Via email to ISP@aemo.com.au

23 June 2025

Submission: AEMO Draft Gas Infrastructure Options Report

The Future Fuels Cooperative Research Centre (FFCRC) welcomes the opportunity to provide feedback on the Draft Gas Infrastructure Options Report (the Draft Report).

Future Fuels Cooperative Research Centre is the industry focussed Research, Development & Demonstration (RD&D) partnership enabling the decarbonisation of Australia's energy networks.

The FFCRC fully supports the opening statement in the Draft Report that *"Integrating gas development projections into the Integrated System Plan allows for more comprehensive analysis underpinning the optimal development path for the National Electricity Market."*

Over the last seven years, the FFCRC has led the development of techno-economic modelling projects and capability to support the integration of gas and electricity planning in Australia, with a key focus on the decarbonisation of energy networks.

Our modelling has focused extensively on the transmission and long duration energy storage (LDES), and it has been pleasing to see FFCRC's work in this area gain recognition the Global Power System Transformation (G-PST) Research Roadmap for Australia, a collaboration between CSIRO, AEMO, University of Melbourne and others.

New FFCRC research on Hydrogen Energy Storage Systems now publicly available

It is particularly well-timed that this consultation coincides with the release of our latest project's (RP1.1-07) final report Long Duration Energy Storage: Techno-economics and provision of reliability and resilience to the NEM. This 144-page report can be accessed via the link provided and is the outcome of over 18 months work by FFCRC researchers at the University of Melbourne. A five page summary report is attached as an Appendix to this submission.

In summary, RP1.1-07 stress-tests AEMO's 2024 ISP using comparable zero-emissions LDES technology case studies and advanced modelling techniques that not only replicate the 2024 ISP operational modelling but also introduce the additional granularity and foresight needed to evaluate both current NEM benefits and the enhanced reliability and resilience provided by LDES.

Of key relevance to this consultation is that this work demonstrates that both Hydrogen Energy Storage Systems (HESS) and Pumped Hydro Energy Storage (PHES), when deployed in strategic locations, have distinct

merits and can coexist synergistically—particularly when assessed across a broad set of metrics, including reliability and resilience.

Key report findings that are also critical to consider in the context of gas infrastructure options and supporting the integration of gas planning into the ISP are:

- Australia has suitable underground geological formations—particularly depleted gas reservoirs (DGR) —located near the high-voltage (HV) transmission network for large-scale HESS deployment.
- Under the projected generation, storage, and transmission expansion plan in AEMO's 2024 ISP, the levelised return on equity (LROE) analysis in this report indicates that HESSs incorporating DGRs in strategic locations such as Victoria and Southern Queensland may be able recover their costs within the first 20 years of operation exclusively through participation in the wholesale NEM.
- Due to their strategic locations, the Otway-Mortlake HESS in Victoria and the Roma-Kogan HESS in Southern Queensland (the HESS-VIC-QLD-4GW scenario) could significantly enhance resilience by maintaining reliability during extended VRE droughts.
- If a severe VRE drought event similar to that of May 2024 occurs during periods of high residual demand—such as in winter—the NEM, under both the HESS-VIC-QLD-4GW scenario and the projected generation, storage, and transmission expansion in AEMO's 2024 ISP, may not be resilient. This suggests that additional firming and backup generation should be planned—particularly in Victoria and Queensland—beyond what is projected in AEMO's 2024 ISP and in this report, to hedge against events like the one in May 2024.

HESS based on DGR merits consideration as a gas infrastructure option

After extensive research the FFCRC considers DGR to be the most promising option for large-scale underground hydrogen storage (UHS) in Australia, due to their large prospective storage capacities and proximity to high-voltage electricity transmission infrastructure, ports, and potential hydrogen production centres.

Although at a lower technology readiness level than salt caverns, many projects worldwide are currently demonstrating the feasibility of storing large volumes of hydrogen in DGR. FFCRC research has already concluded that despite being a well-established technology, salt caverns do not currently appear to be a suitable UHS option for Australia due to their likely remote locations.

While UHS in salt caverns is noted in the Draft Gas Infrastructure Options Report and supporting consultant documents, there is not any mention nor inclusion of UHS in DGR. Our attached report provides useful techno-economic information and analysis to support the consideration of HESSs that incorporate UHS in DGR.

FFCRC supports HESS based on DGR as warranting consideration and inclusion in AEMO's ISP as a long-duration storage option alongside pumped hydro storage, due to their potentially lower capital expenditure and strategic siting, which may enhance system reliability and resilience.

Specifically in response to Consultation Question #6 regarding further options to be considered in the Draft Report, HESS based on DGR should be examined as an additional gas infrastructure option, particularly in extension from the generic sourced options already noted in Appendix A2 (Table 5):

- "Dedicated hydrogen pipeline",
- "Storage pipeline",
- "Underground storage – depleted field".

The FFCRC does not have any further specific responses to the Draft Report's consultation questions, other than Question #6 above.

Evolving to advanced optimisation-based market dispatch modelling in Australia

A relevant key finding that has much broader significance than this consultation, is that the projected generation, storage, and transmission capacities in AEMO's 2024 ISP may not be sufficient to maintain reliability in the NEM through to 2050. This is specifically related to reliability modelling during wind lull events (or Dunkelflaute events).

Overall, the modelling capability developed by the University of Melbourne under the RP1.1-07 project underscores the need for advanced optimisation-based market dispatch modelling frameworks that can adequately evaluate and quantify the potential benefits, as well as the challenges, risks, and opportunities that different types of LDES systems offer to the NEM or other electricity networks and markets.

We appreciate the engagement that AEMO has had with FFCRC researchers to share some earlier insights from this project. The FFCRC research program concludes at the end of this month, and given there has been a significant body of knowledge acquired over the last seven years, we would also appreciate the opportunity to meet with AEMO staff to discuss our latest findings from this project and more broadly across the program.

If you would like to discuss any aspect of this submission please contact myself at david.norman@futurefuelscrc.com or Benjy Lee at benjy.lee@futurefuelscrc.com

Yours sincerely,

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About the Future Fuel CRC

Future Fuels Cooperative Research Centre is the industry focussed Research, Development & Demonstration (RD&D) partnership enabling the decarbonisation of Australia's energy networks.

We work with our partners in a collaborative and connected research community embracing industry, academia and government to:

- Focus on the future of a crucial sector of the Australian energy economy.
- Deliver the full potential of low-carbon fuels in the energy supply mix.
- Find safe and reliable solutions to repurpose existing infrastructure and develop new infrastructure to transport future fuels.
- Inform coordinated national policy and regulation associated with low carbon fuels.
- Protect and extend the reliability and safe operative life of energy infrastructure.
- Enable the structures, protocols and linkages to maximise the value of global low carbon fuel developments for Australia.

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