

Dear ISP Planning Team,

RE: Optimising the Optimal Development Path via Distribution-Level Augmentation

EcoJoule Energy welcomes the opportunity to provide feedback on the Draft 2026 Integrated System Plan (ISP). We specifically commend AEMO for its inaugural inclusion of distribution network development opportunities and the Demand Side Factors Statement. These reforms rightly recognise that in Australia's edge-dominated grid, distribution systems must be treated as active levers in national planning rather than passive interfaces.

As an Australian leader in grid-edge power electronics aimed at increasing CER hosting capability at the lowest cost, EcoJoule's submission focuses on the critical trade-off between centralised transmission reinforcement and targeted distribution-level enhancement. Our central contention is that current ISP modelling—while heading in the right direction—significantly underestimates the immediate, low-cost potential of solid-state voltage support and coordinated distributed storage.

Key Highlights of our Submission:

1. Improving the hosting capability of distributed CER requires solutions focused on the grid edge, where the primary constraints occur. No amount of transmission reinforcement will solve grid-edge voltage problems, which currently constrain rooftop solar.
2. Closing the Information Gap: We note that while DNSPs have provided robust data on thermal limitations, there remains a significant data gap regarding voltage-driven export limits. This asymmetry causes the ISP to structurally understate the value of technologies like STATCOMs, which operate precisely at this voltage constraint interface.
3. Actionable Evidence from NSW: We urge AEMO to integrate the findings of the NSW Distribution System Plan (DSP), which identifies up to \$4.3 billion in value that can be unlocked through better utilisation of existing sub-transmission and distribution capacity.
4. Cost-Efficiency of the "Edge": Our analysis demonstrates that specialised solid-state voltage management can enable incremental hosting capacity at approximately \$250k–\$300k per MW. This is materially below the generic optimisation benchmarks currently utilised in ISP modelling and represents a highly efficient hedge against the rising costs and delivery risks of large-scale transmission projects.
5. Enabling the "Triple-Growth" Trajectory: We recommend that the Final ISP include sensitivities that account for the potential to double or even triple current rooftop PV capacity (leveraging the estimated 179 GW of technical potential) through the removal of distribution-level bottlenecks.

Australia's world-leading rooftop PV penetration requires "Edge Solutions for Edge Constraints." By elevating distribution network development to a "first-class" option in the least-cost development path, AEMO can deliver a more resilient, lower-cost system that achieves near-zero curtailment for Australian consumers.

We would welcome the opportunity to discuss our technical data and cost-down benchmarks with the ISP modelling team to support the finalisation of the 2026 report.

Yours sincerely,



Dr. Mike Wishart
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Submission: Response to AEMO Draft 2026 Integrated System Plan (ISP)

To: Australian Energy Market Operator (AEMO)

From: EcoJoule Energy

Date: 11 February 2026

Subject: Elevating distribution system opportunities and edge-of-grid constraints as core levers in the least-cost plan

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Executive Summary

EcoJoule Energy welcomes the Draft 2026 ISP's explicit inclusion of distribution network development opportunities and a Demand Side Factors Statement. These reforms recognise that distribution systems are *active levers* in planning, not passive interfaces between consumers and transmission.

Australia's electricity grid is unusually *edge-dominated* — with more than **26.7 GW of rooftop solar installed** across over 4 million systems, contributing more than **12–15% of total generation** and driving minimum demand conditions and hosting capacity constraints at the distribution level.

Voltage excursions and export limitations on low- and medium-voltage networks are primarily local phenomena that cannot reliably be resolved through centralised transmission reinforcement alone. These constraints must be addressed at the grid edge using targeted distribution enhancements and modern control technologies.

EcoJoule supports AEMO's finding that distribution network development can reduce PV curtailment to near zero and notes that ~\$160m of voltage management optimisation may unlock additional CER hosting capacity. However, key data gaps (particularly in voltage export limits) and emerging evidence from Distribution System Plans (e.g., NSW DSP value estimates) suggest material upside beyond current ISP quantification.

