

Trading Conduct Report

Market Monitoring Weekly Report

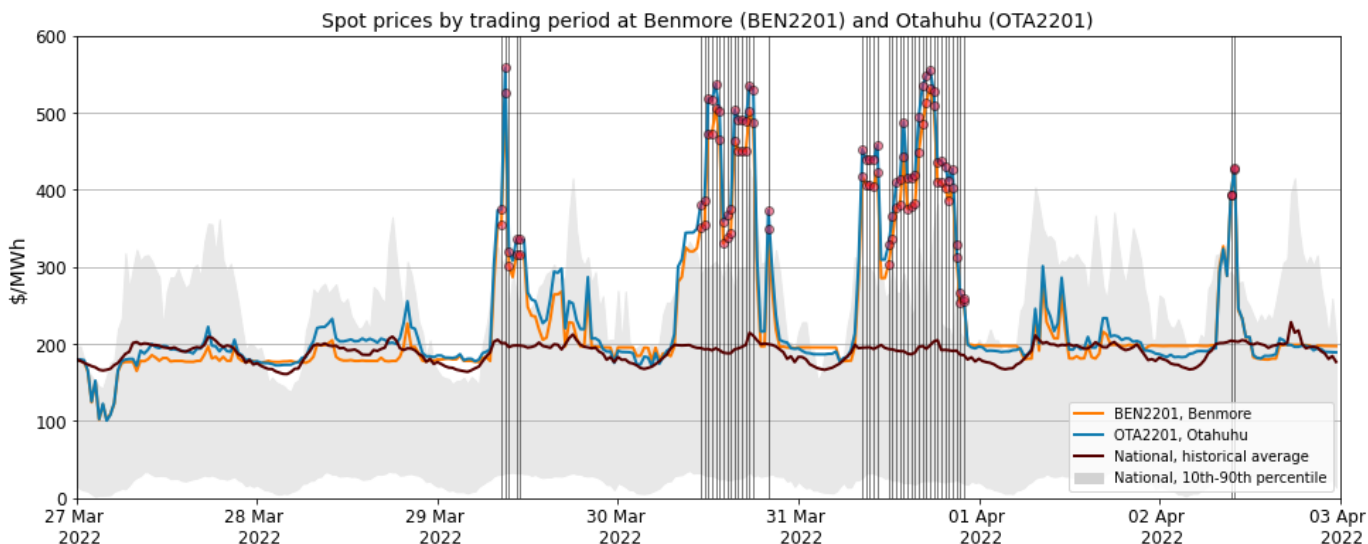
1. Overview for the week of 27 March to 2 April

1.1. While most wholesale spot prices this week appear to be consistent with supply and demand conditions information has been requested in regard to fluctuations at Huntly 4 for trading periods 14-37 between 29 March and 2 April.

2. Spot Prices

2.1. Figure 1 shows wholesale electricity spot prices from the past week at Benmore and Otahuhu alongside historic mean and historic 10th-90th percentiles with the highest priced trading periods marked out by vertical lines. Spot prices between 27 March and 2 April averaged \$237.08/MWh, compared to a historical average of \$122/MWh for the same period.

Figure 1: Wholesale Spot Prices



2.2. The highest (when Benmore or Otahuhu exceeded their historical 90th percentile) priced trading periods for this week are listed below in Table 1. In total there were 49 trading periods flagged.

2.3. The highest price for the week at Benmore was \$531.46/MWh on trading period 36, 31 March. The highest price for the week at Otahuhu was \$558.32/MWh on trading period 19, 29 March.

Table 1: High Priced Periods

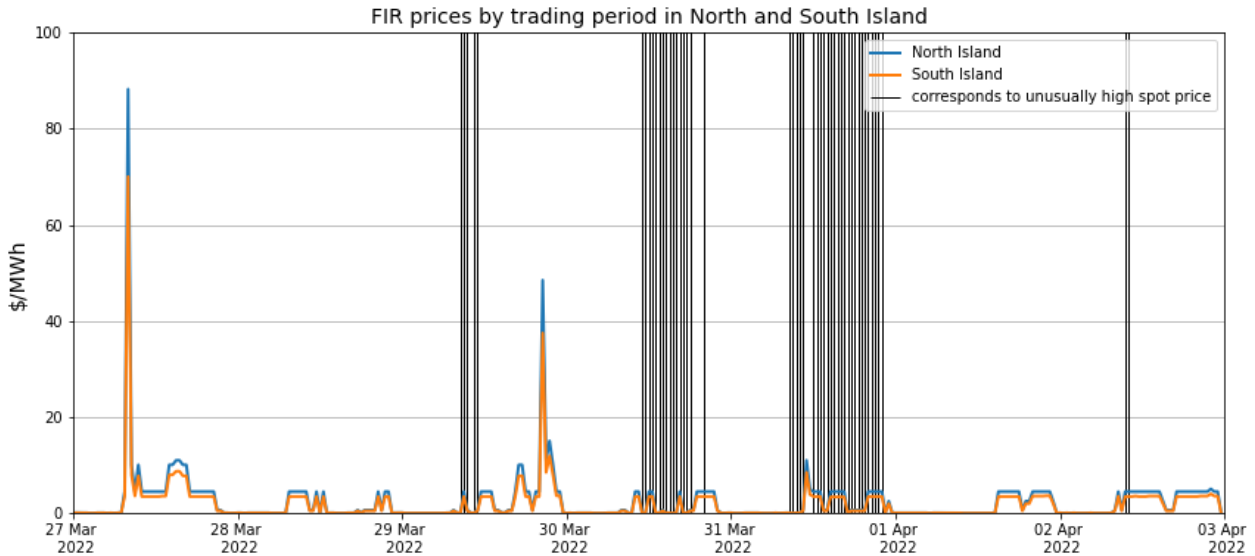
Date	Trading Period	Historic Mean	10th percentile	90th percentile	BEN2201	OTA2201
29/03/2022 8:30	18	200.99	30.78	304.25	355.56	374.12
29/03/2022 9:00	19	201.26	32.66	311.26	524.88	558.32
29/03/2022 9:30	20	195.89	32.89	244.78	301.51	320.42
29/03/2022 10:30	22	198.04	32.38	265.9	315.3	335.63
29/03/2022 11:00	23	197.82	32.64	243.11	316.12	336.08
30/03/2022 11:00	23	194.66	32.7	288.19	351.35	380.34
30/03/2022 11:30	24	193.13	29.93	298.99	354.16	385.1
30/03/2022 12:00	25	193.47	29.14	297.04	472.76	518.29
30/03/2022 12:30	26	191.72	29.09	302.98	472.82	516.15
30/03/2022 13:00	27	194.42	27.26	306.72	506.41	537.35
30/03/2022 13:30	28	191.87	24.42	298.86	465.64	502.43
30/03/2022 14:00	29	188.69	25.85	281.42	330.31	358.85
30/03/2022 14:30	30	187.98	23.64	305.3	337.42	366.72
30/03/2022 15:00	31	187.96	23.75	290.54	344.22	375.43
30/03/2022 15:30	32	193.01	25.34	268.49	462.82	503.63
30/03/2022 16:00	33	194.16	25.93	297.61	450.75	490.07
30/03/2022 16:30	34	196.25	26.22	297.17	450.74	490.11
30/03/2022 17:00	35	198.76	29.14	300.54	449.73	489.77
30/03/2022 17:30	36	214.49	34.5	427.81	502.3	535.34
30/03/2022 18:00	37	210.63	28.36	403.77	486.88	529.17
30/03/2022 20:00	41	199.68	29.93	316.61	349.35	373.15
31/03/2022 8:30	18	195.09	26.6	300.62	416.61	452.55
31/03/2022 9:00	19	195.39	32.16	300.47	405.89	438.63
31/03/2022 9:30	20	195.59	32.38	298.14	405.91	438.68
31/03/2022 10:00	21	193.43	32.47	291.08	403.94	438.66
31/03/2022 10:30	22	195.99	29.77	264.35	423.52	457.69
31/03/2022 12:00	25	193.42	26.47	265.59	303.55	329.52
31/03/2022 12:30	26	192.93	22.98	298.02	336.94	365.65
31/03/2022 13:00	27	191.31	23.27	267.26	377.16	409.18
31/03/2022 13:30	28	190.66	22.23	265.76	380.74	413.07
31/03/2022 14:00	29	190.49	19.87	291.7	443.42	487.83
31/03/2022 14:30	30	187.46	19.98	273.75	375.45	414.72
31/03/2022 15:00	31	186.57	19.75	234.67	378.05	415.38
31/03/2022 15:30	32	188.83	18.05	246.97	381.35	419.83
31/03/2022 16:00	33	196.23	20.74	324.15	448.96	495.15
31/03/2022 16:30	34	197.34	22.52	294.64	484.44	534.48
31/03/2022 17:00	35	193.71	22.64	242.34	513.74	547.72
31/03/2022 17:30	36	198.1	22.47	304.2	531.46	555.85
31/03/2022 18:00	37	203.16	23.05	352.11	509.75	527.38
31/03/2022 18:30	38	204.85	22.73	381.57	410.53	436.46
31/03/2022 19:00	39	192.09	21.45	226.51	409.58	437.75
31/03/2022 19:30	40	192.29	20.85	221.07	402.24	429.91
31/03/2022 20:00	41	191.77	22.13	220.55	386.15	411.17
31/03/2022 20:30	42	190.95	22.22	206.68	402.48	427.06
31/03/2022 21:00	43	191.41	23.69	274.12	313.07	328.34
31/03/2022 21:30	44	186.21	21.56	214.6	253.71	265.53

