16 February 2023

Australian Energy Market Operator
Level 22
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Submitted by email to forecasting.planning@aemo.com.au

2023 Inputs Assumptions and Scenarios Consultation

Snowy Hydro Limited welcomes the opportunity to comment on the Australian Energy Market Operator (AEMO)'s 2023 Inputs Assumptions and Scenarios Consultation.

AEMO plays a central role in providing energy security advice with the market understandably relying on AEMO's guidance on energy market matters. The range of forecasting and planning publications for the National Electricity Market (NEM), including the NEM Electricity Statement of Opportunities (ESOO), the Gas Statement of Opportunities (GSOO), and the Integrated System Plan (ISP) is therefore critical to maintain this guidance.

We are supportive of amendments to the inputs assumptions and scenarios that improve forecasting accuracy, however there continue to be issues that need to be resolved otherwise they could lead to inefficient and inequitable market outcomes. The recent system energy stress, for example, was not simply the product of unrelated disturbances in the NEM.

The proposed changes and additions by AEMO across a range of issues are improvements, however, do not go far enough in certain areas to solve security and reliability gaps that remain in the market. Snowy Hydro's detailed concerns and comments are as follows:

- Support for the removal of the slow change scenario following Australia's commitment to a 43 per cent emissions reduction target by 2030, making the scenario no longer consistent with the policy settings.
- AEMO models their with data from 2011-2021 however this 10 year data assessment is not long enough to capture the full range wind and solar droughts. We recommend a historical profile of 30-50 years.
- AEMO assumes a significant amount of off-shore wind with high capacity factors but there is no assessment of any offshore wind droughts. While the overall capacity factors will be higher than onshore wind, there could be significant deficits of offshore wind output on monthly or even seasonal timescales. It will be vital to model these deficits, which are likely to be exacerbated by offshore wind being clustered in only one or two areas.
- The 2022 AEMO ISP assumed that Tasmanian and Victorian wind output is not correlated. We believe that this assumption is incorrect and nothing has been shown to demonstrate otherwise.
- AEMO needs to be more active in the market to accommodate inflexible generation and / or unpredictable demand over which it has reduced visibility. Individual aggregators or larger customers who want to participate in wholesale and energy services markets are relatively small individually but their cumulative impact is significant.

Wind and Solar Droughts

Variable Renewable Energy (VRE) generation in the NEM is dominated by wind and solar generation. Wind and solar tend to complement one another because their seasonality is different, which leads to annual timescales for both wind and solar being very reliable and the annual energy output not varying too much. On monthly timescales however both wind and solar can vary a lot from the expected (seasonal) amount which requires a more detailed assessment from AEMO.

VRE droughts occur during extended periods of low wind and decreased sunshine hours. The most at-risk period is late autumn to early winter, when solar is seasonally low and before the winter winds develop. Seasonal predictability (i.e. 1-6 months ahead) of wind and solar is very hard, so VRE droughts will nearly always take us by surprise. In June 2017 there was an extended period of low wind coinciding with solar seasonal minimum. Therefore more analysis needs to be undertaken to achieve more detailed data sets or to highlight the risks of extended wind and solar droughts by AEMO.

AEMO projections show renewable droughts can last from days to months but as the amount of VRE in the system increases, the importance of managing this variation increases. A key variable to assess reliability moving forward is the adequate energy supply for prolonged periods of low VRE.

AEMO models their ISP with data from 2011-2021, however this is unlikely to be representative of VRE risk. The Griffith University Paper *"Quantifying the risk of renewable energy droughts in Australia's National Electricity Market (NEM) using MERRA-2 weather data"*[1] recently developed a 42 year backcast of simulation of VRE output across the entire NEM, something AEMO could emulate. This simulation would give a greater data set, increasing the accuracy of AEMO's modeling.

Another paper which could assist AEMO is the Australian Pipelines and Gas Association Frontier report on the *"Potential for Gas-Powered Generation to support renewables"*[2], which developed a simplified model of the electricity system in South Australia to analyse the role of gas-powered generation in a 100% renewable (or close to) electricity system. It found in the forecast 2035 traces, there is a three-month period where wind output is approximately 25% of capacity overall, and a month-long period where wind output is approximately 13% of capacity. This represents a deficit of 64% compared to the average wind output, which was 36% of capacity for the full year.

Transmission will help diversify the risk of renewable droughts in one region, particularly around the worst events. However the market will need long-duration firming to fill the drought gaps.

Off-shore wind assumptions

AEMO's proposal to model offshore wind as an eligible technology in all scenarios, and to model the development of the scale of investment to meet the targets as a sensitivity is sensible. Snowy Hydro is concerned that in the monitoring of input and offshore wind targets, AEMO haven't identified assessing wind droughts in single areas. In Germany for example, Europe's largest economy with the continent's highest wind power capacity, combined output from both on and offshore wind farms fell around 16 per cent in 2021, relative to 2020[3].

AEMO assumes a significant amount of off-shore wind with high capacity factors but there is no assessment of any wind droughts. While overall capacity factors will be higher than for onshore wind, there could be significant deficits of offshore wind output on monthly or even seasonal timescales. It will be vital to model these deficits, which are likely to be exacerbated by offshore wind being clustered in only one or two areas. The Draft Inputs and Assumptions report identifies Victorian government targets as the key driver for offshore wind construction, implying that most offshore wind will be built in that state. This report also assesses that most of the offshore wind capacity will be confined to only 2 Renewable Energy Zones (Gippsland Coast in Victoria and Hunter Coast in New South Wales), due to transmission limits.

