

Electricity prices above \$5,000/MWh

Queensland,
11 November 2021

January 2022

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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 price¹ 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.

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 11 November 2021 the 30-minute price in Queensland reached \$7,149/MWh for the 2 pm 30-minute period. This price was not forecast until just before dispatch.

The main drivers for the high price were:

- Rebidding of around 700 MW of capacity from low to high prices.
- Limited access to low-priced capacity due to generator outages and reduced generator availability.
 - There was over 900 MW of baseload capacity on planned outages.
 - Upgrades to the Queensland-New South Wales Interconnector (QNI) requiring network outages in NSW limited access to cheaper generation in NSW.
- Interaction between the energy and FCAS markets with FCAS prices high at the time.
- Sudden increase in grid demand due to a reduction in rooftop solar generation.

At the time, 21% of capacity in Queensland was offered above \$5,000/MWh.

This report is 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. We are separately requesting information from relevant market participants on rebids and operational conditions on the day.

3 Analysis

3.1 Overview of actual and expected conditions

The Queensland 30-minute price for 2 pm on 11 November 2021 was \$7,149/MWh, comprising of three 5-minute prices above \$11,000/MWh. This high price was not forecast until just before dispatch. Table 1 compares actual and forecast 30-minute prices, demand and availability:

- A high 30-minute price was not forecast.
- Demand for the 30-minute period was 237 MW higher than forecast 4 hours prior.
- Availability for the 30-minute period was 311 MW lower than forecast 1 hour prior.

Table 1: Actual and forecast 30-minute price, demand and available capacity

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
2 pm	7,149	300	281	7,640	7,551	7,403	10,043	10,354	10,275

3.2 Reduced access to low-priced capacity

3.2.1 Some baseload capacity in Queensland was unavailable

980 MW of baseload capacity was unavailable on the day, all of which was planned since at least October 2021 (Table 2).

Table 2: Unavailable baseload generation

Participant	Station	Unit	Registered capacity (MW)	Max avail 2 pm (MW)	Unavailable (MW)	Reason
Callide Power Trading	Callide C	CPP_4	420	0	-420	Planned - Offline since significant failure on 25 May 2021
CS Energy	Gladstone	GSTONE1	280	0	-280	Planned - Offline since 15 July
		GSTONE2	280	0	-280	Planned - Offline since 23 October
Total					-980	

3.2.2 Planned network outages reduced access to low-priced capacity from other regions

There were planned outages to network equipment in NSW due to the upgrade of QNI which limited access to cheaper generation from NSW.

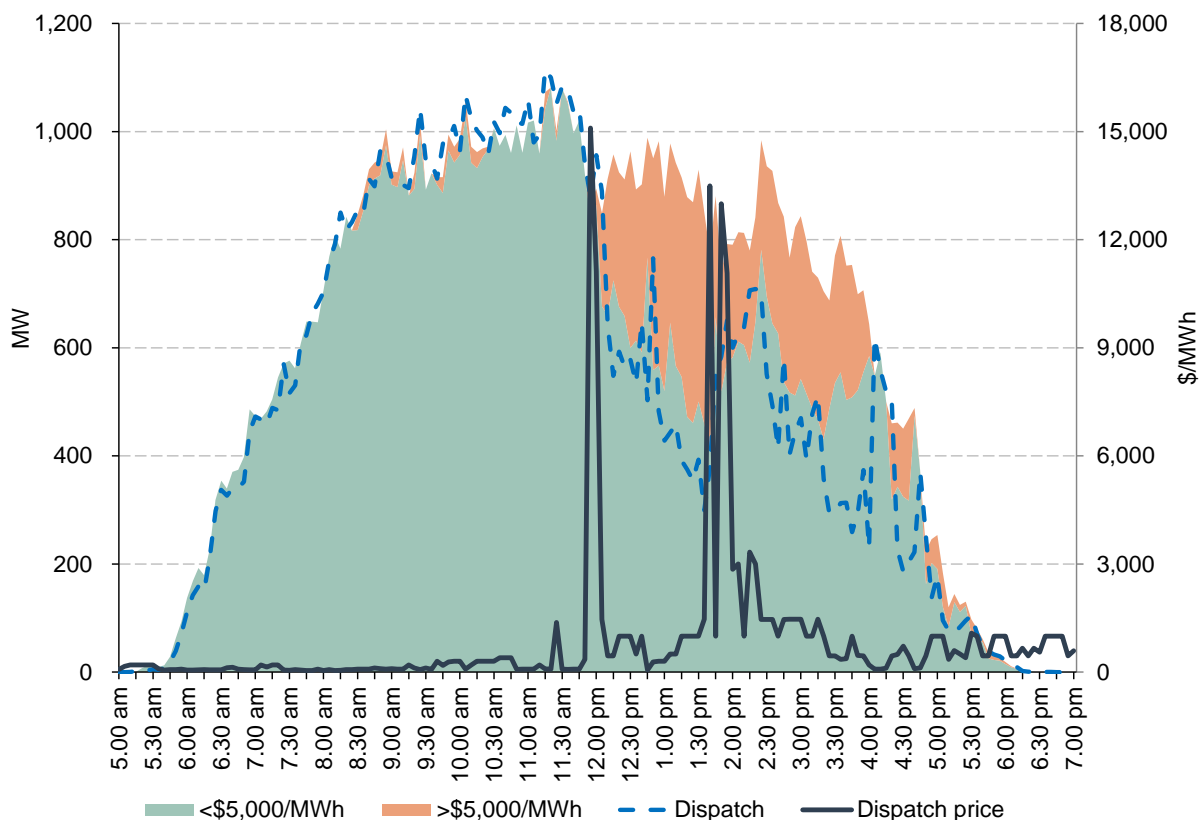
In northern NSW there was a planned outage of the Liddell to Tamworth line as part of the upgrade to QNI, which commenced in May 2020. This limited imports over QNI from NSW to an average of 130 MW for the 2 pm 30-minute period compared to a usual 300-600 MW nominal limit.²

3.3 Rebidding capacity to higher prices contributed to the high price

Rebidding of capacity from low to high prices contributed to the 30-minute price exceeding \$5,000/MWh.

There was around 700 MW of capacity rebid from price below \$1,000/MWh to above \$13,000/MWh. A majority of this rebid capacity was at 7 different solar farms which led to a reduction in grid scale solar generation (Figure 1). There were also rebids at Wivenhoe, Millmerran and Darling Downs. Any rebids that significantly contributed to the price outcomes are contained in *Appendix A: Significant rebids*.

Figure 1: Solar offers



The reasons given for all the rebids related to either Frequency Control Ancillary Services (FCAS) costs or a change in energy price forecast. For example, of the 9

² See AEMO's Interconnector capabilities document https://www.aemo.com.au/-/media/Files/Electricity/NEM/Security_and_Reliability/Congestion-Information/2017/Interconnector-Capabilities.pdf

rebids we identified as significant for 1.40 pm, 6 related to FCAS and 3 to a change in forecast energy price.

Raise 6 and 60 second FCAS prices in Queensland exceeded \$5,000/MW for a majority of the time between noon and 7.30 pm on 11 November. We will be writing about these in a focus story as part of our Q4 2021 Quarterly report. When high FCAS prices occur participants can react in different ways depending on their situation. If a participant doesn't offer a unit in the FCAS market then it does not receive any revenue from the high FCAS prices but must pay for required raise 6 second, 60 second and 5 minute services if the unit is generating.³ So, if the cost of FCAS is greater than what the participant earns from the energy market it may rebid to stop or reduce generating energy and therefore reduce FCAS costs. If it does offer energy and FCAS then it may be beneficial for the participant to rebid to reduce energy generation allowing for more dispatch in the raise FCAS market. Both these scenarios were given by market participants on 11 November 2021 as seen in the rebid reasons "fcas costs greater than ppa revenue" and "Energy/FCAS Tradeoff".

There were also other participants which offered capacity above \$5,000/MWh for the high priced intervals (Table 3). These offers were mostly set up the day prior. The offers for participants with high priced capacity are set out in *Appendix B: Offers greater than \$5,000/MWh*.

