2 August 2022

Trading Conduct Report

Market Monitoring Weekly Report

1. Overview for the week of 24 to 30 July

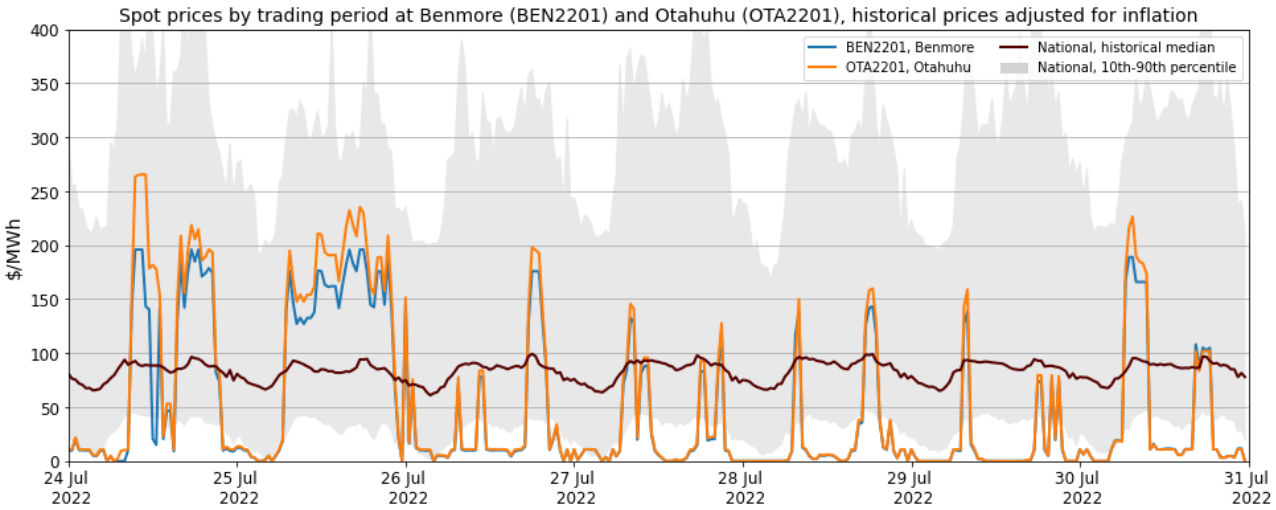
1.1. Overall wholesale spot prices appear to align with market conditions this week.

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. 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 spot prices between 24 and 30 July at Benmore and Otahuhu alongside their historic median and historic 10th-90th percentiles adjusted for inflation. Otahuhu and Benmore spot prices were relatively low this week, falling regularly below their historic median and fluctuating between $0.01/MWh and $265.40/MWh.