Section 5 highlights that *solid-state voltage support devices, such as STATCOMs, offer modular, cost-competitive tools to expand hosting capacity and improve network performance, but are currently under-represented in ISP modelling.*

To strengthen the Final ISP, EcoJoule recommends:

1. Treat distribution network development as primary options in the least-cost development path.
2. Integrate Distribution System Plan outputs into ISP scenarios.
3. Enhance distribution constraint data and modelling of voltage-driven limits.
4. Test sensitivities which enable materially higher rooftop PV growth (including doubling or tripling trajectories) alongside storage and dynamic export solutions.

1. AEMO's expanded distribution focus is timely - and should be strengthened in the Final ISP

EcoJoule supports AEMO's response to the National Electricity Rules change requiring explicit consideration of distribution network capabilities and demand-side factors. The Draft ISP's treatment of distribution network development opportunities is a meaningful step toward end-to-end system planning.¹

However, the Draft ISP also makes clear that this first iteration uses simplified representations and incomplete datasets for distribution constraints - especially for voltage-driven export limits. EcoJoule encourages AEMO to treat the draft distribution results as a lower bound, and to use the 2026 cycle to establish a durable process for integrating DNSP data (and distribution system planning outputs) into the ISP framework, most importantly, including voltage-driven constraints.²

2. The NSW Distribution System Plan provides actionable evidence of distribution-level value

The NSW DSP Opportunities Report estimates \$2.0–\$4.3 billion of value can be unlocked across scenarios by: (i) better using existing sub-transmission and distribution capacity (including distribution-connected generation, mid-scale solar and distribution batteries that can defer augmentation), and (ii) improving coordination of CER (rooftop PV, batteries and EVs).³

The report also documents material cost overruns and delays affecting major NSW transmission and transition projects. This is not an argument against transmission investment; rather, it reinforces why the ISP should fully value complementary distribution options that can provide a buffer to delivery risk and reduce reliance on any single critical path.⁴

EcoJoule recommends AEMO explicitly reference the NSW DSP in the Final 2026 ISP and, where feasible, use DSP outputs to parameterise and validate distribution-level options in ISP sensitivities (and, in future cycles, candidate actionable projects).

¹ See Bibliography: 11 and 1 (p. 24).

² See Bibliography: 2 (pp. 16–17).

³ See Bibliography: 3 (pp. 32–35).

⁴ See Bibliography: 3 (pp. 4, 24) and 1 (p. 24).

3. Edge constraints require edge solutions

A defining feature of the Australian market is the scale of rooftop PV and other CER connected to the distribution network. With millions of systems installed, rooftop PV shapes operational demand, minimum-demand conditions and hosting capacity constraints in ways that are more pronounced than in most international power systems.⁵

The constraint experienced by consumers is often a local export limit driven by voltage rise and sometimes thermal limits on low-voltage feeders, service cables and distribution transformers. Flexible export limits are one of several tools DNSPs can use to manage network hosting capacity while remaining within operational limits, improving utilisation of existing assets and reducing curtailment.⁶

Other tools include voltage control devices such as STATCOMs, voltage regulators and the like. Australia's geography amplifies this. The distribution system spans far more power line-kilometres than the transmission system (AEMO reports ~764,000 km of distribution lines compared with ~44,000 km of transmission lines), including many long, radial feeders. In such networks, upstream transmission reinforcement may have little or no effect on the binding constraint at the customer connection point. This is why edge problems cannot be solved by "centre" investment, and why the ISP must treat grid-edge solutions as a core part of the least-cost plan.⁷

4. Distribution enhancement can reduce total system costs and hedge delivery risk

EcoJoule's central proposition is that distribution system enhancement can often be more technically effective and cost-effective than transmission expansion for addressing edge-driven constraints, reducing curtailment, and enabling additional CER. These investments can also defer or reduce upstream augmentations by increasing utilisation of existing assets and managing peaks locally.⁸

Technology trends strengthen the case. Many grid-edge solutions rely on modular power electronics, communications and software control with shorter deployment cycles than large, linear builds. Global evidence shows rapid cost reductions in key power-electronic components: the IEA reports solar PV module spot prices declined by almost 50% year-on-year in 2023, and long-run PV system benchmarks show module prices have fallen by roughly 90% since 2010. These dynamics support sensitivity testing of plausible

⁵ See Bibliography: 5 and 10.

