Institute for Energy Economics and Financial Analysis
ieefa.org

91 Percy Street
Warwick, QLD 4370
aus_staff@ieefa.org

1 May 2023

To: Australian Energy Market Operator

RE: Consultation paper – Update to the ISP Methodology March 2023

Sent by email to: ISP@aemo.com.au

The Institute for Energy Economics and Financial Analysis (IEEFA) welcomes the opportunity to comment on the Update to the ISP Methodology, March 2023[1] and recognizes the large amount of work AEMO has put into the ISP process so far. The Integrated System Plan (ISP) creates one plan for the National Electricity Market (NEM), enabling coordination of energy industry stakeholders and infrastructure build, and is an important process.

Overall, IEEFA's comments in this submission include recommendations to:

- Improve the ISP's 1.5-degree scenarios – in particular to create at least one additional 1.5-degree aligned scenario
- Improve the balance of demand-side vs supply-side solutions in the ISP cost optimisation
- Provide greater clarity on the allocation of energy efficiency and electrification loads to half-hourly demand profiles
- Reconsider storage derating
- Provide further information on demand-side participation response duration
- Avoid or explain inconsistencies in gas power generation outlooks between the GSOO and ISP
- Incorporate a value of carbon emissions into the ISP methodology
- Clarify the government action required to be in line with different scenarios in ISP reporting
- Provide higher data granularity in generation results

Please see the detailed comments in the pages that follow.

Kind regards,

IEEFA Australia Electricity Team

[1] AEMO. Consultation paper – Update to the ISP Methodology. March 2023.

91 Percy Street
Warwick, QLD 4370
aus_staff@ieefa.org

Improve the ISP's 1.5-degree scenarios

Section 5.7.2 of the draft ISP methodology describes the process by which scenarios will be weighted in the final ISP.[2] This underscores the importance of stakeholders having a credible spread of scenarios to select from.

Interest in planning for a 1.5-degree future in Australia has increased significantly over the past few years.[3] We acknowledge that AEMO has included a 1.5-degree scenario in both the 2022 ISP (*Hydrogen Superpower*) and the 2023 Draft IASR (*1.5°C Green Energy Exports*). An additional 1.5°C scenario was considered for the 2022 ISP (*Strong Electrification*), but was later excluded.

Decarbonisation objectives are an important consideration for stakeholders under the Delphi process for scenario weighting. In the 2022 ISP scenario weighting process, stakeholder sentiments shifted significantly in favour of the decarbonisation scenarios after the federal government committed Australia to net zero emissions by 2050.[4] Further developments in climate policy have occurred since then, including tightening of Australia's 2030 climate commitments, and greater state commitments including in Victoria, which now align closely to the goal of limiting global temperature rise to 1.5°C.[5]

Stakeholders should be able to consider decarbonisation objectives of the scenario as part of a balanced decision, free from the confounding effect of controversial scenario assumptions.

The *1.5°C Green Energy Exports* scenario does not represent a balanced or credible central 1.5°C scenario, as it relies on bullish assumptions regarding the cost and technical barriers to hydrogen uptake. For example, it assumes existing gas pipelines can support 100% hydrogen by 2050 without consideration of costs to networks and consumers, which is unlikely given the system costs involved, the high near-term cost of hydrogen production, and the relative economics of electrification in many sectors.[6]

Uncertainties regarding a future hydrogen economy in Australia are acknowledged in Section 2.5.1 of the draft methodology and the 2022 multi-sector modelling commissioned by AEMO from CSIRO and Climateworks Centre[7] notes the relative economics of electrification as a consistent finding across scenarios.

AEMO should consider a more central, balanced 1.5°C scenario. This scenario should present an alternative technology pathway to *1.5°C Green Energy Exports,* either by focusing on

[2] AEMO. Draft ISP Methodology – For the Integrated System Plan (ISP). March 2023.
[3] For example, see Clean Energy Investor Group and Baringa. Accelerating our energy transition with a credible 1.5C scenario. 2023; ACSI. Chasing 1.5°C. 2022<; over $130 trillion global capital committed towards 1.5°C via GFANZ.
[4] See AEMO's summary of the dual Delphi panel process here, including some stakeholder commentary on the impacts of the federal announcement on scenario likelihoods.
[5] As assessed by Climateworks Centre. Also note that in the 2023 Draft IASR (p.28), *1.5°C Green Energy Exports* is the only scenario that aligns with Victoria's current climate commitments.
[6] For example, see Acil Allen. Economic and Technical Modelling of the ACT Electricity Network. 26 April 2022; CEFC. A practical guide to electrification: For new buildings. April 2022; Climate Council. Switch and save: How gas is costing households. 13 October 2022.
[7] Reedman et al. Multi-sector energy modelling 2022: Methodology and results: Final report. 2022.

