. The ODP includes 'actionable' ISP projects which can be progressed through the regulatory investment test for transmission (RIT-T) process. It also identifies future ISP development opportunities such as storage or demand side developments.

Our role in the ISP

The AER provides oversight of the ISP by ensuring that AEMO's processes are robust, credible and transparent. The requirements and considerations that the AER places on AEMO's forecasting processes are specified in our Forecasting Best Practice Guidelines (FBPG) and Cost Benefit Analysis (CBA) guidelines.

The AER's forecasting guidelines require AEMO's forecasting practices and processes to have regard to the following principles:

- forecasts should be as accurate as possible, based on comprehensive information and prepared in an unbiased manner;
- the basic inputs, assumptions and methodology that underpin forecasts should be disclosed; and
- stakeholders should have as much opportunity to engage as is practicable, through effective consultation and access to documents and information.

AEMO is also required to have regard to our CBA guidelines. Our CBA guidelines aim to ensure that AEMO identifies an optimal development path that promotes the efficient development of the power system based on a quantitative assessment of the costs and benefits of various options across a range of scenarios. In undertaking this assessment, the CBA guidelines require AEMO to:

- balance the risks of premature or overdue investment to consumers;
- ensure that the ODP provides a positive net market benefit in the most likely scenario; and
- have regard to the need for alignment between the ISP and Regulatory Investment Test for Transmission for actionable ISP projects.

Transparency Review Reports

Our Review Report is required to assess the transparency regarding the adequacy of explanations used to support the inputs and assumptions to be used in the ISP. It is not intended to assess the merits of AEMO inputs, assumptions and scenarios. Rather, our role is to focus on the adequacy of AEMO's explanations of key inputs, assumptions and scenarios.

The rules require the AER to publish a transparency review of the Inputs Assumptions and Scenarios Report (IASR) and the Draft ISP. The AER published its first review of the 2021 IASR on 30 August 2021 and the 2022 Draft ISP on 7 January 2022.

Monitoring and compliance

The AER has a separate role in monitoring the ISP's compliance with our CBA guidelines. AEMO is required to submit a report outlining how its ISP has complied with our CBA guidelines. The findings in our transparency review reports have no interaction with our compliance monitoring process, and findings in this report are made independently of that process.

In addition, AEMO is required to provide to the AER a compliance report no later than 20 business days after publishing the IASR

demonstrating, amongst other things, how AEMO has complied with applicable requirements in the FBPG.

Our assessment approach

Rule requirements

The National Electricity Rules (NER) require the AER to provide our views on:[1]

1. Whether AEMO has adequately explained how it has derived key inputs and assumptions and how key inputs and assumptions have changed since the previous ISP; and
2. Key inputs and assumptions have been based on verifiable sources[2], or that AEMO has provided stakeholders with adequate opportunity to propose alternative inputs and assumptions where verifiable sources are not readily available.

The NER also requires AEMO to take actions to address any issues identified in the AER's IASR transparency review report. AEMO must provide further explanation on these issues as an addendum to the IASR; and consult on these issues in the draft ISP.

Our assessment

The NER provides limited time for the AER to review the transparency of the IASR and as such we have focused on the adequacy and verification of the inputs and assumptions that are most likely to have a significant impact on the ISP.

AEMO projects the future NEM to include technologically and geographically diverse resources, including renewable energy, long, medium and short duration energy storage, gas generation and increased transmission, including interconnection. Therefore, the assumed pace of the transition from fossil fuel sources of generation to renewable forms of generation and storage as well as the pace of electrification and the cost of the transmission that connects them to users are key inputs into the ISP modelling.

The 2023 IASR has set out the basis for the key inputs and assumptions and scenarios to be used in the draft and final 2024 ISP. Overall, we consider that AEMO has taken into account key uncertainties in the development of its revised scenario narratives and has undertaken a comprehensive assessment of the ISP parameters relevant to each scenario.

Our review concludes that the majority of AEMO's inputs and assumptions have been adequately explained and AEMO has demonstrated that it has taken into account stakeholder feedback. However, in seeking to promote the transparency of the IASR, we consider there are some aspects of the IASR where AEMO has not adequately explained how key inputs and assumptions have been derived. These matters are set out below.

Public policies

The IASR states that it has included policies that do not meet the 'public policy' requirements[3] in the NER but are expected to meet requirements of the NER and in the event these policies are not committed by the time of the final 2024 ISP, AEMO will exclude these policies and instead may include the impact of these policies in its sensitivity analysis. We expect AEMO to explain how any sensitivities would be used to inform the ODP in the event that a public policy initiative does not meet the requirements in the NER.

