25 May 2022

Trading Conduct Report

Market Monitoring Weekly Report

1. Overview for the week of 15 to 21 May

1.1. The majority of wholesale spot prices this week appear to be consistent with supply and demand conditions though the Market Monitoring team is looking further into some off-peak demand periods which displayed higher prices than what would be historically expected.

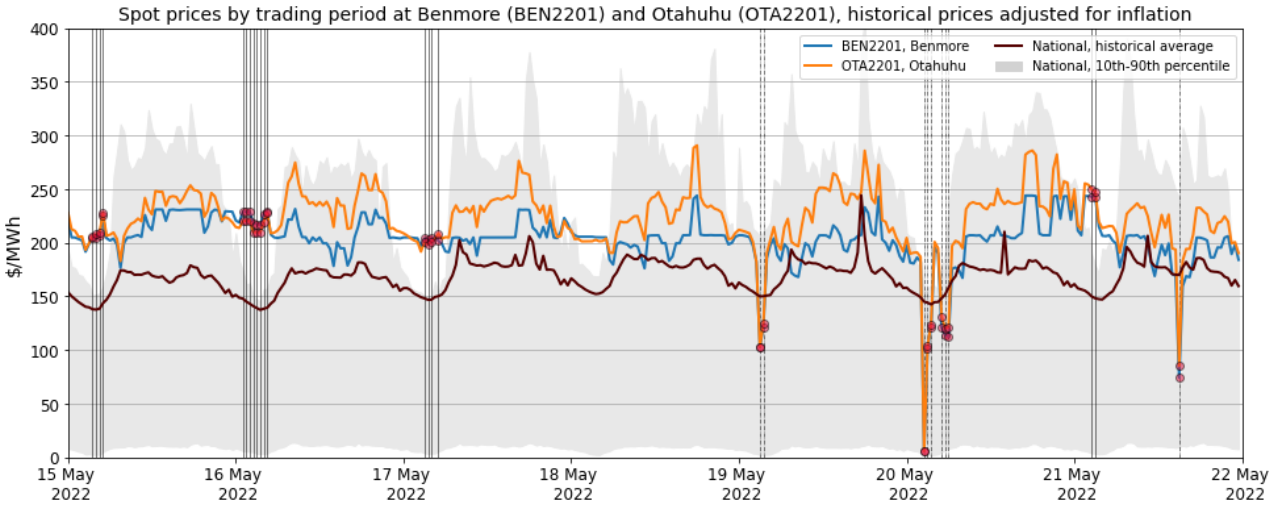
2. Spot Prices

2.1. This report monitors underlying wholesale price drivers to assess whether there are trading periods that require further analysis for the purpose of considering potential non-compliance with the trading conduct rule. To do this, we assess whether spot prices are behaving in line with market conditions. In addition to general monitoring, we also single out unusually high priced individual trading periods for further analysis by identifying when wholesale electricity spot prices at Benmore and/or Otahuhu nodes exceed their historical 90th percentiles. These historically high-priced trading periods are marked out by vertical lines in the majority of figures in this report.

2.2. Figure 1 shows wholesale electricity spot prices from the past week at Benmore and Otahuhu alongside their historic mean and historic 10th-90th percentiles adjusted for inflation. Spot prices between 8 and 14 May across all nodes averaged $230.60/MWh with 95 per cent of prices between $128.89/MWh and $261.19/MWh.

2.3. There were no significant price spikes this week though trading periods marked as highly priced using the criterion of being above the historical 90th percentile of Benmore or Otahuhu flagged a number of off-peak periods.