31/03/2022 22:00	45	185.44	19.13	206.52	254.83	258.79
2/04/2022 9:30	20	204.2	33.55	293.81	393.43	393.56
2/04/2022 10:00	21	203.49	34.32	285.36	427.29	428.2

3. Reserve Prices

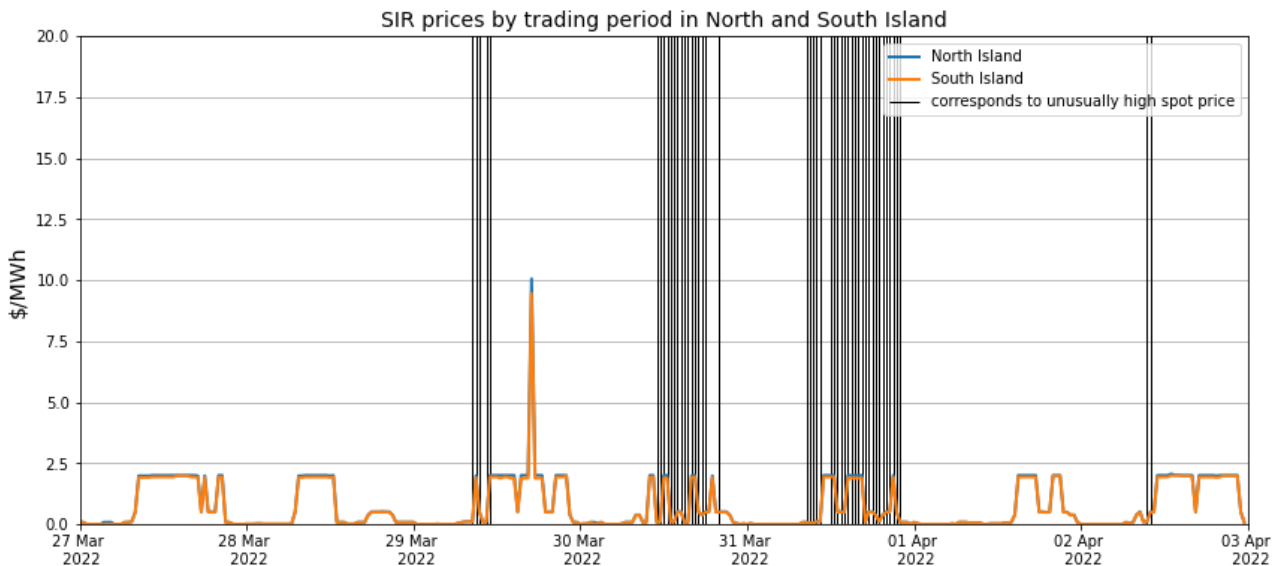
3.1. Fast instantaneous reserves (FIR) prices this week as seen in Figure 2, similarly to the previous week, tended to remain below \$20/MWh, with occasional price spikes to around ~\$90/MWh.

Figure 2: FIR prices by trading period and Island



3.2. Sustained instantaneous reserves (SIR) prices this week as seen in Figure 3, similarly to the previous week, tended to remain below \$10/MWh.