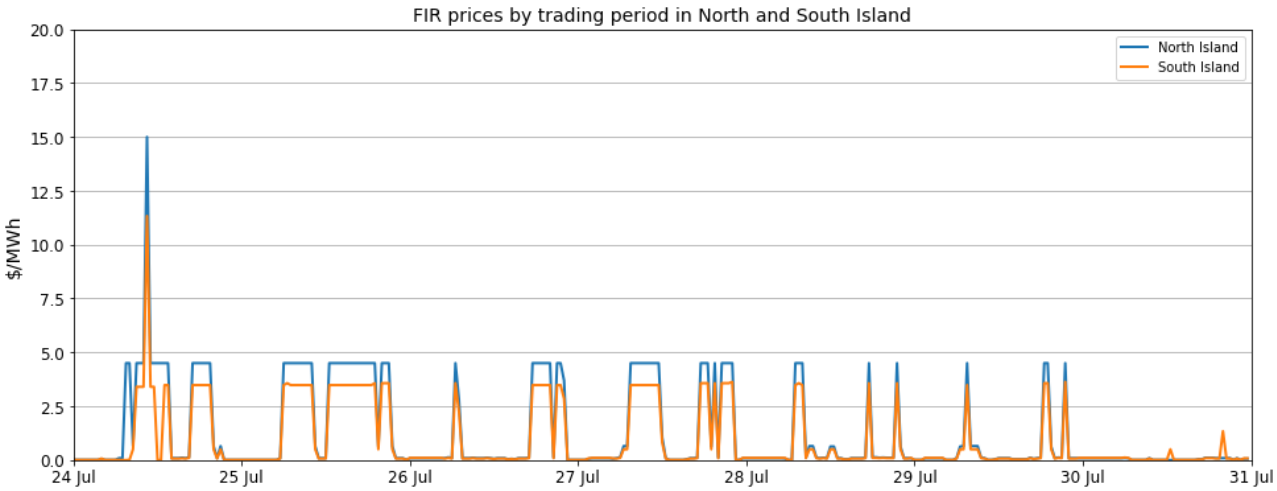
Figure 1: Wholesale Spot Prices



3. Reserve Prices

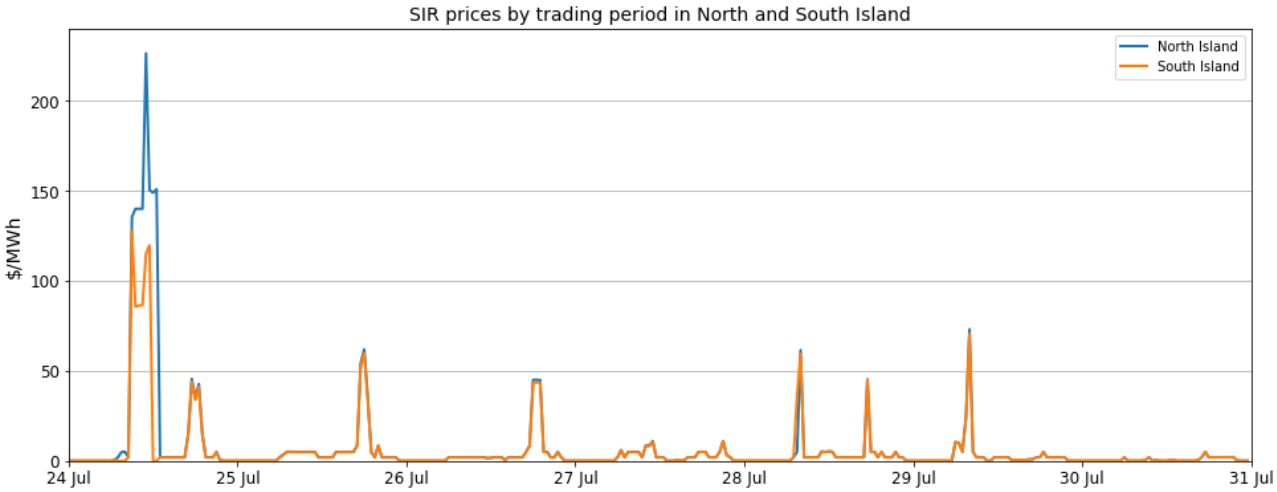
3.1. Fast instantaneous reserves (FIR) prices for the North and South Island are shown below in Figure 2. FIR prices were within historical bounds this week with prices at or below $15/MWh. `

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 prices also fell mainly within historical bounds this week with the exception of some price spikes which reached a little over $250/MWh. The price spikes were likely due to reserves being dispatched instead of higher priced energy offers in an effort to reduce the overall spot price.

Figure 3: SIR prices by trading period and Island



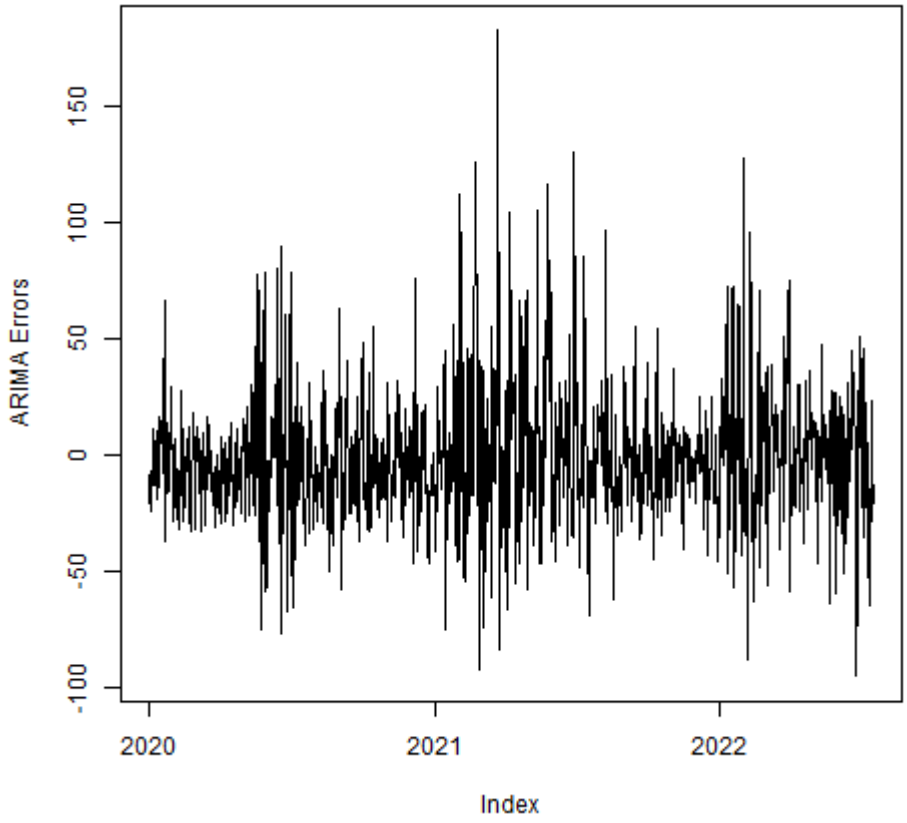
4. Regression Residuals

4.1. The Authority's monitoring team uses a regression model to model 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. Daily residuals this week suggest that prices appear to be 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