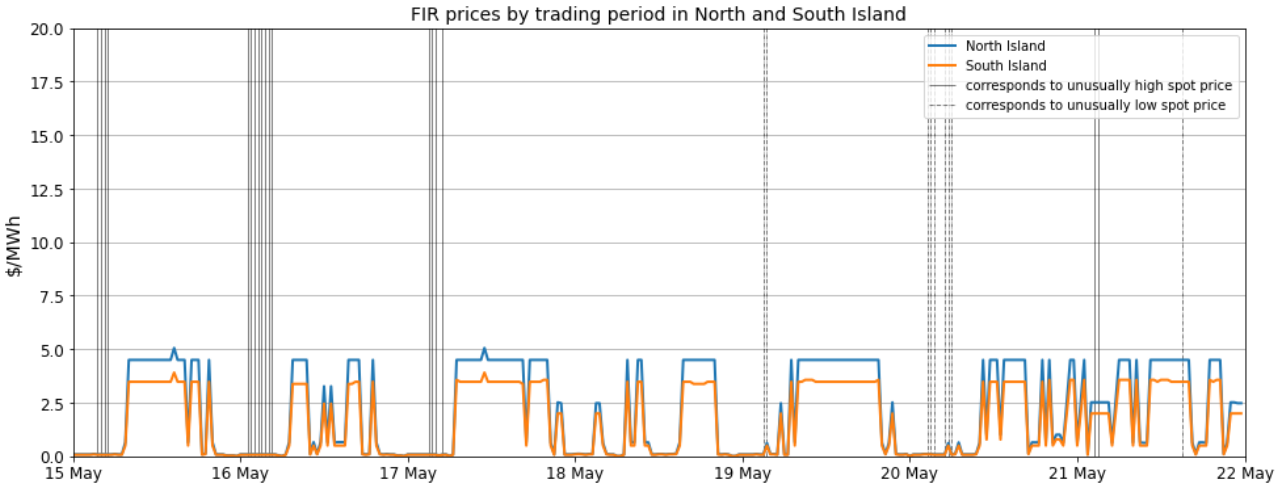
Figure 1: Wholesale Spot Prices



3. Reserve Prices

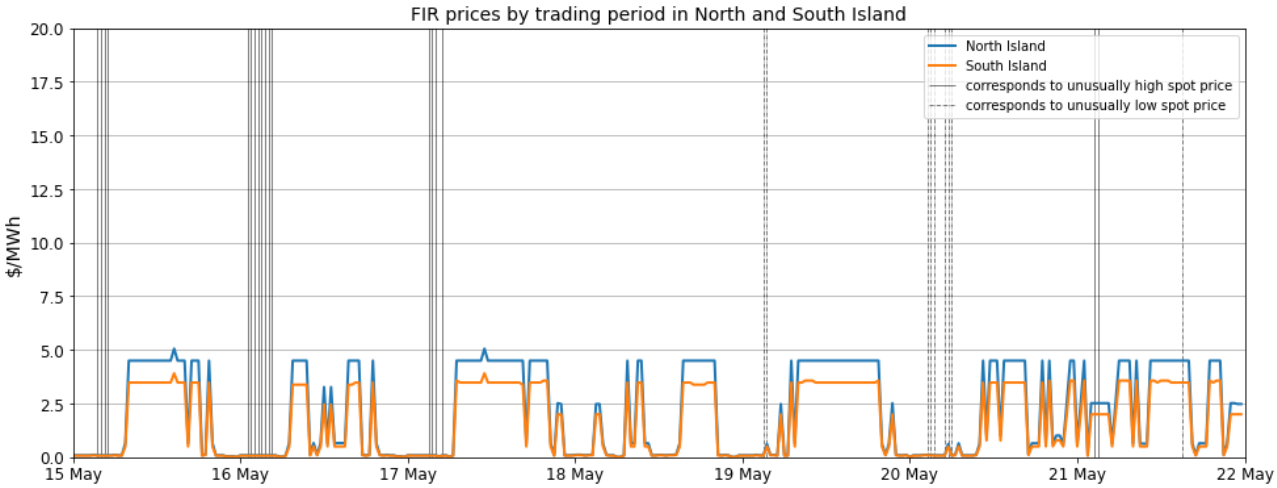
3.1. Fast instantaneous reserves (FIR) prices for the North and South Island are shown below in Figure 2. FIR reserve prices this week were well within normal range at below ~$5/MWh.

Figure 2: FIR prices by trading period and Island



3.2. Sustained instantaneous reserves (SIR) prices for the North and South Island are shown below in Figure 3. SIR reserve prices this week remained within normal bounds at below ~$5/MWh.

Figure 3: SIR prices by trading period and Island



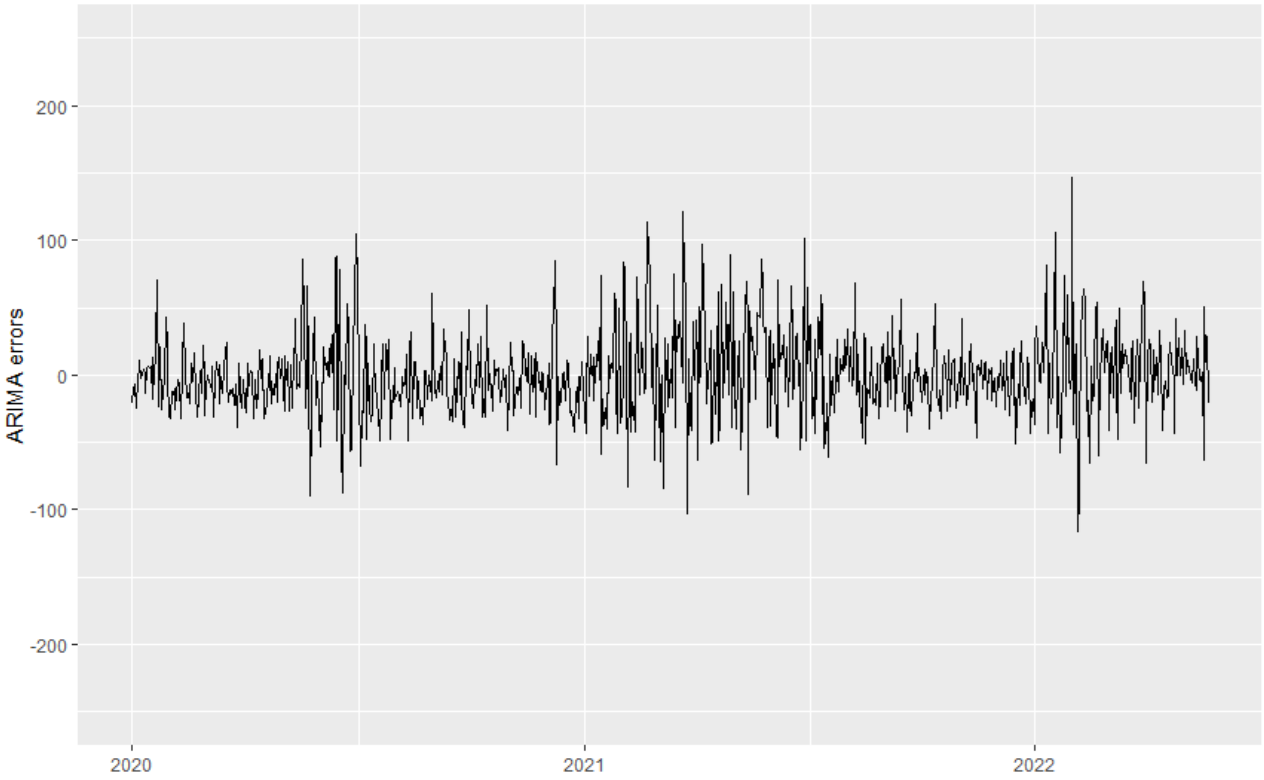
4. Regression Residuals

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[1] on the trading conduct webpage.

