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To: The Australian Energy Market Operator

RE: Submission on AEMO ISP Methodology Consultation (2024)

Thank you for the opportunity to provide input on draft updates to the 2026 ISP methodology.

IEEFA is an independent energy finance think tank that examines issues related to energy markets, trends and policies. The Institute's mission is to accelerate the transition to a diverse, sustainable and profitable energy economy.

We acknowledge that in this consultation, AEMO has presented one of the most significant batch of proposed updates to the ISP methodology since its inception.

We support numerous elements of AEMO's proposed updates. However, in our view, further improvements are necessary to align with the recommendations in Energy Ministers' response to the ISP review, and to ensure the greatest value is achieved from these methodology updates.

IEEFA reaffirms the need for deeper updates to the ISP methodology to allow for the optimisation of both demand- and supply-side solutions, as has also been acknowledged by Energy Ministers.

We have also made several recommendations to improve AEMO's proposal to integrate gas into the ISP, and have provided a response to selected consultation questions.

Our detailed comments are provided in the following pages. Please do not hesitate to contact us to discuss any of the matters raised in this submission.

Kind regards,

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Improving demand-side modelling in the ISP

Although not covered in this issues paper, IEEFA wishes to reinforce the recommendation that AEMO develop an approach to optimise demand-side and supply-side actions in the Integrated System Plan (ISP).

Energy Ministers have recommended that AEMO plan to optimise for the demand-side:

"The System Planning Working Group and AEMO will work with the relevant stakeholders, including DNSPs, to develop a suitable approach to trade off the cost of unlocking increasing tranches of orchestrated CER and distributed resources against other investment options for use in the earliest ISP practicable.

"The System Planning Working Group will report to the Energy and Climate Change Ministerial Council (ECMC) on progress made in implementing this approach following the 2026 ISP."[1]

We acknowledge that this is a considerable undertaking, and may not be feasible to complete before the 2026 ISP. However, we consider this to be one of the most material gaps in the ISP methodology, and development of an approach ought to start now in preparation for future ISPs.

In previous submissions, IEEFA has noted, "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 […] This can lead to a bias where the ISP focuses disproportionately on supply-side measures to reduce system costs."[2]

Below, we propose recommendations for AEMO to improve the demand-side modelling in the ISP:

[1] Energy and climate change ministerial council. Response to the Review of the Integrated System Plan. April 2024. Page 9.
[2] IEEFA. Response to AEMO consultation on updates to the ISP Methodology. 1 May 2023. Page 3.

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Recommendations to improve demand- and supply-side optimisation in the ISP	
a.	Commence development of an integrated approach to include demand-side modelling in the ISP's cost optimisation. This could include updates to the capacity outlook model to incorporate costed demand-side solutions (including energy efficiency, electrification, demand response, CER uptake, etc.) Alternatively, it could involve greater integrations between existing demand-side modelling efforts, such as the multi-sector modelling, with AEMO's capacity outlook, time sequential and/or gas supply models. If it is not possible to complete this approach before the 2026 ISP, development should nonetheless begin early in anticipation of future ISPs.
b.	Consider interim solutions to improve the representation of demand-side solutions in the ISP. Simplified solutions could address some of this gap in time for the 2026 ISP. For example, AEMO could produce a structured set of sensitivities around key demand-side parameters, identifying how these affect overall system costs, and use the findings to inform the assumptions of the core scenarios. AEMO could also consider introducing more iterations between the multi-sector model and capacity outlook model, based on an electricity and/or gas price feedback loop.

Integrating gas into the ISP

1. Do you consider that the proposal to develop a gas supply expansion model appropriately addresses the action in the Energy Ministers' response to the Review of the ISP for additional gas analysis to be incorporated in the ISP? If yes, why? If not, why not, and how could this action otherwise be achieved?

IEEFA supports several aspects of AEMO's proposed approach, including the proposal to collect greater information on the likely cost and feasibility of gas supply and infrastructure additions, and incorporate these costs into the existing gas supply model.