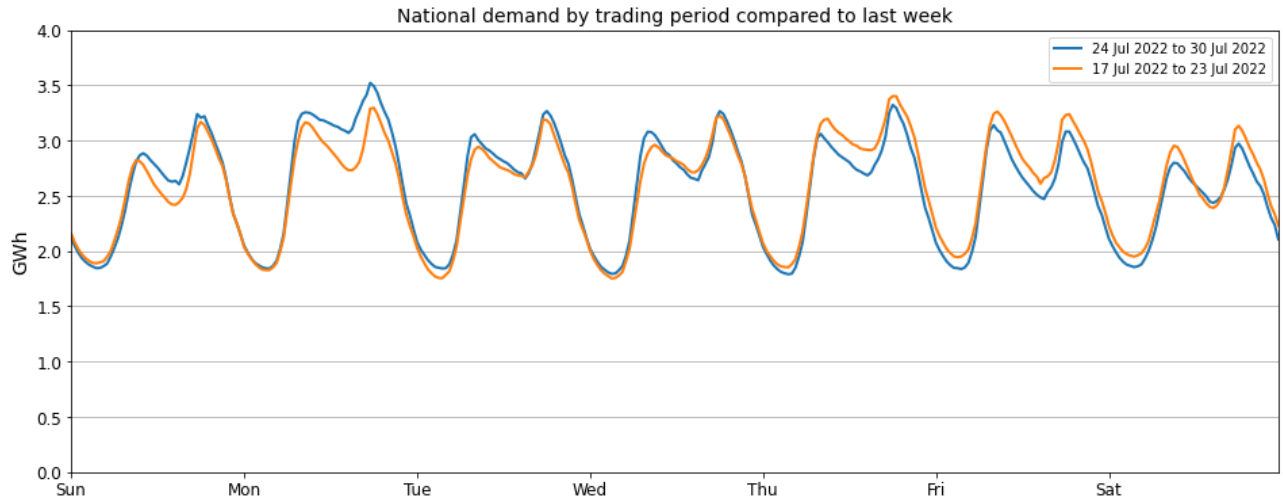
5. Demand

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

5.2. Average daily demand between 24 and 30 July compared to 17 and 23 July was higher at the beginning of the week on Sunday and Monday before dropping lower from Thursday onwards. The reduction in demand likely aided in reducing average daily spot prices for the week.

5.3. Demand peaked on 5.30pm Monday 25 at 6,856 MW, the highest demand peak so far this winter.

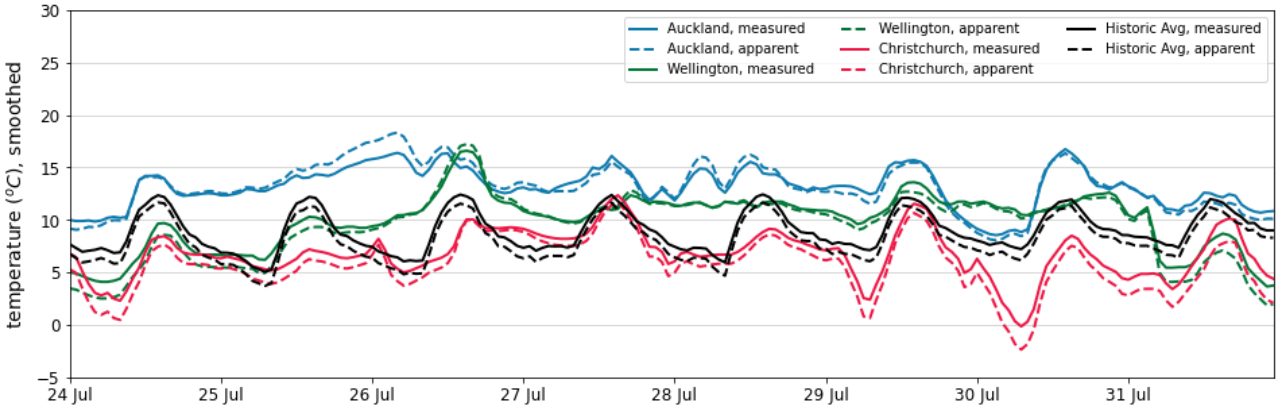
Figure 5: National demand by trading period compared to the previous week



5.4. 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. Also included for reference is the mean historical temperature of similar weeks from previous years averaged across the three main population centres.

