Submission to AEMC Review

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Key Points:

- AEMC's charter is to "keep the lights on" and provide "energy at the best price for consumers". Heavily subsidised wind and solar power does not benefit the consumer in terms of reliability or price.

- The baseline for affordable and reliable electricity is shown in the historical data tables provided by AEMO. Average wholesale prices for 2007-2016 varied by State from $42-53/MWhr. For 2017/18 financial years, average prices varied from $82-104/Mwhr. (with SA the highest in each case)

- Electricity is not a market "commodity" because there is no alternative energy solution for businesses or consumers. Paying all generators the same price – the spot price – for every kilowatt hour they generate when they control the amount of generation available leads to gaming the market to maximise their profitability. This is directly counter to AEMC's and the Government's objectives of affordable and reliable electricity.

- The AEMO market typically has a baseload demand of about 18,000 MW throughout the night. That demand then ramps up to 26-28,000 MW each day with occasional peaks of over 31,000 MW depending on temperatures. During January, coal/gas stations typically provided 16-25,000 MW, hydro provided 500-4,000 MW to cover those peak demands, while wind provided 500-2,500 MW from a nameplate capacity of 4,400 MW, with supply unrelated to demand. Large scale solar provided 0-250 MW so can be ignored.

- As the sun goes down and the wind drops, base load coal/gas stations must be ready to meet demand or there will be an increasing number of blackouts as SA has already experienced. The closure of Hazelwood reduced the availability of baseload capacity and therefore decreased system reliability. The alternatives of batteries and new hydro have not been demonstrated to be cost effective.

- Dr Finkel reported the levelised costs of electricity generation in 2020:

Supercritical coal	$73/MWhr
Combined cycle gas turbine	$83/MWhr
Solar thermal with 12 hours storage	$172/MWhr
Wind (without backup)	$92/MWhr
Open cycle gas turbine	$123/MWhr

    - It is unclear why Dr Finkel did not add a calculation for wind with backup, but that cost is likely to be of order $150/MWhr.
    - All these cost estimates are for new plant, so while we have existing plant we should be able to enjoy wholesale electricity prices more in line with historical prices ie less than $60/MWhr.
    - Note that solar and wind installations also receive an additional payment of about $85/MWhr through the sale of renewable energy certificates, further adding to the retail price of electricity.
- The Clean Energy Regulator reported that an estimated 6,000 MW of new capacity will be delivered through a mix of approximately 25% solar and 75% wind. That could potentially displace about 2000 MW of coal-fired power stations as their average utilisation drops. Liddell coal station in NSW with 2000 MW is scheduled to close in 2022. But when those wind/solar stations operate at their maximum nameplate capacity, massive cutbacks are required from base load coal/gas stations making them increasingly uneconomic. For example, that 6000 MW is equal to the entire output of the Latrobe Valley stations in VIctoria.
- At peak demand with little wind/solar available, reliable backup reserves must be available or Australia will face increasing load shedding (in other words selective blackouts).
- Current and proposed government renewable energy targets and supply plans are reducing electricity network reliability and increasing costs to consumers and industry. It is unacceptable to increase reliability by further increasing electricity costs.
- For each scenario considered by AEMC, the report must include the projected average wholesale electricity cost in $/MWhr. Australia **must** return to affordable and reliable electricity.

Example of a 50% Wind Scenario

Let's look at a simplified scenario of a 50% intermittent wind entitlement in the Australian National Electricity Market. According to the Market Operator AEMO - http://www.aemo.com.au/, the average demand is about 24,000 MW, with an overnight low of 18,000 MW and a summer peak at 6pm of about 31,000 MW.

The 50% target means wind generators will have an entitlement to supply 12,000 MW on average. But if we assume wind generators have an average capacity factor of 30%, at low wind they will supply near zero, while at peak they can theoretically supply up to 40,000 MW (nameplate capacity). However there is a further constraint. With very high wind generation the system can become unstable. For this scenario I have assumed that wind can supply no more than 50% into the grid, so any excess supply must be stored, either through batteries or pumped hydro. So this means with average demand of 24,000 MW, wind will be constrained to 12,000 MW. Note that at night with lower demand, wind would be constrained to 9,000 MW.

Assume profile for wind generation is as follows to deliver an average of 12,000 MW (12 GW) over a 12 day period:

Day	GW generated by wind	Grid Balance
1	12	12 GW ex coal/gas
2	6	18 GW ex coal/gas
3	18	6 GW into storage or production curtailed, 12 ex coal/gas
4	12	6 GW ex storage if available, 6 GW ex coal/gas
5	0	24 GW ex coal/gas or some ex storage
6	6	18 GW ex coal/gas or some ex storage
7	24	12 GW into storage or production curtailed, 12 ex coal/gas
8	6	6 GW ex storage, 12 GW ex coal/gas
9	12	12 GW ex coal/gas
10	30	18 GW into storage or production curtailed, 12 GW ex coal/gas
11	6	6 GW ex storage,12 GW ex coal/gas
12	12	6 GW ex storage if available, 6 GW ex coal/gas
Average	12	12 GW ex coal/gas, but peak 24 GW

Now let’s examine Day 5 with just 24 hours with zero supply of wind - the grid must be fully supplied by coal/gas unless there is stored energy available in the form of hydro or batteries. Dr Finkel reported that the cost of wind with no backup in 2020 would be $92/MWhr, and the cost of solar with 12 hours backup would be $172/MWhr. If wind backup is provided by combined cycle gas turbines, Dr Finkel calculated that cost as $83/MWhr. So wind with backup is likely to cost at least $150/MWhr. New supercritical base load coal was costed at $76/MWhr.

Now consider Day 10 with 24 hours of wind at 75% of maximum capacity, generating 30,000 MW, so it must be curtailed, or used for storage into batteries or pumped hydro. That would require storage capacity for 18,000 MW for 24 hours, that’s equal to about 4,000 SA big batteries. If we look at Snowy 2, and assume it can produce 2,000 MW for 1 week, that equals storage of 288,000 MWhr (ignoring losses) or the equivalent of 2,200 SA big batteries. (Press reports describe Snowy 2 as a 2000 MW battery that could run for 7 days continuously).

However if you examine the scenario I have presented above, to be feasible it requires the ability to pump up to 18 GW into storage over 24 hours, and deliver to the grid up to 6 GW over 24 hours, That’s equal to three Snowy 2’s.

On days when there is zero wind generation, coal/gas generators must be available to meet demand up to the peak demand of 31 GW unless there is substantial storage available on demand. AEMC analysis is required to cost similar scenarios and report the cost in $/MWhr and compare it to other scenarios with lower % intermittent renewables.

Conclusion: Current and proposed government renewable energy targets and supply plans are reducing electricity network reliability and increasing costs to consumers and industry. It is unacceptable to increase reliability by further increasing electricity costs.