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Eli Pack
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Australian Energy Market Operator

Submitted via email: ISP@aemo.com.au

Dear Eli,

Ausgrid submission to the Integrated System Plan (ISP) Methodology Issues Paper

Ausgrid operates the electricity distribution network that powers the homes and businesses of more than 4 million Australians living and working in an area that covers over 22,000 square kilometres from the Sydney CBD to the Upper Hunter in New South Wales.

Ausgrid welcomes measures to improve the assessment of distribution network capabilities for customer energy resources (**CER**) and distributed resources in the ISP. Ausgrid has also supported the rule change proposal currently being assessed by the Australian Energy Market Commission (**AEMC)** to strengthen consideration of demand side factors in future ISPs.

Ausgrid appreciates the engagement with distribution network service providers (**DNSPs)** carried out to date by AEMO, in particular via the Forecasting Reference Group and the DNSP/AEMO hosting capacity working group. Ausgrid has had the opportunity to provide feedback through these forums as the ISP's methodology is developed and look forward to continuing to participate in these forums.

Key items we consider are material for improving the inclusion of distribution network capabilities in the ongoing development of the ISP Methodology are highlighted below.

- Assumptions related to gas and electricity should be consistent across the underlying modelling, testing participant inputs (refer Q3)
- Incorporating DNSP capabilities requires a higher degree of geographic and functional granularity than previously considered in the ISP, to identify the optimal development pathway for CER and distributed resources in the model (refer Q6)
- There are complex interdependencies between forecast load and distributed energy resources (including potential orchestration) on the distribution network that will need to be well understood to accurately model (refer Q6)
- As DNSP use of flexible export limits grows, AEMO will need to consider how these are depicted in the ISP model (refer Q6)
- Modelled behaviour of battery systems of various scales should be refined to better reflect real-world behaviour and limitations (refer Q9)

Our response to the ISP Methodology Issues Paper aims to address specific opportunities to enable the ISP to become more complete view of options to enable the energy transition and are set out in detail in Attachment A.

For further information on this submission, please contact Simon Moore, Senior Policy Advisor via simon.moore@ausgrid.com.au.

Yours sincerely,

Junayd Hollis
Group Executive, Customer, Assets and Digital

Attachment A:

Responses to selected consultation questions

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?

Ausgrid encourages AEMO to include demand-side variables as well as supply expansion options in its proposed approach to expanding gas consideration in the ISP.

We agree with AEMO's proposed approach for incorporating gas in the ISP, as it will assist in understanding the costs and constraints associated with gas pipeline, storage and production augmentations. However, in determining an optimal pathway for the energy system, these costs need to be understood and considered in relation to other changes in the energy system, including electrification and energy efficiency measures which may impact demand for gas. This will ensure that gas generation capacity and consumption modelling is informed by a rounded view of the market dynamics across the whole energy system. It will also ensure any interactions between gas and electricity demand as electrification increases is embedded in AEMO's modelling approach.

The inclusion of fit-for-purpose gas supply and demand modelling will help to encourage the use of consistent modelling approaches and assumptions at the energy distribution level using the ISP scenarios.[1] This is increasingly pivotal in light of recent state and territory decisions to legislate against future gas connections, and the likelihood of similar decisions in other parts of the NEM in future years.

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?

Ausgrid strongly supports improved consideration of CER and distributed resources within the ISP. Capturing these trends and opportunities in the ISP will assist in guiding the most efficient pathway through the energy transition for the energy sector and consumers.

Ausgrid recognises the engagement AEMO has undertaken on integrating distribution network capabilities and CER in the ISP model to date. This early and continued engagement will help to progress the energy sector's collective learning and understanding of these capabilities.

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[1] Ausgrid; Ausgrid submission on Jemena Gas Networks (NSW) Ltd (JGN) access arrangement proposal from 1 July 2025 to 30 June 2030 (2025-30 period); https://www.aer.gov.au/system/files/2024-10/Ausgrid%20-%20Submission%20on%20JGN%202025-30%20Access%20Arrangement%20Proposal%20-%20September%202024.pdf

The Distribution Network Is Playing an Increasingly Central Role

Ausgrid is continuing to develop our capabilities to predict where and when parts of our network will become CER constrained. Inclusion of CER and distributed resources in the ISP will assist in supporting network investments which alleviate CER constraints, particularly where those investments provide faster and more cost-effective ways of meeting system objectives than other types of energy infrastructure. At present Ausgrid's network has relatively low penetration of solar PV (approximately 15% of customers) compared to other NEM DNSPs, but PV uptake is growing rapidly. We project solar PV adoption on our grid will rise from 270,000 customers today to 430,000 customers by 2029, reaching 550,000 customers (double today's level) by 2034.