4.2. Figure 4 shows the residuals of autoregressive moving average (ARMA) errors from the daily model. Residuals were mostly stable this week indicating prices largely aligned with market conditions.

[1] https://www.ea.govt.nz/assets/dms-assets/29/Appendix-A-Regression-Analysis.pdf

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

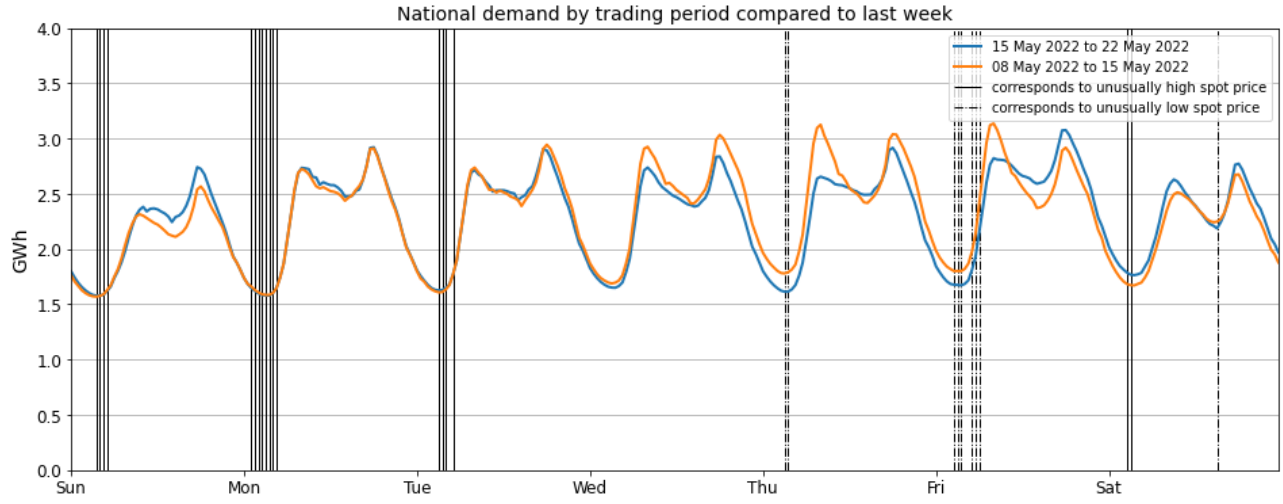


5. Demand

5.1. Figure 5 shows this week's national grid demand against national grid demand from the previous week.

5.2. Daily demand up to Wednesday was similar to demand from the previous week. From Wednesday onwards daily demand began to drop, falling below daily demand from the previous week until Friday.

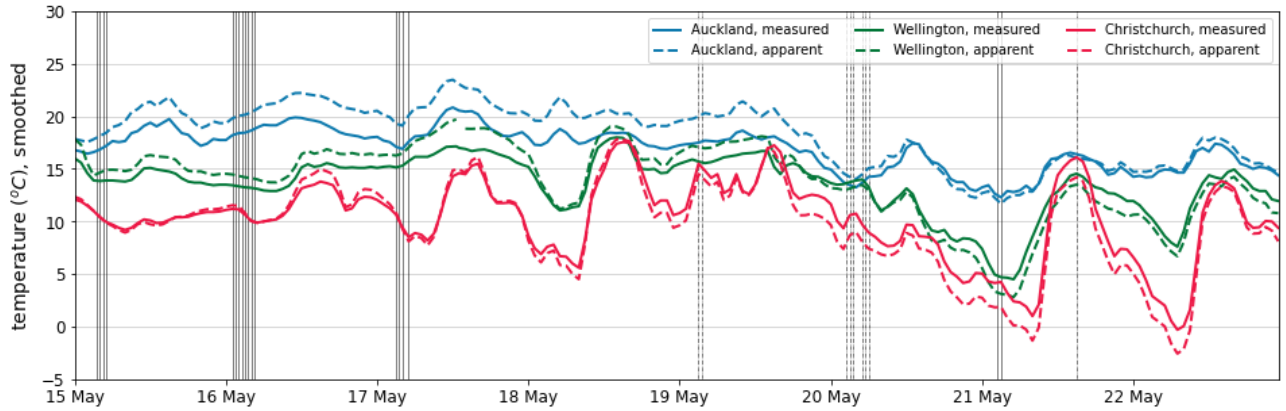
Figure 5: National demand by trading period compared to the previous week



5.3. 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.

5.4. Changes in temperatures correlated to changes in demand this week with increased temperatures associated with decreases in demand and decreased temperatures associated with increases in demand.

