24 August 2022

Trading Conduct Report

Market Monitoring Weekly Report

1. Overview for the week of 14 to 20 August

1.1. Overall wholesale spot prices appear to align with market conditions this week. There were no prices higher than the 90th percentile of historical prices this week.

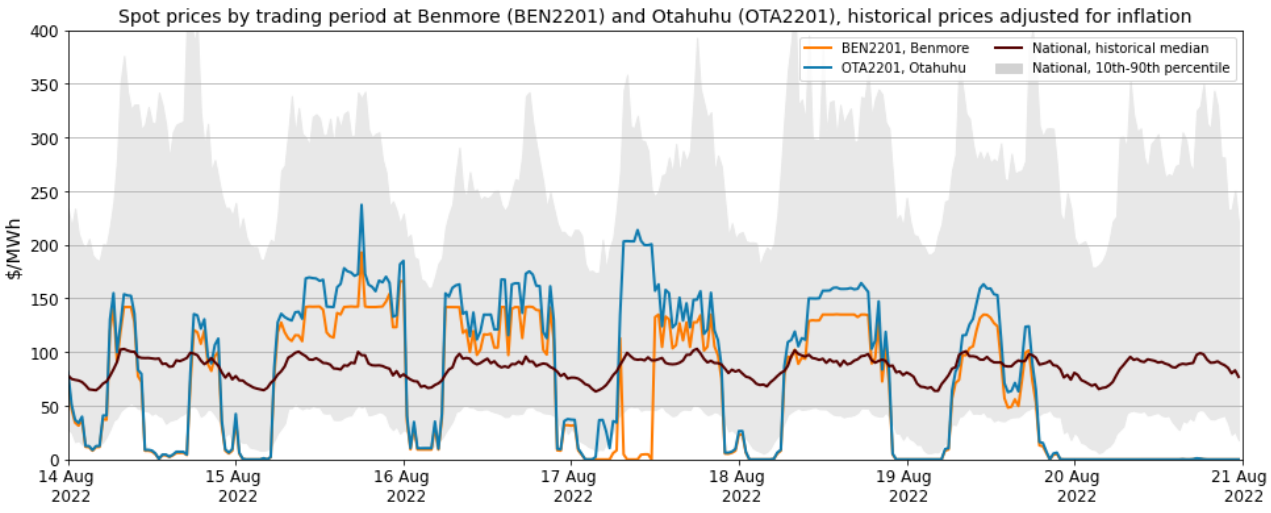
2. Spot Prices

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. This week there were no trading periods where the price was above the 90th percentile of historical prices.

2.2. Figure 1 shows spot prices between 14 and 20 August at Benmore and Otahuhu alongside their historic median and historic 10th-90th percentiles adjusted for inflation. Prices were fairly consistent with daily trends, falling between around $100-200/MWh between peak hours and around $0-50/MWh between off-peak hours.