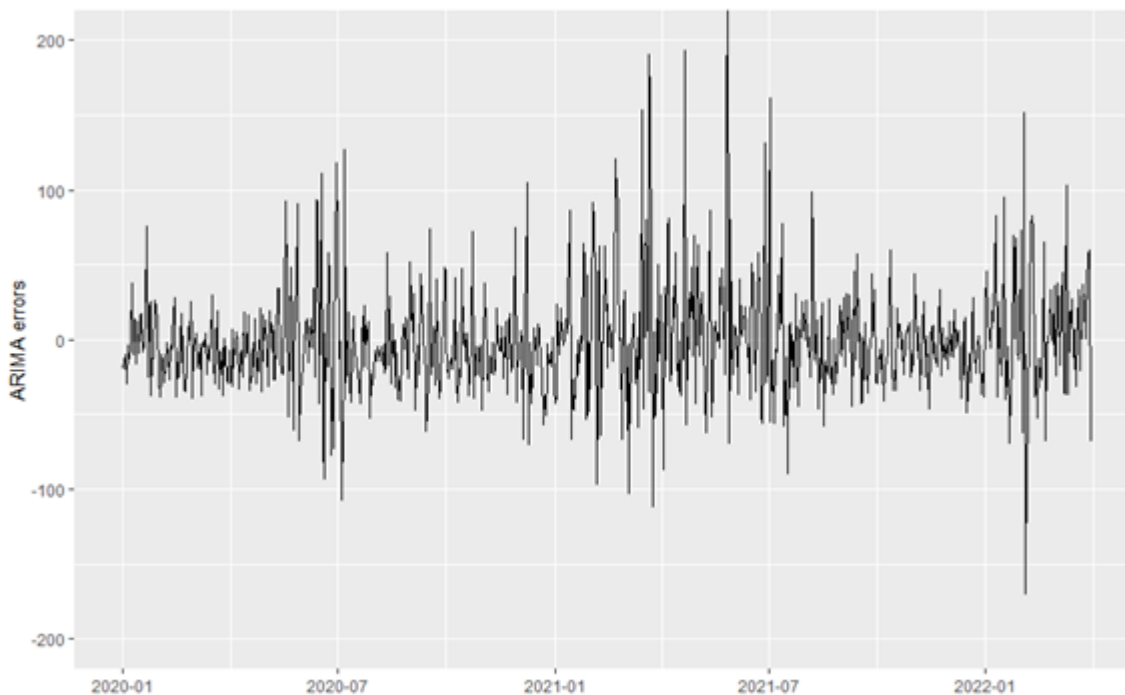
Figure 3: SIR prices by trading period and Island



4. Regression Residuals

- 4.1. The Authority's monitoring team has developed two regression models of the spot price. The residuals show how close the predicted prices were to actual prices. Large residuals may indicate that prices do not reflect underlying supply and demand conditions. Details on the regression model and residuals can be found in Appendix A on the trading conduct webpage.
- 4.2. Figure 4 shows the residuals of autoregressive moving average (ARMA) errors from the daily model. In the last week the largest positive residual (60.2) occurred on 31 March, when spot prices were highest. The largest negative residual (-68.3) occurred the next day on 1 April because the spot price decreased significantly compared to the previous day. The highest priced trading periods on 31 March may therefore be worth investigating further. The remaining residuals were within normal range.

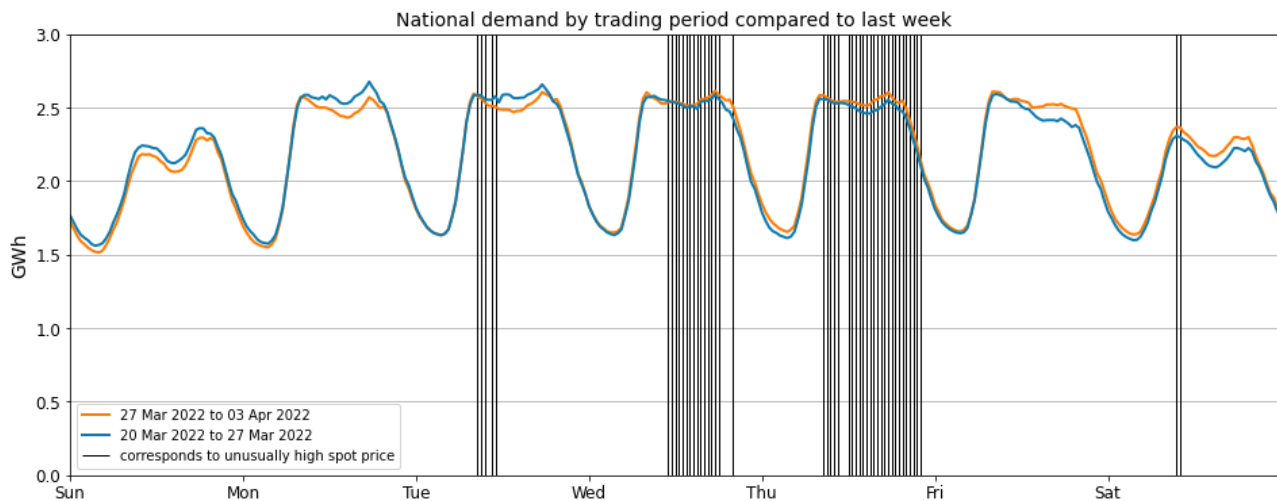
Figure 4: Residual plot of estimated daily average spot price YTD



5. Demand

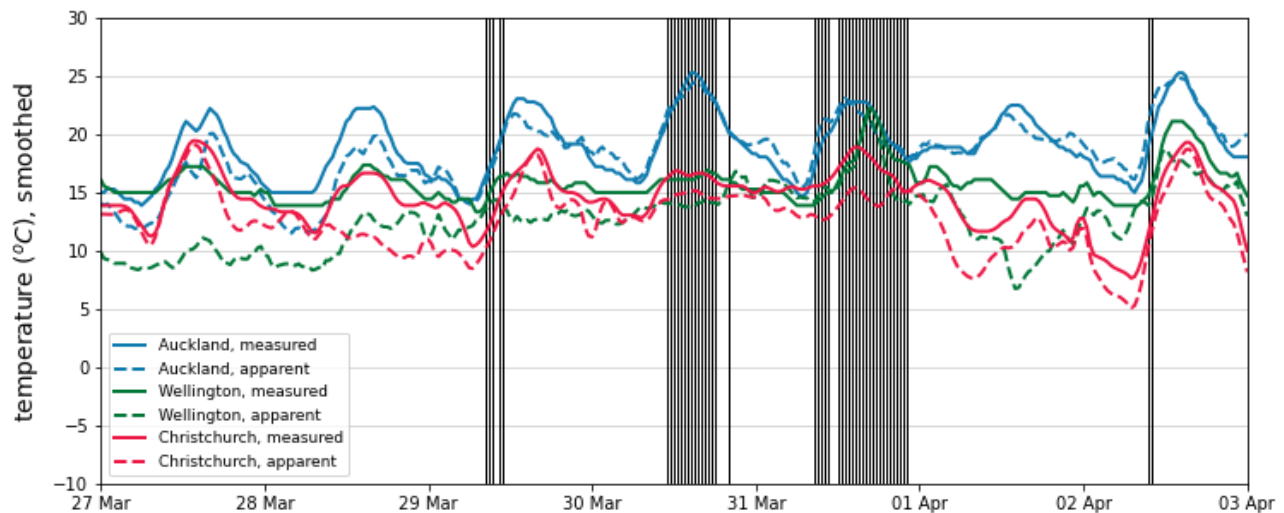
- 5.1. Figure 5 shows national grid demand against national demand from the previous week. Demand this week showed some slight differences compared to the previous week with daytime demand from 27 to 29 March slightly lower and daytime demand between 30 March and 1 April slightly higher. The minimal differences however indicate that the fluctuations in spot prices likely come from supply side factors rather than demand side factors.