Figure 6: Temperatures across main centres

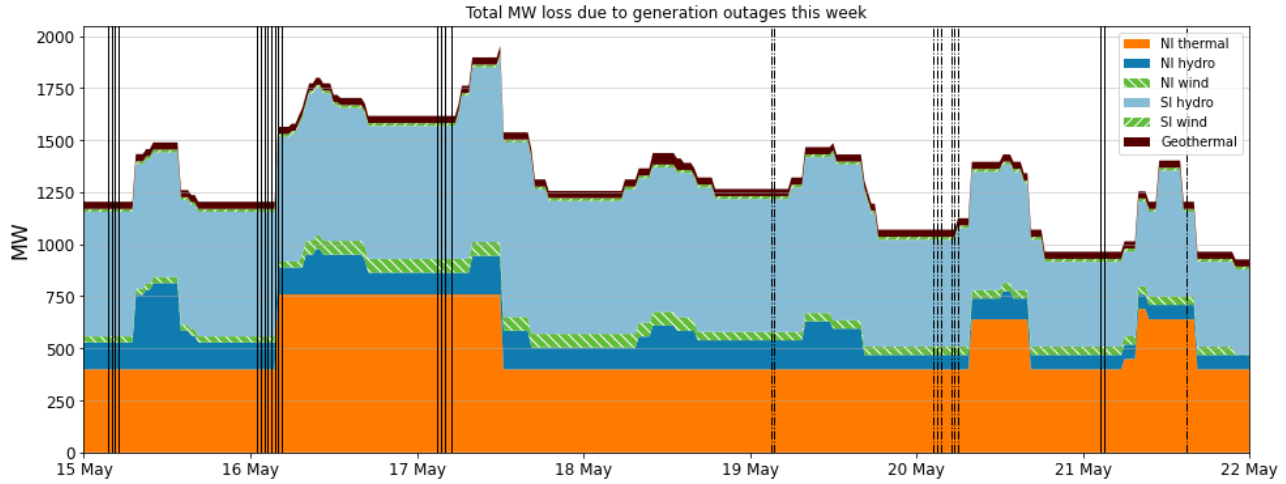


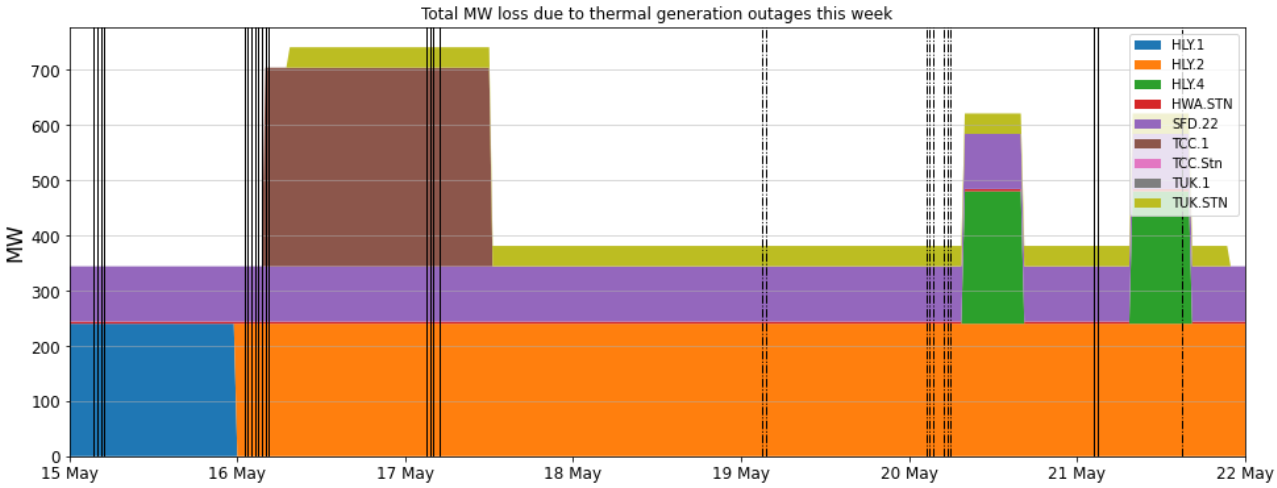
5.5. Though prices were historically high during morning off peak periods from 15 to 17 May as temperatures and off-peak demand this week were similar to temperatures and off-peak demand for the same days in the previous week, shifts in demand are unlikely to be the cause of the unusual prices this week.

6. Outages

6.1. Figure 7 shows generation capacity lost due to outages by fuel type as well as generation capacity lost due to thermal outages. Total generation capacity lost mostly remained below 1,250 MW this week with the exception of 16 May when TCC thermal plant went on outage.

