Electricity spot prices above $5,000/MWh

New South Wales, 16 November 2020

29 January 2021

AUSTRALIAN ENERGY REGULATOR

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1 Obligation

The Australian Energy Regulator (AER) regulates energy markets and networks under national legislation and rules in eastern and southern Australia, as well as networks in the Northern Territory. Its functions include:

- monitoring wholesale electricity and gas markets to ensure energy businesses comply with the legislation and rules, and taking enforcement action where necessary;
- setting the amount of revenue that network businesses can recover from customers for using networks (electricity poles and wires and gas pipelines) that transport energy;
- regulating retail energy markets in Queensland, New South Wales, South Australia, Tasmania (electricity only), and the ACT;
- operating the Energy Made Easy website, which provides a retail price comparator and other information for energy consumers;
- publishing information on the performance of energy markets, including the annual State of the energy market report and biennial effective competition report, to assist stakeholders and the wider community.

The AER is required to publish a report whenever the electricity spot price exceeds $5,000 per megawatt hour ($/MWh) in accordance with clause 3.13.7 (d) of the National Electricity Rules.

The report:

- describes the significant factors contributing to the spot price exceeding $5,000/MWh, including withdrawal of generation capacity and network availability;
- assesses whether rebidding contributed to the spot price exceeding $5,000/MWh;
- identifies the marginal scheduled generating units; and
- identifies all units with offers for the trading interval equal to or greater than $5,000/MWh and compares these dispatch offers to relevant dispatch offers in previous trading intervals.

These reports are designed to examine market events and circumstances that contributed to wholesale market price outcomes and are not an indicator of potential compliance issues or enforcement action.

2 Summary

On 16 November 2020, the spot price in New South Wales reached $7,496/MWh for the 1.30 pm trading interval driven by three dispatch intervals at the price cap. AEMO did not forecast this price.

The high spot price was a result of two main factors.

- At around 12.50 pm there was an unplanned outage of transmission lines in southern New South Wales due to lightning.
    - Constraints invoked at 1.10 pm to manage the outage limited the amount of generation that could flow from Victoria and southern New South Wales to load centres in Sydney, as there was only one main transmission path available.
- New South Wales had limited access to capacity priced below $5,000/MWh.
    - Long-term planned outages on some black coal generators reduced their available capacity from around 9,700 MW by 1,750 MW.
    - Technical issues experienced by a number of generators including a delay in the return to service of Bayswater unit 4 reduced the amount of capacity priced below $5,000/MWh by up to 1,300 MW.
    - There was also limited access to low-priced capacity from Queensland due to the ongoing upgrade of the Queensland to New South Wales (QNI) interconnector.

During the high priced period around 86% of capacity offered by participants in New South Wales was priced below $5,000/MWh but given the limited access to cheap capacity from neighbouring regions and southern New South Wales, capacity priced above $5,000/MWh was required to meet demand.

Rebidding of capacity from prices below to above $5,000/MWh did not contribute to the high price.

The transmission lines were returned to service within about 15 minutes and there were no further high prices.

3 Analysis

The following sections explore the factors that led to the high spot price in detail.

3.1 There was reduced access to low-priced capacity

The spot price in New South Wales reached $7,496/MWh for the 1.30 pm trading interval. The dispatch price was at the market cap price of $15,000/MWh for the 1.10 pm, 1.15 pm, and 1.20 pm dispatch intervals.

3.1.1 Within New South Wales

Long-term planned outages, for upgrades or maintenance, and technical issues experienced by black coal generators meant that there was around 3,100 MW of capacity unavailable for dispatch, out of approximately 9,700 MW of black coal installed capacity (Table 1). This includes a delay in the return to service of AGL's Bayswater 4 unit which removed around 140 MW of capacity priced at the floor from around 9 am (Appendix A).

Most of these were taken into account in forecasts.