However, the proposed approach includes two material drawbacks:

1. **There is no proposed co-optimisation between the gas supply and electricity models**. While we recognise AEMO does not aim to optimise investments in the gas

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sector, those investments will inevitably affect the cost of electricity generated from gas. These costs therefore need to be considered when modelling a least-cost pathway for the electricity sector.

2. **Neither the gas supply nor electricity models is able to optimise for electrification uptake**. Electrification is an effective way to free up gas supplies in the event of supply constraints, and is often more cost-effective than accessing new gas supplies.[3] AEMO's existing models are unable to recognise this, which is a significant limitation.

In combination, these drawbacks are likely to increase the supply-side bias embedded in the ISP modelling approach, and lead to the risk that the ISP electricity sector projections do not adequately reflect a least-cost pathway.

In the tables below, we have recommended several approaches to address this.

Recommendations to address the lack of co-optimisation between the gas supply expansion and electricity models	
a.	Feed costs back from the gas supply expansion model into AEMO's gas price forecasts. The capacity outlook model includes fixed gas price forecasts developed for AEMO by ACIL Allen. These forecasts embed assumptions about gas demand, future gas supply costs and gas infrastructure costs.[4] IEEFA understands there is no proposed feedback loop between the gas supply expansion model and the gas price forecasts. This is a missed opportunity, as AEMO's proposed updates to the gas supply model will yield a more accurate view of the gas supply and infrastructure developments actually required under the ISP scenarios. AEMO should work with ACIL Allen to feed back the outputs of the gas supply expansion model into the gas price forecasts. It could then perform several iterations between the capacity outlook model and gas supply expansion model, until an equilibrium is reached. To make best use of these updated gas price forecasts, AEMO should also apply them to the multi-sector modelling and consider rerunning this model as part of the iterations.
or b.	Embed gas infrastructure costs in the capacity outlook model.

[3] See IEEFA. Reducing demand: A better way to bridge the gas supply gap. November 2023.
[4] ACIL Allen. Natural gas price forecasts for the Final 2023 IASR and for the 2024 GSOO. July 2023.

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	The capacity outlook model considers capital costs associated with building new generation capacity. However, IEEFA understands that associated gas infrastructure requirements are excluded from these costs. AEMO could use the information it proposes to collect on gas expansion options to estimate the additional gas infrastructure costs that would be required to build new gas generators in each region, once current supply limits are exceeded. This could then be introduced as a new cost in the capacity outlook model, allowing that model to trade off gas infrastructure costs alongside other investments in the electricity sector.

Recommendations to address the inability to optimise for electrification	
a.	Include electrification in the gas supply expansion model. IEEFA understands that the gas supply expansion model will consider a range of supply-side solutions to address any shortfall between projected demand, and current or committed gas supplies. In reality, this shortfall could be met by a combination of supply- and demand-side solutions, with a particularly strong financial case for the latter.[5] Electrification, for example, can be conceptualised similarly to supply-side solutions – as an investment that would increase the availability of gas supplies to other end users. The costs of electrification across most sectors is well-researched, and a variety of these inputs are already considered in the multi-sector modelling.[6] However, that model does not have visibility over gas infrastructure constraints. It would therefore make sense to introduce electrification as a potential solution in the gas supply expansion model, to identify the additional level of electrification that makes economical sense under any supply constraints that are identified by the capacity outlook model. This would lead to an ability to trade off supply versus demand solutions.
or b.	Introduce more iterations between the multi-sector model and other ISP models.

[5] IEEFA. Reducing demand: A better way to bridge the gas supply gap. November 2023. Page 5.
[6] CSIRO and Climateworks Centre. Multi-sector energy modelling 2022: Methodology and results – Final report. December 2022. Page 31.

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	Electrification in AEMO's demand forecasts is based on least-cost multi-sector modelling outputs from AusTIMES, which are then carried forward as fixed inputs. AEMO's in-house models are likely to yield more detailed information about electricity and gas prices than is possible within AusTIMES. However, there is no process to feed back this information to AusTIMES. AEMO could work with CSIRO to perform additional iterations between AEMO's models and the multi-sector modelling at a later stage of the ISP development process, to feed back gas and electricity prices into AusTIMES. Gas prices are an exogenous input to AusTIMES, and straightforward to update. Electricity prices are endogenous in AusTIMES, and a method may need to be developed to align these (for example, constraining the generation outcomes of AusTIMES to match those in the capacity outlook model). New electrification forecasts from AusTIMES could then be fed back into AEMO's demand forecasts, and several iterations of this process repeated until the outcomes converge.

