Electricity prices above $5,000/MWh

Queensland,

31 January & 1 February 2022

March 2022

AUSTRALIAN ENERGY REGULATOR

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Inquiries about this publication should be addressed to:

Australian Energy Regulator
GPO Box 520
Melbourne VIC 3001
Tel: 1300 585 165

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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 (known as the National Energy Market), 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 30-minute price[1] 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 30-minute price exceeding $5,000/MWh, including withdrawal of generation capacity and network availability;
- assesses whether rebidding contributed to the 30-minute price exceeding $5,000/MWh;
- identifies the marginal scheduled generating units; and
- identifies all units with offers for the trading intervals 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.

[1] From 1 October 2021, clause 3.13.7 of the NER was amended for 5 minute settlement. Under 5 minute settlement, a trading interval is now comprised of a 5 minute period and the spot price is the price for a trading interval. The 30-minute price is the average of 6 trading intervals and is calculated the same way as previously under 30 minute settlement.

2 Summary

On 31 January 2022, the wholesale price for electricity in Queensland was between $6,798/MWh and $12,179/MWh for the 30-minute periods between 6 pm and 7 pm. On 1 February the 30-minute price was between $13,429/MWh and $14,682/MWh for the 30-minute periods between 5.30 pm and 7 pm.

The high prices on both days were primarily due to:

- High demand
    - The temperature reached 32°C on 31 January and 35°C on 1 February in Brisbane. High temperatures drive a high demand for electricity through air conditioners.
    - Demand on 1 February was the highest this summer to date.
- Reduced availability
    - At least 1,840 MW of capacity was unavailable due to outages during the high priced periods.
    - Network constraints limited Queensland's access to lower priced capacity from the rest of the NEM.

AEMO published forecast lack of reserve notices on both days in order to seek a response form the market. While prices were high on 31 January, AEMO did not intervene in the market as the level of reserve did not fall to critical levels. However, for 1 February, AEMO did not expect to have enough reserve capacity available so it initiated the reliability and emergency reserve trader (RERT) mechanism. AEMO estimates the cost of RERT on 1 February to be around $51 million.

Rebidding of capacity to higher prices did not contribute to the price outcomes on these days.

3 Analysis

3.1 Overview of actual and expected conditions

On 31 January 2022, the wholesale price for electricity in Queensland reached $6,798/MWh, $10,230/MWh and $12,179/MWh for the 6 pm. 6.30 pm and 7 pm 30-minute periods respectively. On 1 February the 30-minute wholesale price reached $13,430/MWh, $13,429/MWh, $14,265/MWh and $14,682/MWh for the respective 30-minute periods between 5.30 pm and 7 pm.

High prices were forecast from the first published forecasts on the previous day.

Table 1 and Table 2 below compare the actual and forecast 30-minute spot prices, demand and available capacity in Queensland on each day.

Our general observations are:

- The 30-minute prices were forecast to be high on both days, due to high temperatures driving high demand.
- On 31 January
  - demand was between 90 MW and 105 MW lower than forecast, one hour prior.
  - availability was between 90 MW and 176 MW lower than forecast one hour prior.
- On 1 February
  - demand was up to 489 MW lower than forecast, one hour prior.
  - availability was between 36 MW and 134 MW lower than forecast, one hour prior.

Table 1: 31 January Actual and forecast 30-minute price, demand and availability

30 minute period	Price ($/MWh)			Demand (MW)			Availability (MW)		
	Actual	1 hr forecast	4 hr forecast	Actual	1 hr forecast	4 hr forecast	Actual	1 hr forecast	4 hr forecast
6.00 pm	**6,798**	**12,595**	**15,100**	**9,038**	**9,129**	**9,086**	**10,022**	**10,112**	**10,023**
6.30 pm	**10,230**	**15,100**	**-**	**8,997**	**9,090**	**-**	**9,699**	**9,875**	**-**
7.00 pm	**12,179**	**15,100**	**15,100**	**9,039**	**9,144**	**9,049**	**9,604**	**9,731**	**9,706**
7.30 pm	4,636	12,595	15,100	8,913	9,022	9,006	9,744	9,703	9,720

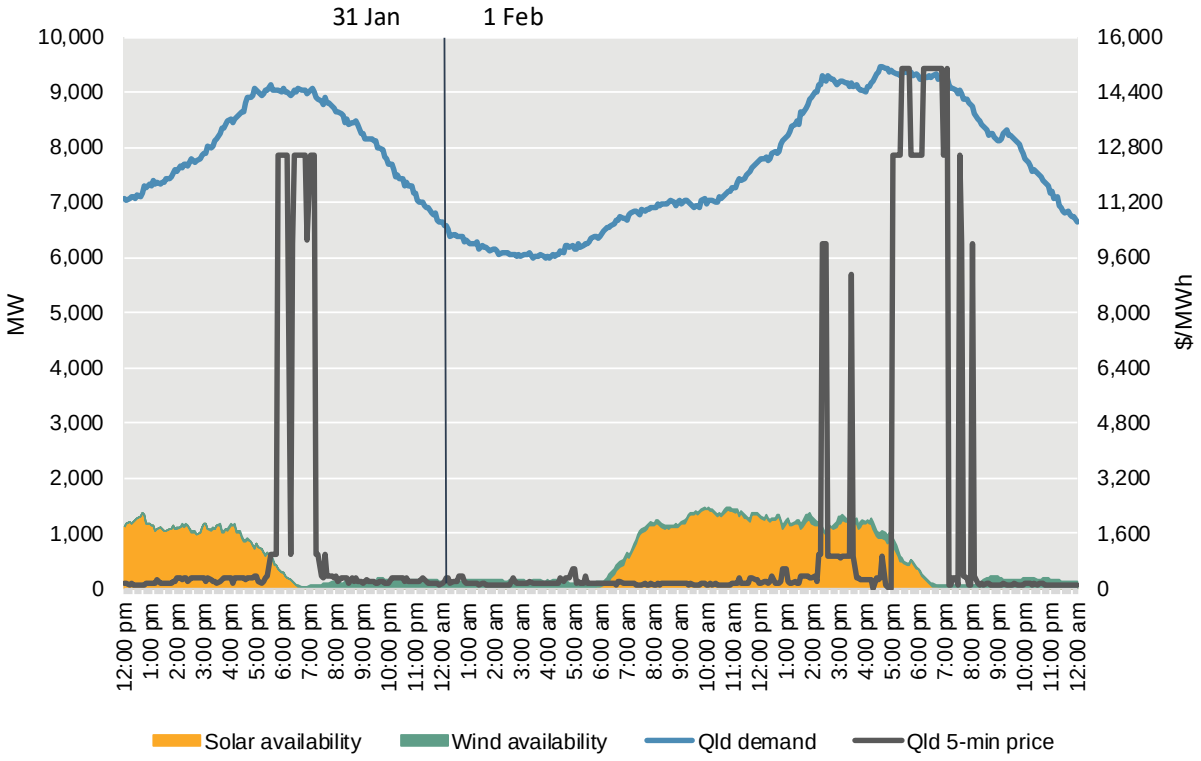
Table 2: 1 February Actual and forecast 30-minute price, demand and availability