Figure 5: National demand by trading period compared to the previous week



5.2. Figure 6 shows hourly temperature at main population centres. The measured temperature is the recorded temperature, while the apparent temperature adjusts for factors like wind speed and humidity to estimate how cold it feels. Temperatures were fairly constant over the week. High priced periods this week occurred at the same time temperatures across main centres peaked rather than when they were at their lowest as we would usually expect indicating once again that fluctuations in spot prices likely come from supply side factors rather than demand side factors.

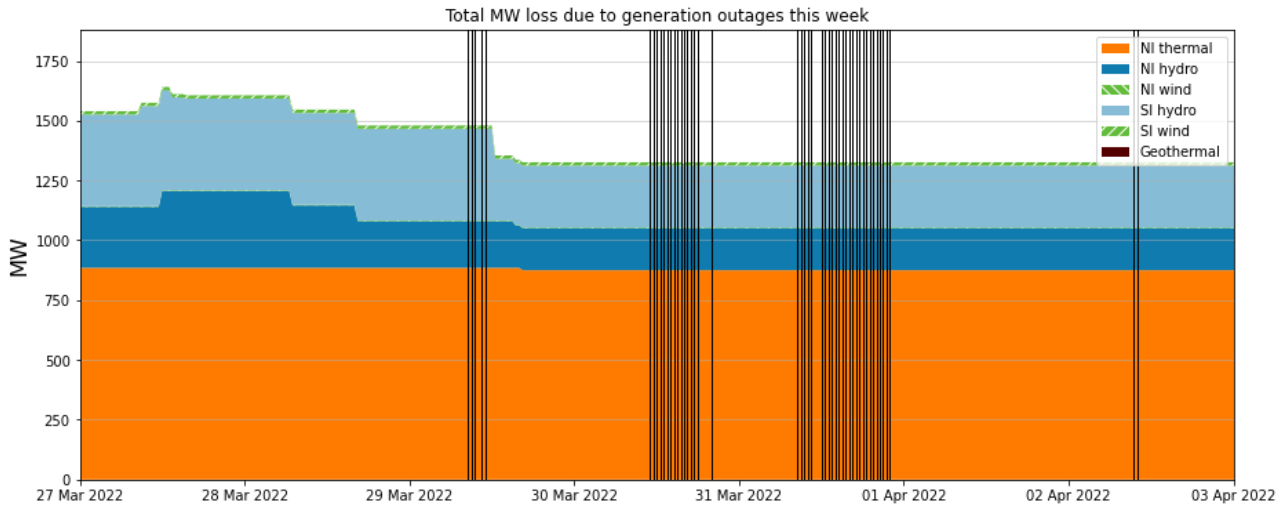
Figure 6: Hourly temperature data (actual and apparent) and humidity data at main population centres



6. Outages

6.1. Figure 7 shows generation capacity lost due to outages between 27 March and 2 April by fuel type. Compared to last week total generation capacity lost due to outages has reduced, falling to below 1,500 MW by the end of the week. Geothermal capacity has fully recovered from the outages last week. However, there was a high amount of thermal generation on outage, particularly due to all the generation at Stratford, including the TCC, being on outage this week, reducing thermal generation capacity by 550MW.

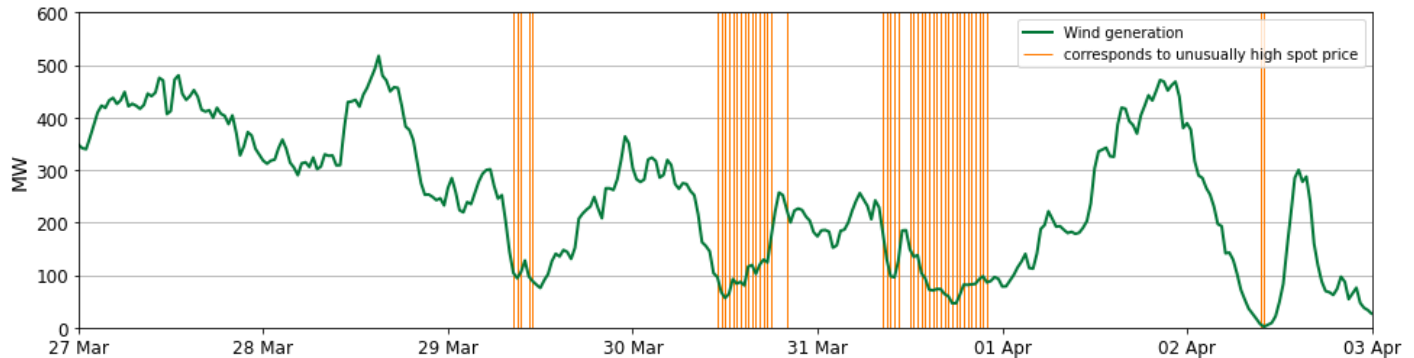
Figure 7: Total MW loss due to generation outages



7. Generation

- 7.1. Observations of generation trends show high prices occurred during periods of low wind generation and high thermal generation.
- 7.2. Wind generation as seen in Figure 8 dropped to some of its lowest points of the week during the highest priced periods (indicated by vertical lines). With wind generation falling below 200MW for much of the middle of the week the loss of low priced generation likely helped push the marginal price for those periods into higher priced tranches.

Figure 8: Wind Generation



- 7.3. Thermal generation as seen in Figure 9, which shows generation at thermal and peaker plants, increased in the middle of the week likely to make up for the shortfall caused by low wind generation. With the loss of the more efficient TCC at the end of the previous week and Stratford Peakers continuing to remain on outage more expensive plant was dispatched increasing marginal prices. Generation at Huntly 4 fluctuated throughout several days. Whirinaki was also deployed for two periods during the week showing how steep the offer curve had become.

