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Samantha Christie
Manager Strategic Planning
Australian Energy Market Operator

Dear Samantha

AEMO's ISP Methodology Issues paper

Transgrid welcomes the opportunity to respond to the Australian Energy Market Operator's (**AEMO**) Integrated System Plan (**ISP**) Methodology issues paper that was published 23 October 2024. The issues paper commences the consultation process to review AEMO's ISP Methodology in accordance with the Australian Energy Regulator's (**AER**) Forecasting Best Practice Guidelines (**FBPG**).

We strongly support AEMO's work in the development of the ISP Methodology. The review provides an opportunity to ensure that the modelling and cost benefit analysis approaches used to prepare the ISP are fit for purpose in the context of Australia's energy transition.

Transgrid's broadly supports AEMO's work including the following key aspects:

- In-depth analysis and consideration of the distribution network capability, opportunities for consumer energy resources (**CER**) and other distributed resources. However, we acknowledge the complexity inherently involved in this level of modelling. Furthermore, developing these assumptions are highly likely to consume time and resources.
- The proposal to adjust the process of actionable ISP projects by considering the Regulatory Investment Test-Transmission (**RIT-T**) processes in the project timing. This will reflect a realistic timeframe for the completion of major projects which are complex and large in nature.

Transgrid looks forward to working with and supporting AEMO on the above points, in particular the inputs and assumptions relating to the distribution network capacity which interfaces with Transgrid's network

Our feedback on AEMO's issues paper questions is contained in the attached submission.

Transgrid is committed to working with AEMO to ensure the appropriate methods and inputs are used in the 2026 ISP. If you have any questions, please feel free to contact Jenna Connellan, Major Projects Planning Manager at jenna.connellan@transgrid.com.au.

Yours faithfully,

Kasia Kulbacka
General Manager of Network Planning

1. Transgrid responses to consultation questions

1.1. Integrating gas in the ISP

No.	AEMO Consultation Question	Transgrid Response
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?	Transgrid broadly agrees with the approach proposed by AEMO in integrating gas in the ISP. We welcome the introduction of the "Gas supply expansion model" in the ISP Methodology. This will enhance the interaction of electricity and gas planning. Transgrid encourages AEMO to clarify whether the Gas Statement of Opportunities (**GSOO**) will consider ISP planning results as an input as this will better reflect the impact conversely.
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?	
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?	
4	What improvements could be made to AEMO's proposed approach to increase consideration of gas availability, considering gas transportation and storage capacity?	
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?	

1.2. Improving demand side modelling

No.	AEMO Consultation Question	Transgrid Response
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?	Transgrid welcomes the proposed approach which is to better understand and incorporate existing and future distribution network capability and opportunity for incorporating CER and other distributed resources. However, we recognise the additional complexity this will bring to the modelling process. Transgrid would welcome further understanding of how AEMO will model the existing distribution network capability and the future augmentation capability in the Network Expansion Options Report (NEOR). We recognise that there will be multiple limitations between Transgrid and the various interconnected Distribution Network Service Provider (**DNSP**) networks. We believe that this work is in its infancy given limitations of the modelling. However we acknowledge AEMO expects this data to evolve and improve over successive ISPs. Transgrid would encourage AEMO to consider the following:

