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Ms Marteena Mckenzie
Senior Stakeholder Engagement Advisor
L 2 - 20 BOND Street,
Sydney
NSW 2000
By email: ISP@aemo.com.au.

1st February 2022

Dear Ms Mckenzie;

Re: Feedback on AEMO Draft ISP 2022.

I recently wrote to the Australian Energy Regulator regarding media statements on the Draft AEMO ISP 2022 released in December.

Since the content of my letter is very relevant to the Draft ISP, I attach a copy of my submission to the AER for AEMO consideration. A copy of the full report referred to can be downloaded from the following link: Decarbonised Electricity - *The Lowest Cost Path to Net Zero Emissions*

Yours faithfully

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Dr Liz Develin
CEO – Australian Energy Regulator
GPO Box 3131,
Canberra
ACT 2601

28 January 2022

Dear Dr Develin,

Re: Integrated Strategic Planning for net-zero emissions from electricity generation

A recent article in the Australian Financial Review (10th Jan 2022) noted the AER had raised queries in relation to the draft AEMO Integrated Strategic Plan (ISP) 2022 released last month for consultation.

In this letter, I wish to:

a) support those AER queries by providing additional modelling evidence for concerns regarding the approach and assumptions implicit in the Integrated Strategic Plan 2022.
b) recommend that regulators require modelling for planning purposes to target and demonstrate "lowest total system cost" optimisation for future electricity asset portfolios.

It is important to acknowledge, the draft ISP 2022 places high priority on new and larger interconnectors to secure a reliable grid. This is an important recommendation that takes account of a grid transforming rapidly to manage an increasing amount of intermittent electricity generation.

The AEMO ISP 2022 however, does not pay sufficient attention to minimising costs to the consumer. A lowest 'total system" cost delivers the lowest cost electricity to consumers.

The ISP 2022 excludes consideration of technologies that can deliver a Lowest Cost System

Several studies[1,2,3] have shown that technologies such as fossil fuel with carbon capture and storage (CCS) and nuclear will be essential to a reliable low cost low emissions electricity system. Yet, these assets do not feature in the ISP "most likely" scenario.

[1] Decarbonising Electricity – The lowest cost path to net zero emissions
[2] What happens when we add big infrastructure to the NEM?
[3] Decarbonising the NEM - A Policy Advice Paper for Achieving Net Zero

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The ISP 2022 does not demonstrate the value of life extension and decarbonising existing power generation assets with CCS. It summarily dismisses likelihood of new fossil fuel+CCS assets on the basis of their levelized cost and long asset life![4] This is irrespective of their value to minimising the cost of a future system.

In an ISP extending over 30 years, nuclear is unreasonably excluded on the basis of current policy settings – taking no account that such settings could well be changed in the forecast period.

Due to the complex natures of grid engineering, market design and policy priorities - a lowest cost reliable and affordable system must include in it some of these more expensive power generation technologies for the grid services they deliver. These essential assets will require deliberate deployment actions.

The scenario planning strategy used by AEMO does not bring low emissions technology options like fossil fuel+CCS and nuclear into their consideration. Modelling assumptions and algorithms exclude these technologies either because of prevalent state and federal policies or on the premise they represent a less than acceptable return on investment to investors on a levelised cost basis.

The ISP 2022 is also not transparent regarding how it forecasts future electricity market design changes and the new behaviour it might generate by investors. It is most likely that any market will drive to maximise returns to investment and not necessarily deliver an optimised low emissions asset portfolio. Markets by their nature do NOT minimise costs to consumers. This latter objective cannot be achieved if those technologies that deliver a lowest cost system are excluded from planning and deployment.

Comparison of ISP 2022 output with Lowest System Cost optimisation for net-zero emissions.