30 minute period	Price ($/MWh)			Demand (MW)			Availability (MW)		
	Actual	1 hr forecast	4 hr forecast	Actual	1 hr forecast	4 hr forecast	Actual	1 hr forecast	4 hr forecast
5.30 pm	**13,430**	**15,100**	**15,100**	**9,342**	**9,831**	**10,088**	**10,114**	**10,164**	**10,207**
6.00 pm	**13,429**	**15,100**	**15,100**	**9,335**	**9,773**	**10,065**	**9,937**	**9,973**	**10,044**
6.30 pm	**14,265**	**15,100**	**15,100**	**9,265**	**9,629**	**9,976**	**9,684**	**9,753**	**9,892**
7.00 pm	**14,682**	**15,100**	**15,100**	**9,274**	**9,222**	**9,905**	**9,644**	**9,778**	**9,801**

3.2 High temperatures drove high demand

The temperature reached 32°C on 31 January and 35°C on 1 February in Queensland.[2] AEMO issued temperature alert market notices (94248 and 94253) on both days. Some demand for electricity can be very sensitive to temperature. Very hot days drive high demand from air-conditioning units. The high priced intervals coincided with the times of high demand, meaning more expensive generation was needed at these times.

Figure 1: Queensland wind and solar availability, demand and 5 minute prices



Source; AER analysis using NEM data

Figure 1 shows how solar farm availability was declining at the time, as the sun was setting, reducing available supply. For the same reason, rooftop PV generation was also declining, so that meant some customers' supply of electricity generation shifted from rooftop PV to the grid, leading demand to increase further.

3.3 Baseload outages reduced the supply of low priced generation

Over 1,800 MW of baseload generation was offline on both days due to technical issues. These outages reduced the supply of generation in the region.

[2] http://www.bom.gov.au/climate/data/index.shtml?bookmark=200

Table 3: Baseload units unavailable in Queensland

Participant	Unit	Fuel type	Summer rating (MW)	Planned/ unplanned	Comment
CS Energy	Kogan Creek	Black coal	720	Planned	Offline since 23 Jan due to 'technical issues'
CS Energy	Callide B 2	Black coal	350	Planned	Offline since 27 Jan due to unit trip
CS Energy	Callide C 4	Black coal	420	Planned	Offline since May 2021
CleanCo	Swanbank E	Gas	350	Planned	Offline since 20 Dec due to technical issues
Total			**1,840**		

3.4 Conditions specific on 31 January 2022

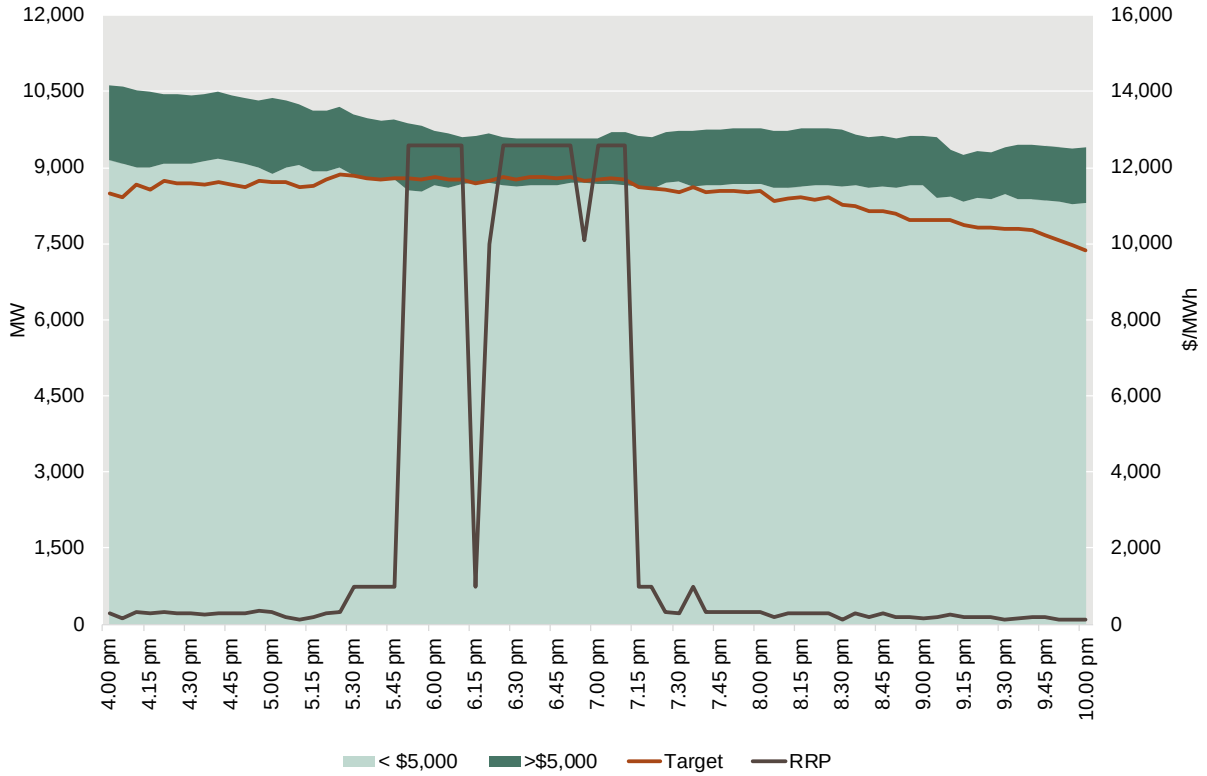
3.4.1 Reduced access to low priced generation

Constrained interconnectors meant up to 440 MW of capacity could not reach Queensland, during the time of the high prices. A system normal constraint bound, limiting imports from NSW across both interconnectors. The Queensland-NSW interconnector (QNI) was limited to around 250 MW, its nominal capacity can be up to 600 MW. Imports on the Terranora DC interconnector were limited to around 17 MW, its nominal capacity is 107 MW. System normal constraints are always invoked. These constraints can limit flow on transmission lines and output by generators based on the normal operation of the grid. The limits can change depending on real-time conditions, demand in a neighbouring region, or the output from the largest generator in a region, for example.

3.4.2 High priced capacity was needed to meet demand

Around 90% of the capacity offered was priced below $5,000/MWh. As demand in the region peaked at around 6 pm each evening, around 100 MW of high priced capacity was needed to meet demand.