Figure 7: Total MW loss due to generation outages

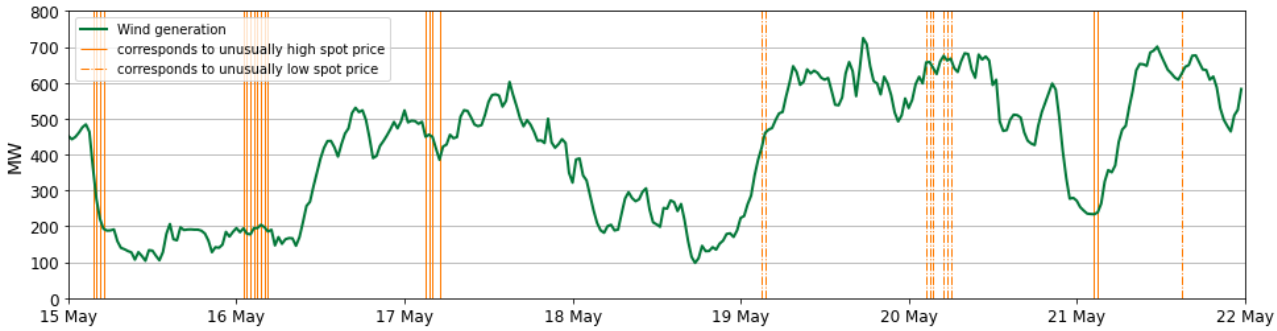




7. Generation

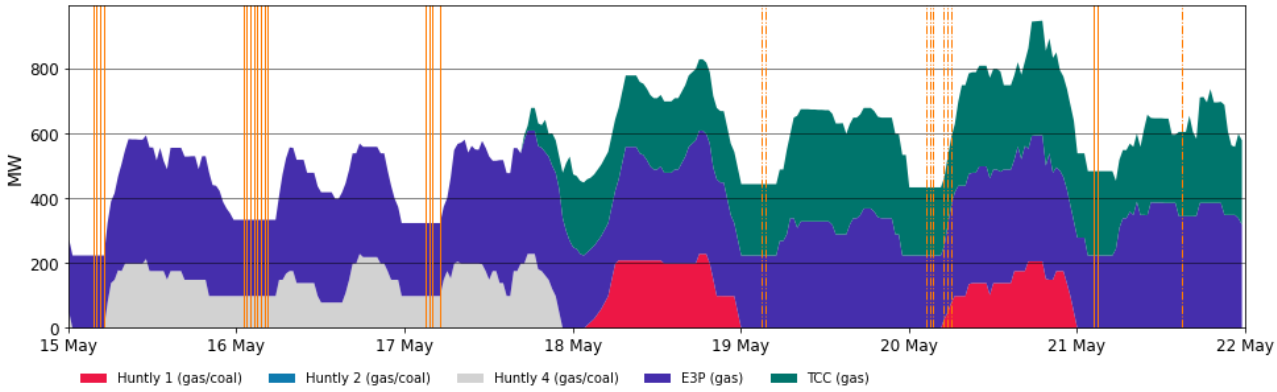
7.1. Figure 8 shows wind generation from 15 to 21 May. Wind generation at the beginning of the week was between 100 MW and 200 MW before rising to ~500 MW on 16 May. Wind generation continued to fluctuate throughout the rest of the week. Low wind generation early in the week may have been the reason for unusually priced off peak demand prices.

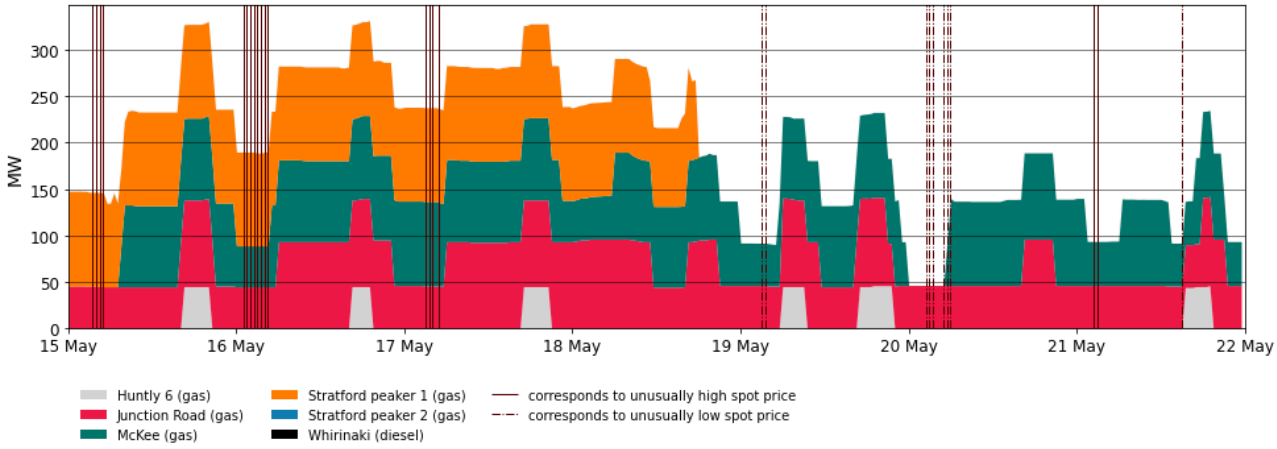
Figure 8: Wind Generation



7.2. Figure 9 shows generation at thermal and thermal peaker plants. TCC started generating in the latter half of the week, combined with high wind generation at the time. This meant Stratford Peaker 1 no longer had to run as it had earlier in the week. Thermal peaker generation decreased to below 200 MW as a result. Overall thermal generation as a percentage of total generation has stayed much the same as previous weeks. With the current high cost of thermal fuels, the high amount of thermal generation continues to be a large contributor to high spot prices.