Table 1: Comparing outcomes from Low Emissions Power Generation Asset Portfolios using MEGs[5]

Year 2050	**AEMO ISP 2022 Portfolio**	**System Cost Minimised Portfolio**
Emissions (kg/MWhr)	Net Zero	Net Zero
Unserved Demand (hours)	66	0
Cost Index ($/yr)	5512	4500
RE Curtailment (TWHrs)	127	3
Key Assumptions		
Fossil fuel + CCS and Nuclear Technology	Not available	Available
Energy storage access	Unconstrained	Constrained
Grid Interconnection	As Planned with additions	Unconstrained

To a first approximation the Table 1 compares two hypothetical power generation asset portfolios. One constituted from the ISP 2022 Step-Change Scenario - identified as “most likely” and the other, a portfolio

[4] AEMO IASR 2021 – Table 21
[5] Electricity System Model (modelling.energy) last accessed 27 January 2022

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minimised for total system cost using published system cost modelling methods[6,7,8]. On just about every metric, *the optimised portfolio shows delivery of net-zero emissions at much lower cost - 23% lower in this case.*

It is recommended that regulators require modelling for planning purposes to target and demonstrate "lowest total system cost" optimisation. The methods should not exclude those technology options that are necessary for lowest system cost to consumers.

Grid Design for Energy Storage in Climate and Renewable Droughts

Large quantities of energy storage are necessary to operate a low emissions grid with high penetration of intermittent renewable energy. Any addition of energy storage whether pumped hydro, batteries or hydrogen will benefit such a grid system. However, it comes at a cost that must be included in any system cost minimisation.

There is insufficient consideration of "climate drought" versus a "renewable energy drought" in the draft ISP 2022. The issue for energy storage is one of maintaining sufficient supply to service periodic drawdown to help bridge periods (several days) of deep wind droughts. This becomes crucial over years when rainfall replenishment is limited by climate droughts that develop over many years. Peak demands in summer is not the issue for a RE heavy grid. Using over 15 years of Australian climate data, it is demonstrable that a renewables dominated east coast grid **will experience greatest stress each winter**, when solar production is at a minimum and is unable to support the grid during any reduction in wind output. Figure 1 highlights these annual climate occurrences in NSW by showing the modelled draw down from storage that could hypothetically supply NSW for 7 days, based on the most recent climate databases.

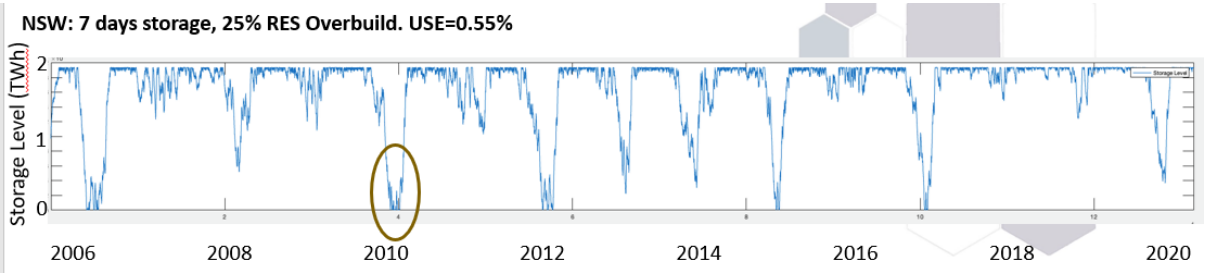

Figure 1: Annual wind droughts highlighted by energy storage drawdown[9]

It is not transparent how storage demand is forecast and deployed in ISP 2022. It is likely that the ISP 2022 treats water behind any dam as unconstrained storage available for deep drawdown to their lower limits when

[6] Boston A and Bongers, G (2021). *MEGS: Modelling energy and grid services to explore decarbonisation of power systems at lowest total system cost. Energy Strategy Reviews 38* 100709

[7] Baik E, Chawla K, Jenkins J, Kolster C, Patankar N, Olson A, Benson S, Long J. (2021). *What is different about different net-zero carbon electricity systems?. Energy and Climate Change.*

[8] Electricity System Model (modelling.energy) last accessed 27 January 2022

[9] Boston A., Bongers G. – Private communication from ongoing research

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required. *Australia's climate variability and current hydro and pumped hydro business models cannot support such an assumption*. The draft ISP 2022 assumptions on capacity and cost are over-optimistic.