Figure 2: Generation offered above and below $5,000/MWh, target and 5 minute price 31 January



Source: AER analysis using NEM data
Note: The capacity priced less than $5,000/MWh is adjusted to show effective availability, where ramp rate limited or FSIP limited capacity could not make it to market.

While participants did shift some capacity into higher price bands leading up to the high priced intervals, there were also participants shifting capacity down into low price bands, negating the effect. As such, rebidding did not contribute to the high price events.

Queensland was around 80 MW short of reserve from 6.45 pm until 7.30 pm, triggering an actual LOR1 (lack of reserve) condition.

LOR is a method AEMO uses to make sure there is enough spare capacity available if there is an unexpected drop in the supply of electricity, either from a generator or an interconnector tripping. See *Appendix C* for a detailed explanation of low reserve conditions.

Further details on the generators involved in setting price during the high-priced periods are provided in *Appendix B: Price Setter.*

3.5 Specific conditions on 1 February 2022

3.5.1 Low reserve capacity and RERT

Higher temperatures were forecast for 1 February and demand was expected to be higher than the previous day. At 1 am on 1 February, AEMO published a market notice (94329) which predicted an LOR3 condition could occur in Queensland from 6 pm to 7 pm that evening. When a level 3 LOR is in place, there is no spare generation available in the region, so AEMO may shed customer load to maintain system security.

By 2 pm, the forecast supply conditions had not improved, so AEMO activated reliability emergency reserve trader (RERT) contracts in Queensland, from 5 pm until 9.30 pm, leading to intervention pricing arrangements. [3]

RERT services are typically provided by unscheduled loads reducing demand on the grid or unscheduled generators providing more energy to the grid. The effect, either way, increases the amount of reserve capacity available, so system security is retained and load shedding is avoided.[4]

AEMO estimates the cost of RERT on this day to be around $51 million but will publish further details by May 2022.[5]

3.5.2 Actual demand was far lower than forecast

Despite the high temperatures, demand started to flatten around 3 pm onwards, while the forecast demand continued to increase. The gap between the 1 hour forecast and actual demand was as much as 785 MW at 4.30 pm. AEMO, the Minister for Energy and Powerlink, the transmission operator, requested customers to reduce their demand if possible. [6]This may have affected forecast accuracy and lowered actual demand.

A localised storm in the south-east of the region damaged power lines and left 30,000 homes without power.[7]

The unplanned drop of demand on the grid, created a significant divergence between actual demand and what was forecast.

[3] See *Appendix D* for more information around intervention pricing arrangements.

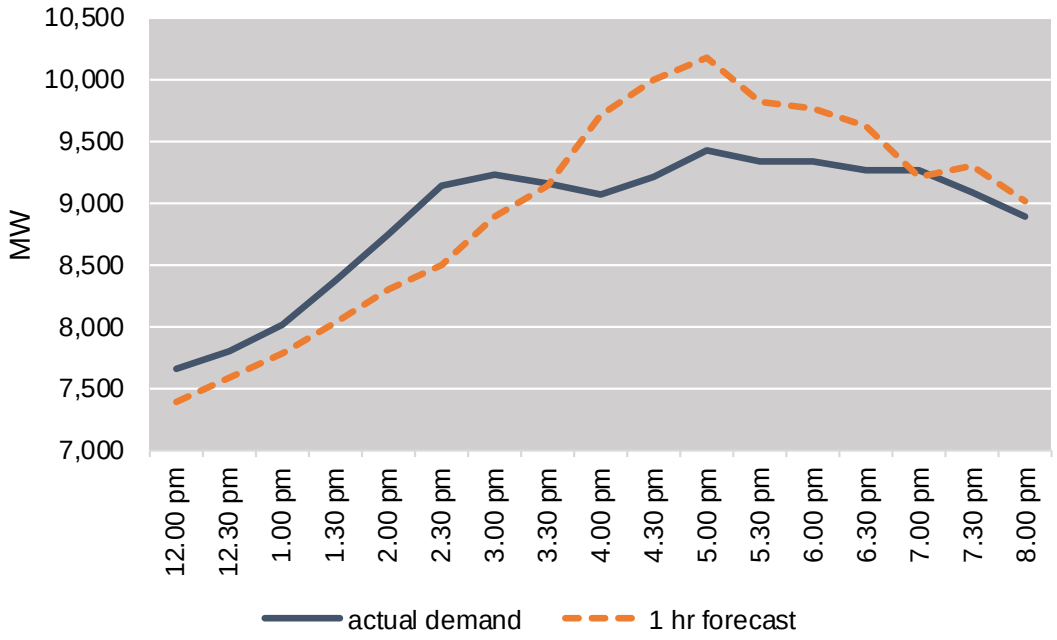
4 https://aemo.com.au/-/media/files/electricity/nem/emergency_management/rert/2022/rert-contracted-report-for-1-and-2-feb-2022.pdf?la=en

5 https://aemo.com.au/-/media/files/electricity/nem/emergency_management/rert/2022/rert-activation-estimates-report-for-1-feb-2022.pdf?la=en

6 https://statements.qld.gov.au/statements/94357

7 https://www.abc.net.au/news/2022-02-02/qld-weather-bom-forecast-brisbane-south-east-severe-storms/100795770

Figure 3: Actual versus 1 hour forecast demand



3.5.3 Availability fell further

At 3.20 pm, one of Stanwell's coal generators, Tarong 2 tripped and did not return to service until around 6.45 pm. Tarong 2's capacity is 350 MW. This unplanned outage combined with 1,840 MW of outages discussed above further reduced the supply of low priced generation in the region.

Despite the lower than forecast demand, an actual LOR2 was declared from 5 pm until 8 pm in the region. AEMO required 443 MW of spare capacity, but only 77 MW was available. This meant that if the single biggest source of electricity in the region was to trip there would not be enough reserve capacity available and load shedding could occur,

Between 93 and 98% of the capacity offered during the times of the high prices was below $5,000/MWh, but high priced capacity was still needed, demonstrating the extremely tight supply conditions on the day.

Rebidding capacity into high price bands did not contribute to the high priced outcomes.

Appendix A: Closing bids shows the participants portfolio with capacity priced above $5,000/MWh during the high priced times.

Australian Energy Regulator

April 2022

4 Appendix A: Closing bids

Figure A1 to A6 highlight the 5-minute offers for participants in Queensland with capacity priced at or above $5,000/MWh for 31 January and 1 February 2022. They also show generation output and the 5-minute dispatch price.