⁶ See Bibliography: 4 and 2.

⁷ See Bibliography: 1 (p. 28).

⁸ See Bibliography: 2 and 1 (p. 24).

cost-down trajectories for electronics- and software-enabled distribution solutions in the ISP.⁹

5. Solid-State Voltage Support (STATCOMs) as a Distribution Planning Instrument

Static synchronous compensators (STATCOMs) represent a class of fast-acting, modular, solid-state voltage support devices particularly suited to radial distribution feeders with high rooftop PV penetration, as commonly found in Australia.

Similarly, the UK energy regulator Ofgem has signalled in 2025 that *provision of network services* such as reactive power and voltage support merits stronger regulatory recognition and may warrant a licensable framework as part of evolving grid service markets - reflecting the growing importance of such services in high-renewables systems worldwide.¹⁰

Australia's edge-dominated network characteristics - millions of rooftop systems connected to long low- and medium-voltage feeders - mean that voltage rise, rather than thermal capacity, is frequently the binding constraint on export capability. Appendix A9 of the Draft ISP notes that DNSPs provided more complete data on thermal limits than on voltage-driven export constraints. Where voltage data are incomplete, modelling necessarily understates the value of technologies that directly expand voltage headroom.

STATCOMs operate precisely at this constraint interface. Installed at feeder or low voltage level, they provide dynamic reactive power support that mitigates voltage excursions during high export conditions. Unlike upstream transmission reinforcement, which may reduce bulk impedance but does not materially alter voltage rise along long LV feeders, low voltage feeder-level voltage support acts directly at the point of constraint.

AEMO's modelling references a broad distribution optimisation benchmark of approximately \$400/kW. Indicative deployment benchmarks for solid-state feeder voltage support suggest incremental hosting capacity can be enabled in the order of ~\$250 - \$300k per MW, materially below generic optimisation cost assumptions. While exact economics will vary by topology, this suggests a potentially lower-cost pathway to achieving AEMO's identified ~3.5 GW additional export opportunity.

Importantly, STATCOM deployment is modular and scalable. Devices can be rolled out incrementally, targeted to the most constrained feeders, and deployed on shorter timelines than major transmission works. In a context where transmission cost estimates have increased and delivery risks are material, such modular distribution instruments provide valuable optionality and risk hedging within the least-cost development path.

⁹ See Bibliography: 8 and 9.

¹⁰ New Power, "Ofgem opens consultation on whether to make grid service provision a licensable activity", April 3, 2025

For these reasons, EcoJoule recommends that AEMO:

- Expand the technology set within “distribution network development opportunities” to explicitly include solid-state voltage support devices;
- Work with DNSPs to improve voltage-constraint datasets to better quantify hosting capacity unlocked by reactive support; and
- Test sensitivities where feeder-level voltage support materially increases rooftop PV hosting capacity alongside dynamic operating envelopes and coordinated storage.