91 Percy Street
Warwick, QLD 4370
aus_staff@ieefa.org

electrification as the more likely alternative to hydrogen, or presenting a technologically-neutral view where system costs of electrification and hydrogen are considered in a balanced way. This would be analogous to the way 1.8°C futures are explored via the central *1.8°C Orchestrated Step Change* with a less certain technology pathway considered in the *1.8°C Diverse Step Change*.

Another 1.5-degree aligned scenario could also be developed including very high levels of Distributed Energy Resources uptake. This would help determine the renewables, storage and transmission build required to serve operational demand in a situation where there is very high consumer uptake of rooftop PV, household storage, electric vehicles and demand-side participation.

The *1.5°C Green Energy Exports* scenario includes significant NEM-connected hydrogen export assumptions, which have not changed materially since the 2022 ISP.[8] These assumptions have little bearing on the underlying economics of other sectors in the economy, but may be highly material to the network development requirements implied by this scenario.

As such, NEM-connected hydrogen exports should be removed or significantly reduced in the core *1.5°C Green Energy Exports* scenario. The impact of hydrogen exports in the NEM would be better explored via a sensitivity analysis, following the process that is described in Section 5.7.2 of the draft ISP methodology.

Improve the balance of demand-side vs supply-side solutions in the ISP cost optimisation

In the current proposed methodology, whole-of-economy system costs and electricity system costs are optimised separately, via the multi-sector modelling and capacity outlook/time-sequential modelling, respectively. The current one-way linkage between these steps leads to a risk that the demand side and supply side are not fully cost-optimised. For instance, the capacity expansion model has no visibility over demand-side measures that could reduce the need for additional capacity at a lower cost than supply-side measures. This can lead to a bias where the ISP focuses disproportionately on supply-side measures to reduce system costs.

Page 20 of the draft methodology states that in the capacity outlook model, "Alternative technologies and non-network solutions are also considered in order to assess the most efficient approach to meet the identified need".[9] However, demand-side solutions are not considered among the listed alternatives. To address this, AEMO should:

- consider other demand-side solutions such as increased electrification or energy efficiency among the non-network solutions considered by the capacity outlook model, or
- improve the feedback interactions between the different modelling stages. For instance, by feeding back network costs from the capacity expansion modelling into the multi-sector modelling.

[8] See 2022 IASR workbook and 2023 Draft IASR workbook.
[9] AEMO. Draft ISP Methodology – For the Integrated System Plan (ISP). March 2023.

91 Percy Street
Warwick, QLD 4370
aus_staff@ieefa.org

Provide greater clarity on the allocation of energy efficiency and electrification loads to half-hourly demand profiles

Section 2.3.2 of the draft methodology states that electrification profiles in the capacity outlook modelling are "down-scaled at a temporal level based on historical electricity consumption patterns to produce half-hourly traces for loads of similar operation. For example, industrial processes follow a baseload profile, whereas residential follows a profile consistent with household gas consumption requirements."

The impact of electrification on peak demand, and hence overall network capacity requirements, is highly sensitive to the assumed load profile. Therefore, we would request that AEMO provides more detail on the half-hourly gas consumption traces used to allocate residential electrification to the half-hourly electricity demand profile.

AEMO's electricity forecasts itemise avoided load due to energy efficiency improvements. However, it is not clear in the draft ISP methodology how this avoided load is incorporated in half-hourly demand profiles. This is material, as energy efficiency savings from thermal building shell improvements are likely to reduce demand during winter and summer daily peak periods.[10] Allocating energy efficiency savings evenly across the underlying demand profile while electrification loads are added to peak periods may overestimate the increase in peak electricity demand. We therefore request AEMO provides greater detail on how these loads are allocated to the half-hourly demand profile.

Reconsider storage derating

IEEFA recommends AEMO reconsider the storage derating methodology proposed and to at least undertake extensive data gathering on this topic from storage proponents and other industry stakeholders, and publish that data in the public domain.