Figure A1: Alina Energy (Braemar A) offers, dispatch and Qld regional reference price (RRP)

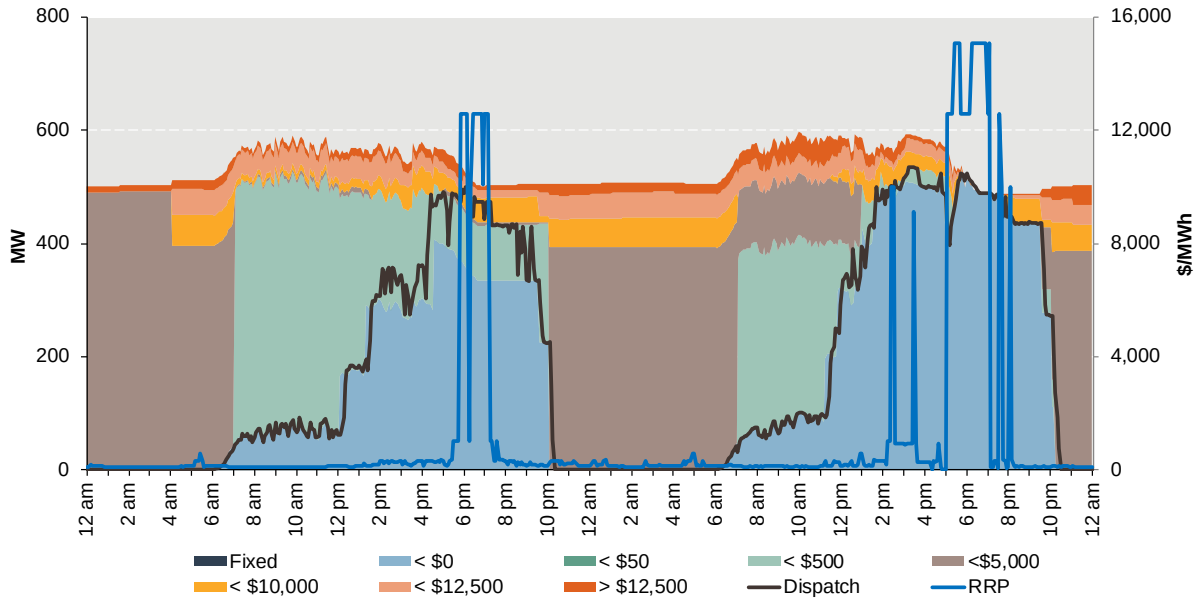


Figure A2: Arrow Energy (Braemar 2) offers, dispatch and Qld regional reference price (RRP)

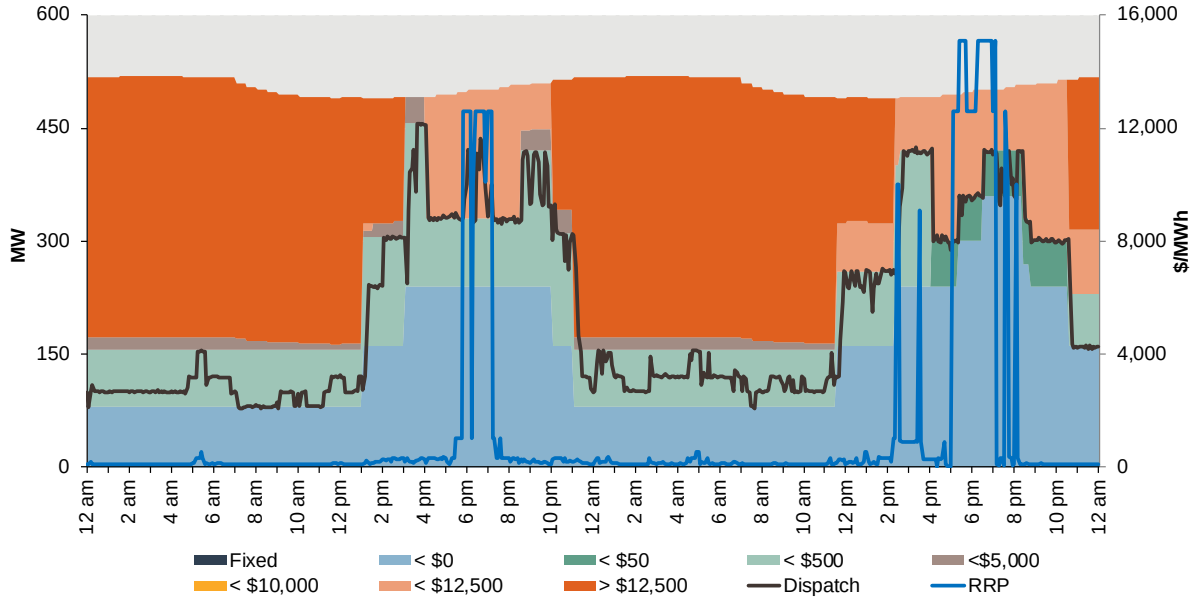


Figure A3: Intergen (Millmerran) offers, dispatch and Qld regional reference price (RRP)

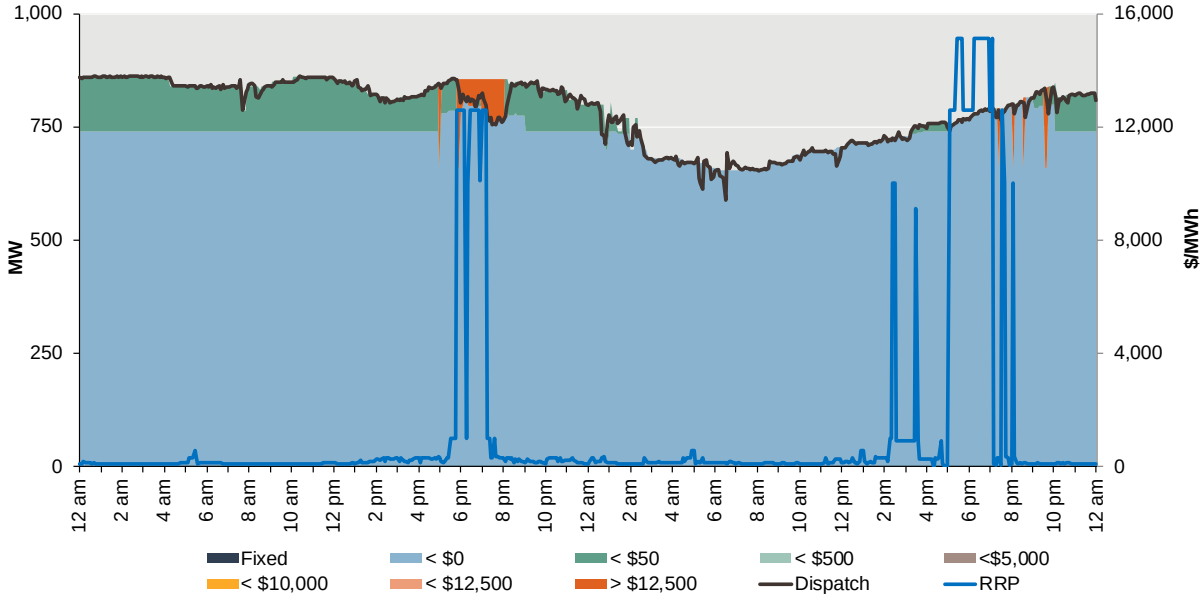


Figure A4: Origin (Darling Downs, Mt Stuart and Roma) offers, dispatch and Qld regional reference price (RRP)

