s27 April 2022

Trading Conduct Report

Market Monitoring Weekly Report

1. Overview for the week of 17 to 23 April

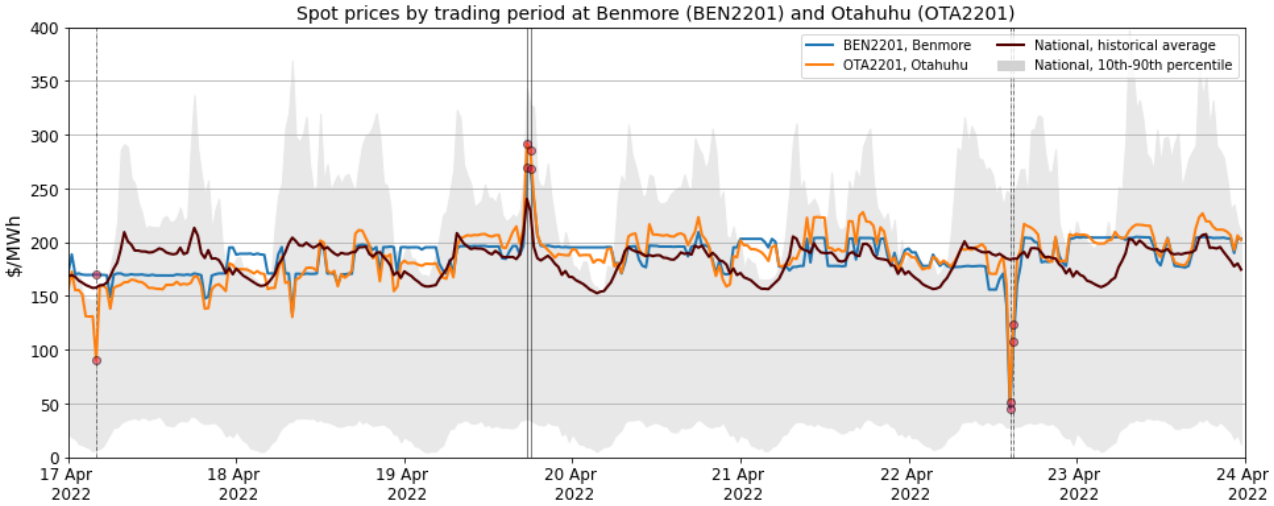
1.1. Wholesale spot prices this week appear to be consistent with supply and demand conditions.

2. Spot Prices

2.1. Figure 1 shows wholesale electricity spot prices from the past week at Benmore and Otahuhu alongside their historic mean and historic 10th-90th percentiles. Historically high priced trading periods (when Benmore or Otahuhu exceed their historical 90th percentile) are marked out by vertical lines and historically low priced periods (when Benmore or Otahuhu falls below their historical 10th percentile) are marked by dotted vertical lines in Figure 1 and the majority of the figures in this report.

2.2. Spot prices between 17 and 23 April averaged $188.49/MWh, for comparison the historical average price for this time of year is $132.59/MWh.

Figure 1: Wholesale Spot Prices



2.3. The highest priced trading periods for the week are listed below in Table 1. There were only two high priced periods marked out this week, both occurring on 19 April.

Table 1: High Priced Periods

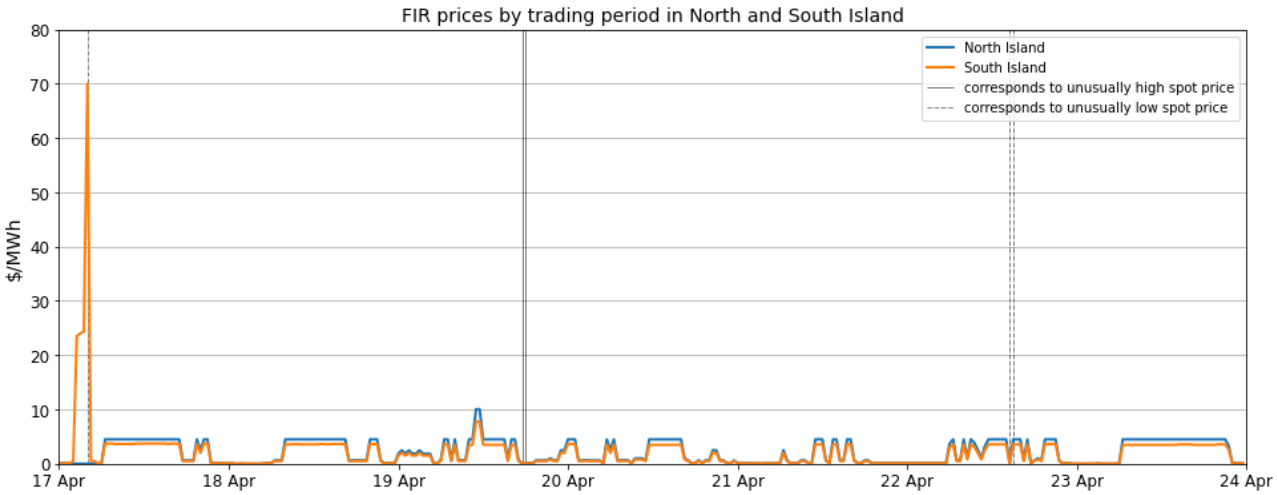
Date	Trading Period	Historic Mean	10th percentile	90th percentile	Benmore	Otahuhu
19/04/2022 17:30	36	240.36	6.28	343.10	268.98	292.19