6. “Solar de-bottlenecking” should be framed as enabling additional rooftop PV, not only removing constraints on present exports

EcoJoule supports AEMO’s modelling of voltage management optimisation and additional CER exports. However, if distribution-level constraints are relieved, benefits are not limited to better utilisation of today’s installed base: improved export capability can unlock materially more rooftop PV investment.¹¹

A CEFC and Property Council analysis estimates Australia is currently using around 5% of available roof space and has a technical potential of about 179 GW of rooftop PV. Compared with today’s installed rooftop capacity (around 26 GW), this indicates the installed base could plausibly double or triple over time if distribution hosting capacity and export settings allow it. EcoJoule therefore recommends a sensitivity in the Final 2026 ISP in which distribution enablement supports materially higher rooftop PV uptake (including potential doubling or tripling trajectories) alongside dynamic operating envelopes and coordinated storage.¹²

Conclusion

EcoJoule supports the Draft 2026 ISP’s expanded distribution focus and encourages AEMO to further elevate distribution network development opportunities in the Final ISP. Australia’s world-leading rooftop PV penetration means that distribution-level constraints - and the tools to address them - are now central to the least-cost pathway.¹³

By incorporating Distribution System Plans (starting with the NSW DSP), improving distribution data inputs, and testing higher yet plausible CER growth sensitivities, the ISP

¹¹ See Bibliography: 2 (pp. 25–31).

¹² See Bibliography: 7 and 6.

¹³ See Bibliography: 1 and 2.



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can better identify solutions that are faster to deploy, lower risk, and lower cost for consumers.¹⁴

¹⁴ See Bibliography: 3.

Bibliography

1. AEMO. Draft 2026 Integrated System Plan (v1.1, 8 Jan 2026).
<https://aemo.com.au/-/media/files/major-publications/isp/draft-2026/draft-2026-integrated-system-plan.pdf> (accessed 11 Feb 2026).
2. AEMO. Draft 2026 ISP Appendix A9: Demand Side Factors Statement (10 Dec 2025).
<https://aemo.com.au/-/media/files/major-publications/isp/draft-2026/a9-demand-side-factors-statement.pdf> (accessed 11 Feb 2026).
3. Ausgrid; Endeavour Energy; Essential Energy. Distribution System Plan Opportunities Report (NSW DSP) (v1, Nov 2025).
<https://d2s3n99uw51hng.cloudfront.net/static/DSP%20Opportunities%20Report-v1.pdf> (accessed 11 Feb 2026).
4. AER. Export limit guidance note (Final, 23 Oct 2024).
<https://www.aer.gov.au/industry/registers/resources/guidelines/export-limit-guidance-note> (accessed 11 Feb 2026).
5. ABS. Household solar electricity generation in the Australian national accounts (2025).
<https://www.abs.gov.au/articles/household-solar-electricity-generation-australian-national-accounts> (accessed 11 Feb 2026).
6. Australian Energy Council. Solar Report – Quarter 1 2025 (State of Solar in Australia).
<https://www.energycouncil.com.au/media/xlzd5qrl/solar-report-q1-2025.pdf> (accessed 11 Feb 2026).
7. CEFC & Property Council of Australia. How much rooftop solar can be installed in Australia? (June 2019).
<https://www.cefc.com.au/insights/market-reports/how-much-rooftop-solar-can-be-installed-in-australia/> (accessed 11 Feb 2026).
8. IEA. Renewables 2023 – Executive Summary (2023).
<https://www.iea.org/reports/renewables-2023/executive-summary> (accessed 11 Feb 2026).
9. NREL. Documenting 15 Years of Reductions in U.S. Solar PV System Costs (2024; published 2025). <https://docs.nrel.gov/docs/fy25osti/92536.pdf> (accessed 11 Feb 2026).
10. IEA PVPS. National Survey Report of PV Power Applications in Australia 2024 (2025).
https://iea-pvps.org/national_survey/nsr-australia-2024/ (accessed 11 Feb 2026).
11. AEMC. Improving consideration of demand-side factors in the ISP (information sheet, 2024).
https://www.aemc.gov.au/sites/default/files/2024-12/erc0396_info_sheet_-_improving_consideration_of_demand-side_factors_in_the_isp.pdf (accessed 11 Feb 2026).
12. New Power, "Ofgem opens consultation on whether to make grid service provision a licensable activity", April 3, 2025,
<https://www.newpower.info/2025/04/ofgem-opens-consultation-on-whether-to-make-grid-service-provision-a-licensable-activity/>