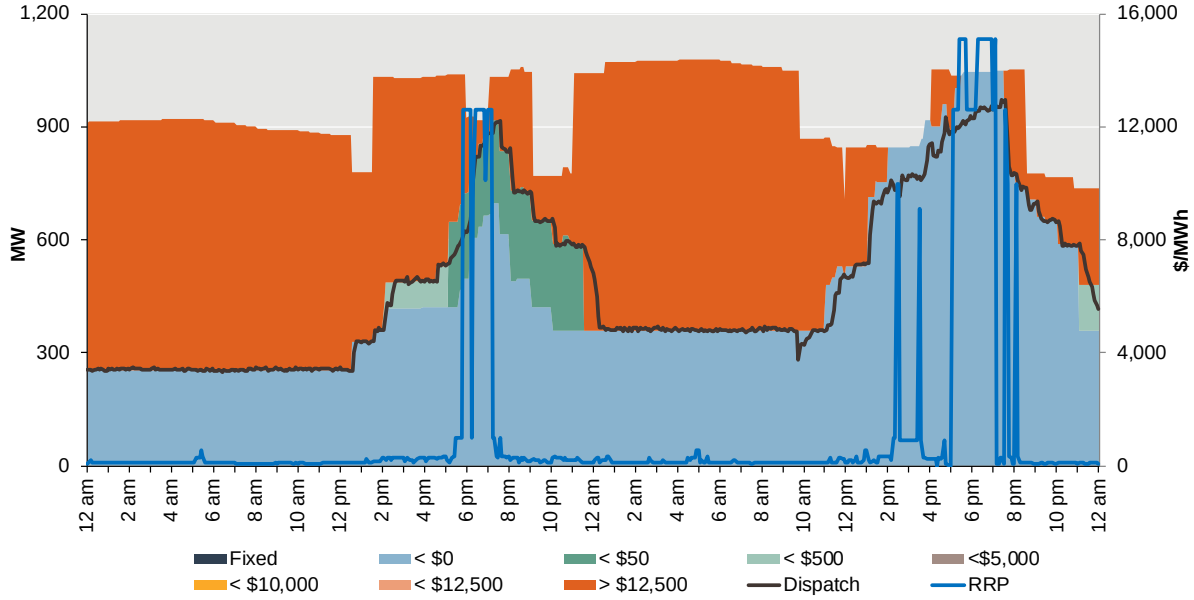


Figure A5: ERM Power (Oakey) offers, dispatch and Qld regional reference price (RRP)

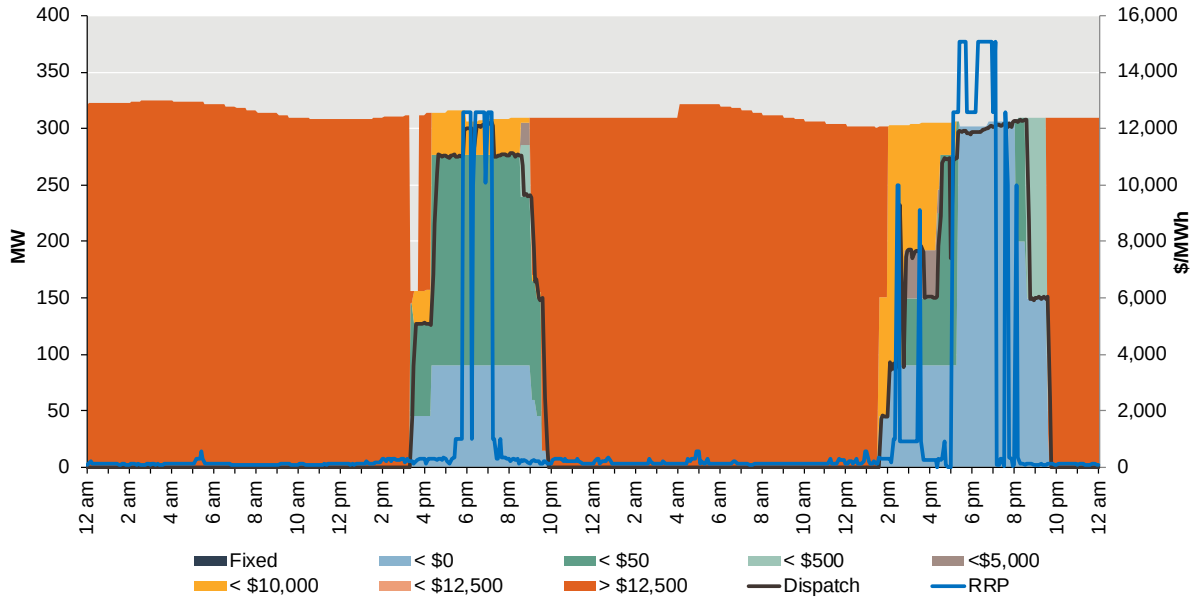
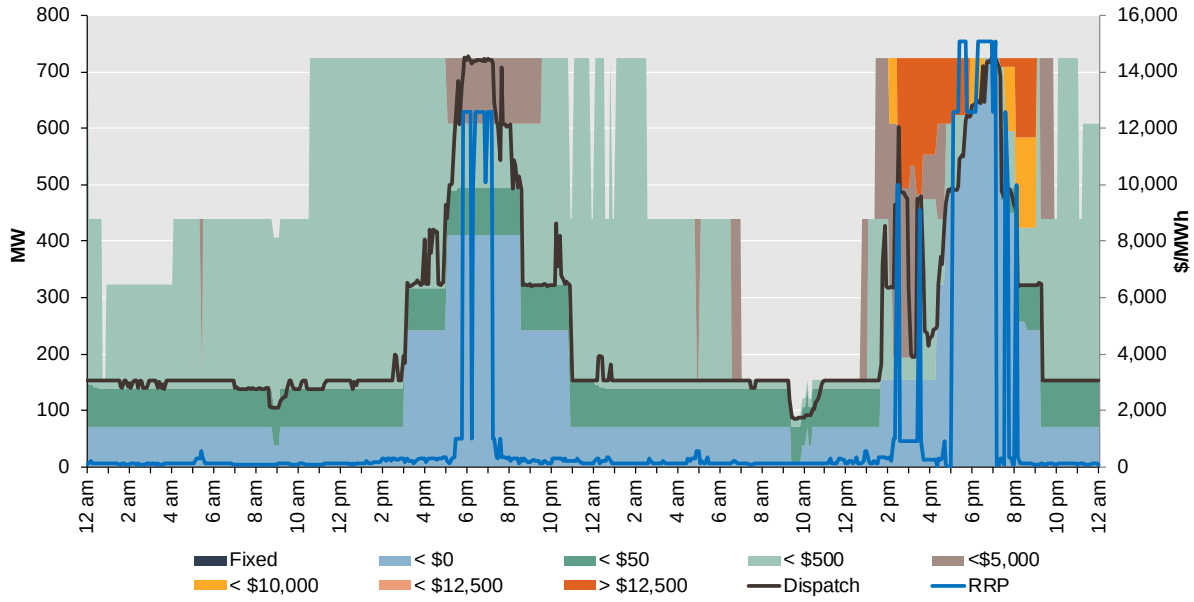