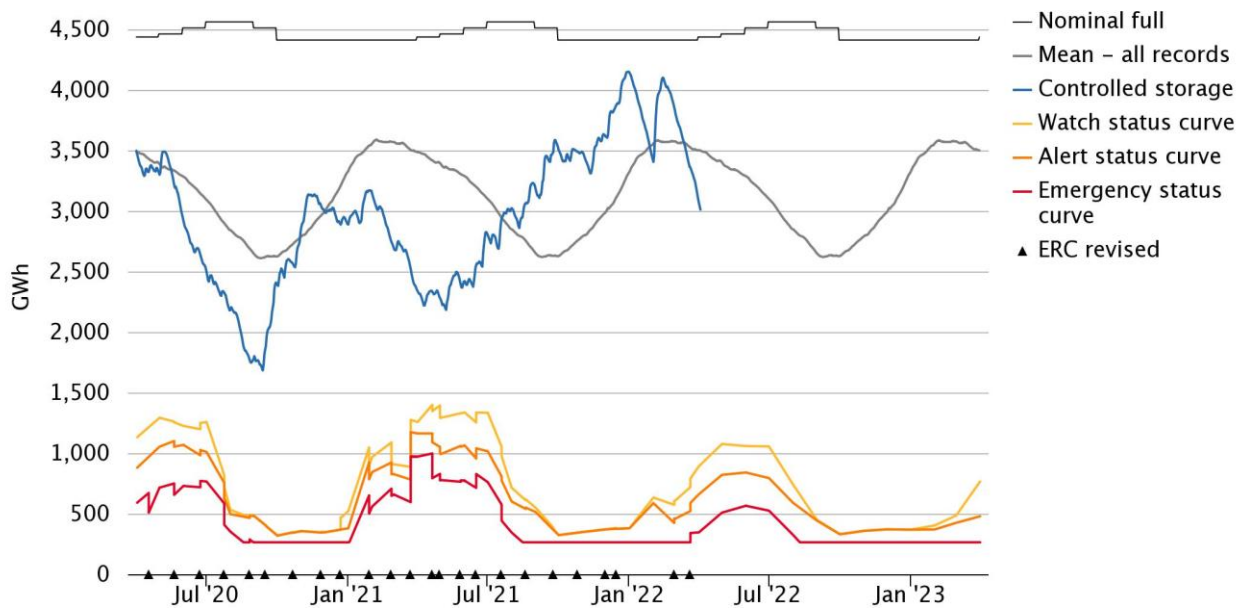
Figure 9: Thermal Generation



8. Storage/Fuel Supply

- 8.1. Spot prices have also been exacerbated by declining hydro storage. Figure 10 shows total controlled national hydro storage which had decreased by 202 GWh from 3,244 GWh on 27 March to 3,042 GWh on 2 April, 458 GWh below the historic mean (3,500 GWh) for 2 April.
- 8.2. Hydro storage has been declining since 14 February. The reason for decreasing storage has been due to historically low hydro inflows with inflows almost ~50 per cent less than historical mean. Drought conditions in Fiordland have caused low inflows into several reservoirs including Lake Manapouri and curtailed generation in the lower South Island.
- 8.3. Hydro generators have become more conservative with their hydro offers as a result, steepening the offer curve and pushing marginal prices up.