2.3. There was price separation between the islands on 17 August, due to an outage at the HVDC link.

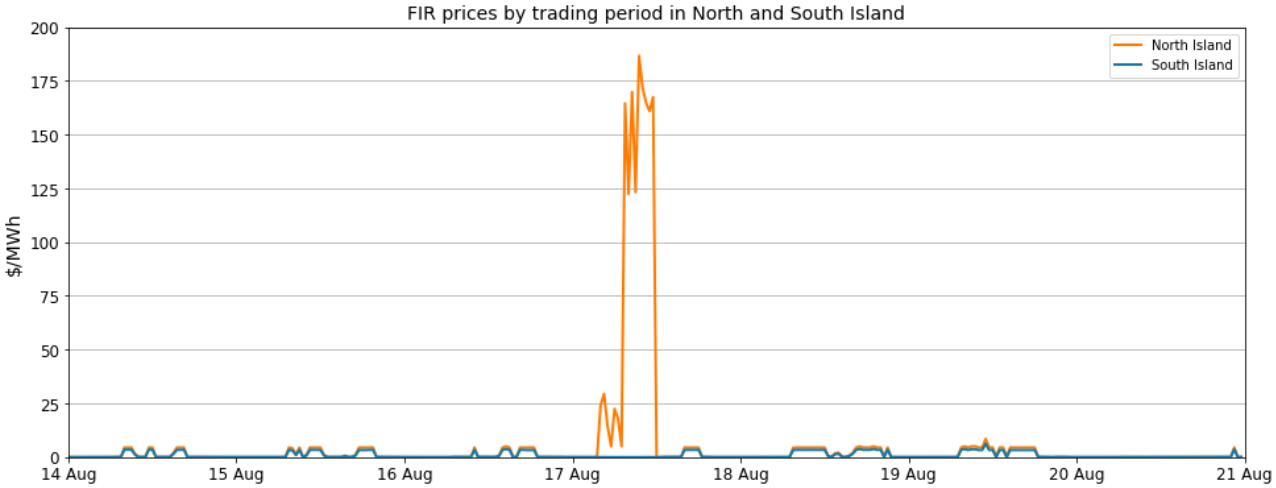
Figure 1: Wholesale Spot Prices



3. Reserve Prices

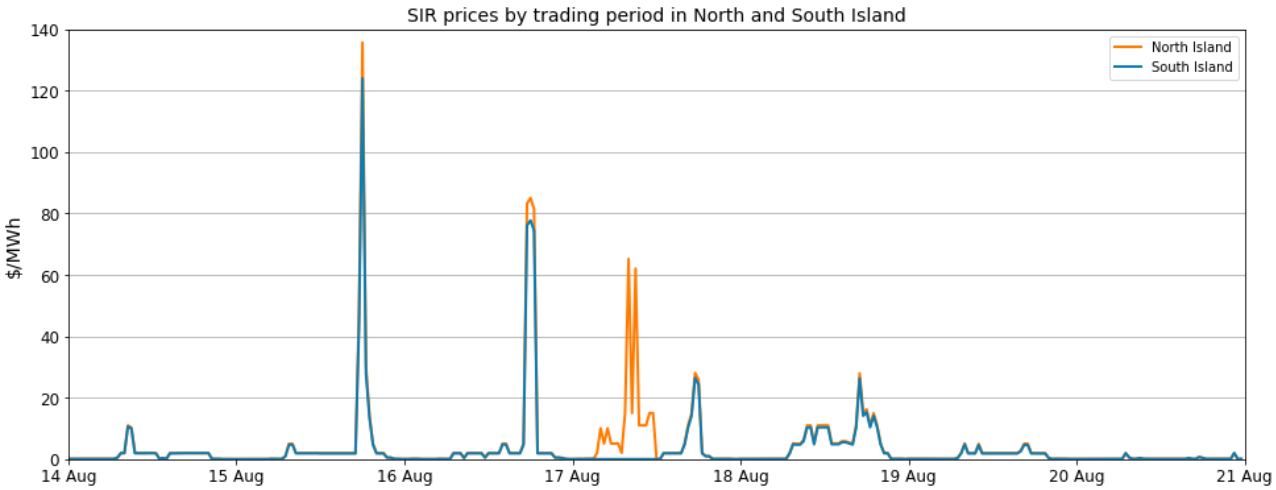
3.1. Fast instantaneous reserves (FIR) prices for the North and South Island are shown below in Figure 2. The majority of FIR prices fell within historical bounds this week with most prices remaining below $5/MWh with the exception of some price spikes in the North Island on 17 August which reached around $175/MWh. The spikes were due to the disconnection of electricity flow between the islands with more reserves needed in the North Island to support its larger demand.