19/04/2022 18:00	37	228.97	34.49	327.28	268.32	285.80

3. Reserve Prices

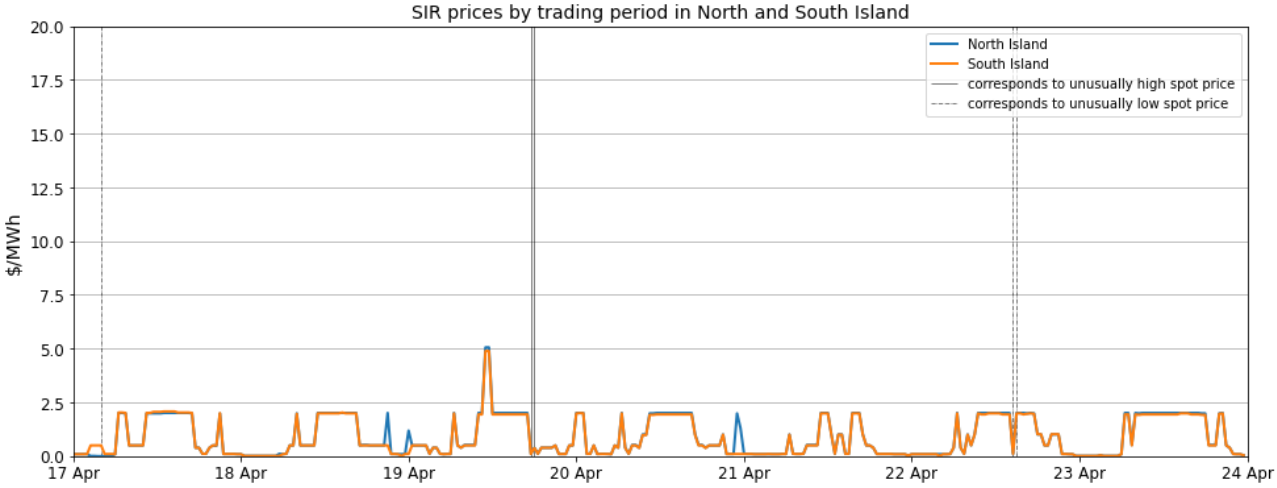
3.1. Fast instantaneous reserves (FIR) prices for the North and South Islands this week are shown in Figure 2. Reserve prices mostly remained within normal bounds this week except for a price spike on 17 April to ~$70/MWh when cleared reserve prices just entered the next price tranche.

Figure 2: FIR prices by trading period and Island



3.2. Sustained instantaneous reserves (SIR) prices for the North and South Islands this week are shown below in Figure 3. SIR reserve prices are well within historical bounds this week, remaining below ~$5/MWh.

Figure 3: SIR prices by trading period and Island

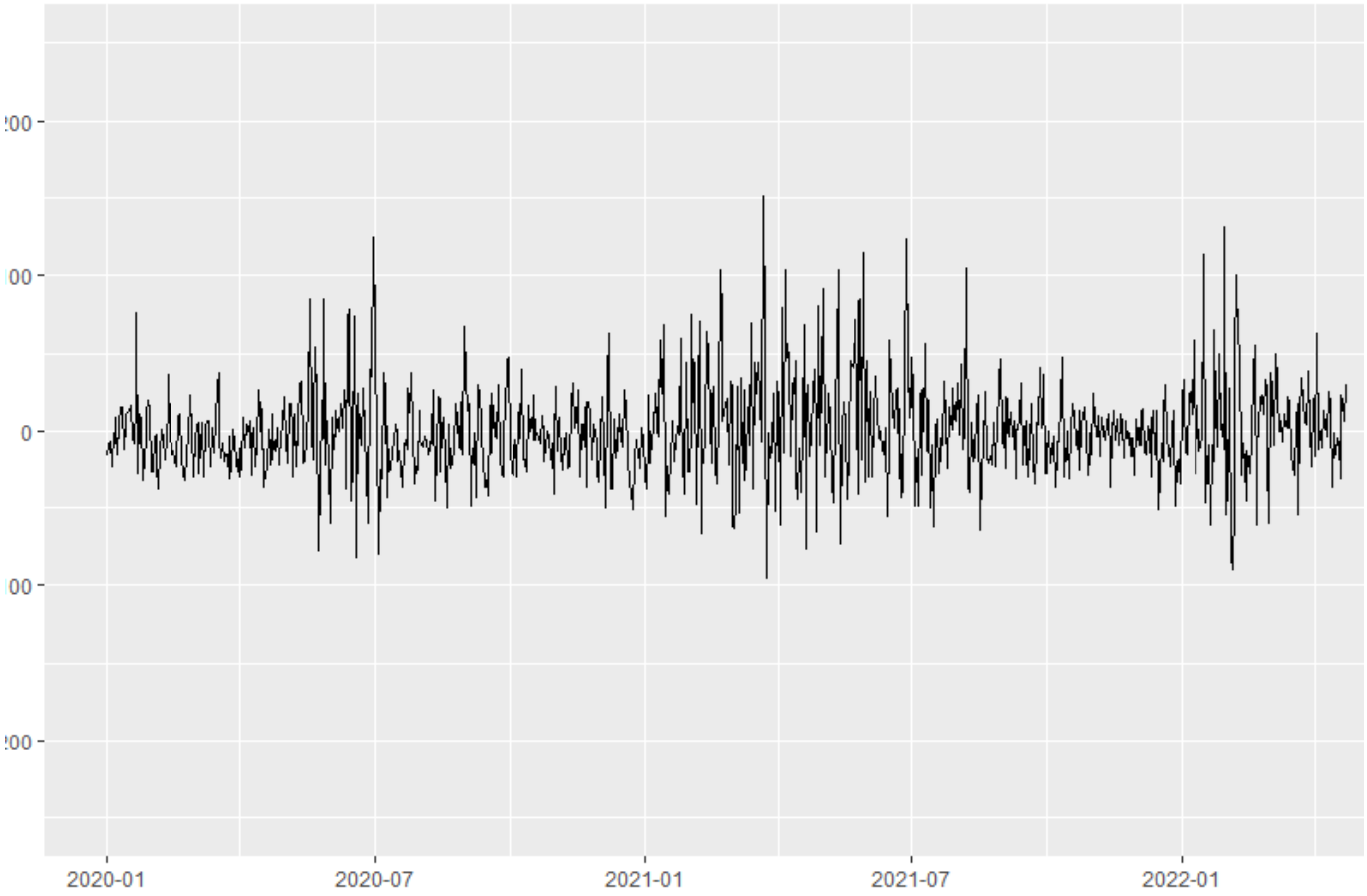


4. Regression Residuals

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. Residuals were stable this week with no fluctuations, indicating prices largely aligned with market conditions.