For example, it would seem that ISP 2022 relies very heavily on the long-term storage from Tasmanian Hydro. Tasmanian Hydro is not pumped hydro, rather it is simply large, impounded hydro storage. The ISP 2022 does not demonstrate how the annual variation of these impoundment levels will accommodate and integrate with deep wind-drought conditions. Demand management will not suffice in these conditions. Current hydro storage business operations have NO incentive to accumulate water in the dam for years awaiting the size of "storage demand" required by a renewables drought. Note that these droughts occur nearly annually with varying degrees of severity.

To appreciate the size of energy storage required, Figure 1 shows the modelled effect of demand on 7 days storage in NSW – i.e.: about 2 TWh. For perspective, Snowy 2.0 Hydro storage - operated conventionally - offers 0.35 TWh of storage and Australia's largest battery in service provides 0.0002 TWh. 7 days storage assumed in the above diagram represents investments of 10's of billions of dollars for small utilisation factors required by low frequency drought events. This is a cost to consumers that should not be excluded in any planning assessment.

It also becomes obvious that the electricity market rules will require major revision/re-design to transform the operating business models of current energy storage assets.

Lower cost options available compared with ISP 2022 most likely scenario

Using the hypothetical ISP 2022 asset portfolio reflecting AEMO's most likely step-change scenario, Figure 2 is a modelled comparison of power generation technology shares. It shows how daily demand is served on an average winter low renewables day in 2050.

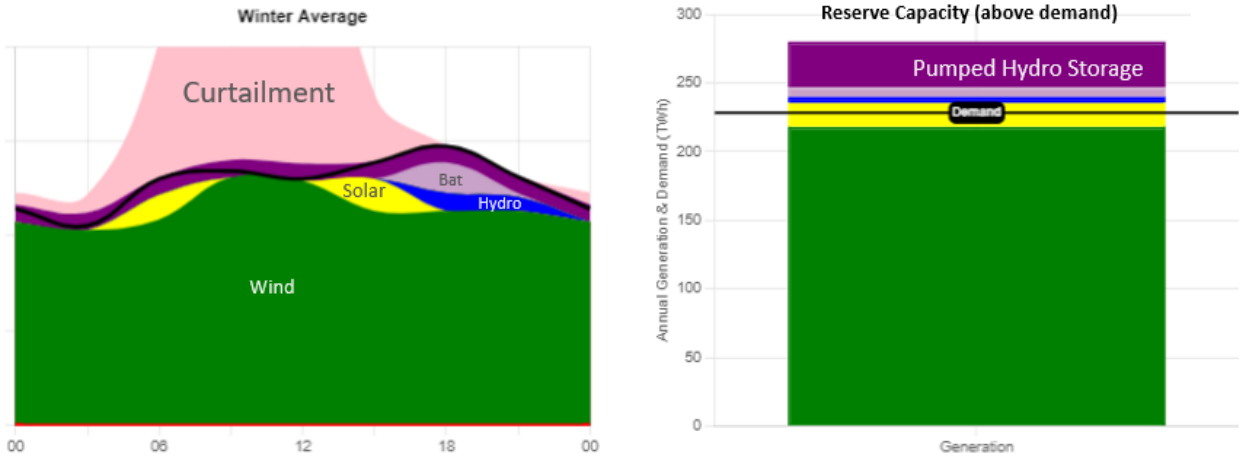

Figure 2: Daily demand reliance on energy storage and reserve capacity constraints during low renewables days – Higher cost portfolio ISP 2022 step change scenario. (Black line represents daily demand)

While demand appears to be supplied for the period, there are large quantities of curtailed (wasted) energy that are evident. It is likely maintaining the required grid reserve capacity will be challenging in this scenario.