Table 1: Offline baseload black coal generators in New South Wales

Participant	Station	Unit	Summer rating (MW)	Capacity available (MW)	Outage
AGL	Bayswater	Unit 1	630	0	Planned – 10 days
AGL	Bayswater	Unit 4	655	85	Unplanned – outage begun 18 days prior and return to service delayed
AGL	Liddell	Unit 2	450	0	Planned – 38 days
AGL	Liddell	Unit 3	450	325	None – lower capacity due to technical issues
EnergyAustralia	Mt Piper	Unit 1	675	0	Planned – 52 days
Delta	Vales Point	Unit 5	660	350	None – lower capacity due to technical issues
Origin	Eraring	Unit 4	680	350	None - lower capacity due to technical issues
Total			**4,200**	**1,110**	

3.1.2 From other regions

The ongoing upgrade of the QNI interconnector limited low-priced capacity from being imported from Queensland into New South Wales. At the time of high prices the import limit into New South Wales was around 450 MW - around half of its nominal limit. Flows at the same time were in excess of the limit, up to 760 MW, to keep the system safe.

3.1.3 Overview of actual and expected conditions

Table 2 shows the actual and forecast spot price, demand and generator availability for the high priced trading interval and shows:

- The spot price was not forecast 4 or 12 hours ahead.
- Demand was 295 MW greater than forecast, 4 hours ahead.
- Availability was 354 MW lower than forecast, 4 hours ahead.

Table 2: Actual and forecast spot price, demand and available capacity

Trading interval	Price ($/MWh)			Demand (MW)			Availability (MW)		
	Actual	4 hr forecast	12 hr forecast	Actual	4 hr forecast	12 hr forecast	Actual	4 hr forecast	12 hr forecast
1.30 pm	7,496	39	39	9,689	9,394	9,290	11,847	12,201	11,663

The delay in the return to service of Bayswater unit 4 contributed to the availability error identified above.

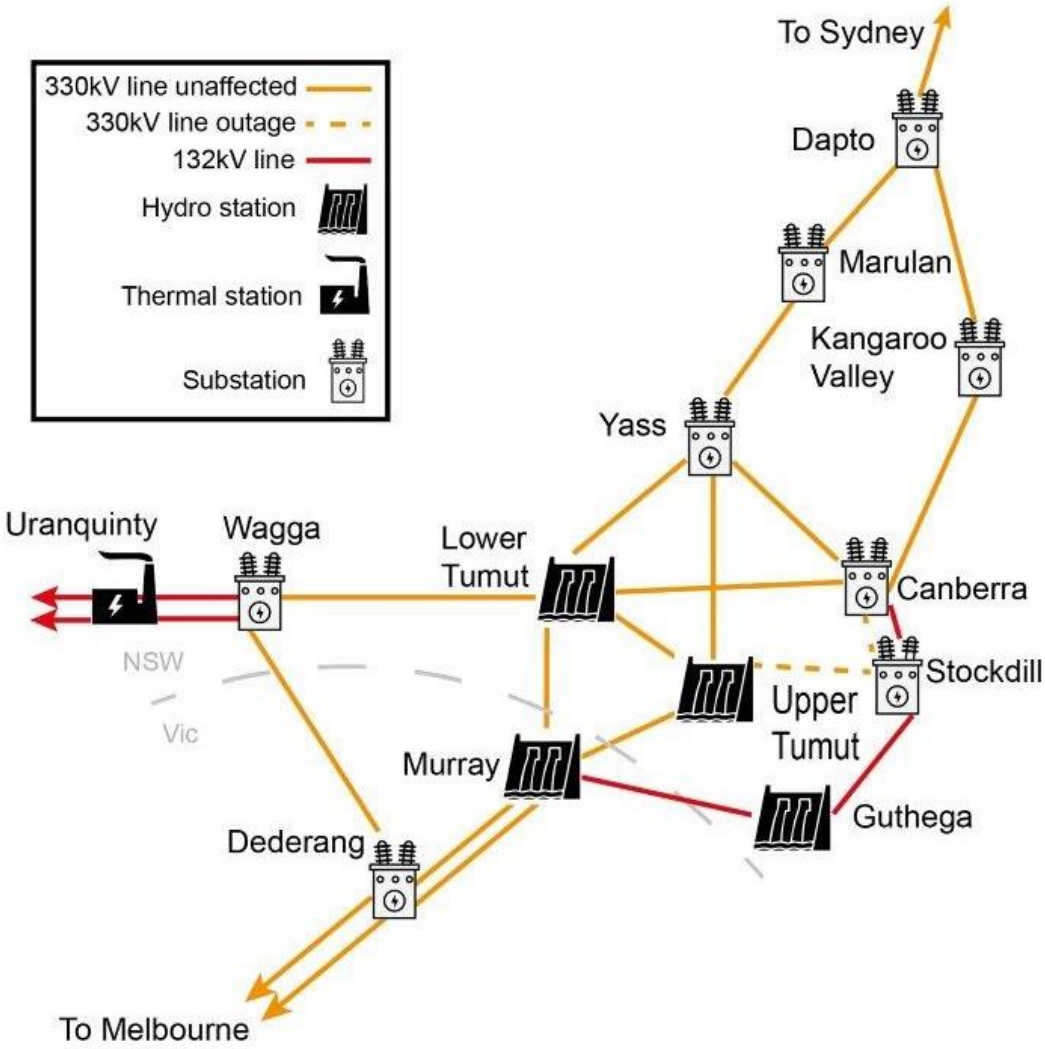
3.2 Unplanned network outages limited generation getting to load centres