Figure A6: CleanCo (Barron Gorge, Kareeya, Swanbank and Wivenhoe) offers, dispatch and Qld regional reference price (RRP)



5 Appendix B: Price Setter

The following table identifies the units involved in setting the price for each 5-minute interval for the 30-minute trading intervals above $5,000/MWh. This information is published by AEMO[8]. What-if pricing set price on 1 February, see *Appendix D* for details.

31 January 2022

Table B 1: Price Setter 31 January 6 pm Queensland

Time	Dispatch price	Participant	Unit	Service	Offer price	Marginal change	Contrib.
5:35 pm	$999.99	CleanCo	W/HOE#2	Energy	$999.99	1.00	$999.99
5:40 pm	$999.99	CleanCo	W/HOE#2	Energy	$999.99	1.00	$999.99
5:45 pm	$999.99	CleanCo	W/HOE#2	Energy	$999.99	1.00	$999.99
5:50 pm	$12,595.00	Arrow	BRAEMAR5	Energy	$12,595.00	0.33	$4,156.35
		Arrow	BRAEMAR6	Energy	$12,595.00	0.33	$4,156.35
		Arrow	BRAEMAR7	Energy	$12,595.00	0.33	$4,156.35
5:55 pm	$12,595.00	Arrow	BRAEMAR5	Energy	$12,595.00	0.33	$4,156.35
		Arrow	BRAEMAR6	Energy	$12,595.00	0.33	$4,156.35
		Arrow	BRAEMAR7	Energy	$12,595.00	0.33	$4,156.35
6:00 pm	$12,595.00	Arrow	BRAEMAR5	Energy	$12,595.00	0.33	$4,156.35
		Arrow	BRAEMAR6	Energy	$12,595.00	0.33	$4,156.35
		Arrow	BRAEMAR7	Energy	$12,595.00	0.33	$4,156.35
30-minute price							**$6,798/MWh**

Table B 2 Price Setter 31 January 6.30 pm Queensland

Time	Dispatch price	Participant	Unit	Service	Offer price	Marginal change	Contrib.
6:05 pm	$12,595.00	Arrow	BRAEMAR5	Energy	$12,595.00	0.33	$4,156.35
		Arrow	BRAEMAR6	Energy	$12,595.00	0.33	$4,156.35
		Arrow	BRAEMAR7	Energy	$12,595.00	0.33	$4,156.35
6:10 pm	$12,595.00	Arrow	BRAEMAR5	Energy	$12,595.00	0.33	$4,156.35
		Arrow	BRAEMAR6	Energy	$12,595.00	0.33	$4,156.35
		Arrow	BRAEMAR7	Energy	$12,595.00	0.33	$4,156.35
6:15 pm	$1,001.02	Alinta Energy	BRAEMAR2	Energy	$1,001.02	1.00	$1,001.02
6:20 pm	$9,999.99	ERM Power	OAKEY1	Energy	$9,999.99	1.00	$9,999.99
6:25 pm	$12,595.00	Arrow	BRAEMAR5	Energy	$12,595.00	0.33	$4,156.35
		Arrow	BRAEMAR6	Energy	$12,595.00	0.33	$4,156.35
		Arrow	BRAEMAR7	Energy	$12,595.00	0.33	$4,156.35
6:30 pm	$12,595.00	Arrow	BRAEMAR5	Energy	$12,595.00	0.33	$4,156.35
		Arrow	BRAEMAR6	Energy	$12,595.00	0.33	$4,156.35
		Arrow	BRAEMAR7	Energy	$12,595.00	0.33	$4,156.35
30-minute price							**$10,230/MWh**

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

Table B 3 Price Setter 31 January 7 pm Queensland

Time	Dispatch price	Participant	Unit	Service	Offer price	Marginal change	Contrib.
6:35 pm	$12,595.00	Arrow	BRAEMAR5	Energy	$12,595.00	0.33	$4,156.35
		Arrow	BRAEMAR6	Energy	$12,595.00	0.33	$4,156.35
		Arrow	BRAEMAR7	Energy	$12,595.00	0.33	$4,156.35
6:40 pm	$12,595.00	Arrow	BRAEMAR5	Energy	$12,595.00	0.33	$4,156.35
		Arrow	BRAEMAR6	Energy	$12,595.00	0.33	$4,156.35
		Arrow	BRAEMAR7	Energy	$12,595.00	0.33	$4,156.35
6:45 pm	$12,595.00	Arrow	BRAEMAR5	Energy	$12,595.00	0.33	$4,156.35
		Arrow	BRAEMAR6	Energy	$12,595.00	0.33	$4,156.35
		Arrow	BRAEMAR7	Energy	$12,595.00	0.33	$4,156.35
6:50 pm	$12,595.00	Arrow	BRAEMAR5	Energy	$12,595.00	0.33	$4,156.35
		Arrow	BRAEMAR6	Energy	$12,595.00	0.33	$4,156.35
		Arrow	BRAEMAR7	Energy	$12,595.00	0.33	$4,156.35
6:55 pm	$10,099.00	Alinta Energy	BRAEMAR1	Energy	$10,099.00	0.77	$7,776.23
		Alinta Energy	BRAEMAR2	Energy	$10,099.00	0.12	$1,211.88
		Alinta Energy	BRAEMAR3	Energy	$10,099.00	0.12	$1,211.88
7:00 pm	$12,595.00	Arrow	BRAEMAR5	Energy	$12,595.00	0.33	$4,156.35
		Arrow	BRAEMAR6	Energy	$12,595.00	0.33	$4,156.35
		Arrow	BRAEMAR7	Energy	$12,595.00	0.33	$4,156.35
30-minute price							**$12,179/MWh**