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

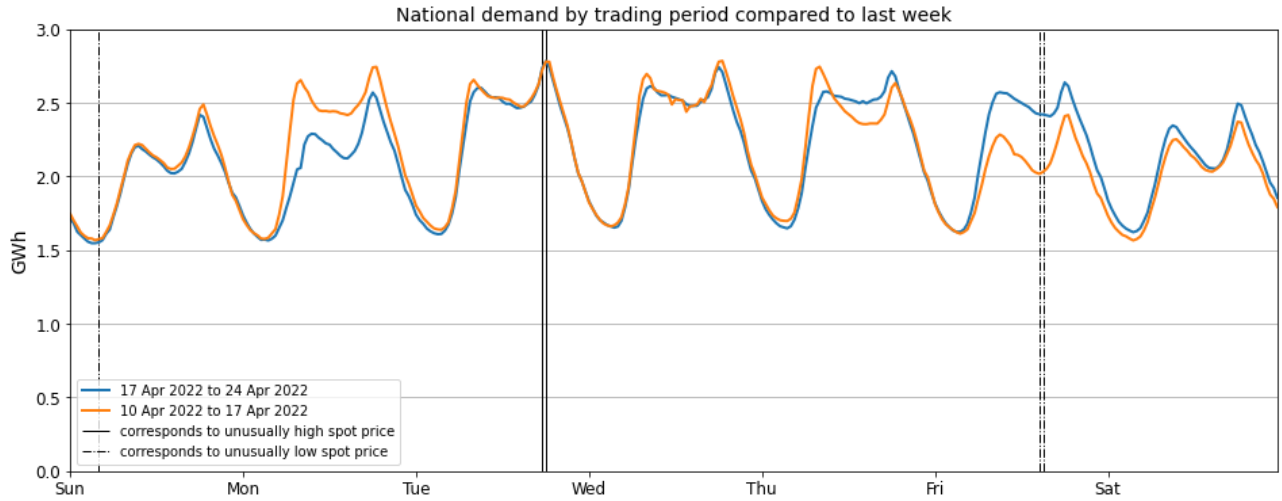


5. Demand

5.1. Figure 5 shows national grid demand against national grid demand from the previous week. Large variances between each week's demand are due to the Easter holidays (demand on a public holiday resembles the demand profile of a weekend day and is noticeably less than week day demand) which fell between 15 and 18 April this year.

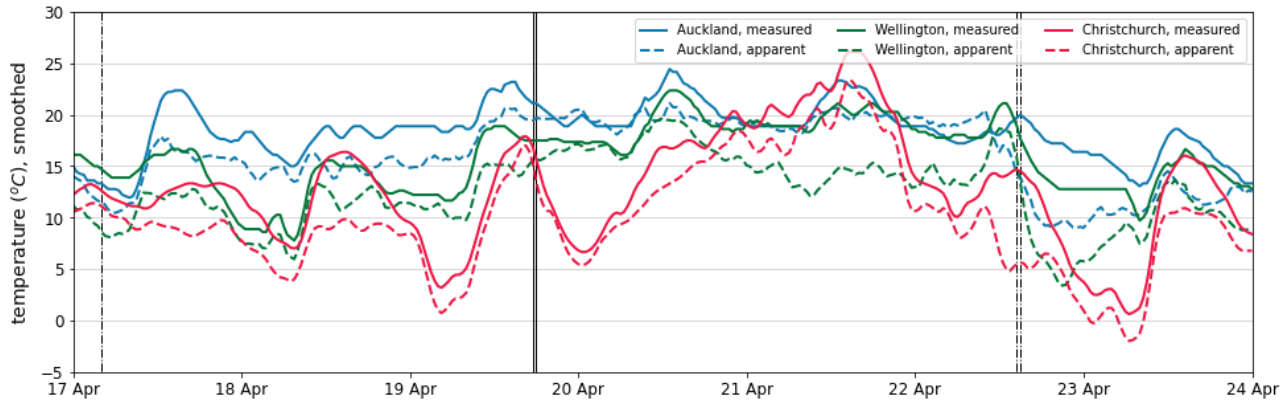
5.2. High priced periods this week coincided with peak demand for the week. Demand peaked at 5,434 MW on 18:00 (TP 37) 19 April, the same time as one of the two high priced trading periods for this week. The other high priced trading period occurred on the trading period just before, 17:30 (TP 36) 19 April, when demand reached 5,344 MW. Therefore, high peak demand was likely a significant factor contributing to the historically high prices for this week.

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



5.3. Temperatures across main population centres as seen in Figure 6 were reasonably high compared to temperatures during other times of the week so weather was unlikely to have caused the high peak demand. With 19 April being the day after Easter Monday consumers returning from holiday may have possibly been the cause instead.

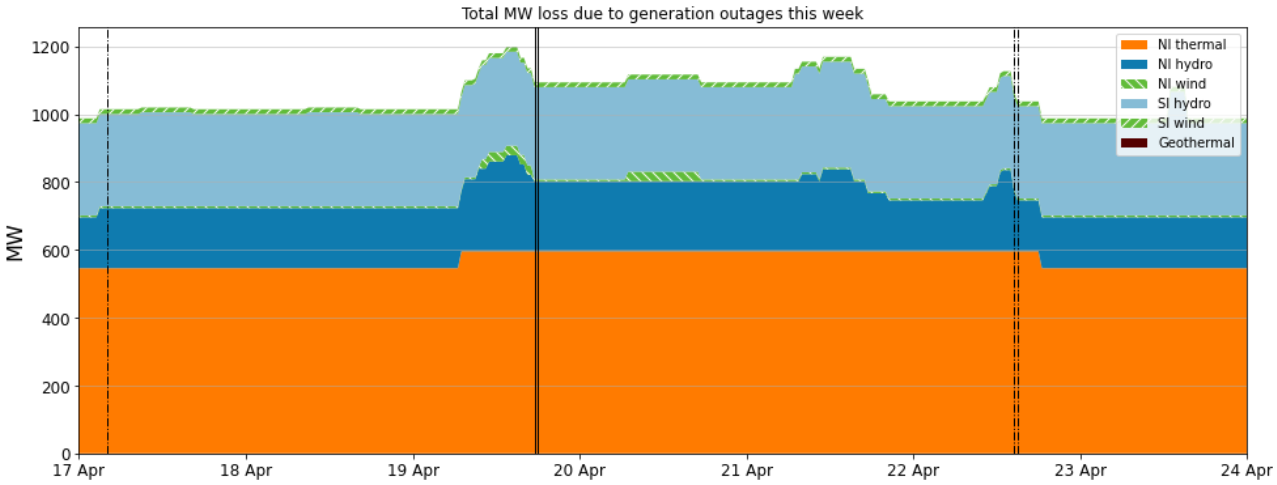
Figure 6: Temperatures



6. Outages

6.1. Figure 7 shows generation capacity lost due to outages by fuel type. Compared to the previous week total generation capacity lost due to outages has reduced, remaining mostly below 1,200 MW. No unplanned outages occurred during the same time as high priced periods this week indicating that unforeseen outages did not play a role in high prices.