Figure 9: Thermal Generation

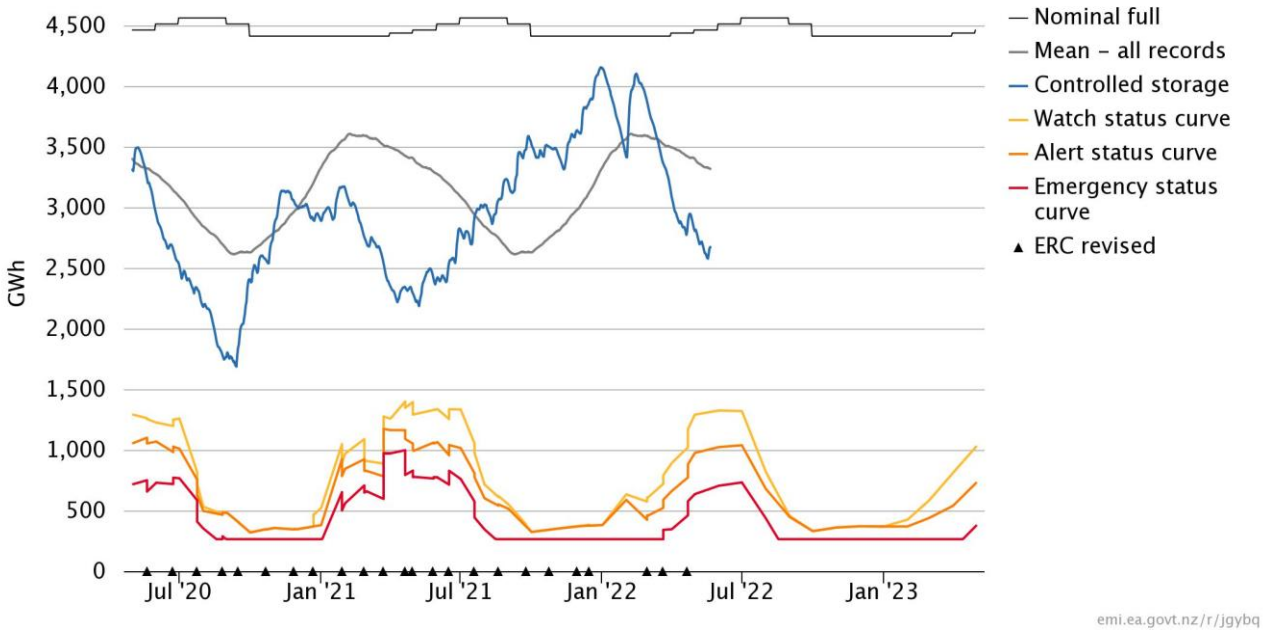




8. Storage/Fuel Supply

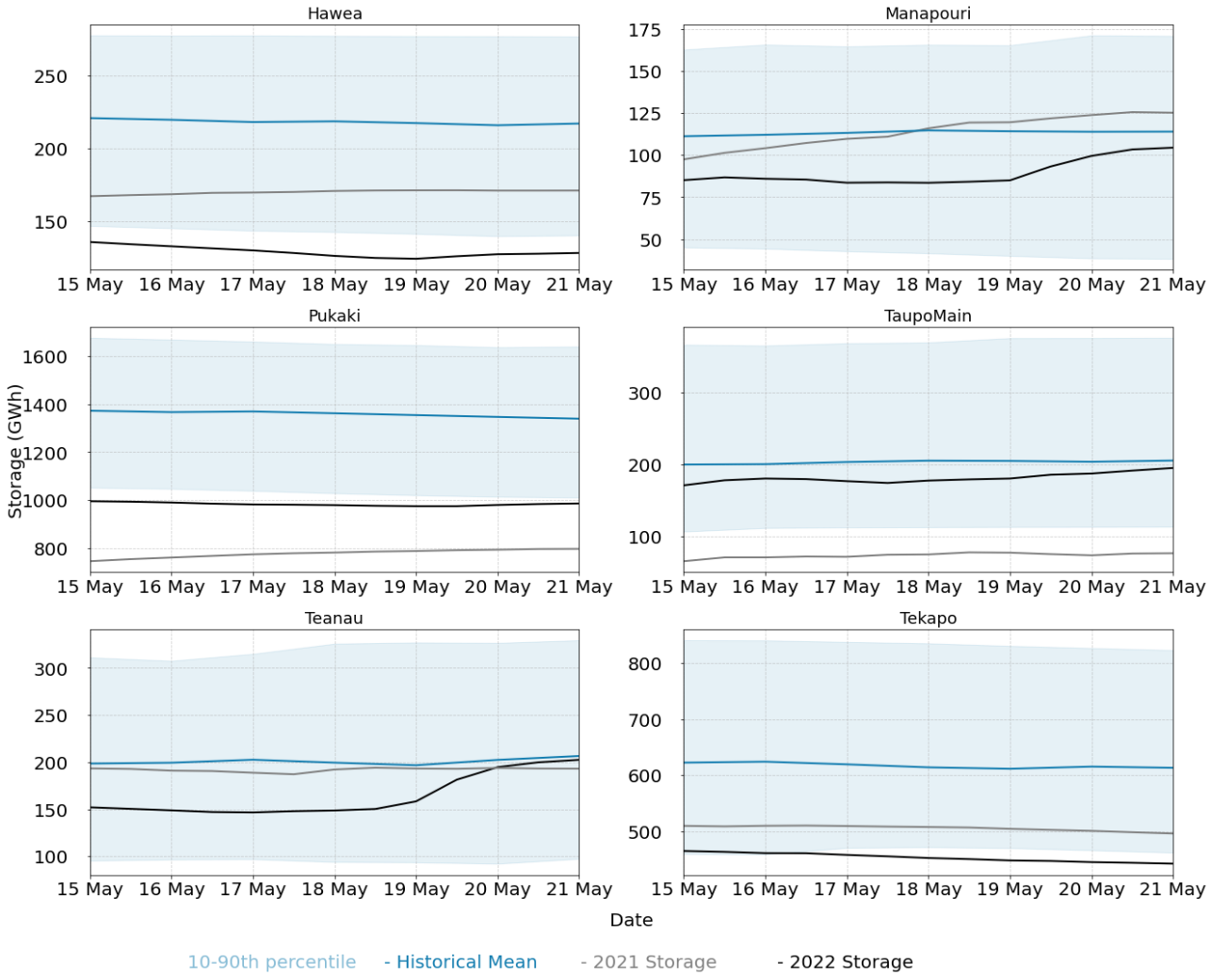
8.1. Figure 10 shows total controlled national hydro storage. Total hydro storage saw a small uptick over the weekend due to rainfall increasing hydro inflows. Total storage however still remains quite low. Low hydro storage increasing the opportunity cost of hydro generation also continues to be a large contributor to high spot prices.