1 February 2022

Table B 4 Price Setter 1 February 5.30 pm Queensland

Time	Dispatch price	Participant	Unit	Service	Offer price	Marginal change	Contrib.
5:05 pm	$12,594.00	Arrow	BRAEMAR5	Energy	$12,594.00	0.33	$4,156.02
		Arrow	BRAEMAR6	Energy	$12,594.00	0.33	$4,156.02
		Arrow	BRAEMAR7	Energy	$12,594.00	0.33	$4,156.02
5:10 pm	$12,594.00	Arrow	BRAEMAR5	Energy	$12,594.00	0.33	$4,156.02
		Arrow	BRAEMAR6	Energy	$12,594.00	0.33	$4,156.02
		Arrow	BRAEMAR7	Energy	$12,594.00	0.33	$4,156.02
5:15 pm	$12,594.00	Arrow	BRAEMAR5	Energy	$12,594.00	0.33	$4,156.02
		Arrow	BRAEMAR6	Energy	$12,594.00	0.33	$4,156.02
		Arrow	BRAEMAR7	Energy	$12,594.00	0.33	$4,156.02
5:20 pm	$12,598.00	Alinta Energy	BRAEMAR1	Energy	$12,598.00	0.52	$6,550.96
		Alinta Energy	BRAEMAR2	Energy	$12,598.00	0.24	$3,023.52
		Alinta Energy	BRAEMAR3	Energy	$12,598.00	0.24	$3,023.52
5:25 pm	$15,100.00	CleanCo	W/HOE#1	Energy	$15,100.00	0.14	$2,114.00
		CleanCo	W/HOE#2	Energy	$15,100.00	0.14	$2,114.00
		Alinta Energy	BRAEMAR1	Energy	$15,100.00	0.06	$906.00

Time	Dispatch price	Participant	Unit	Service	Offer price	Marginal change	Contrib.
		Alinta Energy	BRAEMAR2	Energy	$15,100.00	0.06	$906.00
		Alinta Energy	BRAEMAR3	Energy	$15,100.00	0.06	$906.00
		Stanwell	STAN-1	Energy	$15,100.00	0.15	$2,265.00
		Stanwell	STAN-2	Energy	$15,100.00	0.24	$3,624.00
		Stanwell	STAN-3	Energy	$15,100.00	0.15	$2,265.00
5:30 pm	$15,100.00	CleanCo	W/HOE#1	Energy	$15,100.00	0.50	$7,550.00
		CleanCo	W/HOE#2	Energy	$15,100.00	0.50	$7,550.00
30-minute price							**$13,430/MWh**

Table B 5 Price Setter 1 February 6 pm Queensland

Time	Dispatch price	Participant	Unit	Service	Offer price	Marginal change	Contrib.
5:35 pm	$15,100.00	CleanCo	W/HOE#1	Energy	$15,100.00	0.50	$7,550.00
		CleanCo	W/HOE#2	Energy	$15,100.00	0.50	$7,550.00
5:40 pm	$15,100.00	CleanCo	W/HOE#1	Energy	$15,100.00	0.15	$2,265.00
		CleanCo	W/HOE#2	Energy	$15,100.00	0.15	$2,265.00
		Alinta Energy	BRAEMAR1	Energy	$15,100.00	0.07	$1,057.00
		Alinta Energy	BRAEMAR2	Energy	$15,100.00	0.06	$906.00
		Stanwell	STAN-1	Energy	$15,100.00	0.16	$2,416.00
		Stanwell	STAN-2	Energy	$15,100.00	0.25	$3,775.00
		Stanwell	STAN-3	Energy	$15,100.00	0.16	$2,416.00
5:45 pm	$12,594.00	Arrow	BRAEMAR5	Energy	$12,594.00	0.33	$4,156.02
		Arrow	BRAEMAR6	Energy	$12,594.00	0.33	$4,156.02
		Arrow	BRAEMAR7	Energy	$12,594.00	0.33	$4,156.02
5:50 pm	$12,594.00	Arrow	BRAEMAR5	Energy	$12,594.00	0.33	$4,156.02
		Arrow	BRAEMAR6	Energy	$12,594.00	0.33	$4,156.02
		Arrow	BRAEMAR7	Energy	$12,594.00	0.33	$4,156.02
5:55 pm	$12,594.00	Arrow	BRAEMAR5	Energy	$12,594.00	0.33	$4,156.02
		Arrow	BRAEMAR6	Energy	$12,594.00	0.33	$4,156.02
		Arrow	BRAEMAR7	Energy	$12,594.00	0.33	$4,156.02
6:00 pm	$12,594.00	Arrow	BRAEMAR5	Energy	$12,594.00	0.33	$4,156.02
		Arrow	BRAEMAR6	Energy	$12,594.00	0.33	$4,156.02
		Arrow	BRAEMAR7	Energy	$12,594.00	0.33	$4,156.02
30-minute price							**$13,429/MWh**

Table B6 Price Setter 1 February 6.30 pm Queensland

Time	Dispatch price	Participant	Unit	Service	Offer price	Marginal change	Contrib.
6:05 pm	$12,594.00	Arrow	BRAEMAR5	Energy	$12,594.00	0.33	$4,156.02
		Arrow	BRAEMAR6	Energy	$12,594.00	0.33	$4,156.02
		Arrow	BRAEMAR7	Energy	$12,594.00	0.33	$4,156.02
6:10 pm	$12,594.00	Arrow	BRAEMAR5	Energy	$12,594.00	0.33	$4,156.02
		Arrow	BRAEMAR6	Energy	$12,594.00	0.33	$4,156.02
		Arrow	BRAEMAR7	Energy	$12,594.00	0.33	$4,156.02
6:15 pm	$15,100.81	Stanwell	STAN-1	Energy	$15,100.00	1.00	$15,100.00
6:20 pm	$15,107.27	Stanwell	TARONG#1	Energy	$15,100.00	1.00	$15,100.00
6:25 pm	$15,119.94	Stanwell	STAN-2	Energy	$15,100.00	1.00	$15,100.00
6:30 pm	$15,121.46	Engie	LOYYB1	Energy	$19.18	-0.50	-$9.59
		Engie	LOYYB2	Energy	$19.18	-0.50	-$9.59
		Hydro Tas	REECE2	Energy	$30.82	0.96	$29.59
		Stanwell	STAN-2	Energy	$15,100.00	1.00	$15,100.00
		Basslink	T-V-MNSP1	Energy	$0.00	-0.96	$0.00
30-minute price							**$14,265/MWh**

Table B 7 Price Setter 1 February 7 pm Queensland

Time	Dispatch price	Participant	Unit	Service	Offer price	Mrgl change	Contribution
6:35 pm	$15,116.32	Stanwell	STAN-2	Energy	$15,100.00	1.00	$15,100.00
6:40 pm	$15,114.59	Stanwell	STAN-2	Energy	$15,100.00	1.00	$15,100.00
6:45 pm	$15,102.47	Stanwell	STAN-1	Energy	$15,100.00	0.50	$7,550.00
		Stanwell	STAN-3	Energy	$15,100.00	0.50	$7,550.00
6:50 pm	$15,114.59	Stanwell	STAN-2	Energy	$15,100.00	1.00	$15,100.00
6:55 pm	$15,126.62	Stanwell	TARONG#4	Energy	$15,100.00	1.00	$15,100.00
7:00 pm	$12,594.00	Arrow	BRAEMAR5	Energy	$12,594.00	0.33	$4,156.02
		Arrow	BRAEMAR6	Energy	$12,594.00	0.33	$4,156.02
		Arrow	BRAEMAR7	Energy	$12,594.00	0.33	$4,156.02
30-minute price							**$14,682/MWh**

6 Appendix C: Lack of reserve explained

AEMO is required to monitor the level of reserve, or spare capacity, within each region of the NEM. Reserves are defined as the difference between the volume of electricity that can be made available to consumers, either by local generation or through the network from other regions of the NEM, and the regional customer demand at that time.