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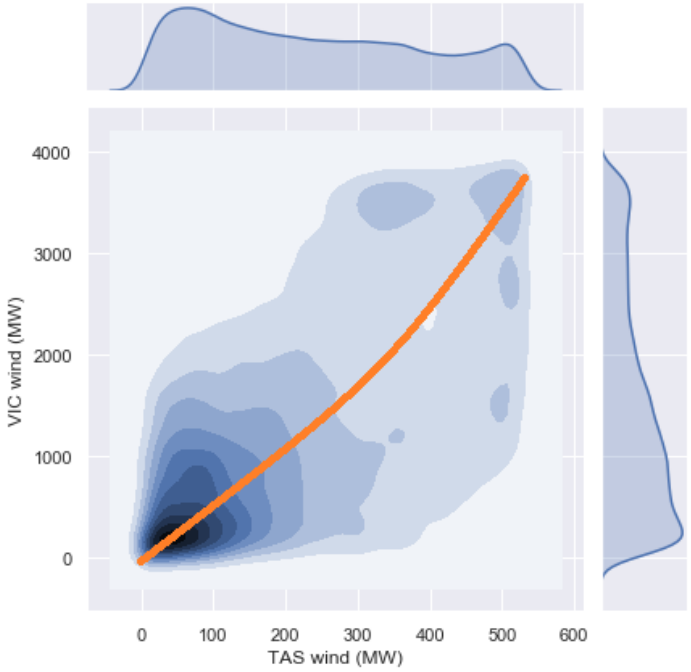
[1] Gilmore,J, Nelson, T, Nolan, T, 2022, *"Quantifying the risk of renewable energy droughts in Australia's National Electricity Market (NEM) using MERRA-2 weather data"*
<< https://www.griffith.edu.au/__data/assets/pdf_file/0024/1615614/No.2022-04-VRE-droughts-modelling-Griffith.pdf >>

[2] *Frontier Economics, 2021, "Potential for Gas-Powered Generation to support renewables"*

[3] *Reuters, 2021, "Analysis: Weak winds worsened Europe's power crunch; utilities need better storage"* << https://www.reuters.com/markets/commodities/weak-winds-worsened-europes-power-crunch-utilities-need-better-storage-2021-12-22/ >>

Wind Correlation

The 2022 AEMO ISP claimed that Tasmanian wind output provides resource diversity with mainland sources, including Victoria. Snowy Hydro believes that this assumption is incorrect. The summary graph below demonstrates, using the ISP2020 data set, that Tasmanian wind generation has a high correlation (0.55) with Victorian wind generation, mostly because they are geographically close to one another so are more closely affected by synoptic scale weather systems through high and low pressure systems. These variations are generally on the scale of multiple days. It is for this reason, if Victorian wind generation is high it is very likely that Tasmanian wind generation is also high, and vice versa. The graph below is a probability density plot (heatmap) of Tasmanian wind generation against Victortian wind generation. The probability density plot of Tasmanian wind is at the top and Victorian wind at the right.



This assumption is a key input to the AEMO's forecasting publications, and by itself needs to be further assessed.

Non-scheduled generation and load

AEMO reviews its list of non-scheduled generators using information from AEMO's Generation Information dataset obtained through surveys, DER registers and publicly available information. More needs to be done in this space however to achieve more accurate information. AEMO notes that large industrial loads compared to the 2021 forecasts are expected to increase in electricity consumption from planned expansions, which indicates the continued growth in load.

At a time when the system is becoming more volatile, Snowy Hydro is concerned by the considerable risk in diluting the information available about demand and supply conditions or reducing the incentives for small or non-scheduled participants to strictly comply with established market procedures. AEMO should seek changes to non-schedule participants and demand otherwise the market will never have the full information it requires. There are already inadequate transparency requirements for non-scheduled customers, who are not required to notify the market of their intentions or bid into the market.

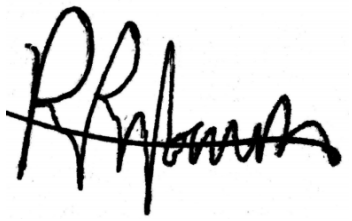
We support AEMO being more active in the market to accommodate inflexible generation and / or unpredictable demand over which it has reduced visibility. Individual aggregators or larger customers who want to participate in wholesale and energy services markets are relatively small individually but their cumulative impact is significant.

About the Snowy Hydro Group

Snowy Hydro Limited is a producer, supplier, trader and retailer of energy in the National Electricity Market (NEM) and a leading provider of risk management financial hedge contracts. We are an integrated energy company with more than 5,500 megawatts (MW) of generating capacity. We are one of Australia's largest renewable generators, the third largest generator by capacity and the fourth largest retailer in the NEM through our award-winning retail energy companies - Red Energy and Lumo Energy. Collectively, they retail gas and electricity in South Australia, Victoria, New South Wales, Queensland and the ACT to over 1 million customers.

Snowy Hydro appreciates the opportunity to respond to the Australian Energy Market Operator (AEMO) 2023 Inputs Assumptions and Scenarios Consultation. Any questions about this submission should be addressed to panos.priftakis@snowyhydro.com.au.

Yours sincerely,



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