Table 3: Capacity offered above \$5,000/MWh for 2 pm

Participant	Station	Fuel type	Capacity (MW) offered >\$5,000/MWh					
			1.35 pm	1.40 pm	1.45 pm	1.50 pm	1.55 pm	2 pm
Alinta Energy	Braemar A	Gas	4	4	1	1		
Arrow Energy	Braemar 2	Gas	170	170	170	170	170	170
Callide Power Trading	Callide C	Coal-Black	27	27	27	27	27	27
Clare Solar Farm	Clare SF	Solar	98	98	83	98	98	98
CleanCo	Wivenhoe	Hydro				285	285	
CS Energy	Gladstone	Coal-Black	200	140	140	140	70	70
Edify Energy	Whitsunday SF	Solar	49	22	21	19	19	18
Elliott Green Power	Childers SF	Solar	2	1				
	Susan River SF	Solar	24	34				
Ergon Energy	Lilyvale SF	Solar	53	53	53	38	39	34
Shell	Oakey	Gas	212	212	212	167	167	112
Genex Power	Kidston SF	Solar	44	39	38	37	34	29
InterGen	Millmerran	Coal-Black	85	85	85	85	85	85
Origin Energy	Darling Downs	Gas	145	145	145	145	145	145
	Mt Stuart	Liquid	388	388	388	388	388	388

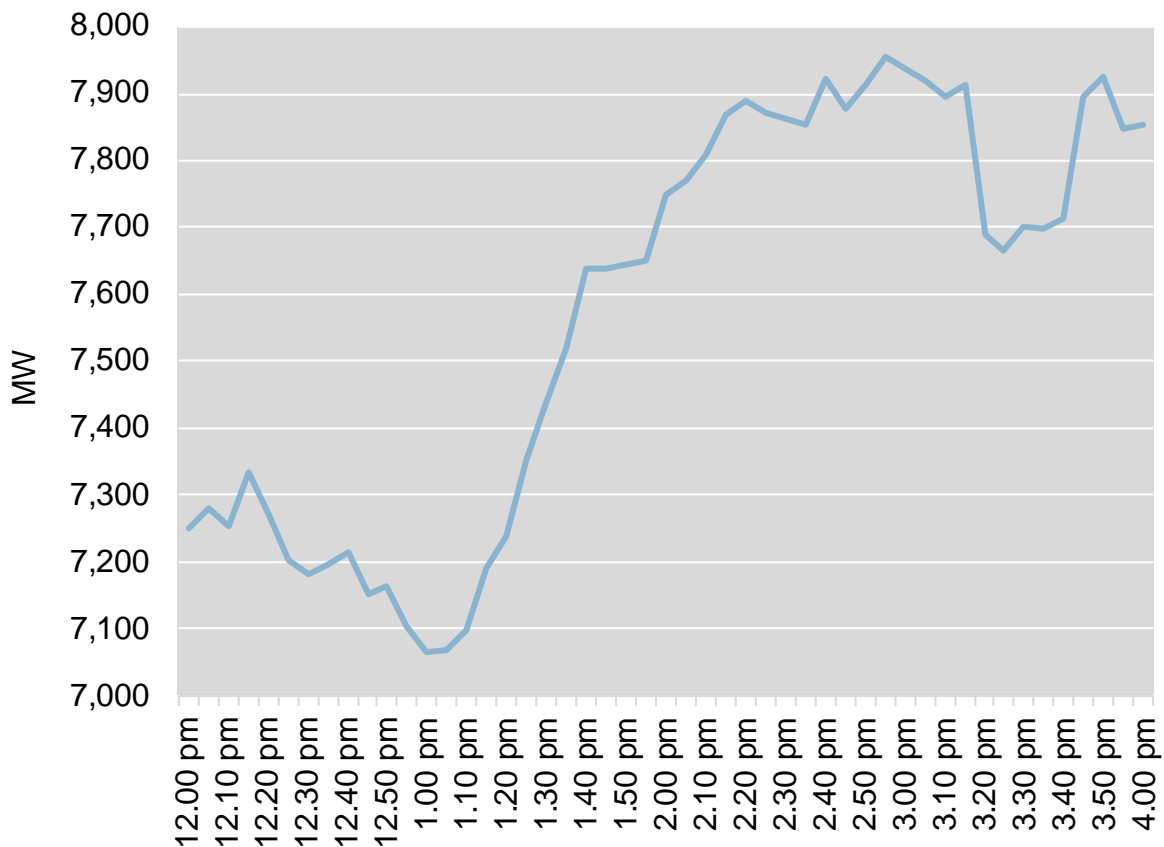
³ https://aemo.com.au/-/media/files/electricity/nem/data/ancillary_services/2020/settlements-guide-to-ancillary-services-payment-and-recovery.pdf?la=en

Participant	Station	Fuel type	Capacity (MW) offered >\$5,000/MWh					
			1.35 pm	1.40 pm	1.45 pm	1.50 pm	1.55 pm	2 pm
	Roma	Gas	61	61	61	61	61	61
Ross River Operations	Ross River SF	Solar	92	88				
Stanwell	Stanwell	Coal-Black	225	225	225	225	225	225
	Tarong	Coal-Black	80	80	80	80	80	80
	Tarong North	Coal-Black	193	193	193	193	193	193
Sun Metals	Sun Metals SF	Solar	29	29	29	29	29	29
Grand Total			2,182	2,095	1,951	2,189	2,115	1,765

3.4 Demand and rooftop solar

Demand was higher than forecast and increased by around 700 MW between 1 pm and 2 pm (Figure 2) driven by a change in rooftop solar output.

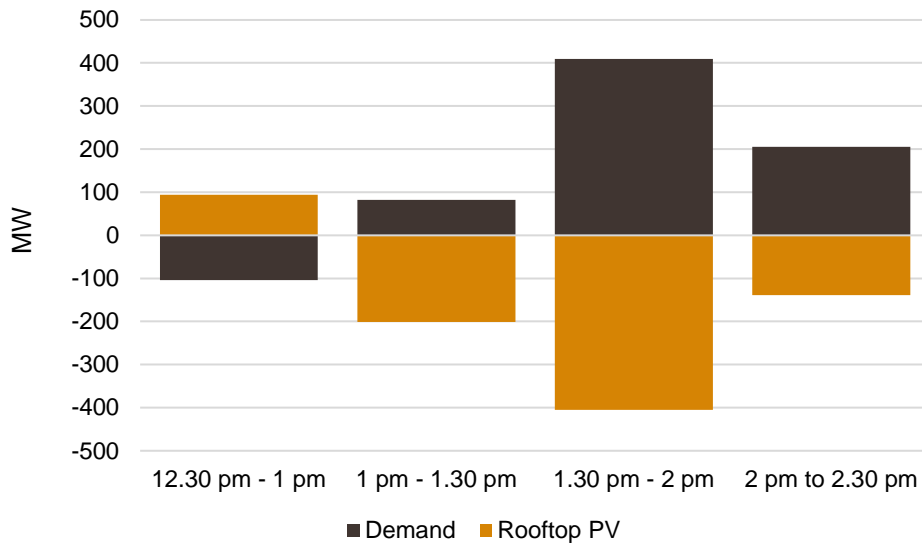
Figure 2: 5-min Demand



Rooftop solar generation reduces the demand for NEM generation, so if there is a change in output there is an opposite change in demand met by NEM generation. From around 1 pm rooftop solar output began to fall, increasing grid demand. The

biggest change occurred between 1.30 pm and 2 pm (Figure 3) when rooftop solar output decreased by 400 MW and there was a corresponding increase in demand.

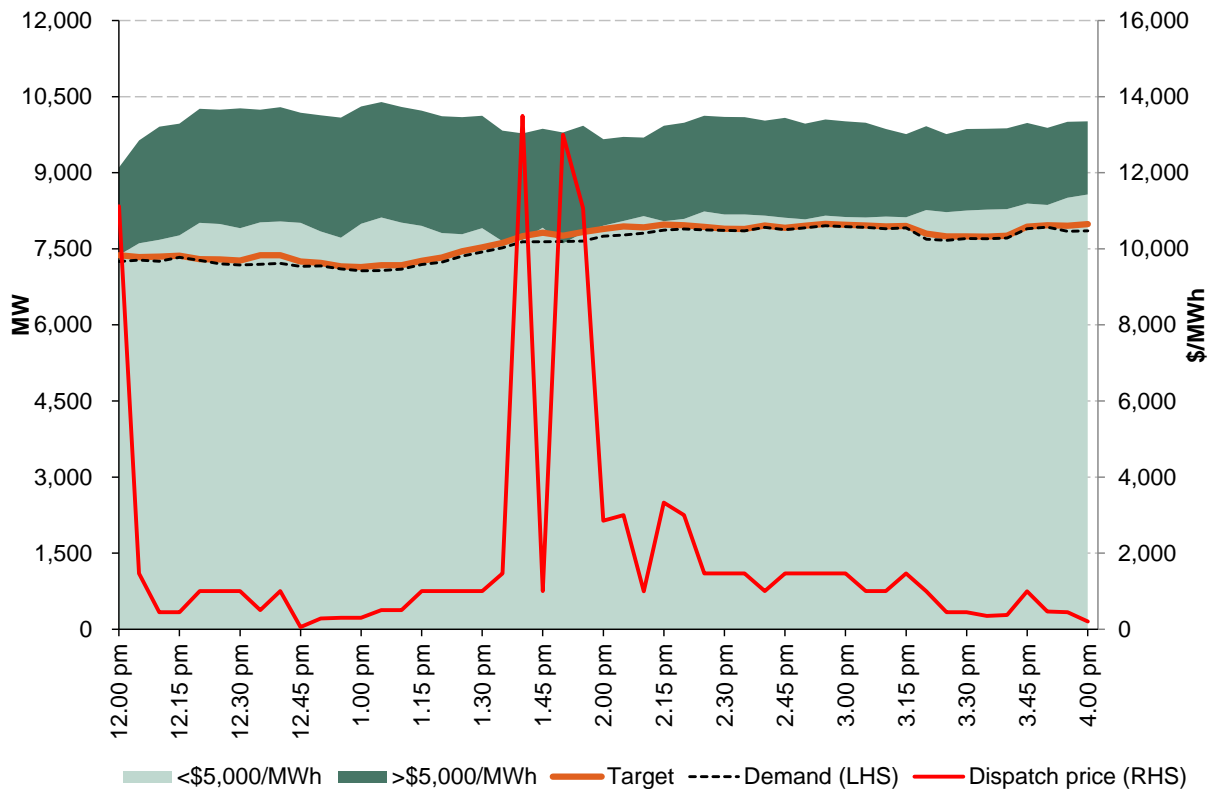
Figure 3: Demand and rooftop solar change between 30-minute periods



3.5 High prices at 1.40 pm, 1.50 pm and 1.55 pm

There were three 5-minute prices that exceeded \$5,000/MWh during the 2 pm 30-minute period. In 2 of these 5-minute periods, capacity priced above \$5,000/MWh was required to meet demand (Figure 4) and in the other the energy price was co-optimised with high FCAS prices.

