Australian Energy Market Operator

Submitted via email: ISP@aemo.com.au

14 April 2025

Submission to Draft Integrated System Plan (ISP) Methodology

The Australian Energy Council welcomes the opportunity to make a submission to the Draft ISP Methodology Draft).

The Australian Energy Council (AEC) is the peak industry body for electricity and downstream natural gas businesses operating in the competitive wholesale and retail energy markets. AEC members generate and sell energy to over 10 million homes and businesses and are major investors in renewable energy generation. The AEC supports reaching net-zero by 2050 as well as a 55 per cent emissions reduction target by 2035 and is committed to delivering the energy transition for the benefit of consumers.

Reliable electricity supply is critical for households and businesses and to date the thermal dispatchable supplied NEM has performed extremely well against this metric. As the transition progresses to weather dependent variable renewable energy (VRE) as the primary source of electricity with storage and gas-powered generation (GPG) providing output time shifting and firming services, maintaining reliability becomes more challenging.

AEMO conducts reliability modelling as part of the ISP process however it is not transparent or accessible for external assessment. AEMO does present a relatively simple VRE drought analysis in the current ISP, but external parties cannot replicate the results because the necessary data is not provided by AEMO. Furthermore, it is not a true representation of reality because it does not include Queensland. AEMO needs to provide more detail on reliability because it is important that it can demonstrate that the assumptions underpinning the Step Change scenario produce a reliable system. If AEMO is confident in its analysis it should welcome external assessment. If the ISP scenarios produce unacceptable reliability outcomes, then it means the generation capacity/mix and demand/supply forecasts (in the ISP) are of little use for participants and stakeholders because it does not accurately represent what is required for a successful transition.

To constructively contribute to the understanding of future reliability risk, we have developed our own 8-day VRE Drought Model and published three papers on the following topics:[1]

1. May 2024 VRE drought capacity factors.
2. May 2024 VRE drought capacity factors applied to year 2040 of ISP VRE drought reliability analysis.
3. AEC 8-day VRE Drought Model: May VRE drought and 2040 ISP generation capacity and operational demand.

Compared to the methodologies in the Draft and the referenced Electricity Statement of Opportunities (ESOO) and Reliability Forecast Methodology Document our modelling methodology is relatively straight forward and readily accessible.[2] Most importantly our modelling uses recent empirically observed VRE capacity factors and the results are easily interrogated because it only models 192 hourly intervals. What

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[1] https://www.energycouncil.com.au/analysis/dunkelflaute-writ-large-may-2024/
https://www.energycouncil.com.au/analysis/may-2024-variable-renewable-energy-drought-and-the-isp-in-2040/
https://www.energycouncil.com.au/analysis/isp-nem-2040-model-with-vre-drought-will-it-be-reliable/

[2] https://aemo.com.au/-/media/files/electricity/nem/planning_and_forecasting/nem_esoo/2023/esoo-and-reliability-forecast-methodology-document.pdf?la=en

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surprised us was even with the most accommodating assumptions, significant USE occurred. Are Model has not been externally reviewed, so we are unsure of the robustness of our assumptions and results. We sent our results and questions relating to our assumptions (ie, have we missed something, statistical properties of the May 2024 VRE drought, etc) to AEMO but have not received any answers.[3]

Obviously, the VRE output and demand modelling for the ISP needs to be far more comprehensive than what is described above but 8-day VRE drought modelling results can be presented in a simple and transparent manner. We suggest that the modelling must include the entire NEM (ie, do not exclude Queensland as the current ISP does) and other useful information such as:

- Storage and gas-powered generation capacity by NEM region.
- Interconnector flows.
- Large scale solar and wind capacity factors by NEM region.
- Detail on gas supply system capacity and how much diesel would be required.
- Traditional hydro generation limitations due to downstream agricultural and environmental obligations.
- Operational demand profile by region.
- Descriptive statistics for the demand profiles and VRE capacity factors. For example, probability of occurrence, mean/standard deviation and other statistics for the full VRE data population, etc.
- Half hourly or hourly granularity.

Attachment 1 sets out results from our latest iteration of the Model.

Any questions about our submission should be addressed to Peter Brook, by email to peter.brook@energycouncil.com.au or by telephone on (03) 9205 3103.

Yours sincerely,

Peter Brook

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[3] Emails sent 26th September and 2nd October 2024.