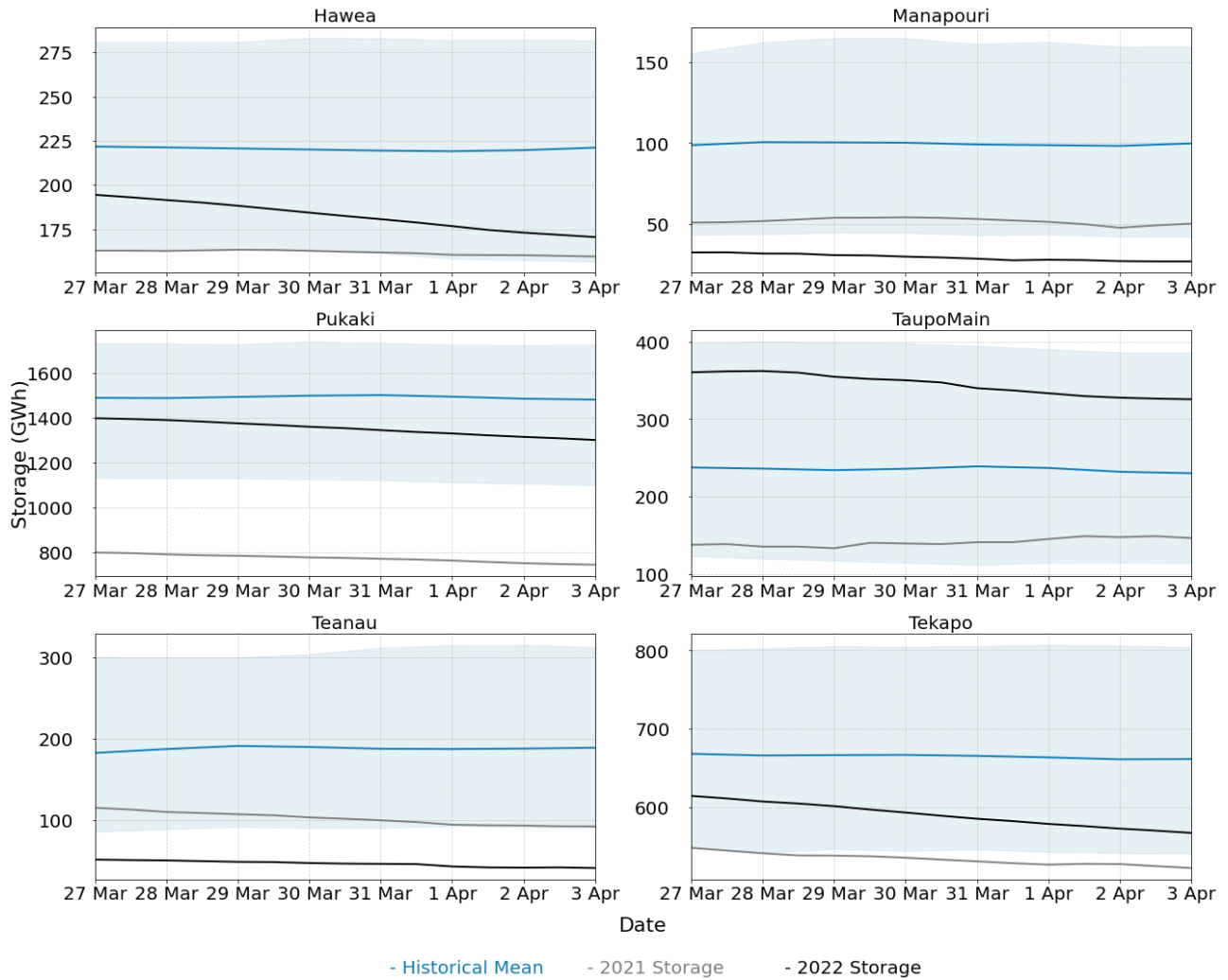
Figure 10: Hydro Storage



emi.ea.govt.nz/r/4jvlh

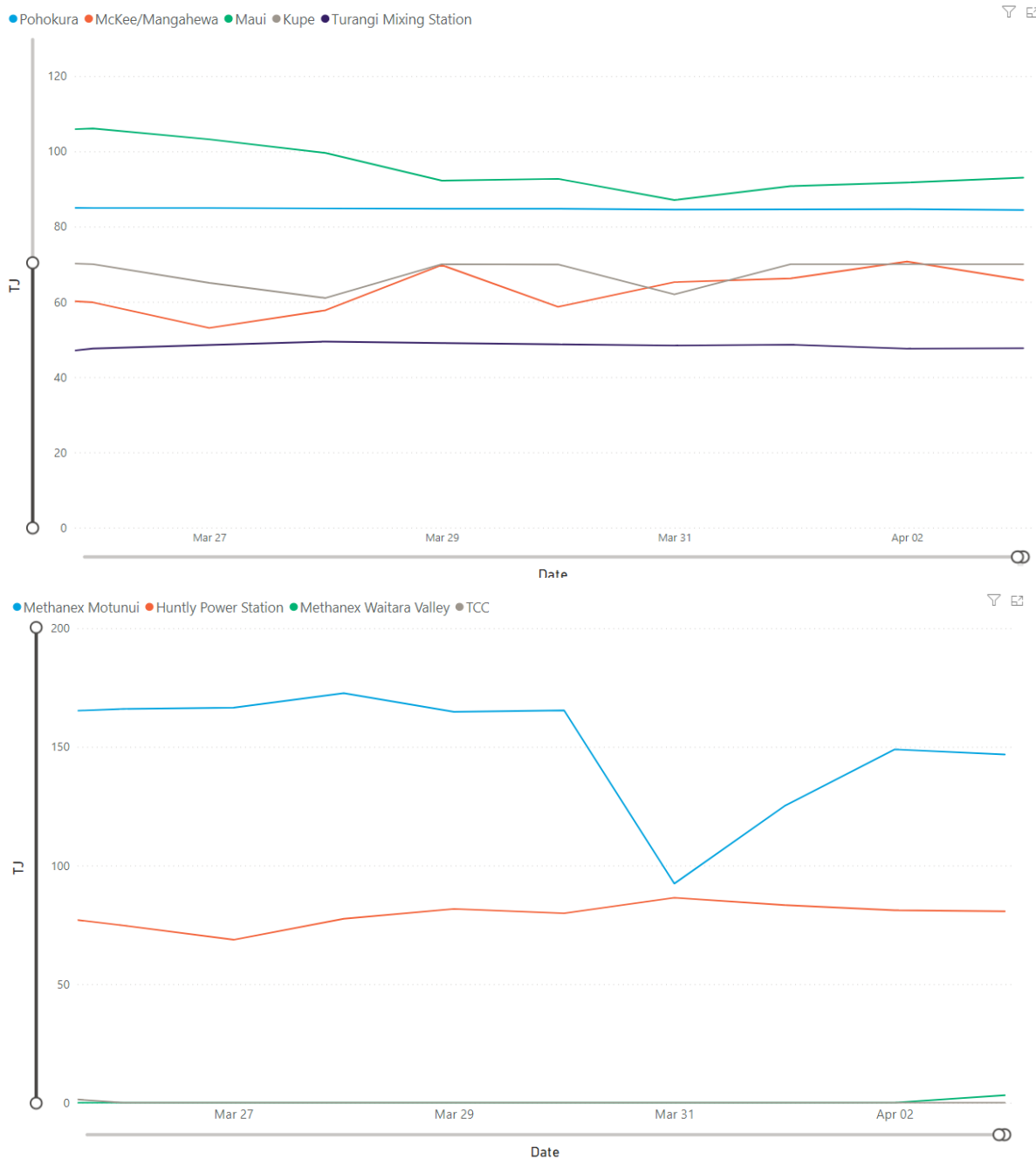
8.4. Figure 11 shows the storage of major lakes over the week 27 March to 2 April. Of the individual lakes only Lake Taupo is above its historical mean. Lake Pūkaki storage has fallen to around ~1,300 GWh and Lake Tekapo is drawing closer to its 10th percentile. Lake Manapōuri and Lake Te Anau continue to be below their low operating range, restricting drawdown from both lakes.

Figure 11: Major Lake Storage



- 8.5. Figure 12 shows gas production from major gas fields in the upper chart and gas consumption by major users in the lower chart courtesy of GIC. Gas production from Mangahewa/McKee and Maūi continues to remain low following their outages from the previous week. The loss in production has pushed gas spot prices to around ~\$20/GJ and subsequently increased the opportunity cost of thermal generation. Total gas production from all fields was 364.67 TJ/day on 2 April.
- 8.6. Overall Huntly gas consumption has been increasing from the increased dispatch of thermal generation.

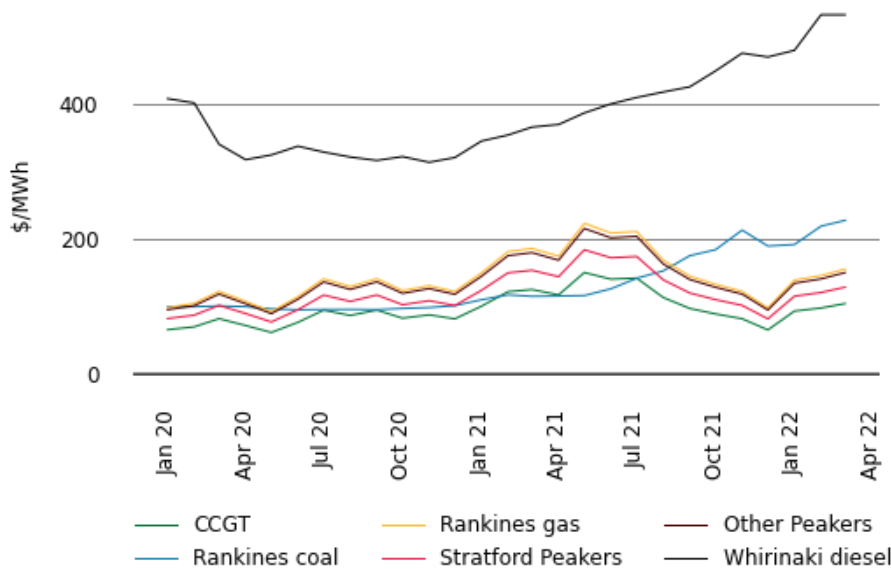
Figure 12: Major Gas Production and Consumption



9. Price versus estimated costs

- 9.1. In a competitive market, prices should be close to (but not necessarily at) the short run marginal cost (SRMC) of the marginal generator (where SRMC includes opportunity cost).
- 9.2. The SRMC (excluding opportunity cost of storage) for thermal fuels can be estimated using gas and coal prices, and the average heat rates for each thermal unit. Figure 13 shows an estimate of thermal SRMCs as a monthly average. The thermal SRMC of gas increased in January and February, likely due to the increase in gas consumption.
- 9.3. The SRMC of coal and diesel both increased due to global supply and demand conditions and remain high. Note that the SRMC calculations include the carbon price, an estimate of operational and maintenance costs, and transport for coal. Indonesian coal prices are currently around ~US\$200/tonne and carbon prices on the secondary market are currently averaging ~\$75/tonne.