Figure 10: Hydro Storage



8.2. Figure 11 shows hydro storage at major lakes compared to the previous year, historic average and historic 10th-90th percentiles. All lakes have shown a small uptick in storage with Manapouri and Te Anau showing the greatest gains relative to size. Lake Hawea, Lake Pūkaki and Lake Tekapo levels continue to hover around their 10th percentiles. Lake Manapōuri and Lake Te Anau now rest comfortably above their 10th percentiles.

Figure 11: Major Lake Storage



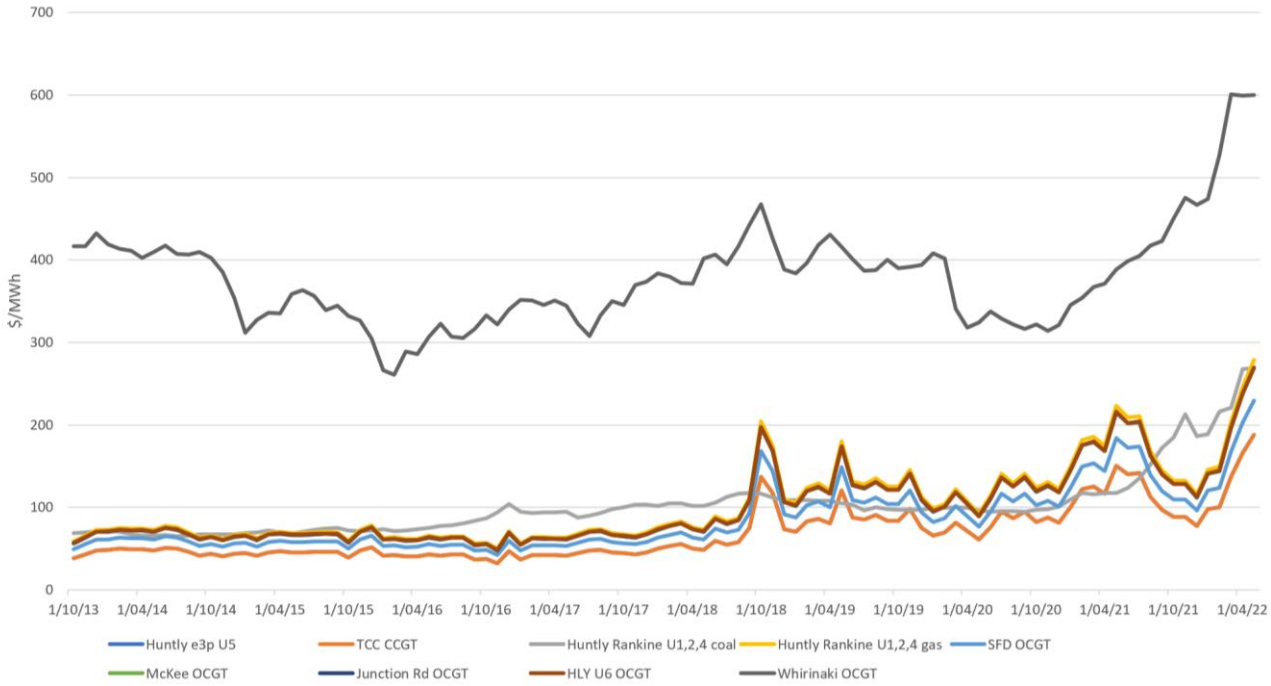
9. Price versus estimated costs

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 12 shows an estimate of thermal SRMCs as a monthly average up to 1 May 2022. The SRMC of all plants has increased sharply since the beginning of 2022.

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. Though recently the international unit cost in terms of USD has dropped for coal, inflation and a weakening NZD has resulted in coal prices increasing to around NZD$430/tonne. Limited local gas production has also put a premium on gas spot prices with the current month long full field outage at Maui gas field (14 May-6 June) pushing the VWAP of gas spot prices to around ~$24/GJ. High historical carbon prices have also affected thermal generation costs with prices on the secondary market currently averaging ~$75/tonne and only set to increase. This puts the latest SRMC of Huntly generation at above ~$270/MWh.

Figure 12: Estimated monthly SRMC for thermal fuels



10. JADE Water values

10.1. The JADE[2] 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 13 shows the national water values to 31 March 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. More details on how water values are calculated can be found in Appendix B[3] on the trading conduct webpage.

10.2. In general, marginal water values have increased when total national hydro storage has decreased. For the last two months water values have been gradually increasing as hydro storage has declined and despite the recent bump in hydro storage water values have almost reached $150/MWh.