This section examines the network capability in southern New South Wales and its contribution to price outcomes.

3.2.1 Network outages

At around 12.50 pm, due to lightning near Canberra there was an unplanned outage of the Upper Tumut – Stockdill 1 330 kV and the Canberra – Stockdill 1 330 kV lines. Figure 1 shows the affected network area, the significant generators, significant substations and the line that was out (yellow dashed). There is a significant amount of generation in the area and with the outages, the main transmission pathway for generation to get through to load centres in Sydney was through the Yass – Marulan 330 kV line. To manage the outage, at 1.10 pm AEMO invoked constraints (discussed in the next section) affecting generation in southern New South Wales and flows on the VIC-NSW interconnector.

Figure 1: network diagram



3.2.2 Constraints

What is a constraint?

In optimising economic generation dispatch and interconnector flows, the National Electricity Market Dispatch Engine (NEMDE) formulates the maximum network capability for every five minute dispatch interval. These capabilities are used to form constraints that describe the maximum capability of each network element and include generator and interconnector coefficients.

Constraints contain a Left Hand Side (LHS) and a Right Hand Side (RHS). The RHS contains all of the inputs that cannot be varied by NEMDE. These inputs include demand and the rating of the relevant transmission line (i.e. how much energy the line can carry without damaging the line or causing unsafe conditions). The LHS contains all of the inputs that can be varied by NEMDE to deliver an outcome that satisfies the requirement of the RHS. These inputs include output from generators and flow on interconnectors. When the LHS equals the RHS then the constraint is binding.

Following the outage of the Upper Tumut – Stockdill and the Canberra – Stockdill lines AEMO imposed additional constraints to manage flows on the remaining lines, limiting the amount of capacity sent towards Sydney. To minimise the dispatch price, NEMDE schedules the cheapest generation sources to meet demand and maintain interconnector flows within limits, so if generation in southern New South Wales is cheaper than the imports from Victoria, it is dispatched before imports and vice versa. In this situation, because of the location of the generators and the transmission outage, if the VIC-NSW interconnector is at its adjusted limit then any excess generation in that area is forced south across the interconnector into Victoria, possibly counter-price (from a high to low priced region).[1]