		• The network capacity of distribution resources is not only limited by the availability of bulk supply points but also triggers network expansion of the existing transmission network once large amounts of CER are connected to the distribution network.
		  • There is a requirement to understand how the distribution network hosting capacity will impact the forecast of underlying demand.
		• Network availability for CER and distribution resources is subject to the location of connection points or bulk supply points on the transmission network. Subregional models may not be granular enough to consider the augmentation required for voltage and frequency control, as well as the technical challenges of ensuring sufficient system strength and system stability.
		  • "Locational factors" should be considered when expansion options are proposed for distribution networks, noting that the same amount of extra hosting capacity in the load centres usually bring more benefit than if that extra capacity is added to other locations.
		• It is critical as an industry that we coordinate transmission network expansion with the necessary expansion of the distribution network to avoid duplication.
		  • Understanding how existing/augmented hosting capacities from various distribution zone substations in a subregion are aggregated will be required to avoid unrealistic planning results.
		• There is a risk in underestimating the cost of integrating CER and other distributed resources if network models do not include the capacity of the transmission network, space constraints, and connection requirements. Insufficient joint planning/consultation at the transmission level could lead to assumptions of the transmission network's ability to accommodate network or generation expansion in the distribution network, that would need to be upgraded at a cost.
		• The consideration of consumer preferences will be required noting that the augmentation of a distribution network may still be needed (driven by the customers' needs) even if it is not preferred in the ISP planning results.
		We look forward to collaborating with AEMO in the NEOR development process to address these difficulties.

1.3. Improving hydrogen electrolyser load modelling

No.	AEMO Consultation Question	Transgrid Response
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.	In addition to the responses Transgrid provided in the Forecasting Methodology consultation, we broadly agree with the proposed changes. Acknowledging that AEMO's hydrogen demand for exports and green steel manufacturing is based on a NEM-wide target, Transgrid proposes AEMO consider how these targets match up with the actual project pipeline for electrolysers and assess how realistic the export forecasts are, based on changing demand dynamics in the international market. We would also recommend AEMO consider the electrolyser profiles assumed are representative, given evolving tariff structures and demand from relevant sectors of the economy. Transgrid welcomes the opportunity to be provided with the assumptions AEMO will make on additional grid electrification requirements from the electrolysers and whether there are any assumptions around off-grid sources catering to energy requirements of these electrolysers.

1.4. Assessing actionability of transmission projects

No.	AEMO Consultation Question	Transgrid Response
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 re-start timing?	Transgrid supports the proposal to adjust testing at the project proponent's timing. In the proponent's proposed timing an Integrated System Plan (**ISP**) Contingent Project Application (**CPA**) is required to be assessed within 40 days, as per the National Electricity Rules (**NER**). Transgrid's experience of this process is 6 – 8 months. Using the project proponent's timing would capture this delay. Transgrid also suggests that considering the proponent's proposed timing would capture the time required to complete a material change in circumstance (**MCC**) assessment and derisking the project from planning approval delays associated with New South Wales (**NSW**) and commonwealth government requirements. We do acknowledge however, that adjusting the timing of actionable projects could introduce complexity where projects no longer meet the required needs and could be replaced by a non-network option. Transgrid recommends that the actionable window change is practical. As such, we look forward to engaging AEMO through Joint Planning in the development of the NEOR to reflect the latest information available to Transgrid's actionable projects.

1.5. Allowing a broader assessment of benefits in take-one-out-at-a-time analysis

Transgrid broadly agrees with this approach while recognising, again, this will introduce additional complexity to the process with more options required as inputs.

1.6. Enhancing selected ISP modelling approaches

1.6.1. Addressing perfect foresight for storage devices in the time-sequential model

No.	AEMO Consultation Question	Transgrid Response
9	Do you agree with AEMO's approach to model storage devices with headroom and foot room 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.	Transgrid supports the approach AEMO has proposed to take to address perfect foresight for storage devices in the time-sequential model.