Figure 4: Closing availability, target and price



At 1.40 pm demand increased by 118 MW and around 270 MW of generation with capacity priced below \$5,000/MWh was unable to be dispatched because they could either not start generating in 5 minutes or were providing raise FCAS instead. As a result 48 MW of capacity that had been rebid from low to high prices was required to meet demand.

At 1.31 pm, effective from 1.50 pm, a rebid by CleanCo at their Wivenhoe Hydro plant shifted 285 MW of capacity from \$1,000/MWh to \$13,000/MWh which set the price for that 5 minutes. The reason given was “Fuel conservation”.

The price for 1.55 pm reached \$11,073/MWh due to the trade off between the energy and FCAS markets with the high price of FCAS contributing to all but \$37/MWh of the price.

The generators involved in setting price during the high-price periods and how that price was determined by the market systems are detailed in *Appendix C: Price Setter*.

Appendix A: Significant rebids

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

Table A1: Significant rebids for 1.40 pm trading interval

Submit time	Time effective	Participant	Station	Capacity rebid (MW)	Price from (\$/MWh)	Price to (\$/MWh)	Rebid reason
12.43 pm		InterGen	Millmerran	85	13	15,100	A QLD1 raise6secrrp change +14488 (12:30 p5 di 11/11/21 13:05 value 14500 vs 12:25 p5 di 11/11/21 13:05 value 12) sl
1.03 pm	1.10 pm	Ergon Energy	Lilyvale Solar Farm	98	0	15,100	fcas costs greater than ppa revenue - sl
1.06 pm	1.15 pm	Clare Solar Farm	Clare Solar Farm	98	-2	15,100	fcas costs greater than ppa revenue - sl
1.08 pm	1.15 pm	Edify Energy	Whitsunday Solar Farm	56	0	15,100	co-optimisation of energy revenues & cr-fcas costs - sl
1.08 pm	1.15 pm	Genex Power	Kidston Solar Project	47	-40	13,394	co-optimisation of energy revenues & cr-fcas costs - sl
1.23 pm	1.30 pm	Ross River Operations	Ross River Solar Farm	116	<-65	15,100	band adj to manage change in forecast price sl
1.23 pm	1.30 pm	Elliott Green Power	Susan River Solar Farm	73	<-42	15,009	band adj to manage change in forecast price sl
1.23 pm	1.30 pm	Elliott Green Power	Childers Solar Farm	55	<-41	14,904	band adj to manage change in forecast price sl
1.24 pm	1.35 pm	Origin Energy	Darling Downs	50	61	15,100	Energy/FCAS Tradeoff SL

Table A2: Significant rebids for 1.50 pm trading interval

Submit time	Time effective	Participant	Station	Capacity rebid (MW)	Price from (\$/MWh)	Price to (\$/MWh)	Rebid reason
12.43 pm		InterGen	Millmerran	85	13	15,100	A QLD1 raise6secrrp change +14488 (12:30 p5 di 11/11/21 13:05 value 14500 vs 12:25 p5 di 11/11/21 13:05 value 12) sl
1.03 pm	1.10 pm	Ergon Energy	Lilyvale Solar Farm	98	0	15,100	fcas costs greater than ppa revenue - sl
1.06 pm	1.15 pm	Clare Solar Farm	Clare Solar Farm	98	-2	15,100	fcas costs greater than ppa revenue - sl
1.08 pm	1.15 pm	Edify Energy	Whitsunday Solar Farm	56	0	15,100	co-optimisation of energy revenues & cr-fcas costs - sl
1.08 pm	1.15 pm	Genex Power	Kidston Solar Project	47	-40	13,394	co-optimisation of energy revenues & cr-fcas costs - sl
1.24 pm	1.35 pm	Origin Energy	Darling Downs	50	61	15,100	Energy/FCAS Tradeoff SL

Electricity 30-minute prices above \$5,000/MWh

Submit time	Time effective	Participant	Station	Capacity rebid (MW)	Price from (\$/MWh)	Price to (\$/MWh)	Rebid reason
1.31 pm	1.50 pm	CleanCo	Wivenhoe	285	1,000	15,100	fuel conservation

Table A3: Significant rebids for 1.55 pm trading interval

Submit time	Time effective	Participant	Station	Capacity rebid (MW)	Price from (\$/MWh)	Price to (\$/MWh)	Rebid reason
12.43 pm		InterGen	Millmerran	85	13	15,100	A QLD1 raise6secrrp change +14488 (12:30 p5 di 11/11/21 13:05 value 14500 vs 12:25 p5 di 11/11/21 13:05 value 12) sl
1.03 pm	1.10 pm	Ergon Energy	Lilyvale Solar Farm	98	0	15,100	fcas costs greater than ppa revenue - sl
1.06 pm	1.15 pm	Clare Solar Farm	Clare Solar Farm	98	-2	15,100	fcas costs greater than ppa revenue - sl
1.08 pm	1.15 pm	Edify Energy	Whitsunday Solar Farm	56	0	15,100	co-optimisation of energy revenues & cr-fcas costs - sl
1.08 pm	1.15 pm	Genex Power	Kidston Solar Project	47	-40	13,394	co-optimisation of energy revenues & cr-fcas costs - sl
1.24 pm	1.35 pm	Origin Energy	Darling Downs	50	61	15,100	Energy/FCAS Tradeoff SL
1.31 pm	1.50 pm	CleanCo	Wivenhoe	285	1,000	15,100	fuel conservation

Appendix B: Closing bids

Figures B1 to B16 highlight the 5 minute offers for participants in Queensland with capacity priced at or above \$5,000/MWh during the periods in which the 5-minute price exceeded \$5,000/MWh. They also show generation output and the 5-minute price.

Figure B1: Alinta (Braemar A, Collinsville SF and Rugby Rub SF) offers, dispatch and dispatch price