2. Do you agree with the proposal for AEMO to develop at least one gas development projection per ISP scenario, and apply the projection as an input to the capacity outlook model? If yes, why? If not, what method would you recommend for the inclusion of gas development projections in the ISP?

IEEFA does not agree that the proposed approach will fully meet Energy Ministers' recommendations, which call for a capability "to identify and iteratively analyse the gas sector project trade-offs with electricity development needs, with the sole aim of optimising electricity infrastructure investments in the ISP".[7]

Our understanding is that AEMO's proposes to develop a gas development projection per scenario, informed by gas power generation (GPG) demand outputs from the capacity outlook and time sequential models. This gas development projection would then be reapplied in iteration as a constraint to the capacity outlook model.

The benefit of this approach is unclear – as the initial gas development projection would theoretically already be aligned with the unconstrained outcomes of the capacity outlook and time sequential models.

This does not provide a mechanism for AEMO's models to consider trade-offs between gas and electricity sector developments.

[7] Energy and Climate Change Ministerial Council. Response to the Review of the Integrated System Plan. April 2024. Page 7.

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To effectively analyse these trade-offs, AEMO's approach should involve some level of cost feedbacks between the gas and electricity sector models. Our response to question (1) suggests several approaches that would allow for this.

3. What alternative approaches should AEMO consider for enhancing the incorporation of gas in the ISP to address the action in the Energy Ministers' response?

IEEFA's response to question (1) suggests several alternative or complementary approaches that would more closely align to the Energy Ministers' recommendations.

4. What improvements could be made to AEMO's proposed approach to increase considerations of gas availability, considering gas transportation and storage capacity?

AEMO states that its gas supply expansion model will, "Consider cost-efficient gas supply and transport expansion options identified through gas industry stakeholder engagement."[8] This appears to imply a narrower engagement focus than other AEMO processes. For example, the Inputs, Assumptions and Scenarios consultation process includes a much broader range of stakeholders, beyond one industry.

While AEMO should consult with gas industry stakeholders to develop the inputs to its gas supply expansion model, it should broaden this consultation to a wider range of stakeholders, as in other processes. This will reduce the risk of bias, and will likely increase the information available to inform the model.

5. What improvements could be made to AEMO's proposed approach in its capacity outlook models to improve the representation of fuel usage for gas generation, particularly for mid-merit capacity?

IEEFA considers that the most material improvement would be to incorporate cost information from the gas supply expansion model into the capacity outlook model. This could be via fuel costs or capital costs, as discussed in our response to question (1).

IEEFA requests AEMO elaborate on its suggestion to "adapt the operation of mid-merit gas generators in the capacity outlook model to improve alignment between modelled and actual outcomes".[9] This implies that the current approach may be resulting in unrealistic outcomes – although this is not explained.

IEEFA expects that AEMO's capacity outlook and time sequential models should, in conjunction, identify the level of gas generation and capacity that is consistent with a least-cost pathway for the electricity sector.

[8] AEMO. Integrated System Plan (ISP) Methodology – Issues paper – Standard consultation for the National Electricity Market. October 2024. Page 18.
[9] Ibid. Page 20.

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Enhancement of distribution network modelling in the ISP

6. What are your views on AEMO's proposed inclusion of distribution network capabilities and their impact on CER within the ISP model? What further enhancements could be made?

IEEFA supports an increased consideration of distribution network capabilities in the ISP, and considers that AEMO's proposed approach will provide valuable planning information. However, we do not consider that this update alone meets the recommendation from the Energy Ministers' response to the ISP review.