5.5. Apparent temperatures this week were relatively consistent with historic trends for this time of year averaging around 10°C with some days milder than others. Grid demand continues to follow seasonal trends, increasing when temperatures decrease and decreasing when temperatures increase.

Figure 6: Temperatures across main centres

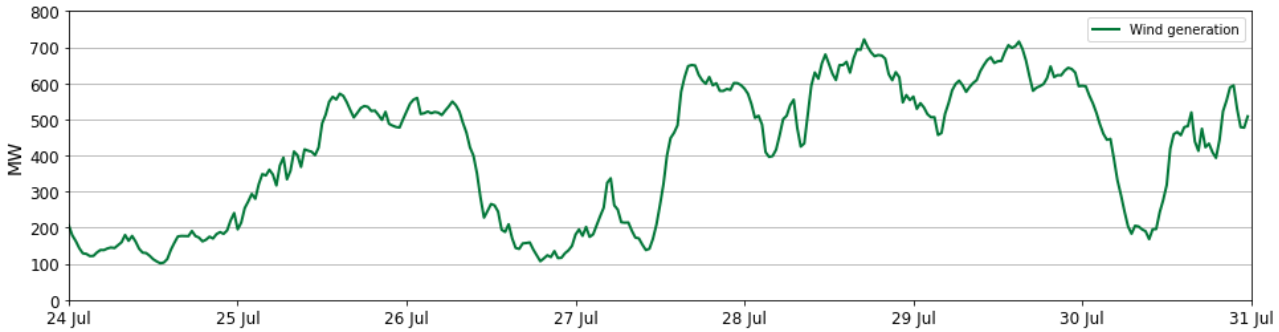


6. Generation

6.1. Wind generation from the past week as seen below in Figure 7 was high for the majority of week, generating between 500 MW and 700 MW consistently. High wind generation likely contributed to low spot prices this week with spot prices falling close to $0/MWh during periods of high wind generation.