Figure 7: Total MW loss due to generation outages

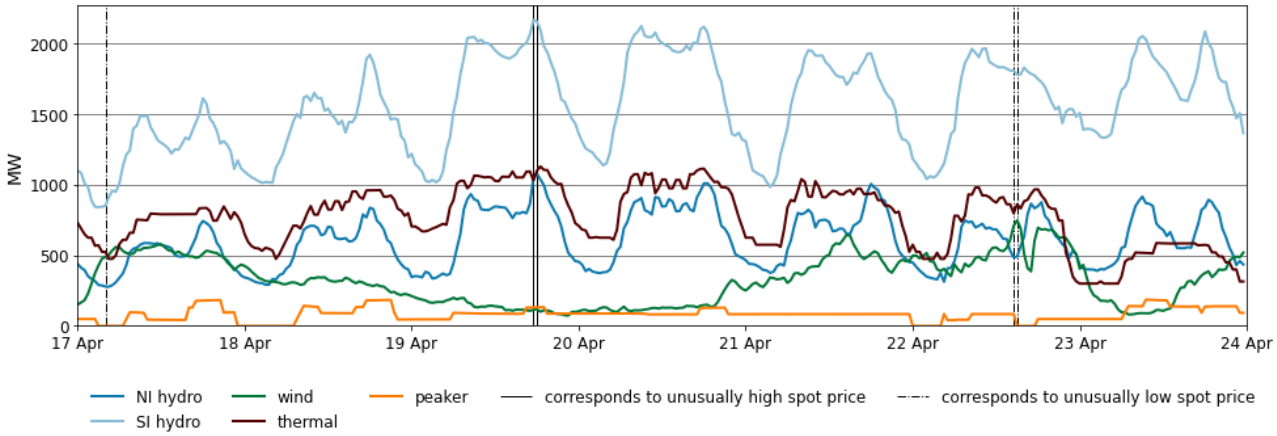


7. Generation

7.1. High prices this week coincided with periods of low wind generation and high hydro and high thermal generation.

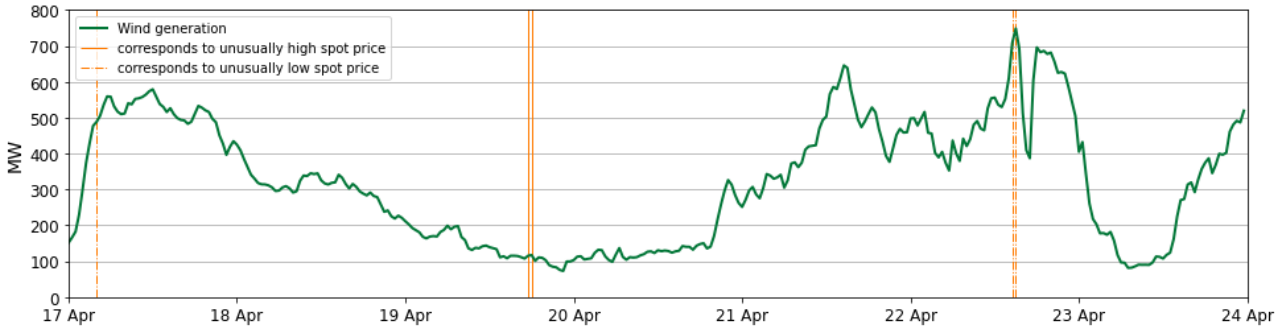
7.2. As a percentage of total generation, thermal generation continues be a higher percentage than we would historically expect for this time of year though recent increases in hydro inflows have decreased the need for thermal generation. Thermal generation totalled around ~18 per cent of total generation this week, down by around ~4 per cent from last week. Usually, we would expect thermal generation to be around ~10 per cent for this time of year. Hydro generation totalled around ~50 per cent of total generation this week, up by around ~4 per cent from last week. Usually, we would expect it to be in the high 50s for this time of year. The general decline in the total percentage of hydro generation and increase in thermal generation is one of the main driving forces behind high prices currently.

Figure 8: Generation by Fuel



7.3. Historically high prices this week occurred when wind generation was almost at its lowest point for the week as shown in Figure 9 suggesting that declining wind generation compounded with peak demand to increase prices. Wind generation declining to just above ~100 MW likely meant the loss of low priced generation pushed the marginal price for those periods into higher priced tranches.