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 fell mainly within historical bounds this week with the majority of prices falling below $20/MWh with the exception of some price spikes which reached up to $140/MWh. Excluding the spikes in the North Island on 17 August (which were due to the separation between islands) these price spikes were likely due to co-optimisation with 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

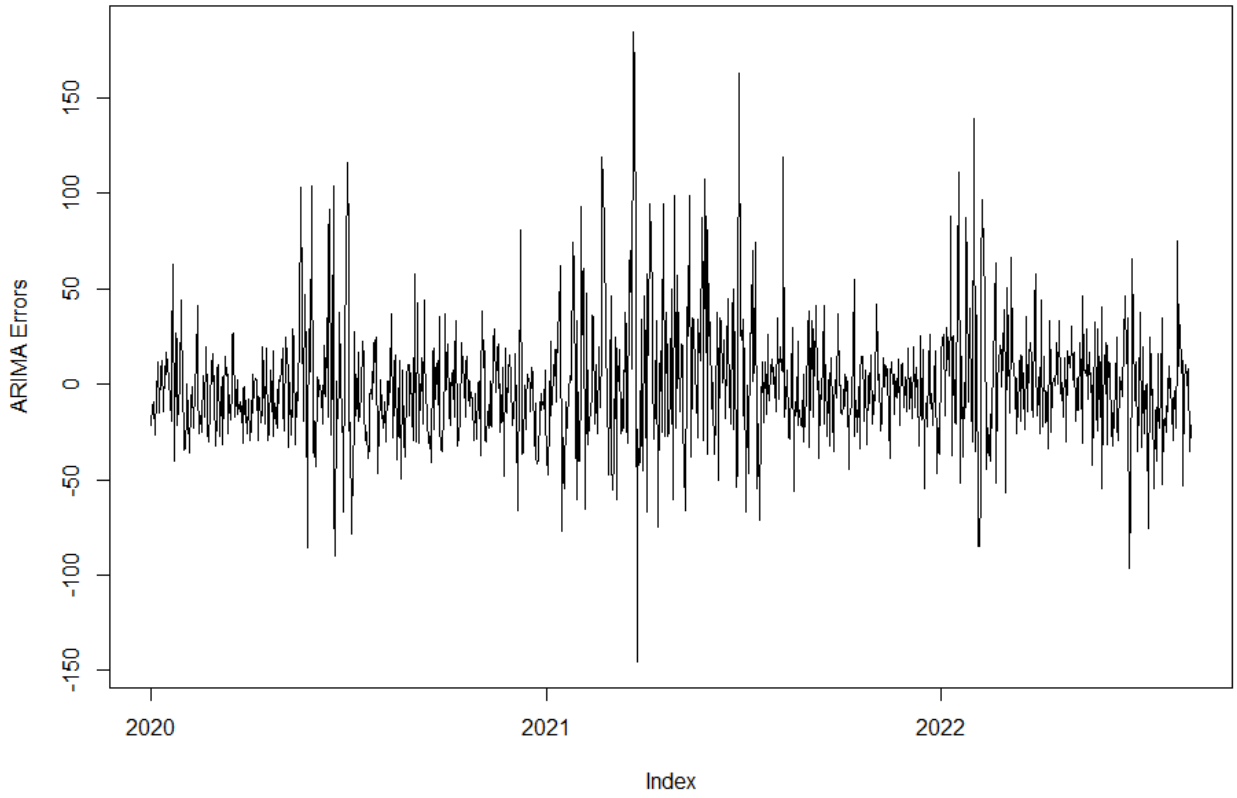


4. Regression Residuals

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. The largest residuals occurred for the days when there were lower daily average prices (Sunday 14 August, Friday 19 August)