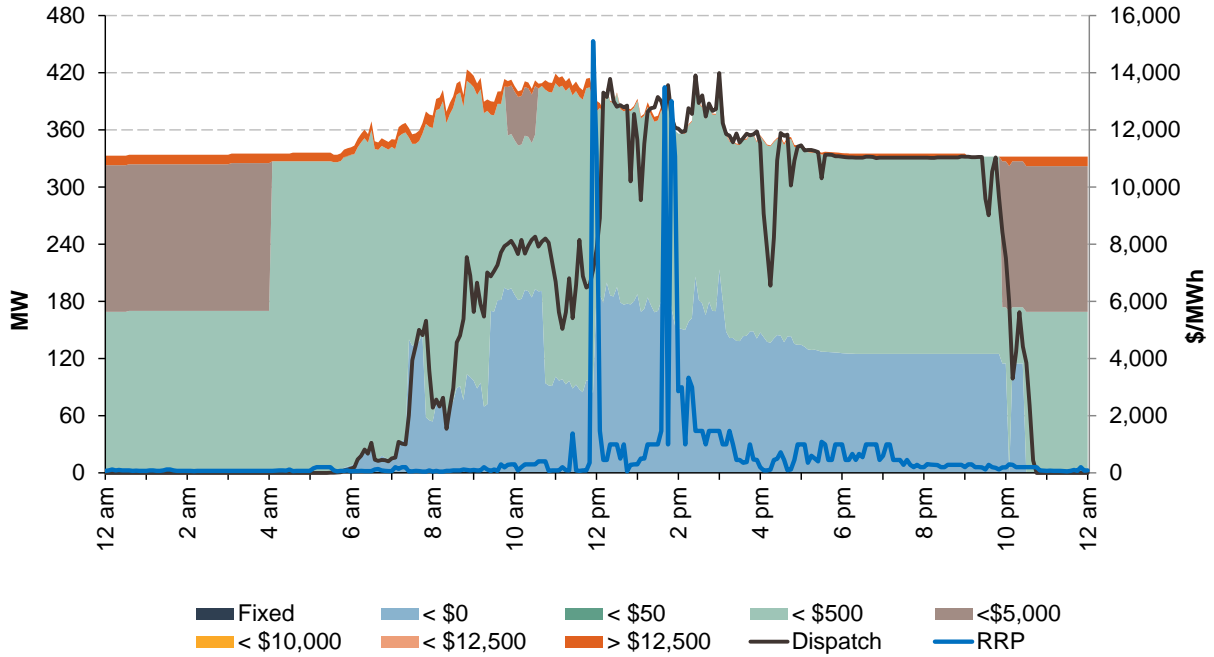


Figure B2: Arrow Energy (Braemar 2) offers, dispatch and dispatch price

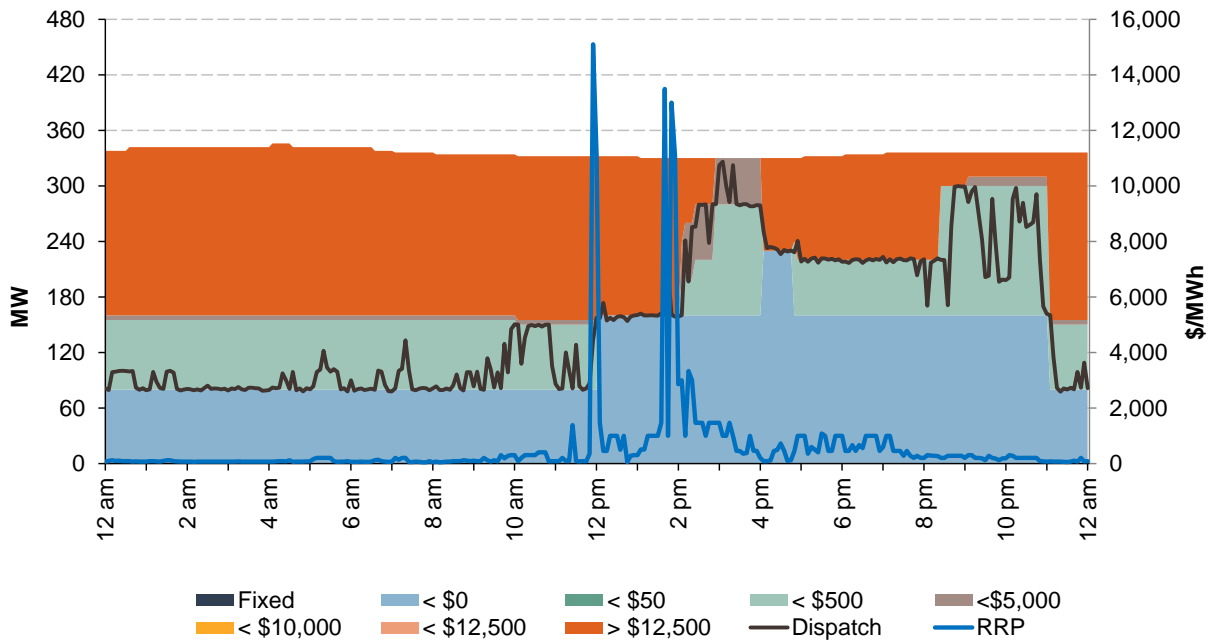


Figure B3: Callide Power Trading (Callide C) offers, dispatch and dispatch price

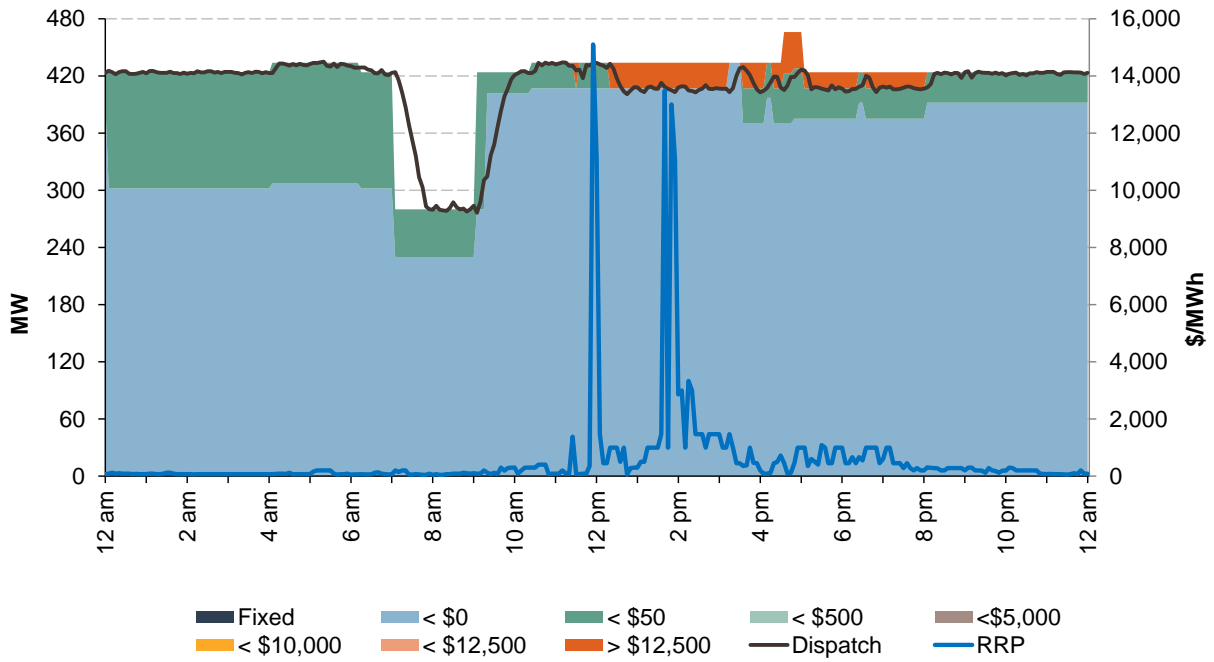


Figure B4: Clare Solar Farm (Clare Solar Farm) offers, dispatch and dispatch price

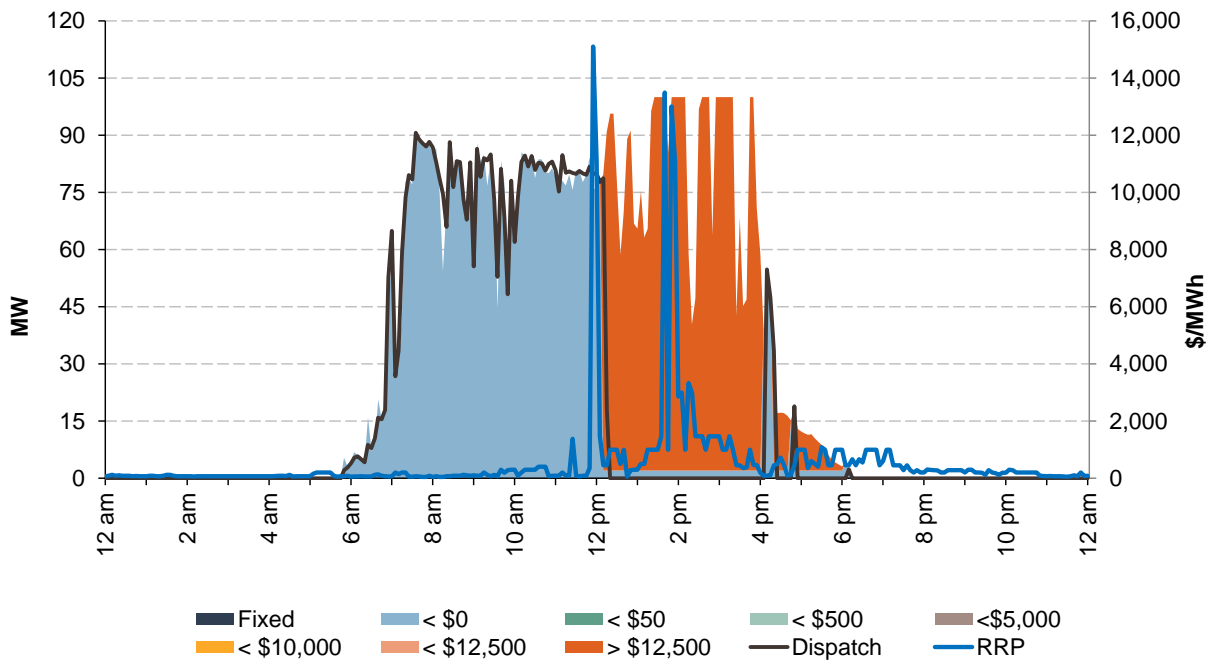


Figure B5: CleanCo (Barron Gorge, Kareeya, Swanbank E and Wivenhoe) offers, dispatch and dispatch price