There is also scope to significantly increase the penetration of solar PV on the rooftops of commercial and industrial customers by leveraging the 25 million square metres of commercial and industrial rooftop space in our network. We are also working closely with the NSW Government to consider opportunities to connect renewable generation and storage to our network to enable a faster and lower cost transition.

Improving understanding of distribution network level opportunities will ultimately support more efficient investment decision making across the energy sector and a lower cost and impact for customers as the system transitions. This can be achieved by having the Optimal Development Pathway (ODP) in the ISP consider both distribution network generation hosting capacity and utility scale distribution connected resources.

Ausgrid broadly supports AEMO's proposed approach to incorporating distribution network capabilities in the ISP. However, we note opportunities to connect utility scale renewable generation and storage will also need to be considered when assessing the capabilities of the distribution network. We also note within each of the variables depicted in Figure 4 of the Issues Paper outlining the distribution network capabilities and opportunities for CER and other distributed resources, there will be complexities and uncertainties that will be challenging for distribution networks to provide actionable data on.

Increasing Detail of Distribution Network Modelling

To better understand the constraints faced by DNSPs (at least at key transmission connection points), AEMO will need to develop out the ISP model's ability to incorporate more detail about distribution networks. We have been working collaboratively with AEMO as part of their DNSP/AEMO forecasting group (for preparation of IASR and ISP) to increase the level of detail and strongly encourage this work to continue.

In particular, we recommend AEMO should provide further detail on how it will consider the interaction of assumptions around CER growth and distribution network capacity. When the ISP model encounters volumes of CER deployment that hit network constraints or a shortfall in generation in a NEM region, it is Ausgrid's understanding that the ISP pathway modelling will iteratively select the most appropriate investment option to unlock more generation based on the rank order of capacities unlocked and corresponding costs relevant to that DNSP and region. We understand the most appropriate investment option could be either a transmission or distribution network expansion, or a combination of both. How the ISP model addresses these pivot points will be a significant determinant of the ultimate outputs in the ISP, the efficiency of the ODP, and the costs for customers of the energy transition.

The model will also have to be able to take into account critical interdependencies between network loads and available hosting capacity. For example, the forecast hosting capacity for a DNSP is materially impacted by the take-up of data centres, customers' ability to take-up larger distribution connected DER and the ways in which flexible loads (such as EVs, hot water loads and home batteries) can be orchestrated. As the granularity of the ISP increases, the assumptions about these different technologies / use cases, and the assumed relationships between them, will become more important to model in a way that corresponds to real world behaviour. We recognise that this is likely to be an iterative process, refined over the course of future ISPs. However, it is important that the modelling architecture equips AEMO to add in layers of detail over time as more data from DNSPs and other market participants becomes available.

DNSPs are developing and expanding the use of flexible export limit (**FEL**) functionalities, which increases the ability for customers to generate for self-consumption and export to the grid at other times and improves a network's ability to manage risks arising from minimum operational demand events. We recommend that AEMO considers the impact FELs would have in its ISP modelling. It may be the case that more widespread adoption of FELs proves a more cost-effective way of enabling CER than other alternatives in the model.

The Issues Paper makes reference to cost curves that will be used to inform modelling of various aspects, including distribution network augmentations. Given the pace of change of transformation in some parts of the network and the challenges faced by transmission-connected generation resources, we encourage AEMO to give further consideration to the timing of possible network augmentation options. For example, distribution- or sub-transmission connected renewable generation or BESS projects may have a significant real-world advantage if they prove faster to develop and connect, particularly where existing capacity on distribution networks can be used. Only with a fuller understanding of the relative timings, associated with distribution- or sub-transmission developments as compared to transmission alternatives, will a more optimal picture emerge from the modelling work.