Figure 4: Residual plot of estimated daily average spot price



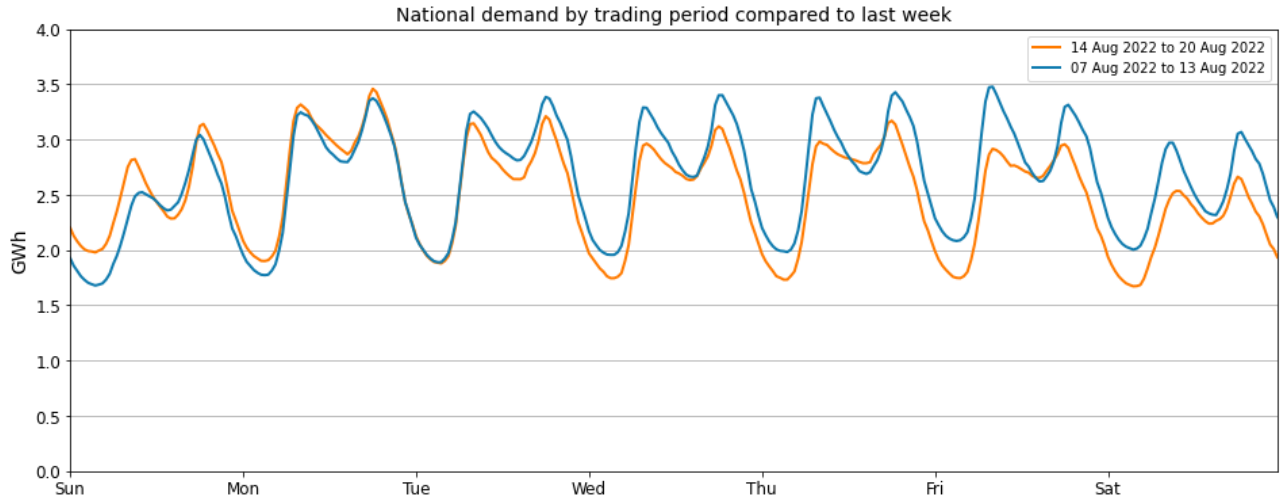
5. Demand

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

5.2. Daily grid demand gradually dropped over the week, decreasing as temperatures - as seen in Figure 6 - increased. Compared to the previous week (7 to 13 August) demand for most of this week (14 to 20 August) is noticeably lower, likely due to the warmer weather. Sunday and Monday were the only exception to this, while colder temperatures remained.

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

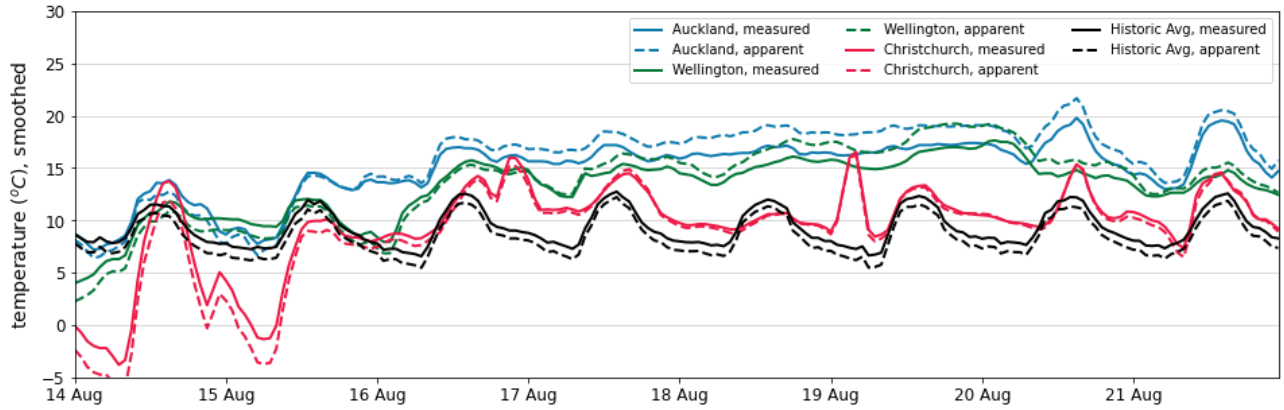
Figure 5: National demand by trading period compared to the previous week



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

5.4. Compared to the previous week apparent temperatures this week (after Monday) have risen, falling between 10 and 20 degrees Celsius for the majority of the week. Almost all main centres were above the historical mean temperature from 16 August onwards with the higher temperatures likely contributing to lower demand this week.