1.6.2. Enhancing analysis of system security

No.	AEMO Consultation Question	Transgrid Response
10	What risks should AEMO consider when assessing how inverter-based resources (IBR) can complement synchronous machines in providing system strength and inertia?	System Strength: Transgrid would like to propose the following points for consideration on how the System Strength rule is currently applied: • Considering that available fault level (**AFL)** is dependent on the withstand Short Circuit Ratio (**SCR)** of the generator and the fact that the withstand SCR is referenced to Synchronous Fault level, not Available Fault Level, there appears to be gap for the areas of the network which have relatively low synchronous fault level and high volume of Inverter Based Resources (**IBR)** connected. This leads to a condition that in the Singe Machine Infinite Bus (**SMIB**) environment, the generator passes the SMIB withstand tests, but the network has no room to accommodate further IBR. This is while, all previous IBRs have used up the existing AFL existing in the network without compensating for the decrease in the AFL. This gap appears to be more pronounced by inclusion of the stability factor (alpha =1.2). • Transgrid is preparing a separate technical note for AEMO to reconsider the stability coefficient and will present it separately. • The current AFL methodology for system strength describes how the contribution and the effect of Synchronous and Asynchronous generators should be considered but does not explore the effect of Static Var Compensators (**SVC**s). Transgrid would welcome a recommendation from AEMO on this topic. Inertia: • Transgrid would welcome AEMO's advice on planning for the non-linearities of grid forming batteries providing synthetic inertia.

		For example, grid forming batteries appear to have a dependency on a pre-dispatched value. We support AEMO's guidance to determine how headroom is allocated, at which State of Charge, and the Rate of Change of Frequency (**ROCOF**) of the event. • Transgrid understands some Battery Energy Storage System (**BESS**) technologies which provide synthetic inertia, have shown undesired behaviour when the frequency events are associated with faults (i.e. large reduction of active power post fault). This can lead to a frequency problem if it happens at a large scale, specifically after the retirement of the large coal generators. Therefore, we propose the credibility of this technology for replacing or contributing to inertia/frequency control is assessed with a large-scale deployment of grid forming batteries studied for future years, with lower levels of coal generation. Relying on the observation of limited relatively small size batteries while there is still many large coal power plants in service may not highlight this risk. • Transgrid cautions on relying solely on the PSCAD modelling from single events to assess the inertial response, as lower levels of state of charge may limit synthetic inertia capabilities if there are multiple consecutive events. This may require additional modelling, field testing and working more closely with the OEM to better understand performance during multiple events, particularly if the BESS is at lower states of charge.
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.	Transgrid broadly supports AEMO's proposed costing and modelling approach for system security services. However, we recommend that AEMO consider the timing of ongoing RIT-Ts and the implications for the delivery timing of synchronous condensers to ensure the modelling assumes a realistic first-available date for synchronous condensers. Transgrid encourages AEMO to consider the potential for low-cost hydro units to provide system strength, where feasible, to reduce the need for coal to remain online.

1.6.3. Modelling directional renewable energy zone transmission constraints

AEMO proposes to introduce a separate REZ transmission constraint for REZ import (to be applicable only for REZs with large dispatchable loads). The $FlowFlowpath$ is excluded in this import constraint equation. Transgrid agrees this is valid for REZs that have large dispatchable load capacity less than the total REZ solar and wind generation capacity. However, if the large dispatchable load is supplied from other sources in the network, we propose considering the $FlowFlowpath$. As an example: if Snowy 2.0 pumped hydro is considered the dispatchable load of Tumut REZ, this load will need to be supplied by either SW REZ or CWO REZ solar or wind generation (outside of the Tumut REZ). Thus the flow path from CNSW to SNSW impact the Tumut REZ import.

1.6.4. Improving representation of wind resource diversity in large renewable energy zones

No.	AEMO Consultation Question	Transgrid Response
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?	Transgrid broadly agrees with accuracy enhancements via improved representation of wind resources.

2. General Transgrid comments on ISP Methodology

In addition to the questions outlined in the ISP methodology issues paper, Transgrid makes the following key points:

- We encourage AEMO to apply realistic time-based build limits to REZ and transmission developments.
- Transgrid would encourage AEMO to provide more detail on the interactions between the "Single-stage long-term (**SSLT**) model", "Detailed long-term (**DLT**) model" and the "time-sequential model" in the Final ISP Methodology paper. For example, the existing ISP methodology indicates that future variable renewable energy (VRE) is optimised in the DLT model. However, if the DLT is optimised after dividing the whole horizon into multiple steps, as indicated in the paper, how can the DLT model ensure the future VRE build-up path is optimal, that is seen from the whole planning horizon.