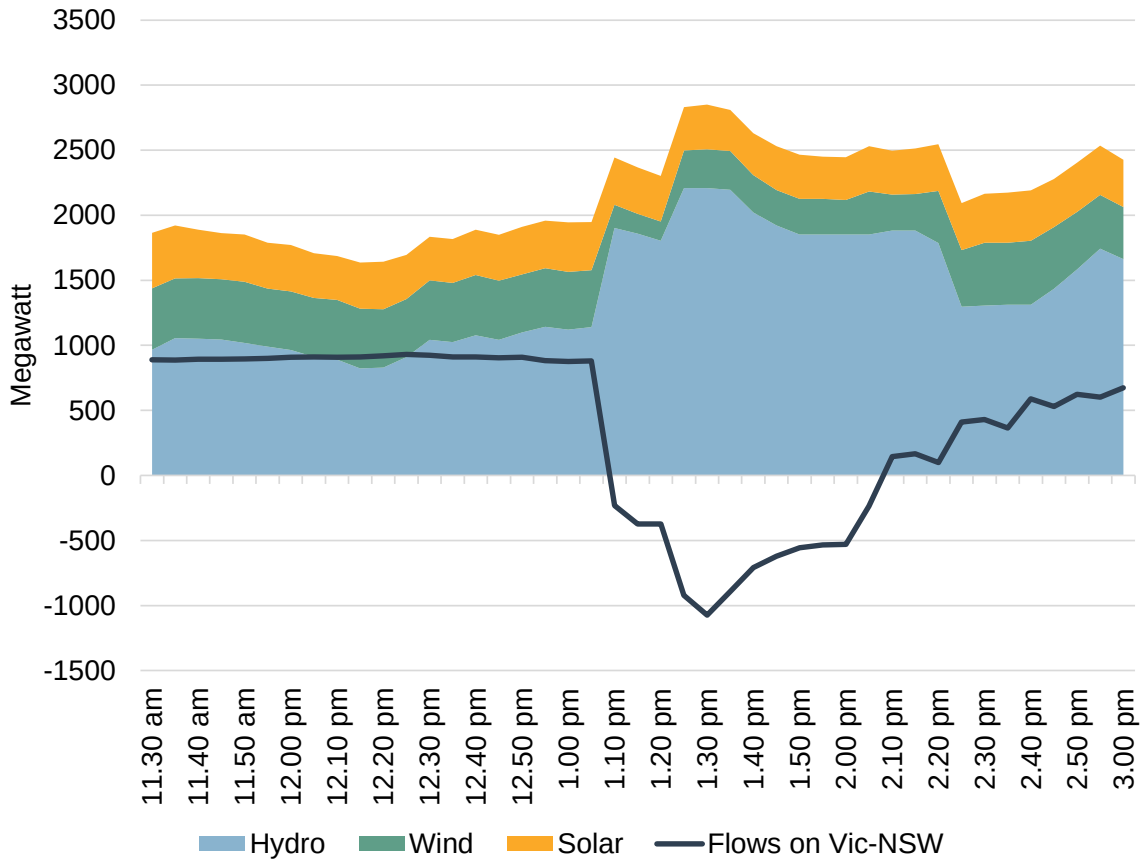
The output of generators on the LHS of the constraint is co-optimised with interconnectors on the LHS. The participants with the largest generator capacity that affect these particular constraints are Snowy Hydro (2,285 MW) and Origin (600 MW).[2] There are also a number of wind and solar farms, ranging from 40 MW to 320 MW, that affect this constraint to a lesser degree.

When the constraints were invoked and prices went to the cap at 1.10 pm, Tumut's generation increased as there was significant capacity priced below $500/MWh. As a result there was more generation coming over the VIC-NSW interconnector and being generated in southern New South Wales than the constraint allowed. This resulted in an 1,100 MW swing in flows across the VIC-NSW interconnector and flows out of New South Wales and into Victoria (Figure 2). The constraint also resulted in excess generation in the area (which was negatively priced) to be backed off. To make up for this, around 110 MW of capacity priced above $5,000/MWh had to be dispatched for three dispatch intervals.

1 https://www.aer.gov.au/wholesale-markets/performance-reporting/special-report-the-impact-of-congestion-on-bidding-and-inter-regional-trade-in-the-nem

2 On this constraint Snowy hydro controls Tumut (1,500 MW), Upper Tumut (616 MW), Blowering (80 MW), Guthega (60 MW) and Hume (29 MW) and Origin energy controls Uranquinty (600 MW)

Figure 2: Generation output and flow on the Vic-NSW interconnector



The transmission lines were returned to service within about 15 minutes and there were no further high prices.

Appendix B details the generators involved in setting the price during the high-price periods, and how that price was determined by the market systems.

The closing bids for all participants in New South Wales with capacity priced at or above $5,000/MWh for the high-price periods are set out in Appendix C.

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Appendix A: Significant Rebids

The rebidding tables highlight the relevant rebids submitted by generators that impacted on market outcomes during the time of high prices. It details the time the rebid was submitted and used by the dispatch process, the capacity involved, the change in the price of the capacity was being offered and the rebid reason.