Value of emission reduction

AEMO states that the new emissions objective as part of the National Electricity Objective will be applied to the draft ISP. Whilst we consider this

1 NER, cl. 5.22.9

2 For the purposes of our Review we have interpreted a 'verifiable source' to be from a reputable and independent source consistent with our RIT-T application Guidelines

3 5.22.3(b) of the NER specifies that in determining *power system needs*, as it relates to a *NEM participating jurisdiction*, *AEMO* may consider a current environmental or energy policy of that *participating jurisdiction* where that policy has been sufficiently developed to enable *AEMO* to identify the impacts of it on the *power system* and at least one of the following is satisfied:

- A commitment has been made in an international agreement to implement that policy;
- that policy has been enacted in legislation; there is a *regulatory obligation* in relation to that policy;
- there is material funding allocated to that policy in a budget of the relevant *participating jurisdiction;* or
- the *MCE* has advised *AEMO* to incorporate the policy.

may be appropriate, AEMO has not provided any further information in the report. We expect AEMO to explain any inputs and assumptions that are relevant to applying a value of emissions reduction.

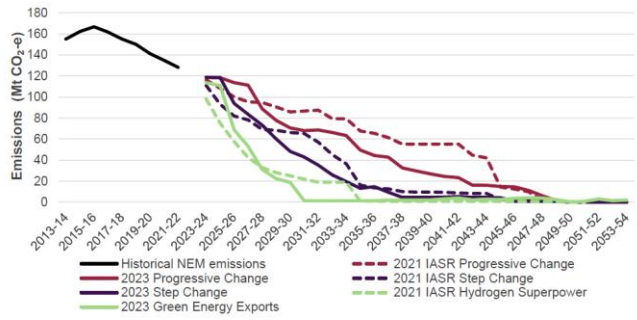
Social licence

AEMO states that it intends to include a sensitivity that explores the risks associated with 'social licence' (commonly referred to as community acceptance of a network project) such as alternative project options that reflect greater 'limitations' and higher costs to address social licence issues. We expect AEMO to explain any inputs and assumptions used to identify social licence considerations for the purposes of any sensitivity analysis.

Carbon budgets

The IASR has included assumed carbon budgets for each scenario to achieve net zero carbon emissions by 2050 (refer to Figure 1).

Figure 1 Actual and forecast NEM emission trajectories, all scenarios



The IASR provides carbon budgets for the NEM for the 2024-25 to 2029-30 period and 2024-25 to 2051-52 period. These carbon budgets have been derived from multi-sectoral modelling undertaken by the CSIRO and Climate Works.[4]

CSIRO and Climate Works estimate carbon budgets for Australia (all sectors) for the period 2021-50. They do this by estimating global carbon budgets linked to different probabilities of various temperature outcomes, translate these budgets into a carbon dioxide-equivalent budget that includes other greenhouse gases, and derive Australia's share of these global budgets.[5]

To arrive at carbon budgets for the NEM for the 2024-25 to 2051-52 periods based on the multi-sector modelling, AEMO must adjust for the different time periods and adjust the all-Australia budgets into NEM-only budgets. We consider that the IASR does not adequately explain how the NEM-only carbon budgets are derived.

We expect AEMO to provide further explanation of the assumptions used to derive the NEM-only carbon budgets.

Consumption and demand

The IASR utilises AEMO's latest assumptions and historical data used to train its models for developing electricity consumption forecasts.

Generally, AEMO updates its projections of energy consumption and demand at least annually and there are several forecast components that are updated to feed into its models.

There are a number of assumptions that we expect AEMO to provide further information on the data source or explain these assumptions.

When compared with 2021 IASR scenarios, AEMO has not clearly explained why there is less evidence of widespread electrification and therefore how this slower investment in electrification has been reflected in the updated forecasts. We observe that since the 2023 IASR was published that the Victorian Government has announced a ban on gas connections to new residential and government buildings from 1 January 2024 and expect the impact of this policy will be included in the draft ISP.

When modelling historical demand profiles, AEMO states that it samples AEMO meter data but does not specify if this data is based on basic meter data or interval meter data. We expect AEMO to clarify its data source and provide an explanation of how this is applied in jurisdictions with differing levels of interval meters.

4 AEMO, 2023 Inputs Assumptions and Scenarios Report, July 2023, pp. 42-43.

5 CSIRO and Climate Works, Multi-sector energy modelling 2022: methodology and results, December 2022, pp. 88-91.

AEMO discusses the impact that electrification has on daily and seasonal load shape, showing how electrification is likely to affect usage profiles on a winter or summer day. However, there is no example given for how electrification may affect shoulder periods including Autumn and Spring. We expect to AEMO explain why these periods do not need to be discussed.

AEMO has made certain assumptions regarding hydrogen usage by residential, commercial, and industrial users. Residential and commercial users are assumed to reach 8-10 per cent hydrogen in distribution pipelines by 2030, while industrial is forecast to reach 40-80 per cent. We observe it is not clear how industrial hydrogen will reach 40-80 per cent, and we consider this needs further explanation from AEMO.

AEMO forecasts growth in electricity connections, which is one of the main drivers of forecast electricity consumption. We consider that AEMO needs to explain the basis for the assumed growth in electricity connections. AEMO should further explain how population growth affects connection growth, as it appears that in some scenarios growth in connections is greater than population growth.