AEMO notes that, "By inclusion in the capacity outlook model, existing capabilities and augmentation opportunities may be compared with utility-scale generation and storage options, and transmission network investment options."[10]

However, IEEFA's understanding is that consumer energy resources (CER) uptake will continue to be a fixed input into the capacity outlook model. This implies that the model would simply identify the least-cost combination of distribution augmentation options needed to meet the fixed level of CER uptake. There would not appear to be any opportunity for the model to explore trade-offs with utility-scale generation, storage and transmission.

Furthermore, IEEFA has previously observed that AEMO's forecasts may underestimate CER uptake:

"IEEFA's analysis suggests that AEMO's forecasts of rooftop solar and electric vehicle (EV) vehicle-to-grid (V2G) in the draft 2024 ISP are conservative in several respects. Therefore, DER [CER] could play an even greater role in the system than AEMO is currently estimating in its Step Change (central) scenario."[11]

If CER continues to be a fixed input to the ISP, it will be necessary to explore a reasonable range of uncertainty around CER uptake, which is driven by a range of factors beyond distribution network capabilities. One approach would be to include a "high CER" sensitivity in the 2026 ISP.

More detailed recommendations to improve CER forecasts can be found in the IEEFA briefing note: Integrated System Plan needs greater ambition on DER to be a true whole-of-system plan.

[10] AEMO. Integrated System Plan (ISP) Methodology – Issues paper – Standard consultation for the National Electricity Market. October 2024. Page 24.
[11] IEEFA. Integrated System Plan needs greater ambition on DER to be a true whole-of-system plan. May 2024. Page 1.

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Other methodology updates

7. Do you agree with AEMO's proposals to improve its hydrogen electrolyser load modelling, or have further enhancements to suggest? Please provide any supporting evidence.

IEEFA supports the proposal to disaggregate hydrogen electrolyser loads for greater clarity.

We urge AEMO to reconsider including direct hydrogen exports in the core ISP scenarios, as this is a highly speculative new load. Increasing evidence suggests that direct exporting of hydrogen does not make financial sense.[12] Furthermore, there are unresolved questions surrounding whether such projects would be connected to the NEM.

In previous submissions IEEFA has noted:

"IEEFA recommends that no direct exports of hydrogen be included in any core scenarios of the ISP, given that directly exporting hydrogen does not appear to make financial sense."[13]

"If AEMO still considers prospective direct hydrogen exports to be a useful parameter to explore, this would be best done via a sensitivity."[14]

8. What are your views on AEMO's proposal to test previously-actionable projects for actionability at the project proponent's timing within the actionable window, and at a later restart timing?

No response.

9. Do you agree with AEMO's approach to model storage devices with headroom and footroom energy reserves and imperfect energy targets in the time-sequential modelling component? What improvements should be made to model energy storage limits to better reflect actual behaviour and address issues of 'perfect foresight'? Please provide any supporting evidence.

IEEFA agrees with AEMO's intention to improve the modelling of storage devices to address "perfect foresight" issues.

While we do not have specific comments on the methodology at this stage, we would support an adaptive approach where AEMO tests the proposed methodologies to ensure they produce realistic outcomes.

For example, AEMO's observations regarding the previous approach appear to suggest an unrealistic outcome – as long winter periods with high residual demand are more likely to be predicted in advance, compared to short and sporadic periods.

[12] IEEFA. Submission to the Review of the National Hydrogen Strategy. August 2023. Page 4.
[13] IEEFA. Submission: AEMO's Draft 2024 Inputs, Assumptions and Scenarios Report (IASR) scenarios. August 2024. Page 5.
[14] Ibid.

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10. What risks should AEMO consider when assessing how inverter-based resources (IBR) can complement synchronous machines in providing system strength and cost?

No comment.

11. Do you agree with AEMO's approach for uplifting cost and modelling representation for system security services in the ISP? If not, what alternative methods would you recommend? Please provide any supporting evidence.

No comment.

12. Do you agree with AEMO's proposal to model more than two wind resource quality tranches for geographically large REZs? If not, what alternatives should AEMO consider?

IEEFA supports the proposal to increase the number of wind resource quality tranches in REZs where this makes geographic sense. The NEM is an unusually large and geographically diverse interconnected grid, and its diversity of wind and solar resources may be a material factor affecting system reliability.