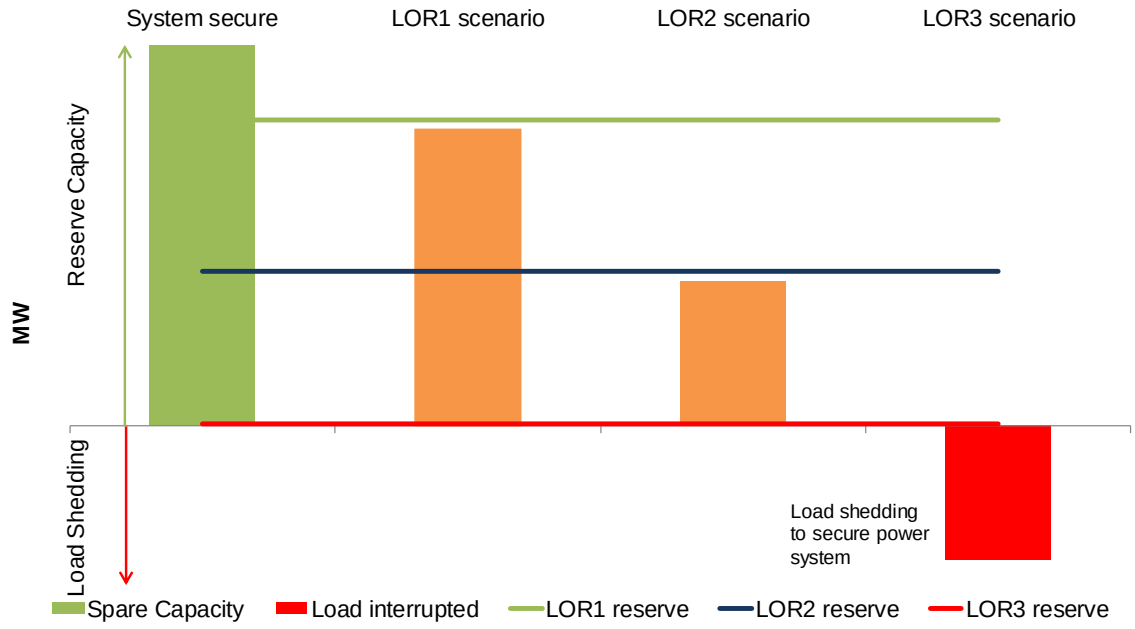
Reserves are an indicator of the supply demand balance and an important tool to communicate with the market potential and actual shortfalls. This is achieved through the release of lack of reserve (LOR) notices by AEMO. Forecast LOR notices are designed to elicit a market response from generators to increase their declared available capacity or retailers to reduce demand to address any forecast reserve shortfalls. Actual LOR notices are also issued when the thresholds are actually triggered.

There are 3 reserve thresholds, which relate to managing power system security following a defined number of unplanned failures of either transmission or generating equipment (credible contingencies). An example of a credible contingency would be the failure of a large generator or the failure of a transmission line that would reduce interconnector capacity.

The 3 LOR levels are broadly categorised as follows:[9]

- LOR1: declared when AEMO the minimum level of reserves are low enough that load shedding is likely to occur in the event of the two largest credible contingencies in a region.
- LOR2: declared when AEMO the minimum level of reserves are low enough that load shedding is likely to occur in the event of the single largest credible contingency in a region.
- LOR3: declared when the minimum level of reserves are at (or below) zero, where customer(s) load would be, or is, shed in order to maintain power system security.

Figure 4: Spare capacity and lack of reserve



9https://aemo.com.au/learn/energy-explained/energy-101/aemo-market-notifications-explained

Figure 4 shows the four possible reserve scenarios graphically. Assuming that the horizontal axis line represents a situation when supply equals demand, then excess generating capacity (above the x axis) amounts to spare or reserve capacity. As discussed above, the 3 reserve levels are shown as 3 horizontal lines, reserve requirements for LOR1 in green, for LOR2 in blue and where there are no reserves and all capacity is being used to meet demand, LOR3, in red. The solid green and amber blocks represent spare capacity. As the spare capacity drops below a reserve line (the horizontal lines) either by a reduction in available capacity or an increase in demand, a new reserve condition exists. AEMO monitors this situation continuously and issues LOR notices to inform participants. When there is insufficient capacity to meet demand load must be shed for load other than non-interruptible load (including commercial, industrial and residential customers) and an LOR3 is issued.

7 Appendix D: Intervention pricing arrangements

At times, AEMO, may need to override the normal dispatch process to maintain system security. In accordance with the National Electricity Rules, a dispatch interval where an AEMO intervention event occurs, must be declared an intervention price dispatch interval and set the energy and Frequency Control Ancillary Service (FCAS) prices for all regions as if AEMO had not intervened in the market. An intervention pricing interval is declared when AEMO directs a participant to operate plant other than in accordance with dispatch instructions, or activates a reliability and emergency reserve trader (RERT) contract.

RERT contracts refer to specific arrangements by AEMO by which additional capacity may be made available under special circumstances. AEMO may dispatch or activate RERT contract(s) to address a power system security situation.

Under normal operations AEMO sets targets for generation and interconnectors and determines wholesale electricity market prices (energy and FCAS) in a single calculation for every five minute dispatch interval. Under "Intervention pricing" these are calculated twice for each dispatch interval, one taking into account the direction called "Intervention" and one that does not include the direction called "What-if".

The "Intervention" calculation takes into account the direction by AEMO and is used to set targets for generation in order to meet demand. The pricing outcome of this calculation is not received by the generators.

The "What-If" calculation does not take the direction into account and is used to calculate the wholesale electricity market price and is received by generators. The generation targets calculated are not used to dispatch generation.

These calculations dispatch generation to meet demand (intervention calculation) while providing the pricing signal to indicate a shortage of supply (what-if calculation).