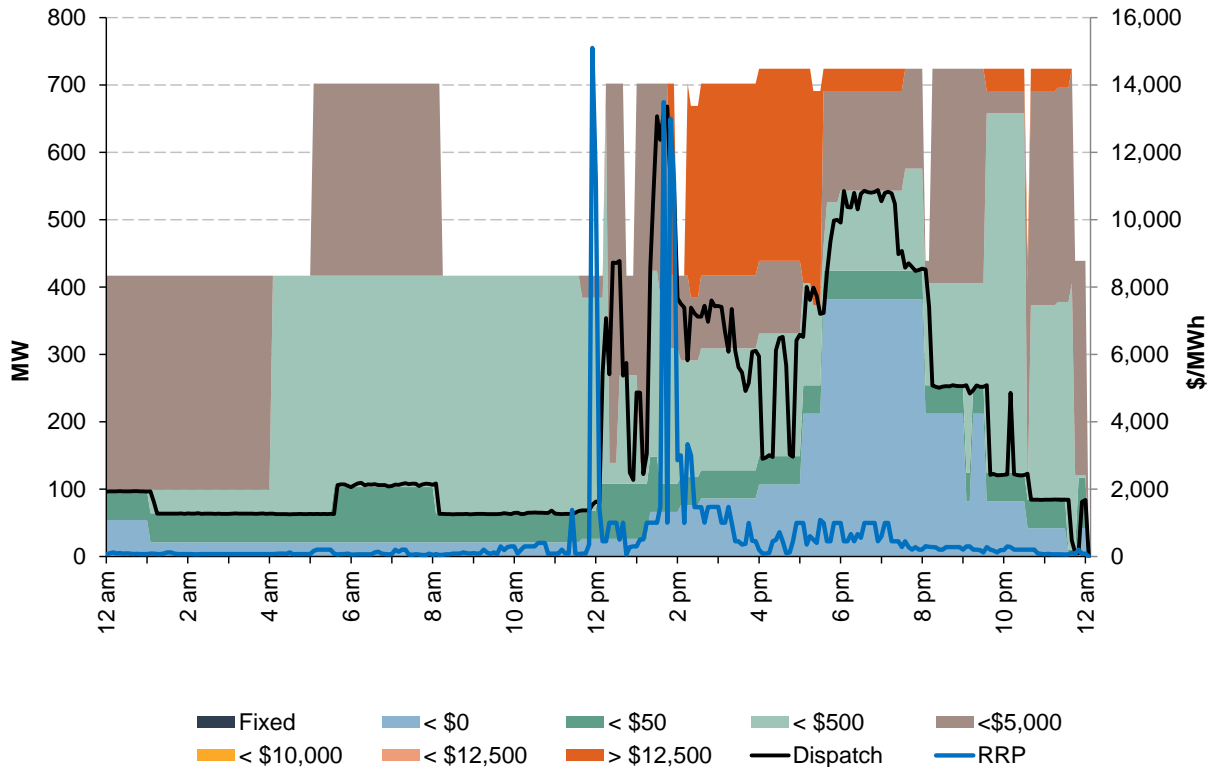


Figure B6: CS Energy (Callide B, Gladstone and Kogan Creek) offers, dispatch and dispatch price

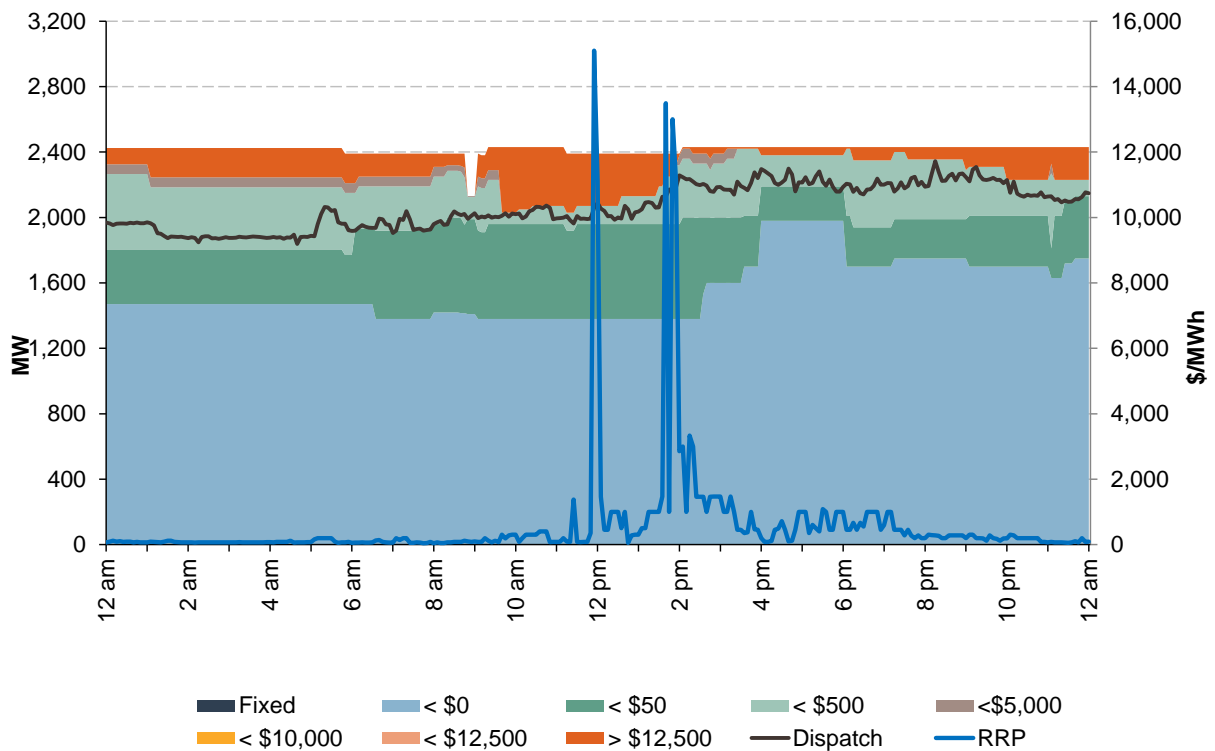


Figure B7: Edify Energy (Hamilton SF, Hayman SF and Whitsunday SF) offers, dispatch and dispatch price

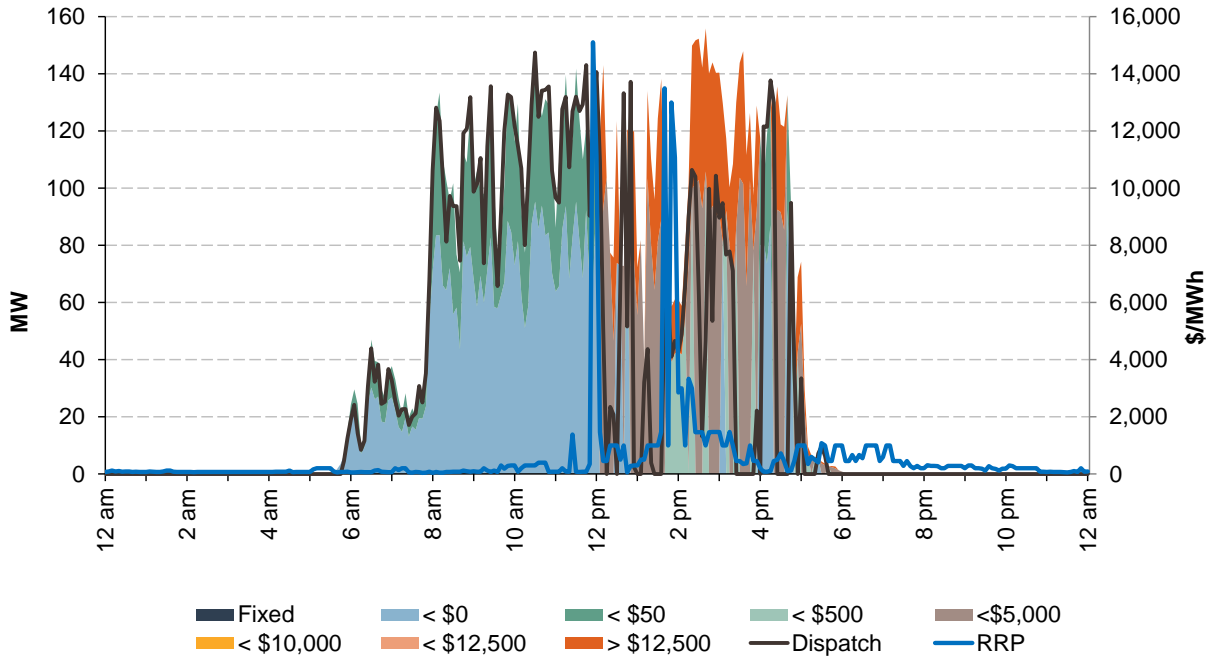


Figure B8: Elliot Green Power (Childerfs SF and Susan River SF) offers, dispatch and dispatch price