Figure 9: Wind Generation

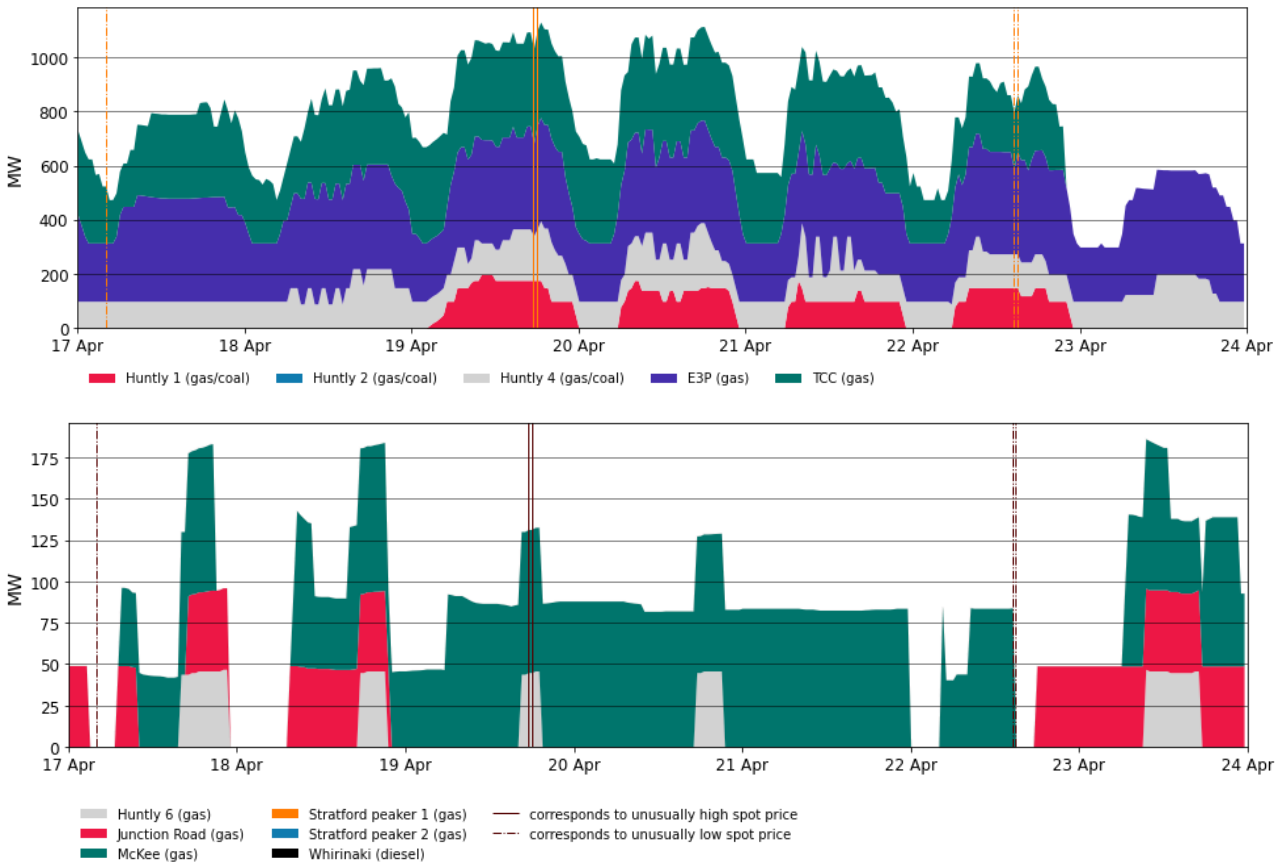


7.4. Correspondingly thermal generation was high during historically high prices this week.

7.5. Figure 10, which shows generation at thermal and thermal peaker plants, shows thermal generation running at high levels this week with thermal generation continuing to play a greater role in supporting baseload generation, making up for reduced hydro generation.

7.6. All thermal plants are running regularly during the week except for Huntly 2. Of the peaker plants the Stratford Peakers continue to remain on outage with McKee and Junction Road continuing to have the greatest output.

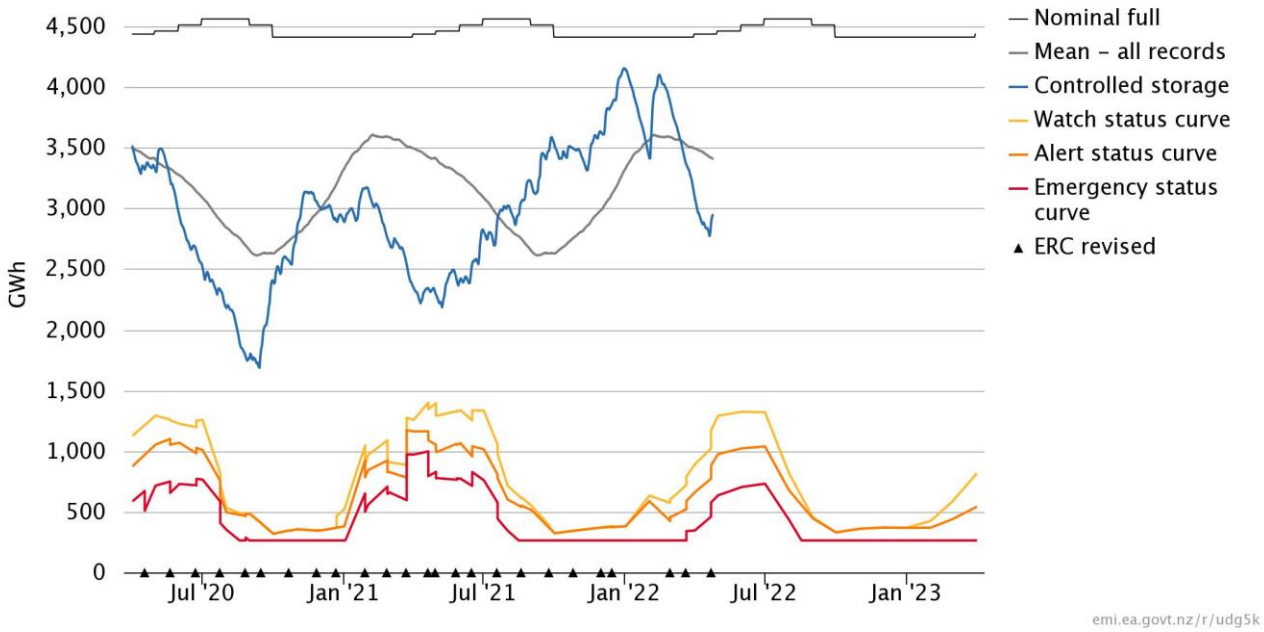
Figure 10: Thermal Generation



8. Storage/Fuel Supply

8.1. Figure 11 shows total controlled national hydro storage. Total hydro storage has increased this week, the first time since mid-February, due to a mixture of conservative hydro generator behaviour and an influx of inflows at Lakes Manapouri and Te Anau.