Table 3: Significant energy rebids for 1.30 pm

Submitted time	Participant	Station	Capacity rebid (MW)	Price from ($/MWh)	Price to ($/MWh)	Rebid reason
8.59 am	AGL Energy	Bayswater	-60	-1000	N/A	0855~P~020 REDUCTION IN AVAIL CAP~208 RTS 1HR LATER THAN EXP
10.32 am	AGL Energy	Bayswater	-20	-1000	N/A	1030~P~020 REDUCTION IN AVAIL CAP~208 RTS LATER THAN EXP
10.59 am	AGL Energy	Bayswater	-20	-1000	N/A	1055~P~020 REDUCTION IN AVAIL CAP~208 RTS LATER THAN EXP
11.25 am	AGL Energy	Bayswater	-35	-1000	N/A	1125~P~020 REDUCTION IN AVAIL CAP~208 RTS LATER THAN EXP
12.48 pm	AGL Energy	Bayswater	-8	-1000	N/A	1245~P~010 UNEXPECTED/PLANT LIMITS~108 LOAD/RAMP VARIATION DURING RTS

Appendix B: Price setter

The following table identifies for the trading interval in which the spot price exceeded $5,000/MWh, each five minute dispatch interval price and the generating units involved in setting the energy price. This information is published by AEMO.[3] The 30-minute spot price is the average of the six dispatch interval prices.

Table 4: Price setter for the 3.30 pm trading interval

DI	Dispatch Price ($/MWh)	Participant	Unit	Service	Offer price ($/MWh)	Marginal change	Contribution
1.05 pm	$47.70	EnergyAustralia	MP2	Lower 6 sec	$0.14	-1.02	-$0.14
		Origin Energy	ER03	Lower 60 sec	$1.03	-1.02	-$1.05
		CS Energy	GSTONE5	Lower 60 sec	$3.73	1.02	$3.80
		CS Energy	GSTONE5	Lower 6 sec	$3.73	1.02	$3.80
		Origin Energy	DDPS1	Energy	$39.75	1.04	$41.34
1.10 pm	*$15,000*	Crookwell Development	CROOKWF2	Energy	-$1,000.00	-475.19	$475,190.00
		New Gullen Range Wind Farm	GULLRSF1	Energy	$0.00	17.13	$0.00
		New Gullen Range Wind Farm	GULLRWF1	Energy	$0.00	275.78	$0.00
		New Gullen Range Wind Farm	GULLRWF2	Energy	$0.00	183.28	$0.00
1.15 pm	*$15,000*	Snowy Hydro	TUMUT3	Energy	-$1,000.00	-156.72	$156,720.00
		Snowy Hydro	UPPTUMUT	Energy	-$1,000.00	-30.47	$30,470.00
		Lal Lal Wind Farms	YENDWF1	Energy	-$48.25	187.28	-$9,036.26
1.20 pm	*$15,000*	Snowy Hydro	TUMUT3	Energy	-$1,000.00	-98.49	$98,490.00
		Snowy Hydro	UPPTUMUT	Energy	-$1,000.00	-19.15	$19,150.00
		AGL Energy	LYA4	Lower reg	$0.00	117.43	$0.00
		AGL Energy	LYA4	Energy	$8.95	117.43	$1051.00
		Engie	LOYYB1	Lower reg	$13.95	-117.43	-$1638.15
1.25 pm	-$32.09	First Solar	BERYLSF1	Energy	-$32.09	1.00	-$32.09
1.30 pm	-$41.85	Lal Lal Wind Farms	YENDWF1	Energy	-$48.25	0.87	-$41.98
Spot Price		**$7,496/MWh**					

[3] Details on how the price is determined can be found at www.aemo.com.au

Appendix C: Closing bids

Figures C1 to C3 highlight the half hour closing bids for participants in New South Wales with significant capacity priced at or above $5,000/MWh during the periods in which the spot price exceeded $5,000/MWh. They also show generation output and the spot price.