6.2. Wind generation dropped below 200 MW on 24 and 26 July, coinciding with spikes in spot prices.

Figure 7: Wind Generation

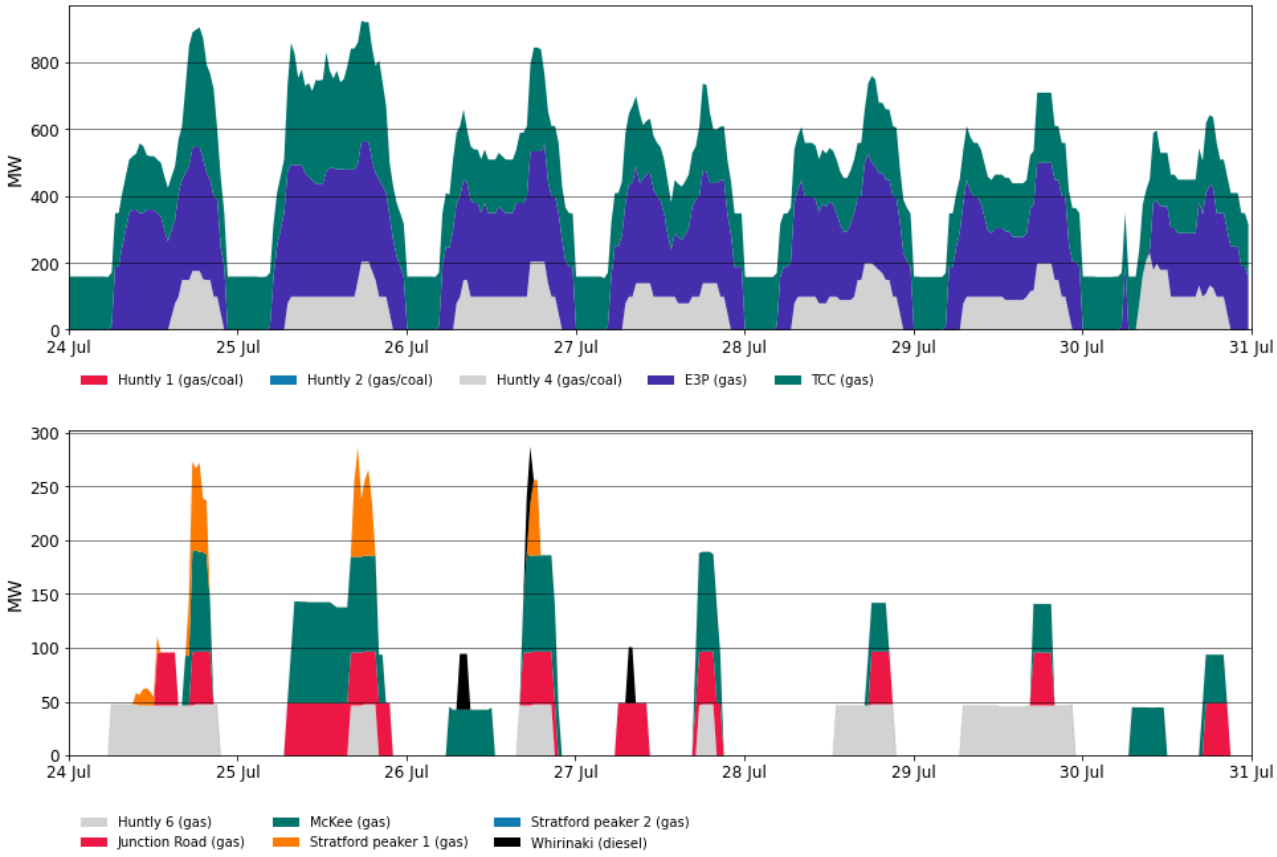


6.3. Figure 8 shows generation at thermal and thermal peaker plants from the past week. Peak thermal generation fell mostly below 800 MW during the week whereas in previous weeks with low renewable generation peak thermal generation would be closer to 1,200 MW. When thermal generation was at its highest point for the week coincided with when spot prices were at their highest point for the week therefore high thermal generation likely contributed towards high spot prices and below average thermal generation likely contributed towards low spot prices.

6.4. Despite low spot prices Whirinaki was dispatched at three points during the week. As advised by Contact this was for testing purposes and as such was not driven by market conditions.