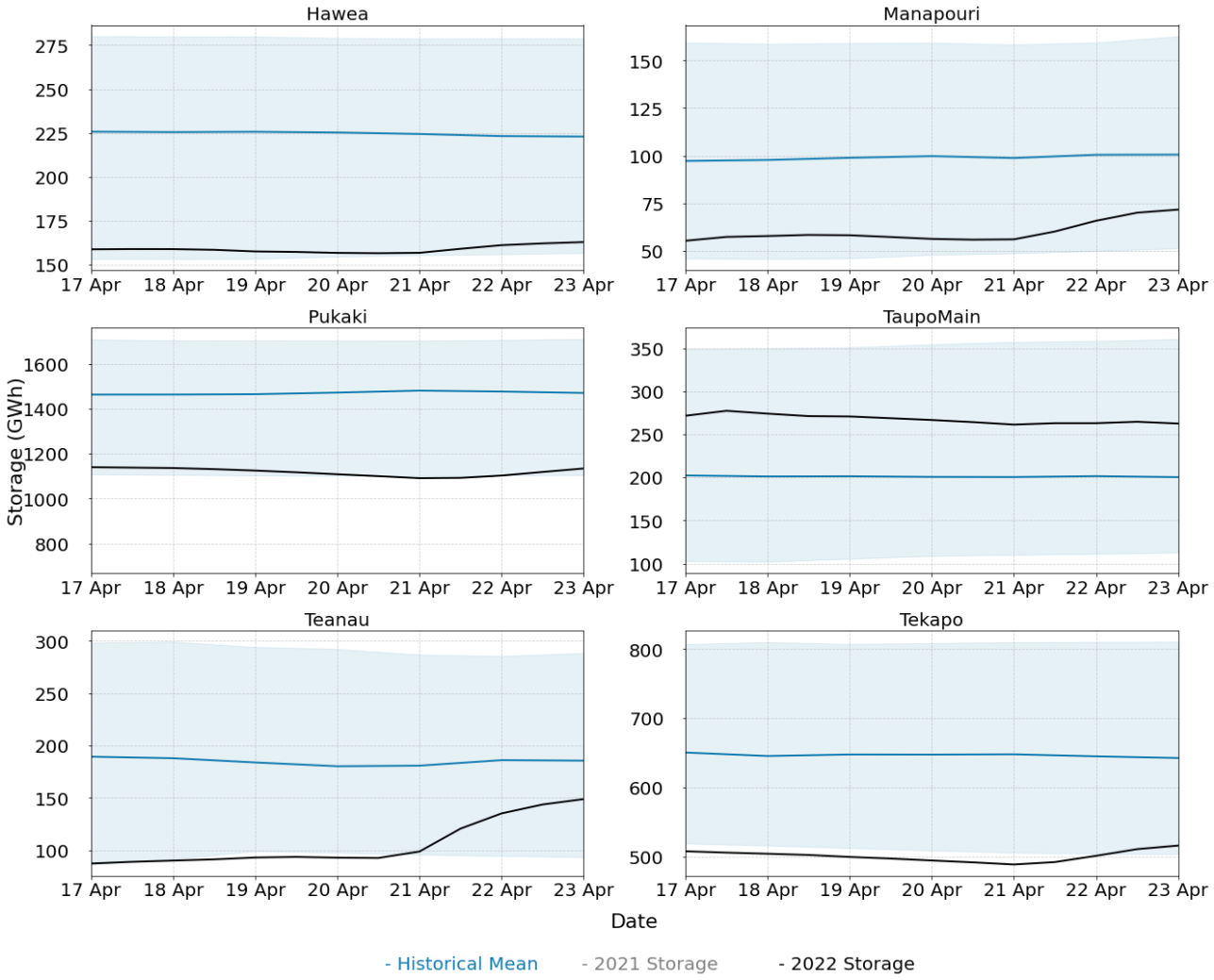
Figure 11: Hydro Storage



8.2. Figure 12 shows the storage of major lakes. Of the individual lakes only Lake Taupo continues to remain above its historical mean.

8.3. Following recent rain hydro storage at Lake Manapōuri and Lake Te Anau has risen. As both lakes were below their low operating ranges for an extended period of time however it is hard to stay whether generators will change their conservative behaviour or choose to continue to try and conserve water. Lake Hawea, Lake Pūkaki and Lake Tekapo continue to remain close to their historical 10th percentiles though still remain above their low operating ranges. It is likely that hydro prices will continue to remain highly priced.

Figure 12: Major Lake Storage



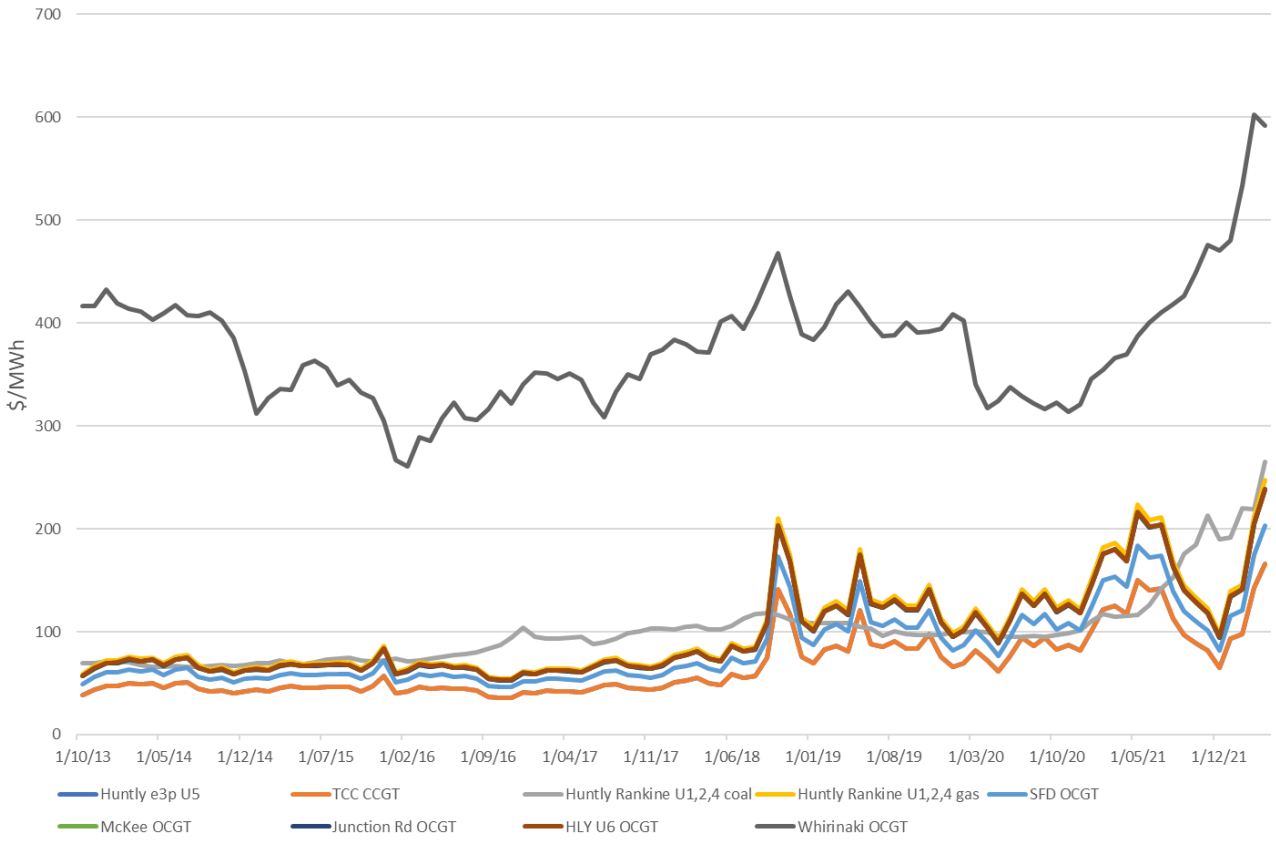
9. Price versus estimated costs

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. Note that the SRMC calculations include the carbon price, an estimate of operational and maintenance costs, and transport for coal. Figure 13 shows an estimate of thermal SRMCs as a monthly average up to 1 April 2022. The SRMC of all plants has increased sharply in March.