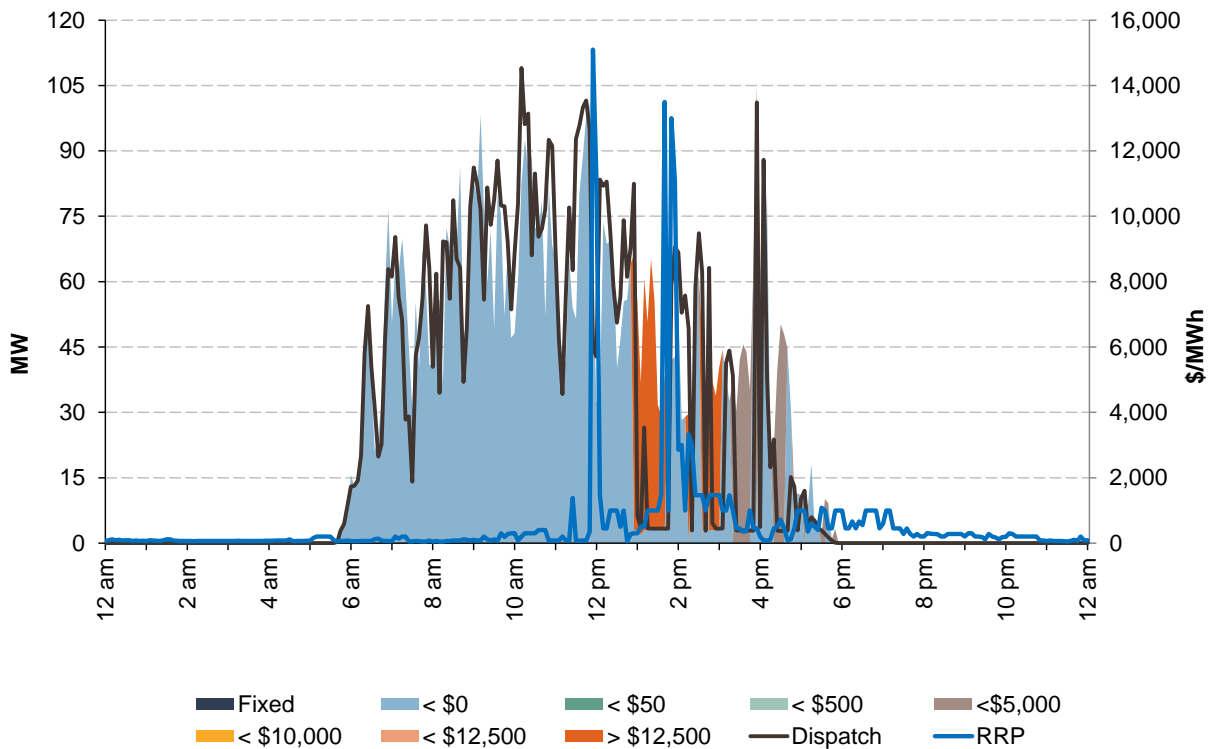


Figure B9: Ergon Energy (Barcaldine, Lilyvale SF and Mt Emerald WF) offers, dispatch and dispatch price

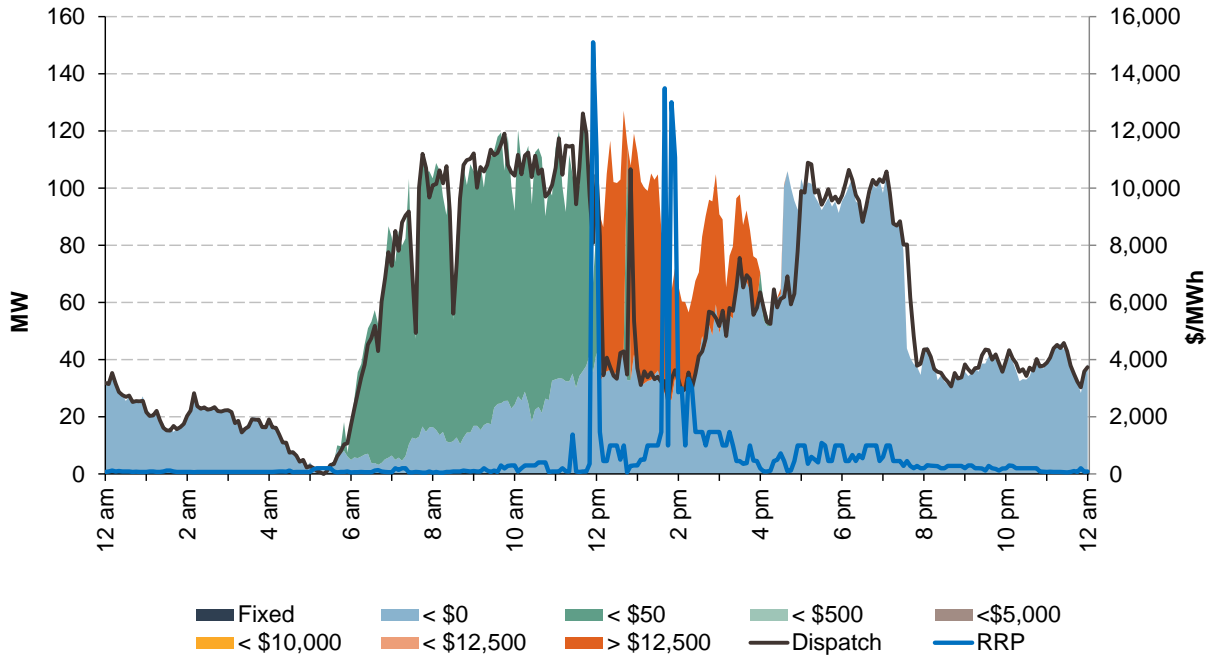


Figure B20: Genex Power (Kidston SF) offers, dispatch and dispatch price

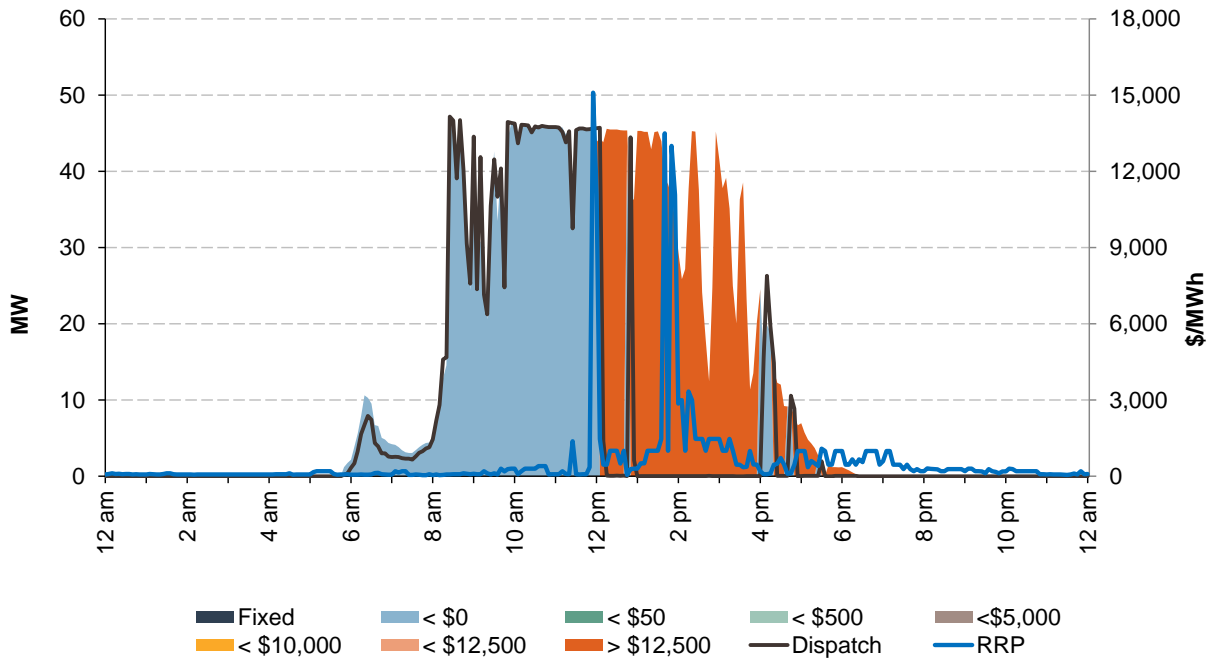


Figure B11: Intergen (Millmerran) offers, dispatch and dispatch price

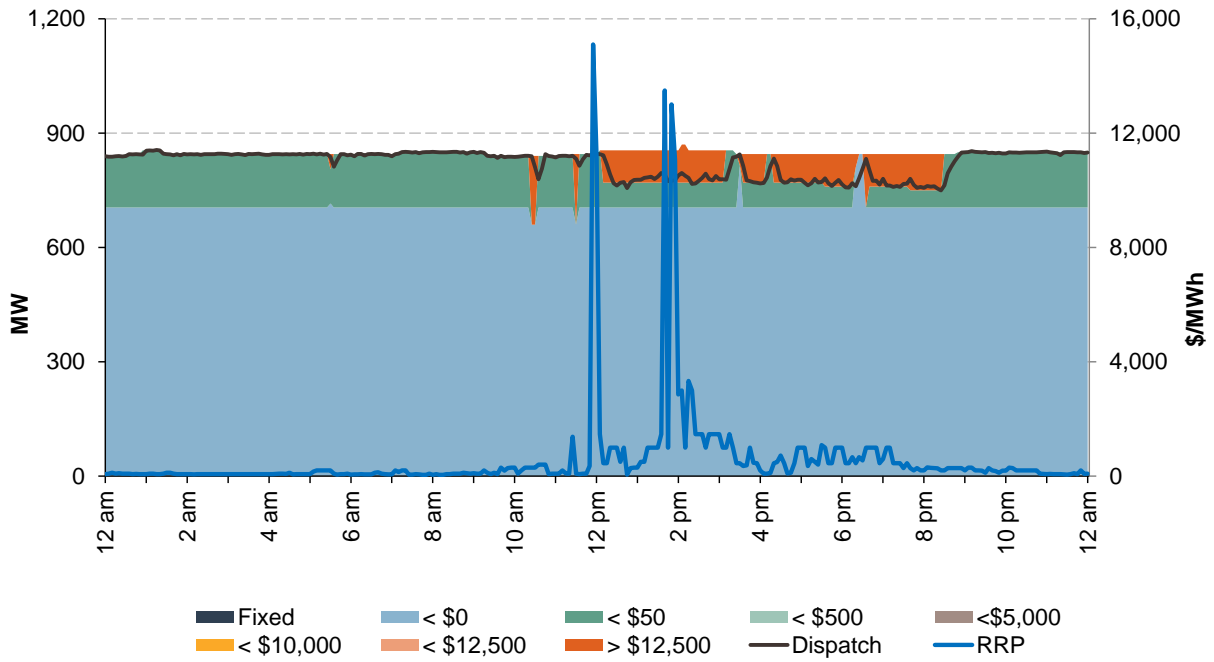


Figure B13: Origin (Darling Downs power station, Mt Stuart, Roma) offers, dispatch and dispatch price