6.5. E3P ran briefly on 30 June during the hour of 6:00am for frequency keeping purposes.

Figure 8: Thermal Generation



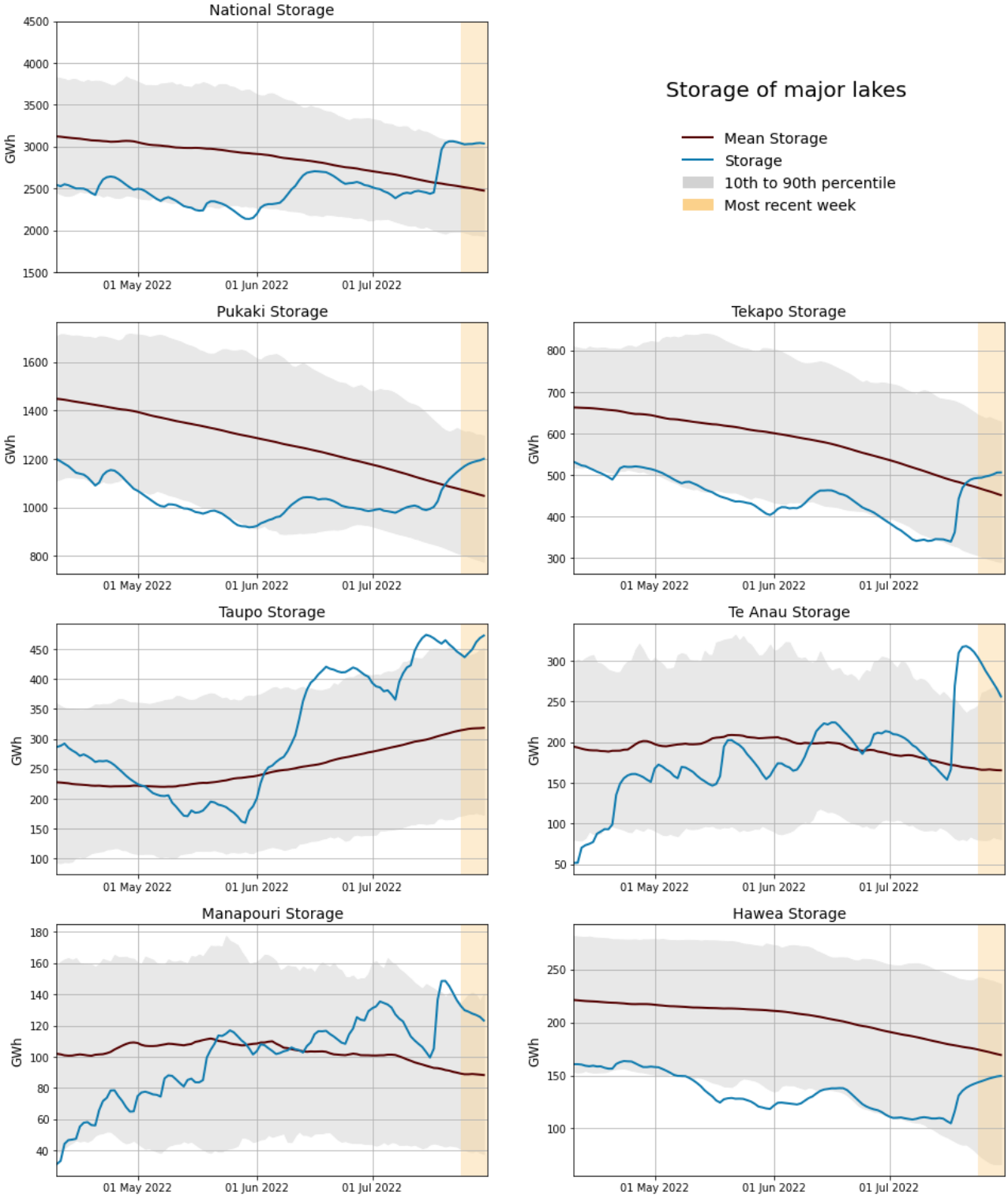
7. Storage/Fuel Supply

7.1. Figure 9 shows total controlled national hydro storage as well as the storage of major catchment lakes including their historical mean and 10th to 90th percentiles.

7.2. High hydro inflows, a result of recent heavy rainfall, have contributed to a large increase in controlled hydro storage across all major catchments. Currently all major lakes with the exception of Lake Hawea have storage above their historical mean.

7.3. The increase in inflows likely contributed to below average spot prices this week with the lowered opportunity cost of hydro generation increasing low priced hydro generation offers.

Figure 9: Hydro Storage



8. Price versus estimated costs

8.1. 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).

8.2. 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.

8.3. Figure 10 shows an estimate of thermal SRMCs as a monthly average up to 1 August 2022. The SRMC of gas fuelled plants has fallen from its peak in May 2022 while the SRMC of diesel and coal fuelled plants continues to remain high.

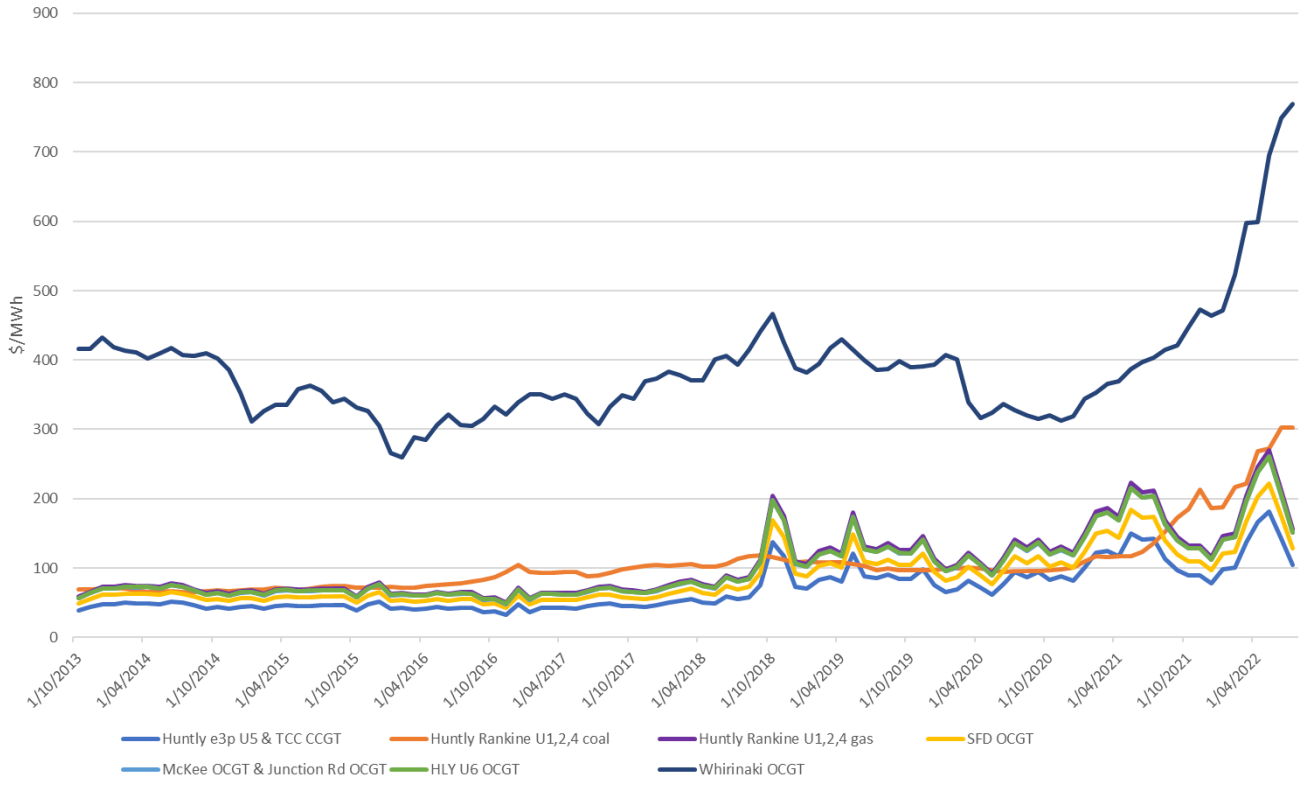
8.4. The SRMC of coal and diesel have remained largely unchanged due to global supply and demand conditions. As well as supply disruptions caused by Covid, the Russian-Ukraine conflict has increased the premium on all international coal due to sanctions placed on Russia.