Provision of information

DNSPs will need sufficient time to process hosting capacity information required by AEMO. In Ausgrid's case, it can take up to a month to clean data relevant for its load flow simulation system analysis. This process can also be resource intensive, sometimes requiring significant manual asset checks. Some businesses may be further advanced in their internal processes, so timeframes required to meet AEMO's data requests could vary substantially across the NEM.

AEMO, to meet ISP timelines, will require data at certain points well in advance of the release of Ausgrid's Distribution Annual Planning Report.

We note discussions to-date during the AEMO/DNSP hosting capacity working group is favouring alignment of the provision of DNSP hosting capacity information with AEMO's standing data request in February. Ausgrid supports this timing as it will ensure consistency across the information provided by DNSPs to AEMO and will also provide AEMO with sufficient time to properly consider the information provided for inclusion in the cycle for AEMO's scenario planning under its Inputs Assumptions and Scenarios Report.

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.

Ausgrid supports work to refine the modelling approach to BESS of various scales in future ISPs. Energy storage will play a growing role as more variable renewable energy is deployed. More accurately reflecting its behaviour has the potential to affect the ODP.

However, with the information supplied to date by AEMO, it is difficult to judge how close an approximation of real-world behaviour will be delivered by the modelling. We encourage AEMO to provide further guidance, and to continue consultation with market participants involved in the deployment and connection of BESS at transmission, distribution and behind-the-meter scales.

In particular, we note the Issues Paper states that "In reality, battery operators make dispatch decisions with uncertainty about market conditions in future periods. The risk management involved in deciding to dispatch energy now versus missing out on a higher-price interval later leads batteries (and other short-duration storage devices) to be dispatched at lower capacity rates than perfect foresight modelling suggests – or potentially not at all, even when this dispatch may be required by the power system." This claim merits further justification and analysis. We also note that other factors may contribute to the divergence between modelled and real-world behaviour, in particular warranty terms (minimum and maximum state of change) that limit BESS utilisation.

Ausgrid supports the AEMO's proposal to model storage devices with headroom and footroom energy reserves as described in the Issues Paper. However, it is not clear how reserving proportions of available storage for use in pre-determined, near-emergency situations would "provide increased flexibility" as the Issues Paper states. We would welcome further clarification from AEMO on what it means by "increased flexibility" in this context and how it ties in with imperfect foresight modelling.

Ausgrid is interested in the development of AEMO's proposed concept of "energy planning with error", which would "apply imperfect assumptions of generator outages, renewable energy availability and demand conditions to the short-term energy plan that influences storage operation". Further detail is needed to understand how this concept would be applied, particularly as it is unclear how AEMO proposes to model the interplay between "energy planning with error" and "increased flexibility" in its future work.

We also note an outstanding issue with respect to BESS modelling deriving from AEMO's 2023 Inputs Assumptions and Scenarios Report. We recommend a change in approach so that battery storage degradation is no longer applied on an aggregated basis of 16% over

20 years, but instead factors in the age of individual BESS units within the system.[2] This adjustment would more accurately reflect the condition of batteries of different ages within the model.

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

Ausgrid sees limited risk from the assessment of IBR in providing system strength and inertia services. Ausgrid is connecting increasing volumes of load with grid-forming inverters, including the <5MW BESS systems being deployed under the Commonwealth Government's Community Batteries for Household Solar program.

The impact on system strength from the distribution network on the transmission network will likely be small. Grid forming inverters, being self-remediating, are not considered in system strength calculations. Grid forming inverters can also operate at much lower short circuit ratios.

Grid following inverters rely on system fault levels (typically >3 times the inverter rating) to operate correctly. Any complimenting benefit would fall back to the grid forming IBRs, which need to overcome network and transformer impedances with fault current that is also limited by the inverter.

Ausgrid welcomes further work to develop understanding of the impacts of transmission-connected IBRs on system strength and security. However, due to the low risk of spillover effects from the distribution to transmission system, we consider modelling of IBR on the distribution network is not needed.

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.

See response to Question 10.

[2] AEMO; *2023 Inputs, Assumptions and Scenarios Report*; https://www.aer.gov.au/system/files/2023-11/2023%20Inputs%20Assumptions%20and%20Scenarios%20Report_1_0.pdf; p. 113