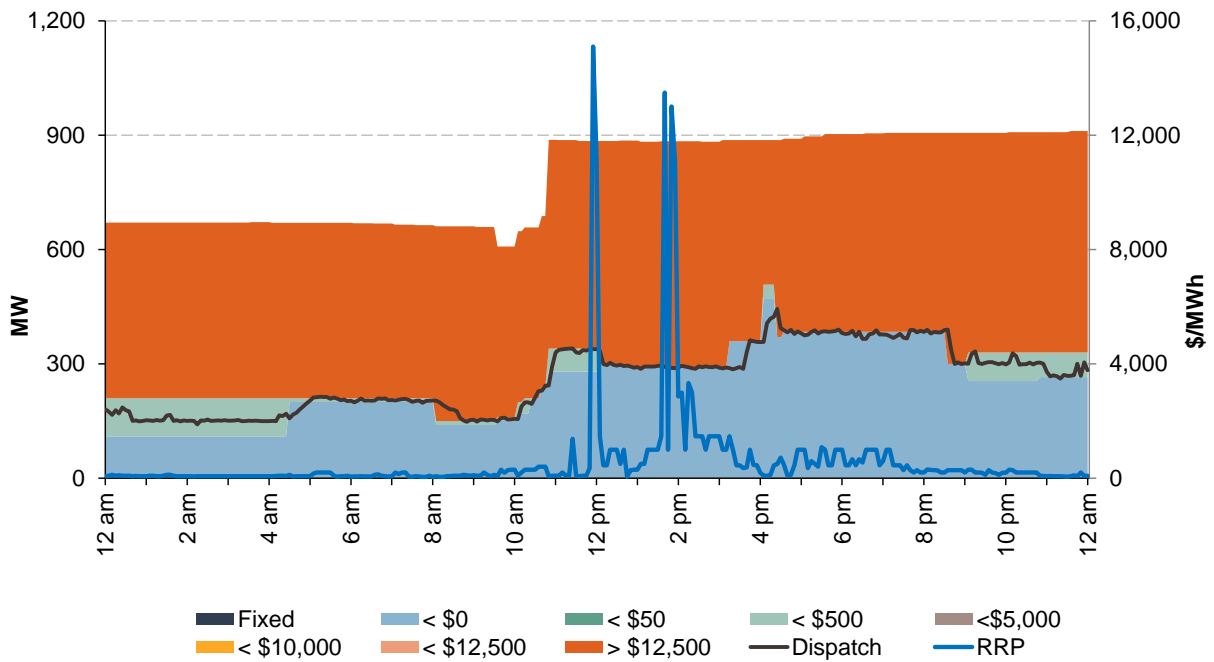


Figure B13: Ross River Operations (Ross River SF) offers, dispatch and dispatch price

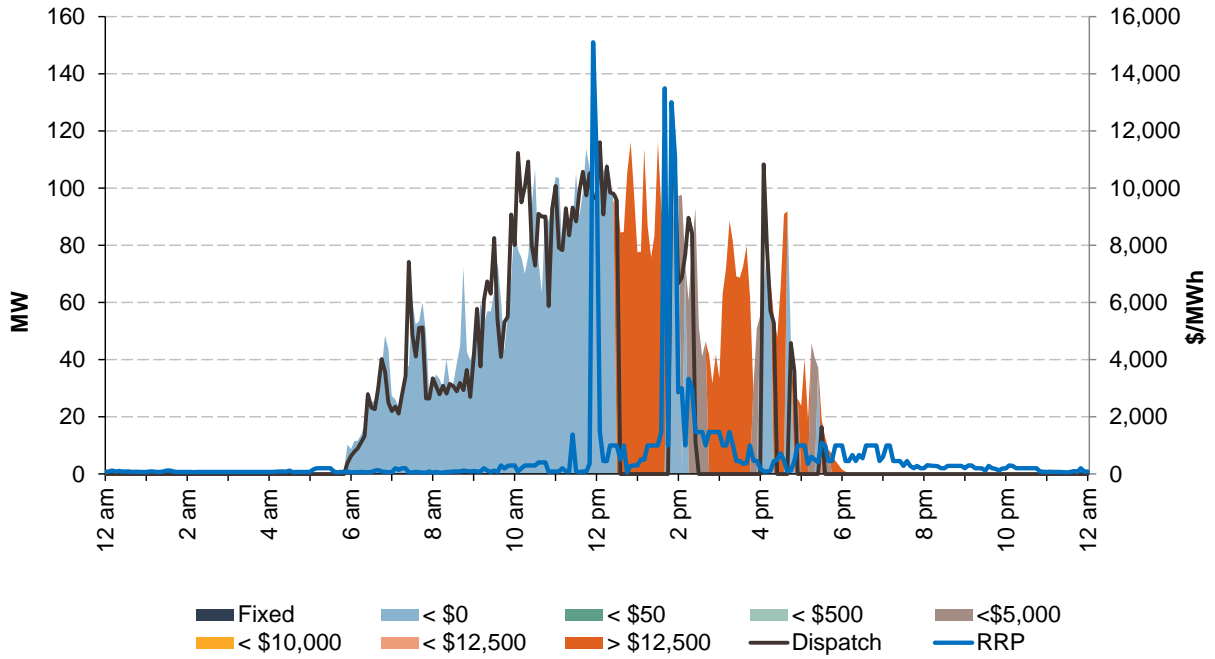


Figure B44: Shell (Oakey) offers, dispatch and dispatch price

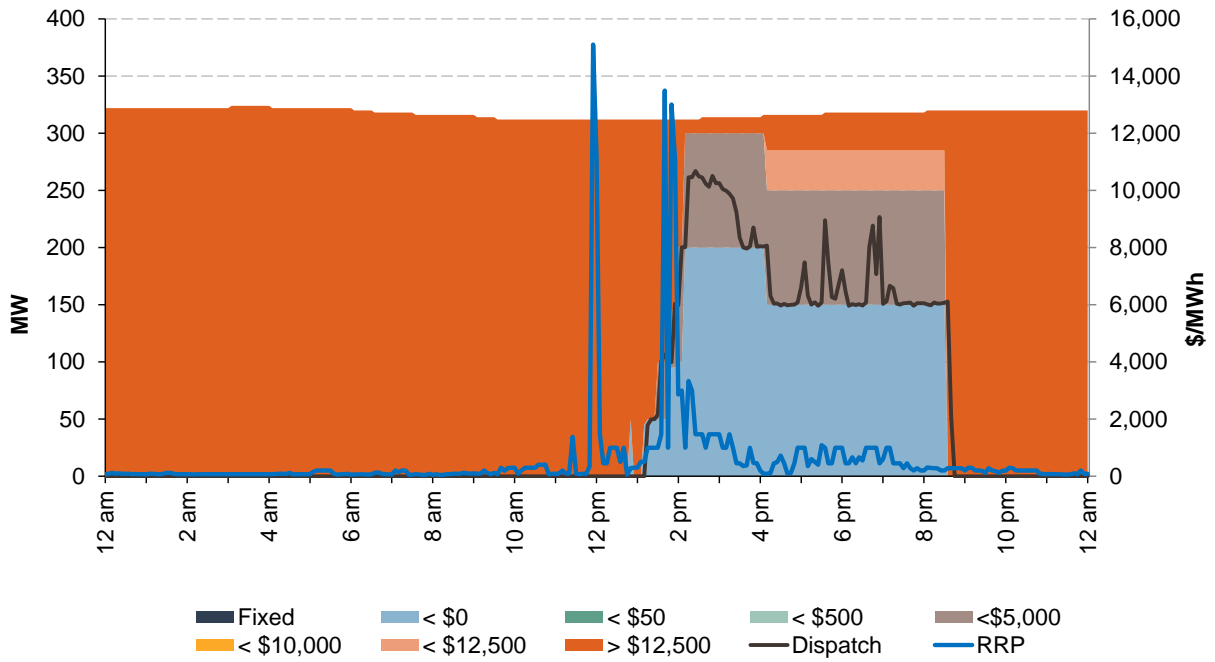


Figure B15: Stanwell (Stanwell, Tarong, Tarong North) offers, dispatch and dispatch price