8.5. The most recent price for Indonesian coal was around $504/tonne. The increase in diesel and coal prices has put the latest SRMC of Whirinaki and coal fuelled Huntly generation to $770/MWh and $302/MWh respectively.

8.6. SRMCs of gas run thermal plants have decreased to between $100/MWh and $150/MWh with the recent downturn at Methanex freeing up gas supply and successful well tie-ins at Pohokura gas field also increasing supply.

8.7. More information on how the SRMC of thermal plants is calculated can be found in Appendix C[2] on the trading conduct webpage.

Figure 10: Estimated monthly SRMC for thermal fuels



9. JADE Water values

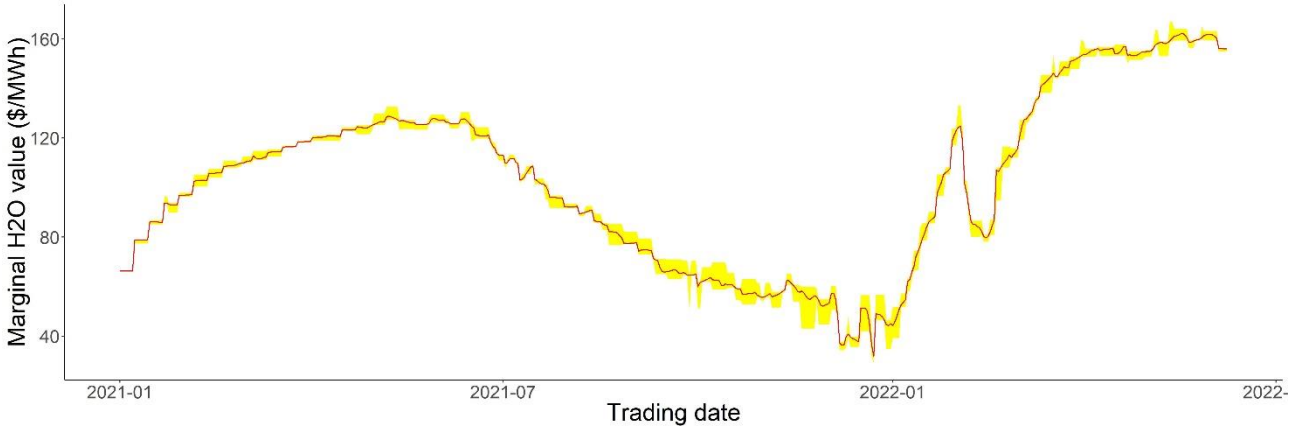
9.1. The JADE[3] model gives a consistent measure of the opportunity cost of water, by seeking to minimise the expected fuel cost of thermal generation and the value of lost load and provides an estimate of water values at a range of storage levels. Figure 11 shows the national water values to 8 June 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

[2] https://www.ea.govt.nz/assets/dms-assets/30/Appendix-C-Calculating-thermal-SRMCs.pdf
[3] 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.

on how water values are calculated can be found in Appendix B[4] on the trading conduct webpage.

9.2. 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 putting the latest water values at around ~$150/MWh.

Figure 11: Water Values



10. Offer Behaviour

10.1. Figure 12 shows this week's daily offer stacks, adjusted to take into account wind generation, transmission constraints, reserves and frequency keeping.[5] The black line shows cleared energy, indicating the range of the average final price.