Consumer risk preferences

AEMO updated its ISP Methodology in June 2023 and included amendments providing that it may consider consumer risk preferences when using its professional judgment to select an optimal development path in the ISP.[6]

The updated ISP methodology discusses consumer risk preferences in relation to the following trade-off:

- Defer capex but incur risk of capex cost increases; or
- Bring forward capex to remove risk of capex cost increases.

AEMO has not explained from where it will source consumer risk preferences or provided further detail on how it will consider consumer risk preferences in selecting an ODP.

We expect AEMO to provide further explanation regarding any assumptions relevant to consumer preferences.

Victoria storage targets

The Victorian Government has pledged a target of 2.6 GW of renewable energy storage capacity by 2030, with an increased target of 6.3 GW of storage by 2035. The IASR has included the Victorian Government's intended storage targets in all scenarios.[7]

The IASR makes clear that the storage target applies to both short-duration and long-duration energy storage systems, and the workbook published with the IASR shows that the modelled target will include eligible large-scale energy storage including "existing, anticipated, committed, and new entrant batteries of 1hr–8hr, as well as pumped hydro of 8hr–48hr".[8] It is not clear whether or not aggregated embedded energy storages (referred to as Virtual Power Plants or VPPs) are assumed to contribute to the Victorian storage target.

We expect AEMO to provide clarification on this issue.

Concessional finance

The IASR notes that the Federal Government's Rewiring the Nation program is looking at a range of measures to support development of ISP projects and REZ developments, including $20 billion of concessional loans and equity to invest in transmission infrastructure projects.

The AEMC is currently assessing a rule change request addressing how concessional financing provided by government funding bodies should be treated within the regulatory framework when some benefits may be intended to be shared with consumers.

6 AEMO, ISP Methodology, June 2023, p. 100.

7 AEMO, 2023 Inputs Assumptions and Scenarios Report, July 2023, p. 32.

8 AEMO, 2023 IASR assumptions workbook, energy policy targets sheet.

The IASR provides that AEMO will not incorporate the impact of concessional finance in the draft or final 2024 ISP.[9]

While this approach may be appropriate, we expect AEMO to provide further explanation in the draft 2024 ISP to make explicit the reasons for this assumption.

Fuel and renewables

The fuel and renewable assumptions provided by AEMO provide modelling around gas, coal, and renewable resources. For the 2023 IASR these assumptions have been updated with forecasts that consider recent government policy extending the existing gas cap of $12/GJ.

We consider that as AEMO has assumed in other parts of the IASR that hydrogen is going to be a widely used fuel source, its price should be modelled in this section alongside other fuel sources.

Additionally, it is unclear why gas prices in Hobart are forecast to be significantly higher than the rest of the NEM. We expect AEMO to provide clarification as this is a clear outlier in its current forecasting.

Power system security

AEMO's power system security assumptions highlight changes in the various scenarios from new generation and transmission investments and how they change the scale and location of services needed for power system security.

The IASR details the unit commitment assumptions made by AEMO, with AEMO ultimately assuming that the requirement to maintain a minimum dispatch of coal-fired generation will end.

Currently for NSW, Queensland, and Victoria, AEMO applies a 'half-life' approach and assumes that the number of units required will halve in a certain number of years depending on the scenario. However, we consider this assumption has not been adequately explained given there is already a timeline for closure of several coal plants. We expect AEMO to explain the basis for the half-life approach.

Further, there is little detail discussing the assumptions regarding which power system security services will come online and when. Rather AEMO only states that they expect a mix of technologies to be delivered. We expect AEMO to explain the relevant mix of technologies that will be assumed to meet system security requirements.

Renewable energy zones (REZs)

AEMO has included a new candidate offshore REZ in the vicinity of North-East Tasmania with limited explanation.

We expect AEMO to explain the basis for the inclusion of this new zone.

Unknown risk factor for estimated transmission costs

The 2023 Transmission Expansion Options Report is an accompanying report to the IASR. In it, AEMO explains how its approach to cost estimation in the ISP deviates from the Association for Advancement of Cost Engineering (AACE) cost estimation framework.

In particular, while the AACE framework adopts asymmetrical accuracy bands to reflect the greater upside risks that projects face, AEMO adds a contingency allowance to the cost estimate that results in estimates with symmetrical accuracy bands.

AEMO explains why it has made this variation, but they do not adequately explain how it has derived the unknown risk factor. We expect AEMO to provide further explanation on this issue.

Employment factors

The IASR includes employment factors for transmission, generation and storage builds as an input to estimates for workforce requirements needed to implement the ISP.

However, AEMO has not adequately explained how it has derived these factors. We expect

9 AEMO, 2023 Inputs Assumptions and Scenarios Report, July 2023, p. 35.

AEMO to provide further explanation on this issue.

Growth in weather extremes

The IASR states that the 2024 ISP will explore adaptations to historical weather conditions to increase the frequency of weather extremes.

Whilst this may be appropriate, AEMO has not explained what inputs these adaptations will be based on. We expect AEMO to explain the basis for any adjustments to historical weather conditions.