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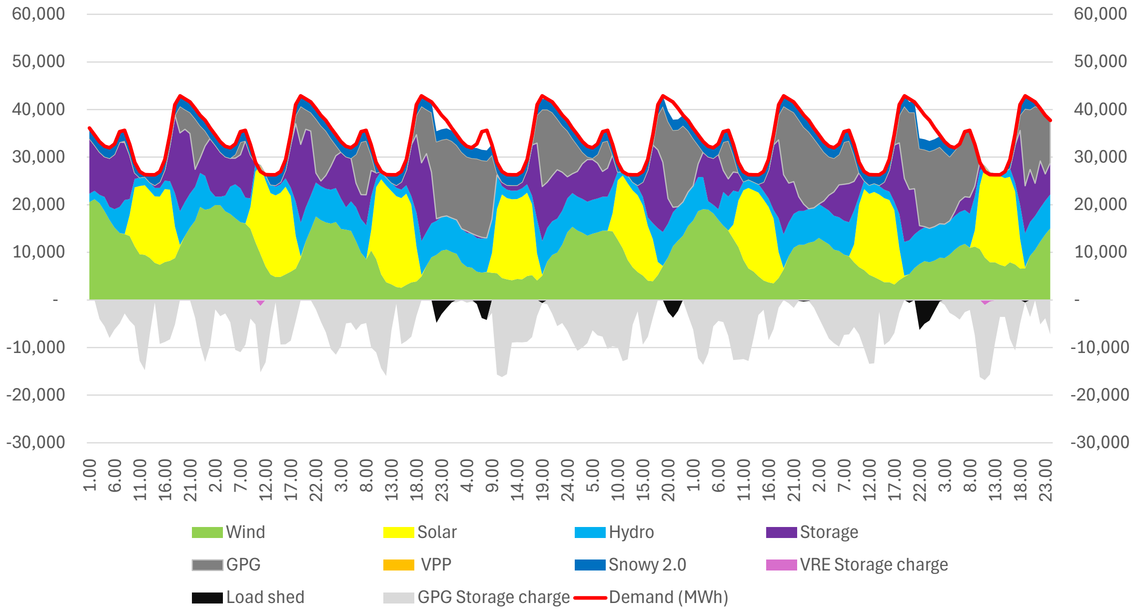
Attachment 1:

Changes from last publication:[4]

- Hydro will go to 100 per cent to meet any supply shortfall and will reduce out put if not required ie, it is not used to charge batteries.
- Any spare GPG will be used to charge storage if it requires it and is not generating. Except for shallow storage that can charge if it is generating less than its maximum output and has depleted storage. This is because it is assumed that they are all 2-hour units and will be the most numerous type of storage. Hence some can be discharging while others are charging.

Figure 1: AEMO ISP 2040 average winter demand increased by two per cent – 8-day VRE drought (20-27 May 2024 VRE capacity factors)



As shown in Figure 1, 48 GWh of USE or 0.018% assuming 271 TWh of annual operational demand. GPG accounts for nearly all storage recharging. Figure 2 shows how storage is almost fully depleted by the end of eight days.

[4] https://www.energycouncil.com.au/analysis/isp-nem-2040-model-with-vre-drought-will-it-be-reliable/

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Figure 2: Storage levels, MW capacity, charging and discharging – 8-day VRE drought