9.3. The SRMC of coal and diesel have both increased due to global supply and demand conditions (as well as supply disruptions caused by Covid, the Russian-Ukraine conflict has increased the premium on all international coal due to sanctions placed on Russia – the third largest exporter of coal and largest exporter of gas in the world). Indonesian coal prices are currently around US$280/tonne (~$415NZD). Limited local gas production also puts a premium on gas spot prices. Historically high carbon prices have also affected all generation with prices on the secondary market currently averaging ~$75/tonne and only set to increase. This puts the current SRMC of Huntly generation at around ~$250/MWh.

Figure 13: Estimated monthly SRMC for thermal fuels



10. JADE Water values

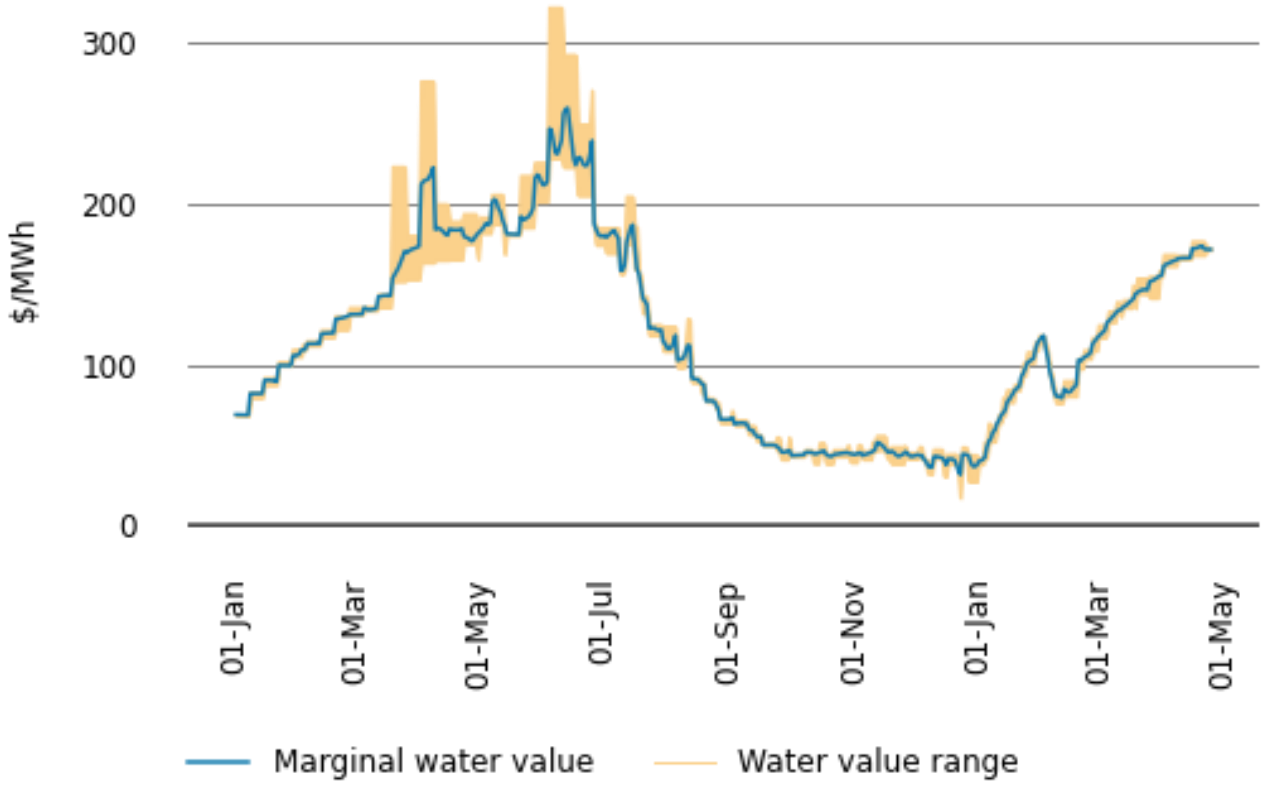
10.1. The JADE[1] model gives a consistent measure of the opportunity cost of water, by seeking to minimise the expected fuel cost of thermal generation and the value of lost load and provides an estimate of water values at a range of storage levels. Figure 14 shows the national water values[2] to 25 April 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. So far this year water values have increased when hydro storage has decreased and thermal fuel costs have increased. In the week between 17 and 23 April water values averaged around ~$169/MWh. The most recent rise in price is likely due to the storage at most South Island lakes falling to around their historical tenth percentiles and the rise in international coal costs.