Figure 13: Estimated monthly SRMC for thermal fuels



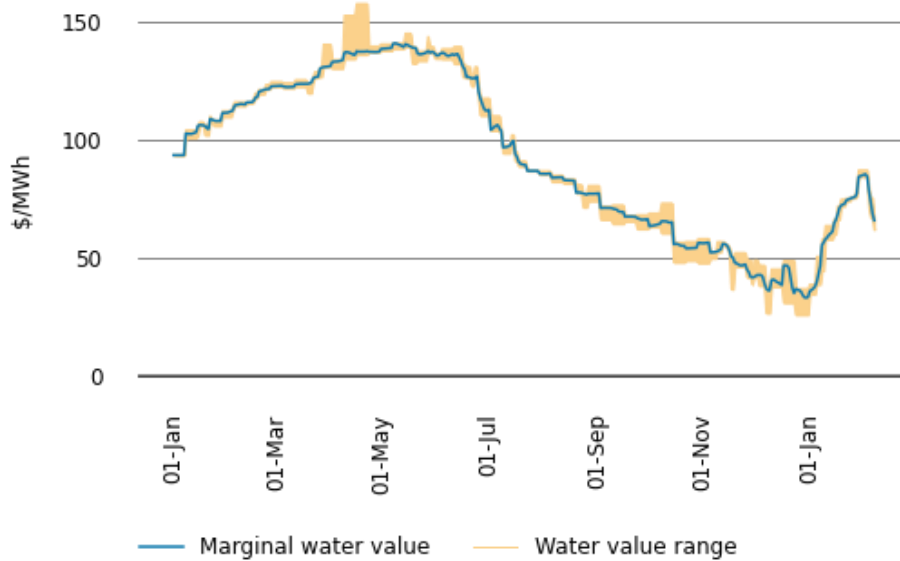
10. JADE Water values

- 10.1. The JADE¹ model gives a consistent measure of the opportunity cost of water, by seeking to minimise the expected fuel cost of thermal generation and the value of lost load and provides an estimate of water values at a range of storage levels. Figure 14 shows the national water values² to 20 February 2022 using values obtained from JADE. The outputs from JADE closest to actual storage levels are shown as the yellow water value range. These values are used to estimate marginal water value at the actual storage level, indicated by the blue line. More details on how water values are calculated can be found in Appendix B on the trading conduct webpage.
- 10.2. The marginal water value declined from June to December as hydro storage levels increased and gas costs decreased. In January, the water values increased as hydro storage decreased and gas costs increased. Between February 1 and 13 hydro storage increased which caused a steep decline in the water value, shown in figure 17. Since 20 February hydro storage has declined so the water value has likely increased

¹ JADE (Just Another DOASA Environment) is an implementation of the Stochastic Dual Dynamic Programming (SDDP) algorithm of Pereira and Pinto. JADE was developed by researchers at the Electric Power Optimisation Centre (EPOC) for the New Zealand electricity market.

² The national water values are estimated assuming all hydro storage reservoirs are equally full.

Figure 14: JADE water values for January 2021 to February 2022



11. Offer Behaviour

- 11.1. Figure 15 shows this week's daily offer stacks, adjusted to take into account wind generation, transmission constraints, reserves and frequency keeping.³ The black line shows cleared energy, indicating the range of the average final price.
- 11.2. High thermal costs and increased hydro costs have created a steep offer curve. The loss of TCC and declining wind generation have caused cleared offers this week to reach the \$200-300/MWh tranche most days of the week with marginal prices reaching the \$400/MWh and \$500/MWh tranches for certain trading periods.
- 11.3. The pre-dispatch offers in the short term lead up to high prices showed no changes that would suggest generators were trying to take advantage of market conditions.
- 11.4. Figure 16 shows the offer stack during the period when prices were at their highest at Benmore for this week and Figure 17 shows the offer stack during the period when prices were at their highest at Otahuhu for this week. The first chart of both figures demonstrates the steepness of the offer curves at the time.

³ The offer stacks show all offers bid into the market (where wind offers are truncated at their actual generation and excluding generation capacity cleared for reserves) in price bands and plots the cleared quantity against these.