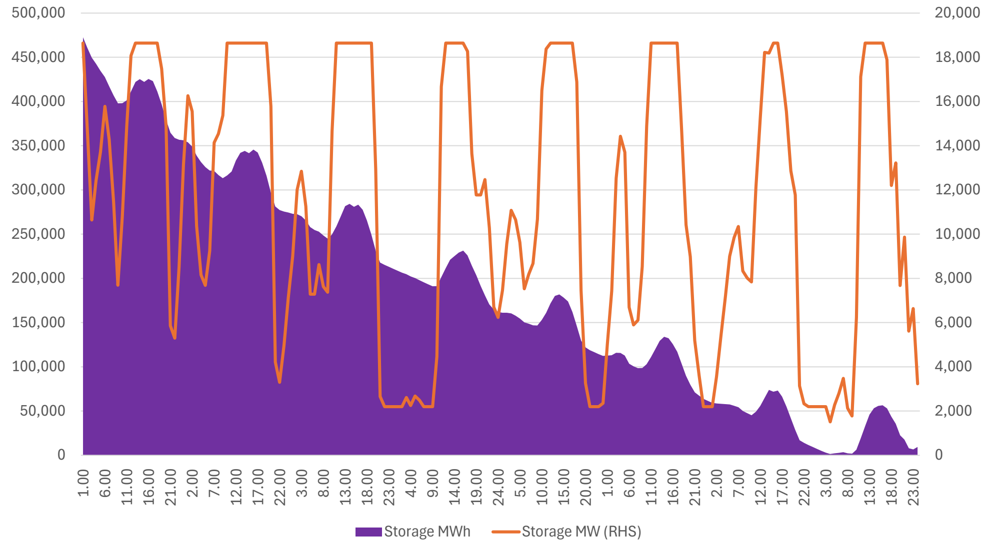


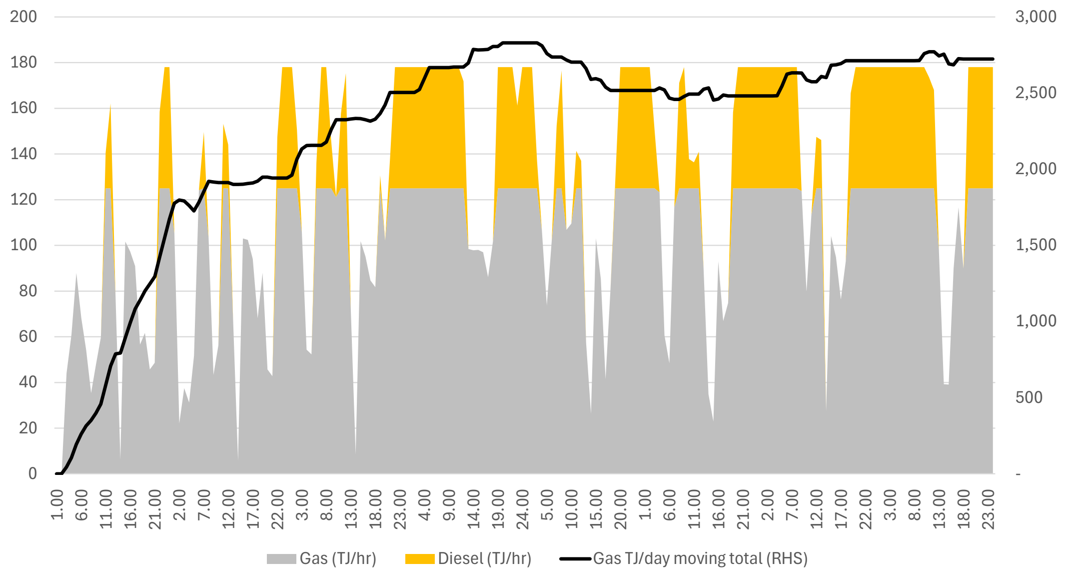
Table 1 shows that shallow and medium storage fully cycled 39 and eight times respectively. Storage consumed 1.1 TWh charging (net of losses 0.9 TWh) and generated 1.4 TWh.

Table 1: Storage operational statistics – 8-day VRE drought

	Snowy 2.0	Borumba	Deep Storage	Medium Storage	Shallow Storage	Total
Capacity GW	2.200	1.998	1.097	3.770	9.573	19
Storage MWh	349,980	47,952	42,101	28,429	17,932	486,394
Start MWh	349,980	47,952	42,101	28,429	17,932	486,394
Generation MWh	368,125	123,215	81,197	224,707	592,573	1,389,817
Finish MWh	-	-	-	-	9,323	9,323
Cycle efficiency	0.76	0.76	0.76	0.85	0.84	
Full charge cycles	0.1	2.1	1.2	8.1	38.8	2.26
Charge gross	23,876	99,030	51,442	230,915	695,195	1,100,458
Charge net	18,145	75,263	39,096	196,278	583,964	912,746
Loss	5,730	23,767	12,346	34,637	111,231	187,712

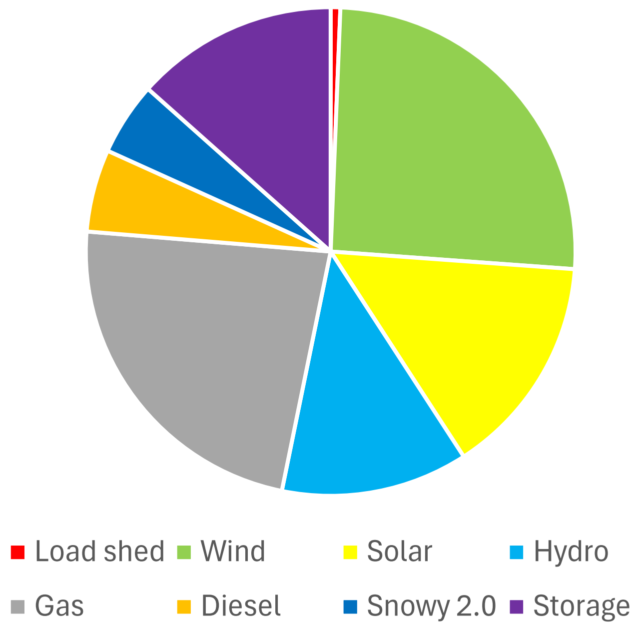
GPG maximum daily quantity (MDQ) is capped at 3,000 TJ/day, after that diesel is used. Removing this constraint would result in MDQ reaching 3,777 TJ. Overall, 19.4 PJ of gas and 104 ML of diesel are consumed to produce 2.2 TWh at an average capacity factor of 70 per cent. Emissions would exceed 1 MT.

Figure 3: Gas and diesel usage and gas MDQ – 8-day VRE drought



In Figure 4, note the large contribution from hydro which has an average capacity factor of 69 per cent and total output of 941 GWh. Gas and diesel generation are charging storage 50 per cent of the time.

Figure 4: Generation and load shed shares – 8-day VRE drought.



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