Figure C1 - EnergyAustralia (Mt Piper, Tallawarra) closing bid prices, dispatch and spot price

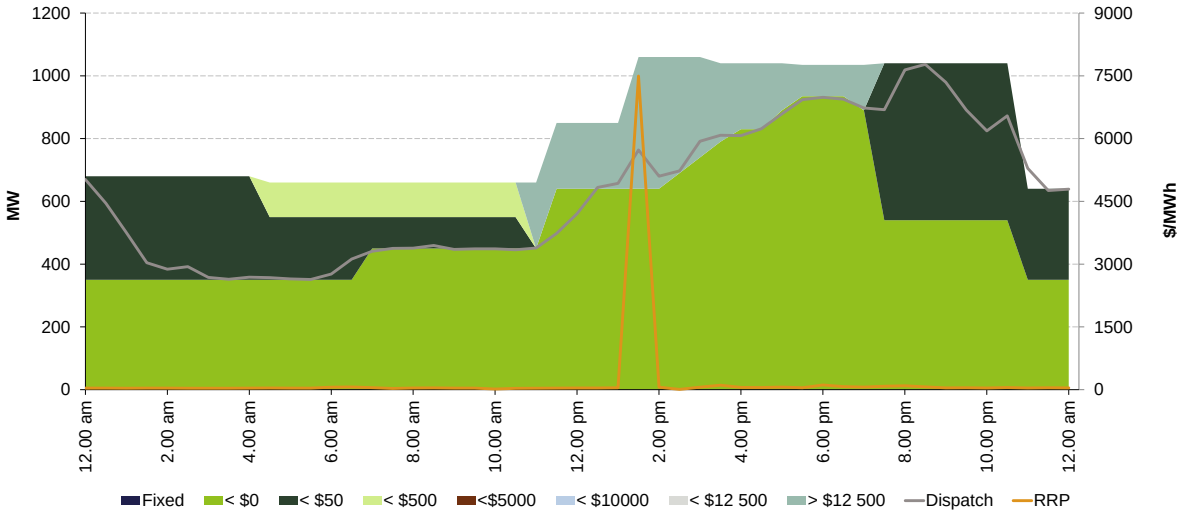

Figure C2 - Origin (Eraring, Shoalhaven, Uranquinty) closing bid prices, dispatch and spot price

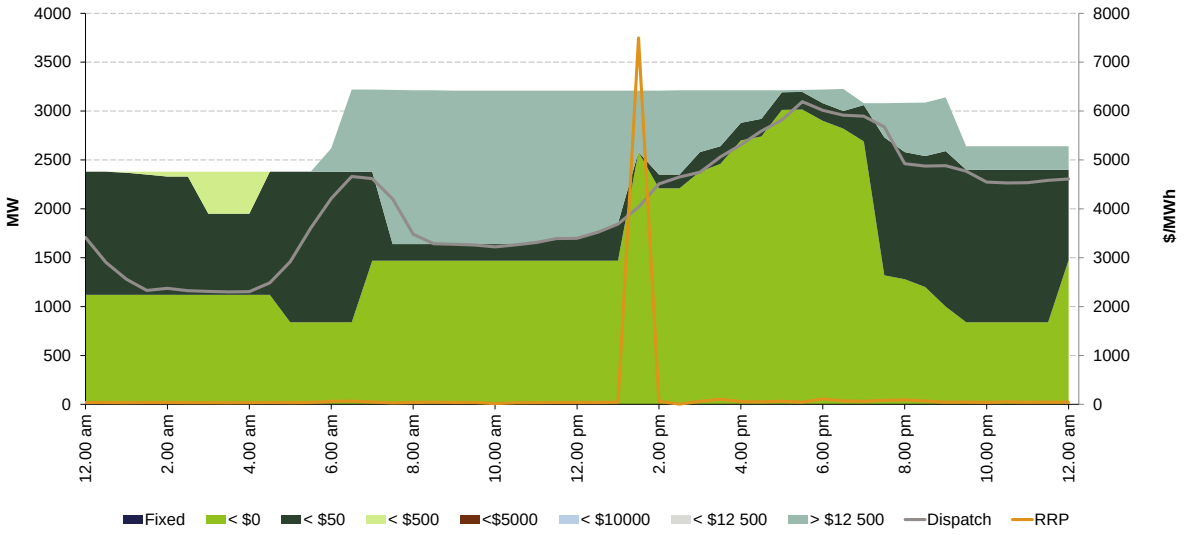

Figure C3 – Snowy Hydro (Colongra, Tumut, Upper Tumut, Guthega, Blowering) closing bid prices, dispatch and spot price