[2] 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.
[3] https://www.ea.govt.nz/assets/dms-assets/29/Appendix-B-JADE-water-value-model.pdf

Figure 13: Water Values

11. Offer Behaviour

11.1. Figure 14 shows this week's daily offer stacks, adjusted to take into account wind generation, transmission constraints, reserves and frequency keeping.[4] The black line shows cleared energy, indicating the range of the average final price.

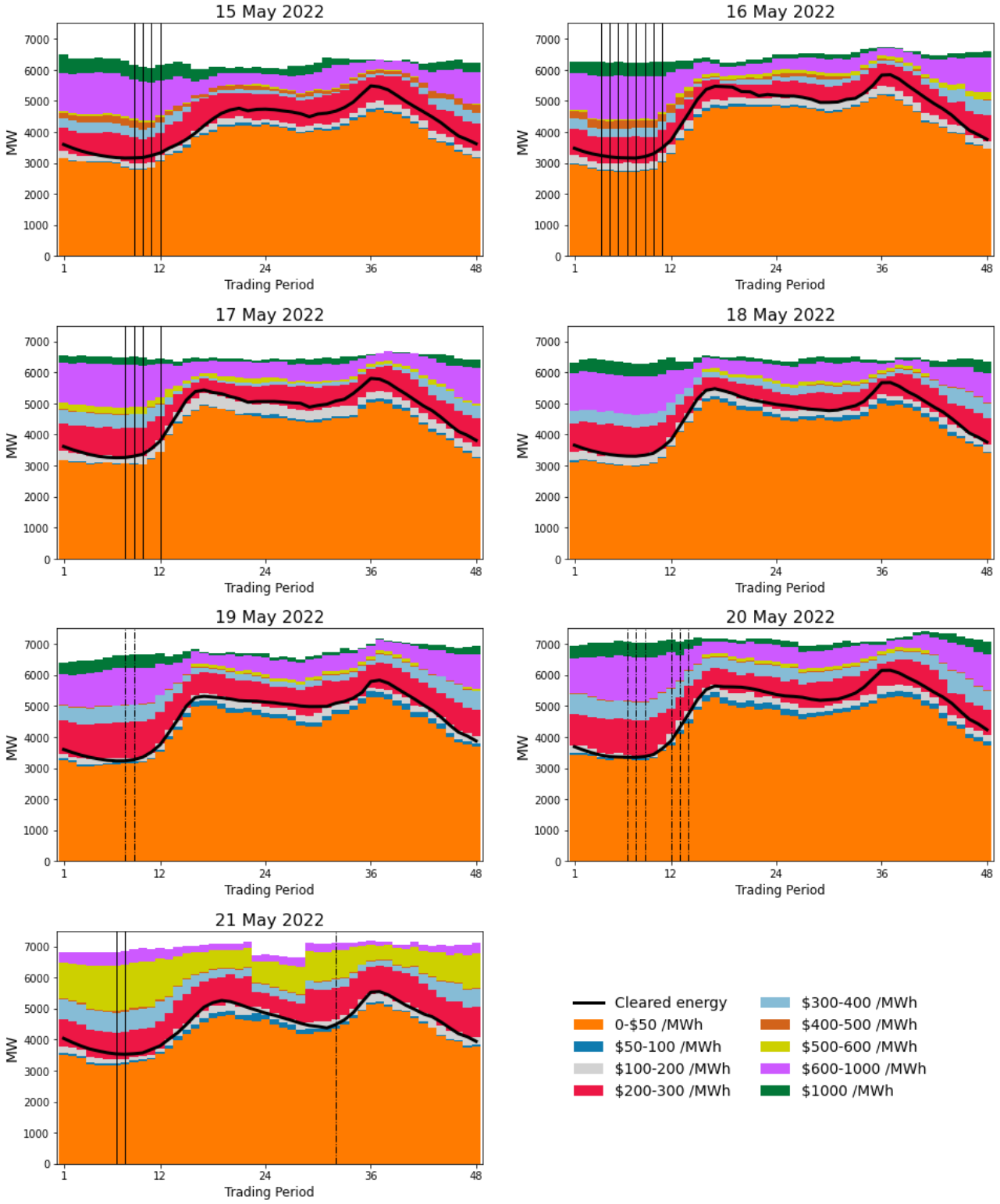
11.2. High thermal and hydro generation opportunity costs as detailed above continue to drive a steep offer curve.

11.3. Compared to the previous week the amount of $0/MWh to $50/MWh offers has not changed however the offers in higher bands have shown shifts in quantities offered. $100/MWh to $200/MWh offers this week have significantly decreased in lieu of $200/MWh to $300/MWh offers. The number of $400/MWh to $500/MWh offers have also decreased in favour of $300/MWh to $400/MWh offers.

11.4. A large part of the increase in $200/MWh to $300/MWh offers can be attributed to changes in wind generation this week compared to the previous week, with less wind this week decreasing the amount of lower priced offers. This had the most effect on morning off-peak prices earlier in the week with prices higher than we would historically expect despite aligning with market conditions.

[4] 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 14: Daily offer stack



12. Ongoing Work in Trading Conduct

12.1. Most prices corresponded to what we would expect with current market conditions this week. The Market Monitoring team will be looking further into some off-peak demand periods which displayed higher prices than what would be historically expected. Currently it looks as though those prices were the result of Stratford Peaker 1 needing to be run to cover load due to low wind generation.

12.2. Further analysis is being done on the trading periods in Table 1 as indicated.

Table 1: 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
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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