The 50% derating for devices with less than 2 hours duration of storage appears to be a very significant derating and IEEFA is concerned it might not represent the future behavior of battery storage projects. This derating could therefore potentially result in lower short duration storage ISP build out than optimal.

The historical behaviour of storage devices may not necessarily predict the future behaviour of those devices. For example, large-scale storage has historically gained a larger portion of revenue from Frequency Control Ancillary Services (FCAS) but according to the AEMO QED Q4 2022, battery projects gained a higher amount of revenue from energy than FCAS in Q2 2022 and Q3 2022 (though that reversed in Q4 2022).[11] The dominant revenue stream of battery projects could change in the future, meaning that battery storage value optimisation algorithms could change. Therefore, setting a blanket storage derating factor based on historical data in which behaviour was based on different value optimisations may be inaccurate.

[10] See Energy Efficiency Council. Clean Energy Clean Demand. April 2023.
[11] AEMO. Quarterly Energy Dynamics Q4 2022. January 2023.

91 Percy Street
Warwick, QLD 4370
aus_staff@ieefa.org

Further, the behavior of large-scale batteries could be quite different to that of aggregated embedded energy storages and they may require different treatment.

Provide further information on demand-side participation response duration

On page 21 of the consultation paper, AEMO proposes to "limit the daily energy contribution from the reliability-response band of DSP [demand-side participation] to a maximum of two hours of continuous operation, as this is the expected duration of typical peak unserved energy (USE) events and aligns with the duration of trigger events upon which the DSP forecast is based".

IEEFA has not seen enough justification to show that a 2 hour operation limit on DSP in the reliability-response band is the right course forward. Further information and data on this point are required. USE events of the future high variable renewable energy NEM may look quite different to past USE events, therefore limiting DSP duration based on the duration of past USE events could be fraught. DSP could have a much larger role in the future, and policy and market design could change to encourage DSP to participate much more – in all price bands. The limit on DSP proposed appears to be due to current market settings and historical USE events rather than technical capability. This may prevent modelling of some of the potential benefits DSP could deliver.

Avoid or explain inconsistencies in gas power generation outlooks between the GSOO and ISP

A common set of scenarios is presented in both AEMO's Gas Statement of Opportunities (GSOO) and ISP, which sets an expectation that these scenarios will be consistent across both reports.

Both exercises report gas power generation outlooks, with the GSOO focusing on gas consumption for power generation, and the ISP focusing on electricity generation and capacity. Assuming no significant changes in plant heat rates, it would be expected that gas consumption for power generation broadly follows gas electricity generation. This was not the case in the 2022 GSOO and ISP. The 2022 GSOO reported somewhat stable gas consumption for power generation from 2024–41 in *Step Change*, whereas the 2022 ISP reported a 344% increase in gas power generation in the same scenario over the same period (see figure below).[12]

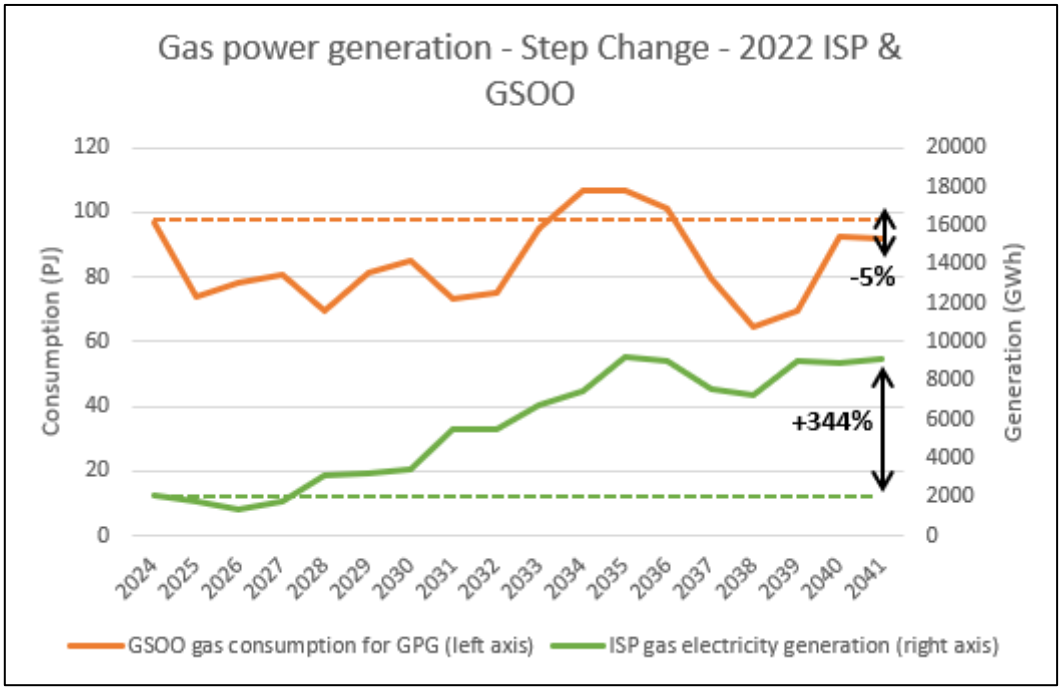
This difference may be due to the GSOO using direct outputs from the time-sequential model, compared to the ISP which draws from the capacity outlook model. Page 57 of the draft ISP methodology notes that one purpose of using the time-sequential model is to provide insights on the feasibility of the generation and transmission outlook. The effectiveness of this approach is questionable if the final iterations of the capacity outlook model and time-sequential model are depicting very different gas generation outcomes.