[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



11. Offer Behaviour

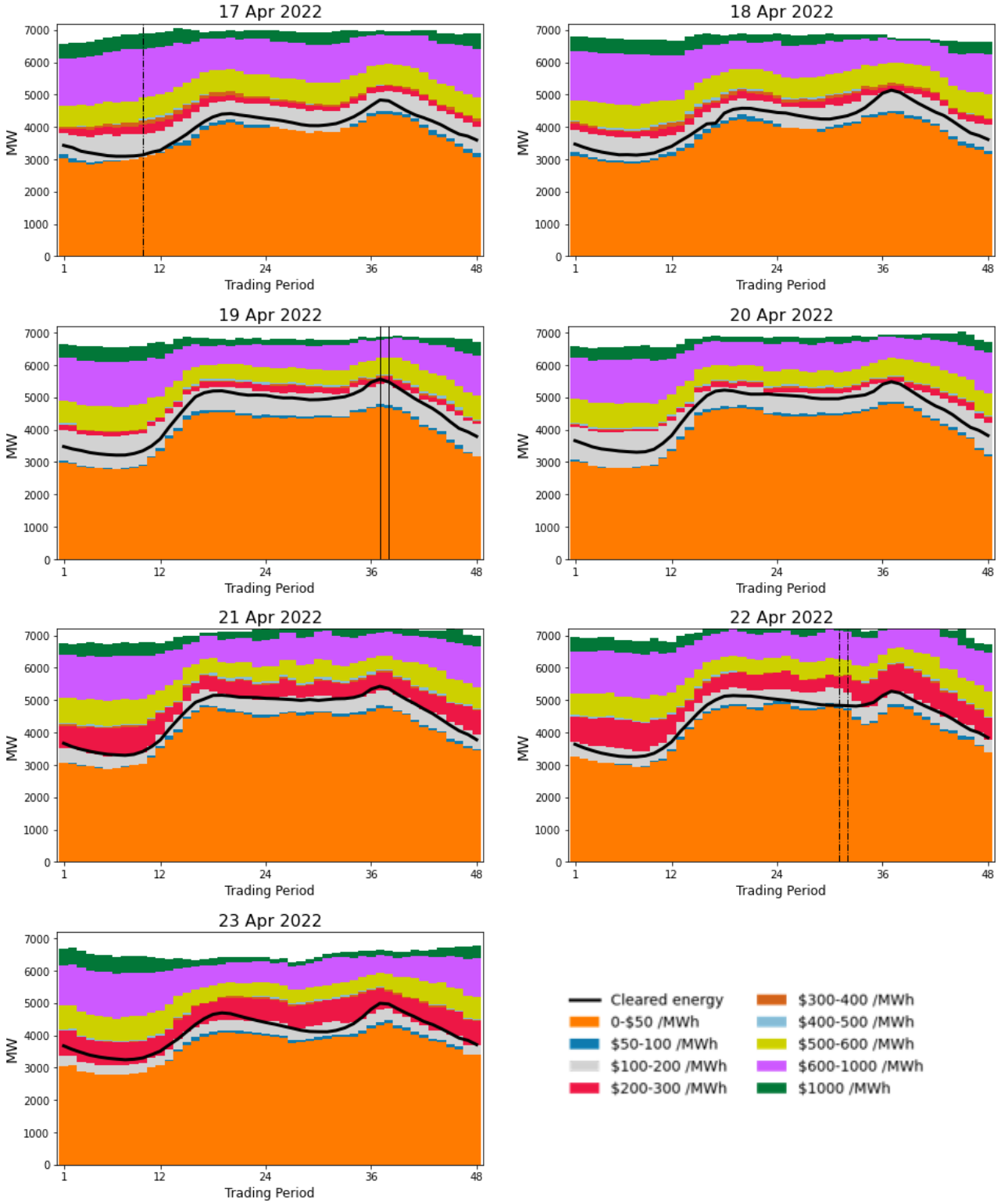
11.1. Figure 15 shows this week's daily offer stacks, adjusted to take into account wind generation, transmission constraints, reserves and frequency keeping.[3] The black line shows cleared energy, indicating the range of the average final price.

11.2. Offer curves continue to remain steep due to high thermal and hydro prices. While most cleared generation has remained within the $100-200/MWh tranche the narrow band of offers means cleared generation occasionally enters the $200-$300/MWh band, pushed up by small increases in demand or drops in wind generation.

11.3. The amount of mid-priced offers within the $300-500/MWh tranche continues to remain low with the next sizeable amount of generation offered from $500/MWh, likely due to generators pricing generation to avoid dispatch where possible in order to conserve fuel in the lead up to winter.

[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.

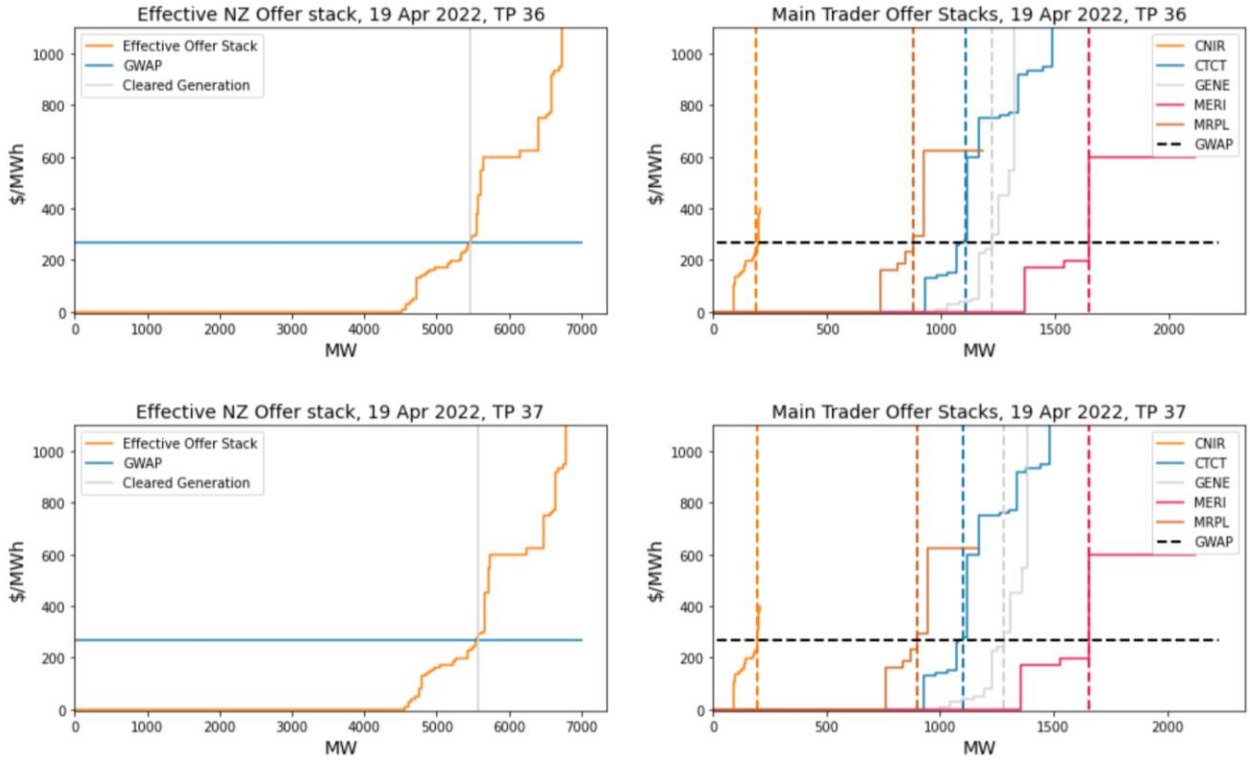
Figure 15: Daily offer stack



11.4. Figure 16 shows the offer stack of the high priced trading periods for this week. High demand and low wind generation combined with the steepness of the offer stack are the factors which pushed prices up for the trading periods 36 and 37 on 19 April.

11.5. 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.

Figure 16: Offer Stack TP 36,37 19 April



12. Ongoing Work in Trading Conduct

12.1. Following the previous week's report spot prices on 14 and 16 April have been finalised with all periods appearing to be consistent with market conditions.

12.2. High prices on 19 April appear to be driven by high demand and low renewable generation.

12.3. Further analysis is being done on the trading periods in Table 2 as indicated.

Table 2: Trading periods identified for further analysis

Date	TP	Status	Notes
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.
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