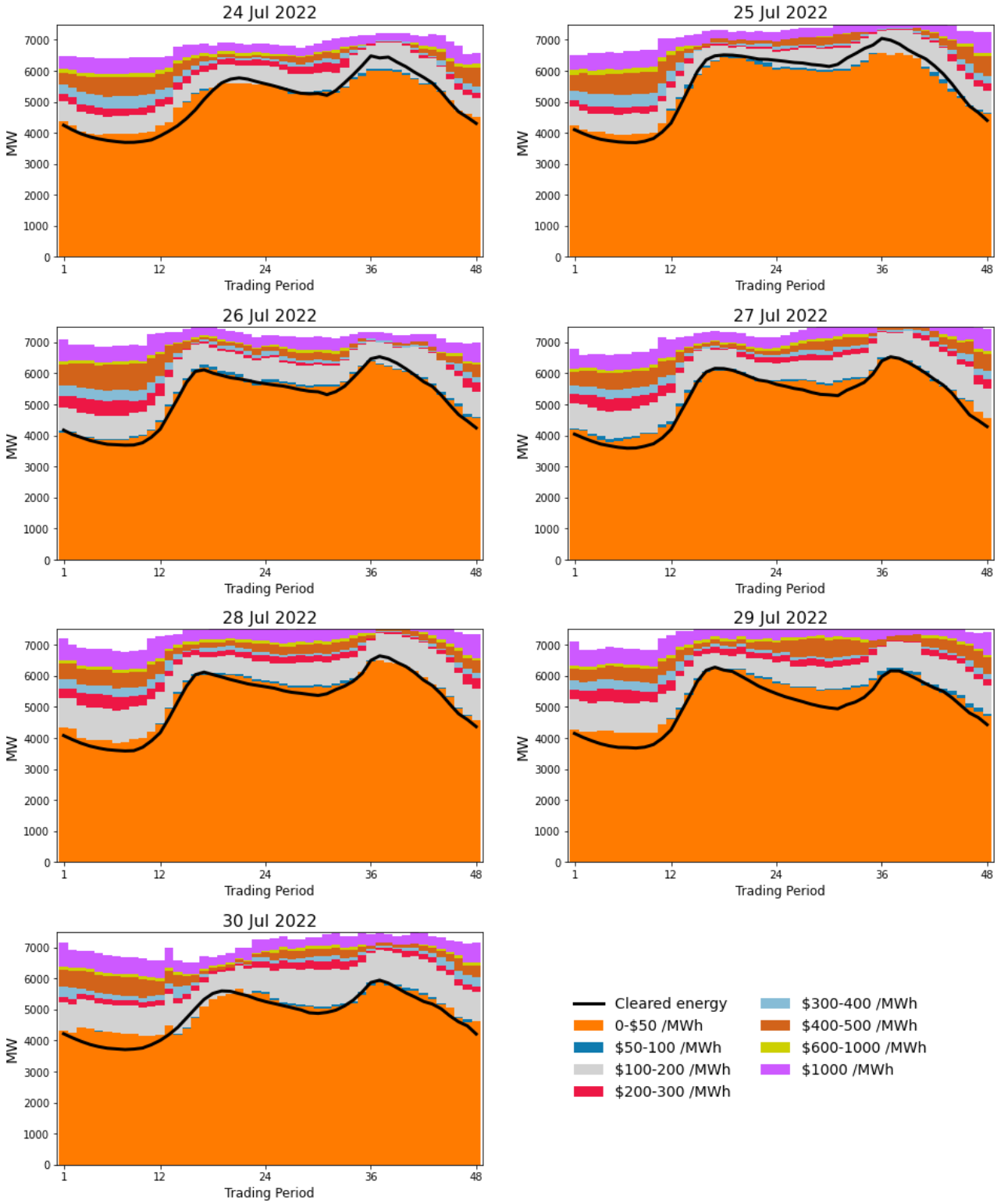
10.2. Cleared energy remained primarily within or below the $200/MWh range this week with high wind generation and high hydro inflows increasing the amount of low priced renewable generation offers.

10.3. 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.

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

[5] 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 12: Daily offer stack



11. Ongoing Work in Trading Conduct

11.1. This week prices appeared to be consistent with supply and demand conditions. High spot prices were likely a result of high demand, decreasing wind generation and increasing thermal generation.

11.2. 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
19/02/22-24/02/22	Several	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.
29/06/2022	26-48	Further analysis	The Authority is making enquires with Genesis regarding offers at both Huntly 1 and Huntly 4 - the addition of only high priced offers at Huntly 1 lead to $700/MWh+ pricing on trading period 36.
19/07/2022, 21/07/2022	36	Completed	An enquiry was made to Transpower about constrained generation during certain periods on 19 and 21 July. Transpower responded that generation was constrained on by SPD to provide reserves.