[12] GSOO gas consumption data is from AEMO Forecasting Portal – Gas annual consumption as at April 2023. Publication: GSOO 2022; Category: GPG; Region: All regions; Scenario: Step Change
ISP data is from 2022 ISP Generation Outlook – Final ISP Results – Step Change – CDP2 – Mid-merit gas generation + Peaking Gas+Liquids generation.

91 Percy Street
Warwick, QLD 4370
aus_staff@ieefa.org

Integration between the capacity outlook model and time-sequential model should be tightened. For instance, the NEM carbon budget should be applied to the time-sequential model as a constraint, as it is for the capacity outlook model, to avoid the time-sequential model assuming infeasible levels of coal generation in the decarbonisation scenarios.

If the 2024 ISP still depicts a discrepancy in gas power generation outcomes compared with the GSOO (we note that the 2023 GSOO still shows trends that are closer to the 2022 GSOO than the 2022 ISP), AEMO should provide commentary on why this is the case, and the relative merits of both forecasts. This is particularly material given current uncertainties around the role of gas generation in firming renewable supply.



Incorporate a value of carbon emissions into the ISP methodology

IEEFA supports AEMO's suggestion to incorporate a value of carbon emissions in the cost benefit analysis step, with the below considerations.

10. **Do stakeholders agree that the ISP methodology should be updated to be flexible in response to near-term changes to the National Electricity Objective (NEO)? If not, why not?**
    Yes.
11. **Do stakeholders agree with AEMO's proposed approach to incorporate a value of carbon emissions? If not, what alternatives should be considered?**
    Yes, with the following considerations:
    - The assumed cost of carbon should accurately reflect the economy-wide implied carbon price as it varies over time under each scenario.
    - Where possible, the value of carbon emissions should be reported in a disaggregated format, to allow readers to understand the specific abatement cost for particular investments.

91 Percy Street
Warwick, QLD 4370
aus_staff@ieefa.org

- The cost of carbon should not be used as an input to the ISP modelling in place of the current carbon budgets. It should also not be used to justify the use of carbon offsets as an alternative to decarbonising the electricity system.

Clarify the government action required to be in line with different scenarios

During the 2022 ISP process, in which the step change scenario was nominated by stakeholders as the most likely scenario, IEEFA observed that the ISP step change scenario was considered to be a 'business as usual' by some stakeholders. However, embedded in the ISP step change scenario settings were renewables and storage assumptions and forecasts that would require significant government action to be realised.

IEEFA therefore requests that in the 2024 ISP reporting that it is made very clear in the upfront messaging which scenarios do and do not require significant additional government action, and the kinds of policies and parameters that have been assumed in each scenario.

Provide higher data granularity in generation results

IEEFA requests that half hourly generation results (by technology, by state if possible; for all future years or for as many time periods as possible) be released in the 2024 ISP process. This would be a great way to increase stakeholder understanding of the NEM's requirements on shorter timeframes, and would help stakeholders understand the financial viability of various forms of generation into the future. It would enable stakeholders to do their own analysis using the ISP data, ensuring higher stakeholder alignment regarding the requirements of the future NEM.