Figure 15: Daily offer stack

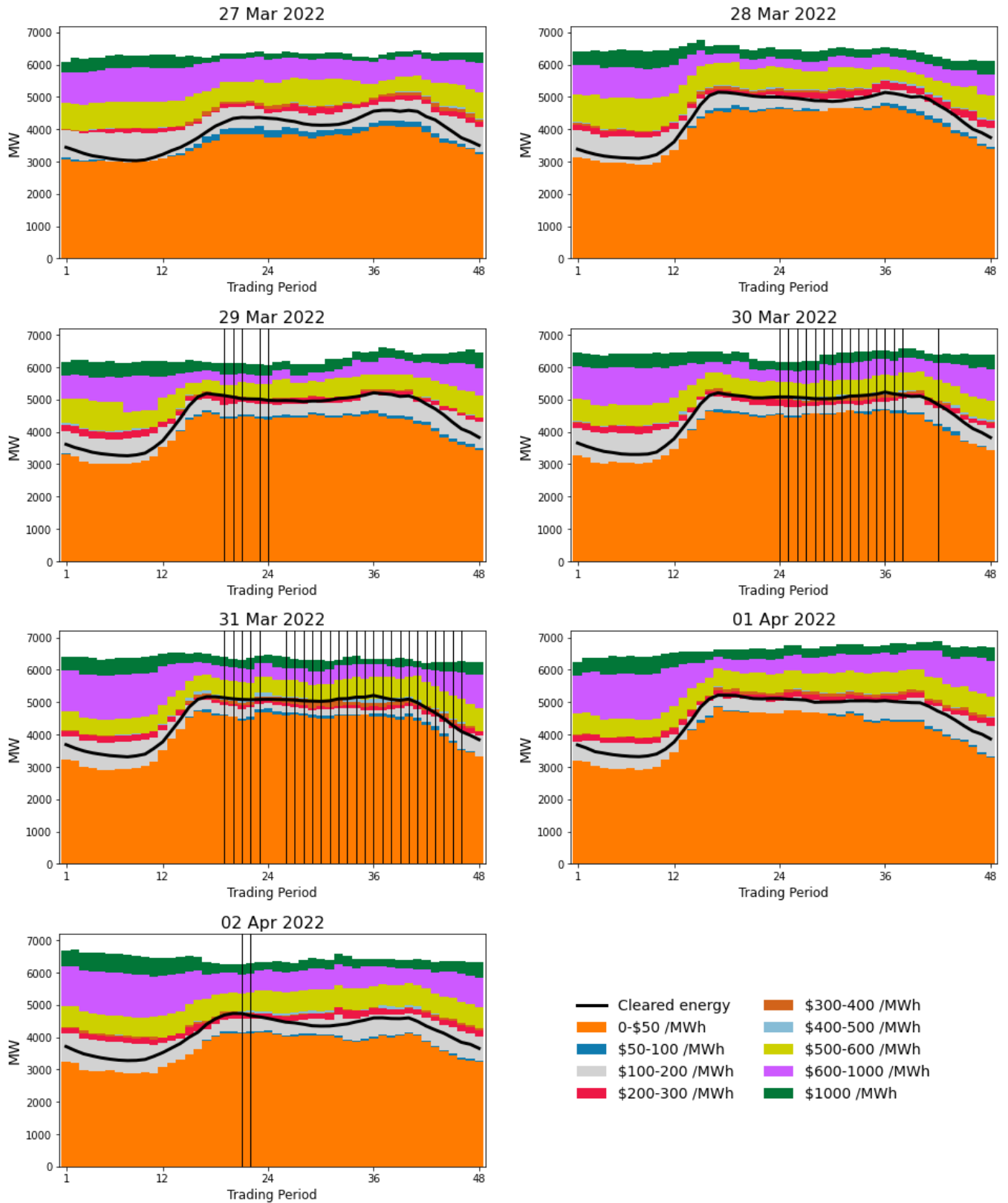


Figure 16: Offer Stack TP 36, 31 March

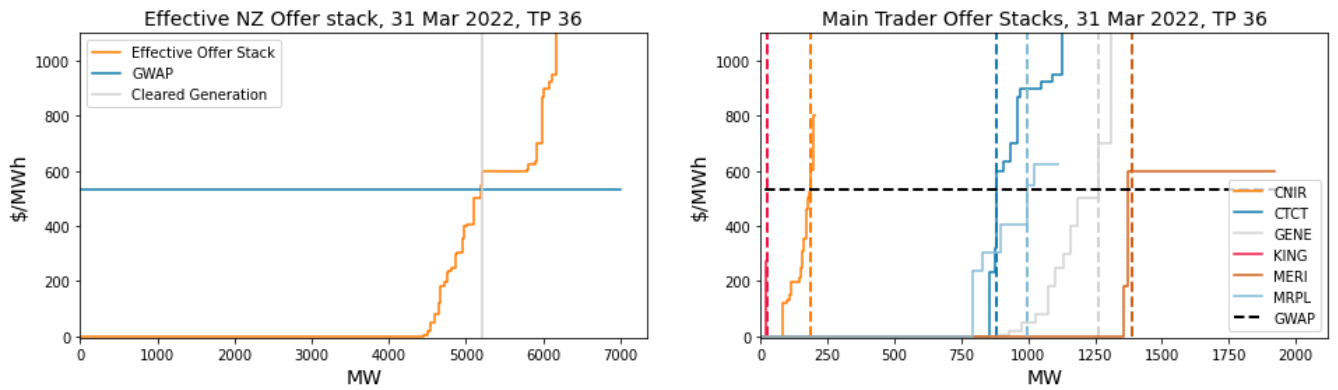
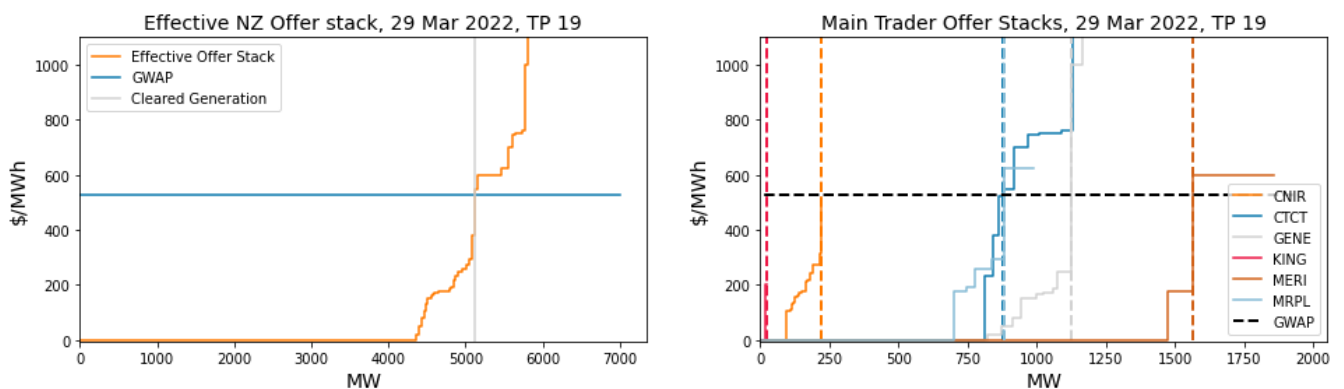


Figure 17: Offer Stack TP 19, 29 March



12. Ongoing work in Trading Conduct

- 12.1. High prices on 29,30 and 31 March appear to be driven by low wind generation, high thermal generation, a loss of generation capacity from TCC and decreasing hydro storage. Further information has been requested from Genesis in order to understand why generation at Huntly 4 was fluctuating.
- 12.2. Further analysis is being done on the trading periods in Table 2 as indicated.
- 12.3. New information has been obtained regarding recent high priced offers of thermal peakers between 10 and 13 March and resolved without need for further action.
- 12.4. Further information has also been received regarding reserve offers between 19 February and 21 February and will be further analysed.

Table 2: Trading periods identified for further analysis

Date	TP	Status	Notes
29/03-02/04	14-37	Information requested	Information requested in regards to fluctuations at Huntly 4.
10/03-13/03	All	Resolved	The Authority requested further information from Contact and Todd regarding recent high priced offers of thermal peakers between 10 and 13 March. Between the 8 and 10 March there was an unplanned outage at Ahuroa which reduced the supply

of gas to TCC. As a result, Contact sourced gas from the market which reduced the available gas for thermal peakers. This was economically efficient as the TCC is more efficient than thermal peakers. This was also reflected in gas spot prices which were 130% higher on 11 March than one week earlier. The high priced offers of the thermal peakers therefore reflected the temporary scarcity of gas in the market

03/03-05/03	4-10	Further analysis	Branch constraint, high prices in lower South Island
19/02-24/02		Compliance enquiries in progress	After reviewing information received from Genesis regarding offers from Tekapo B while Lake Tekapo was spilling, this case has been passed to compliance to assess if the offers were compliant with trading conduct rules.
19/02-21/02	Several	Further Analysis	Further information has been received and will be further analysed
08/02-12/02	Several	Further Analysis	High inflows but continued high prices
30/06/21-20/08/21	Several	Compliance enquiries in progress	The Authority's compliance team has obtained information regarding withdrawn reserve offers and high energy prices. Further clarification and analysis is under way to consider compliance with the Code.
30/06/21-21/08/21	Several	Compliance enquiries in progress	The Authority's compliance team has obtained information regarding withdrawn reserve offers and high energy prices. Further clarification and analysis is under way to consider compliance with the Code.