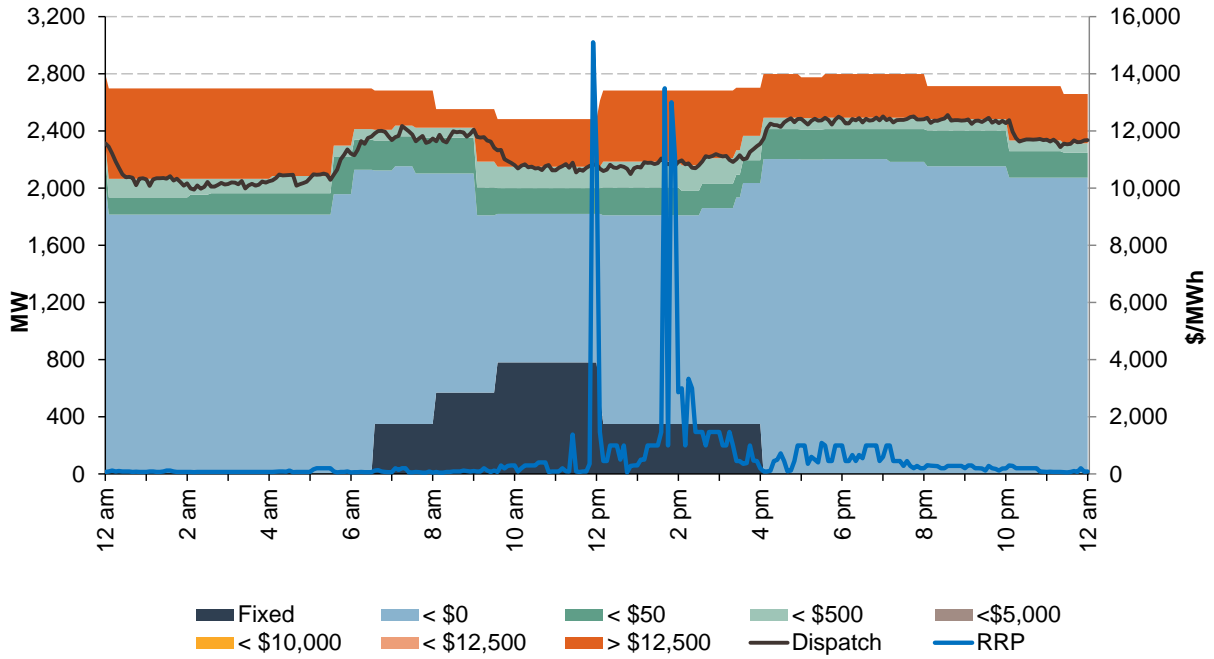
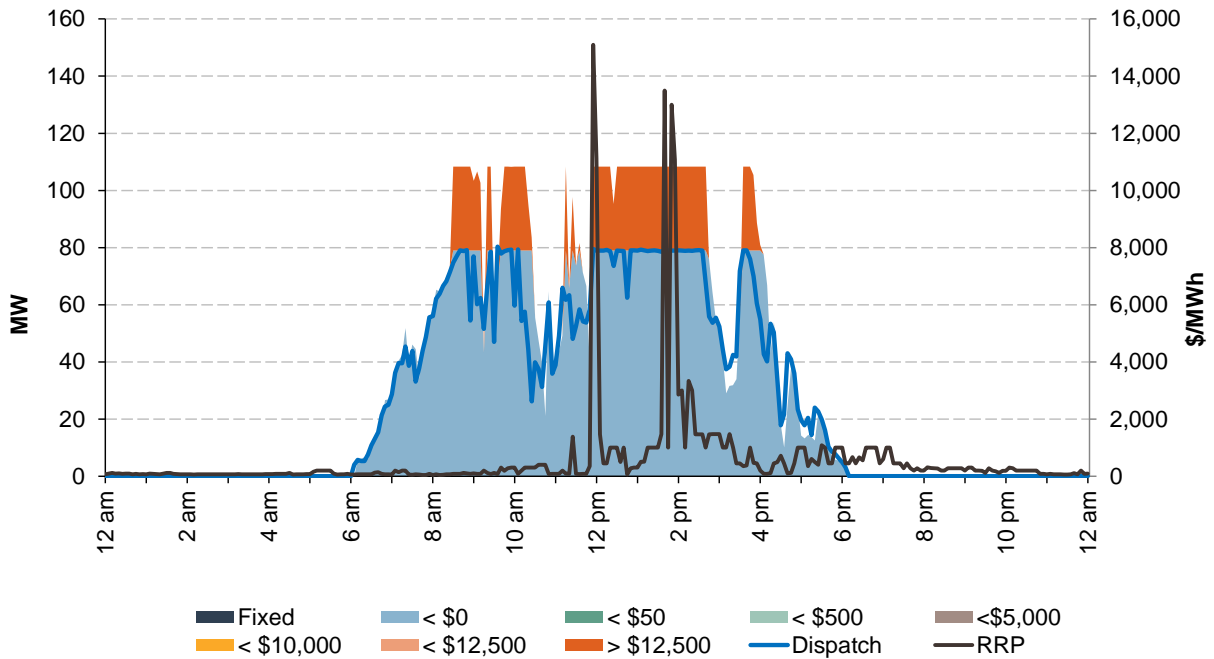


Figure B16: Sun Metal (Sun Metals SF) offers, dispatch and dispatch price



Appendix C: Price setter

The following table identifies for the 5.30 am 30-minute period, each 5-minute price and the generating units involved in setting the energy price. This information is published by AEMO.⁴ The 30-minute price is the average of the six 5-minute intervals. The prices that are in italics are capped at the price cap of \$15,100/MWh when published by AEMO.

Table C1: Price setter

Time	Dispatch price	Participant	Unit	Service	Offer price	Marginal change	Contribution
13:35	\$1,469.01	Clermont Solar	CLERMSF1	Energy	\$1,469.01	1.00	\$1,469.01
13:40	\$13,495.02	Arrow Energy	BRAEMAR5	Energy	\$13,495.02	0.50	\$6,747.51
		Arrow Energy	BRAEMAR7	Energy	\$13,495.02	0.50	\$6,747.51
13:45	\$1,000.00	CleanCo	W/HOE#1	Energy	\$1,000.00	0.21	\$210.00
		CleanCo	W/HOE#2	Energy	\$1,000.00	0.79	\$790.00
13:50	\$13,000.00	CleanCo	W/HOE#2	Energy	\$13,000.00	1.00	\$13,000.00
13:55	\$11,072.75	CS Energy	CALL_B_1	Energy	\$36.62	1.00	\$36.62
		CS Energy	CALL_B_1	Raise 60 sec	\$86.62	-0.38	-\$32.92
		CS Energy	CALL_B_1	Raise 6 sec	\$86.62	-0.38	-\$32.92
		CS Energy	GSTONE4	Raise 6 sec	\$14,500.00	0.38	\$5,510.00
		CS Energy	GSTONE6	Raise 60 sec	\$14,500.00	0.38	\$5,510.00
14:00	\$2,854.66	CleanCo	W/HOE#1	Energy	\$1,000.00	2.00	\$2,000.00
		CleanCo	W/HOE#1	Raise 5 min	\$0.87	-2.00	-\$1.74
		CS Energy	GSTONE5	Raise 60 sec	\$14,500.00	1.00	\$14,500.00
		CS Energy	GSTONE6	Raise reg	\$33.73	1.00	\$33.73
		CS Energy	GSTONE6	Raise 60 sec	\$14,500.00	-1.00	-\$14,500.00
		CS Energy	GSTONE6	Raise 6 sec	\$14,500.00	-1.00	-\$14,500.00
		Alinta Energy	LOYB2	Raise reg	\$9.61	-1.00	-\$9.61
		Enel X Australia	ASNENC1	Raise 5 min	\$0.49	1.00	\$0.49
		Stanwell	TARONG#1	Energy	\$69.10	-0.33	-\$22.80
		Stanwell	TARONG#1	Raise 5 min	\$300.89	0.33	\$99.29
		Stanwell	TARONG#1	Raise 6 sec	\$15,100.00	0.33	\$4,983.00
		Stanwell	TARONG#2	Energy	\$69.10	-0.33	-\$22.80
		Stanwell	TARONG#2	Raise 5 min	\$300.89	0.33	\$99.29
		Stanwell	TARONG#2	Raise 6 sec	\$15,100.00	0.33	\$4,983.00
		Stanwell	TARONG#4	Energy	\$69.10	-0.33	-\$22.80
		Stanwell	TARONG#4	Raise 5 min	\$300.89	0.33	\$99.29
		Stanwell	TARONG#4	Raise 6 sec	\$15,100.00	0.33	\$4,983.00
30 minute price		\$7,149/MWh					

⁴ Details on how the price is determined can be found at https://aemo.com.au/-/media/files/electricity/nem/it-systems-and-change/nemde-queue/nemde_queue_users_guide.pdf?la=en