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For an alternative configuration, where all low emissions technologies are used, Figure 3 below shows there exists asset portfolios that can deliver to net zero objectives at a much lower system cost (see Table 1 above) - while maintaining better reliability through severe wind drought periods. Instructively, such a portfolio would also minimise curtailment (wasted energy) through avoiding asset overbuild in the network.

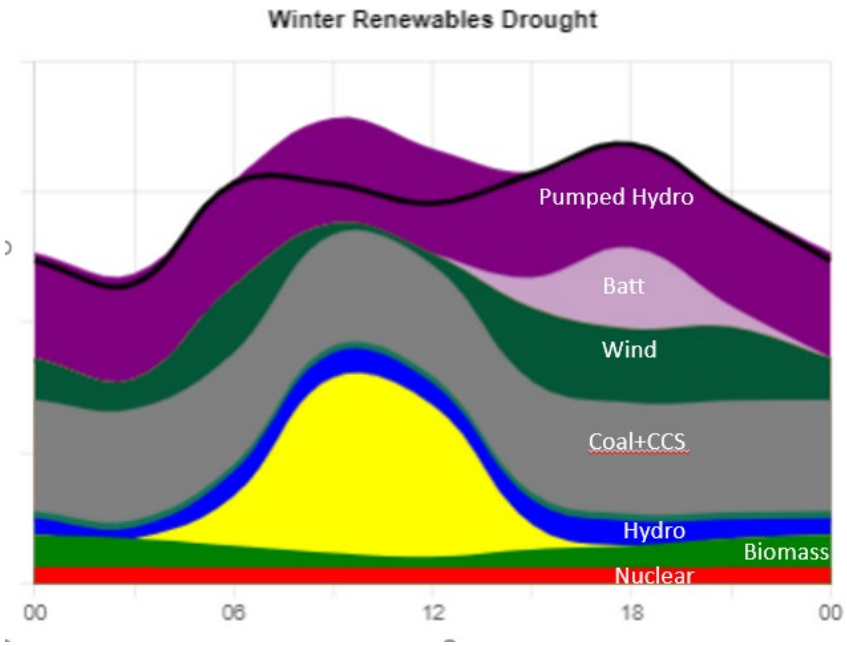

Figure 3: Daily demand reliance on energy storage during deep wind droughts - cost minimised asset portfolio including fossil fuels, CCS and nuclear

Engaging diverse modelling perspectives

Attached with this letter, I commend to you an assessment approach developed by independent experts to minimise total systems cost for a low emissions east coast electricity grid. *While objectively targeting decarbonisation, this assessment is not encumbered by having to conform to state or federal policy intent of the day. Rather, it seeks to target the least cost outcome for electricity consumers and the economy.* The basis and method used for the study is available in the academic literature and has been extensively peer reviewed. ***I encourage the AER to engage the independent MEGs modelling service - with your own inputs and assumptions - to robustly test emerging low emissions power generation asset portfolios for their system cost credentials***.

In Summary

All technologies should be made available to target a net-zero emissions grid for 2050 and modelled using a total system cost approach.

Higher cost technologies such as fossil fuel with CCS and nuclear will assist deliver the lowest cost electricity system. The ISP 2022 will be deficient if it does not include strategies for bringing these technologies into the system.

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Accountability for delivering the lowest cost electricity system must be transparent and identifiable across all the agencies engaged in regulating and operating the electricity markets.

Finally, while net zero emissions by 2050 is a worthy aspiration, 90% reduction in carbon emissions can be achieved at a significantly lower cost if fossil fuel generation is allowed to underpin the stability of the grid. In the interests of costs to the consumer and the economy, the good (90% emissions reduction) should not be held hostage to the perfect (net-zero emissions).

Yours faithfully,

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Cc:
Ms Kathie Standen, AER Executive General Manager
Consumer Advocate - Response to AEMO Draft ISP 2022

Encl: G.Bongers, A Boston et al - *Decarbonised Electricity – A low-cost path to net-zero emissions, Feb 2021*