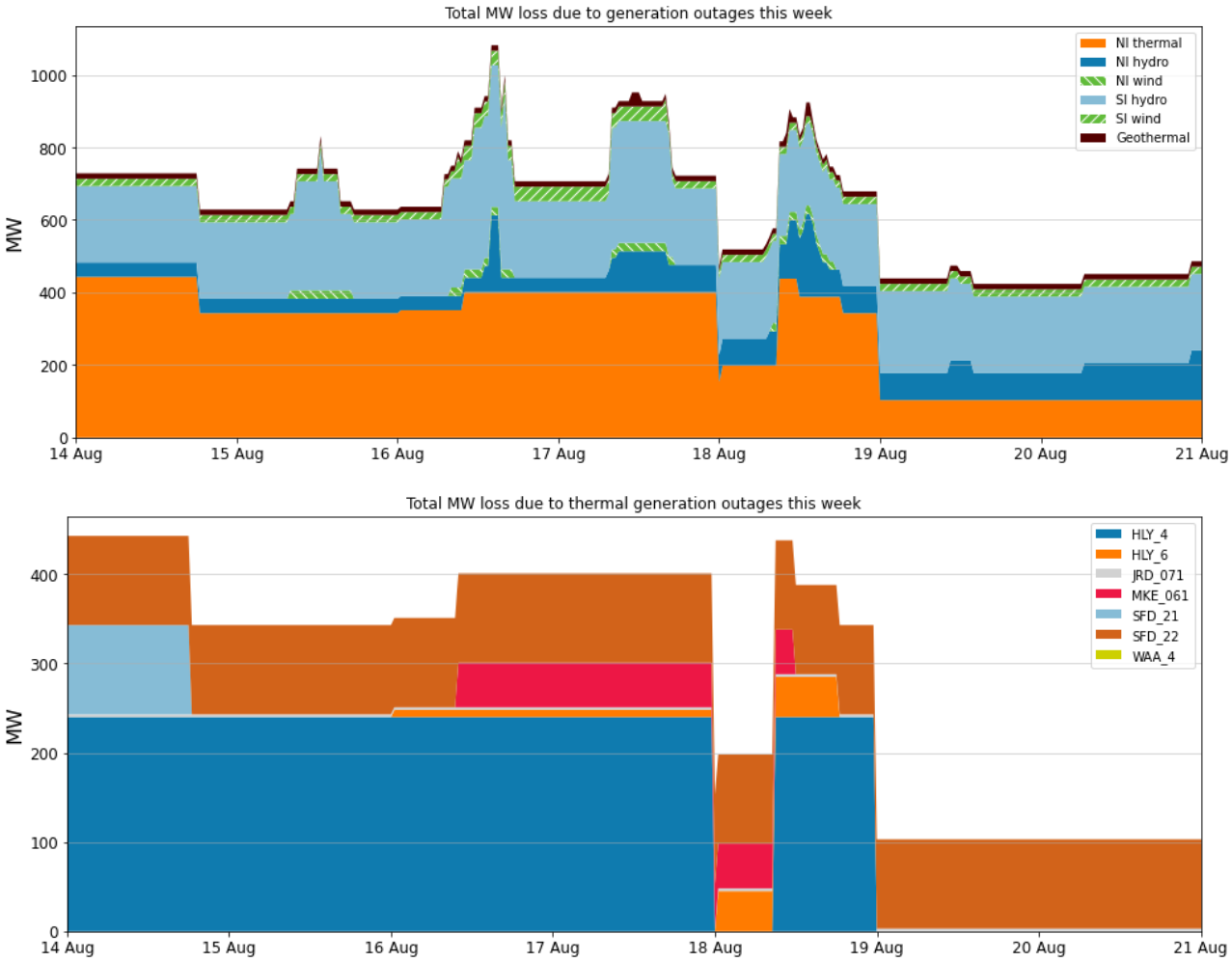
Figure 6: Temperatures across main centres



6. Outages

6.1. Figure 7 shows generation capacity lost due to outages between 7 and 13 August as well as generation capacity lost due to thermal and thermal peaker outages. Total capacity lost due to outages was around ~700 MW at the beginning of the week, falling from 19 August to around ~400 MW by the end of the week due to Huntly Unit 4 returning from outage.

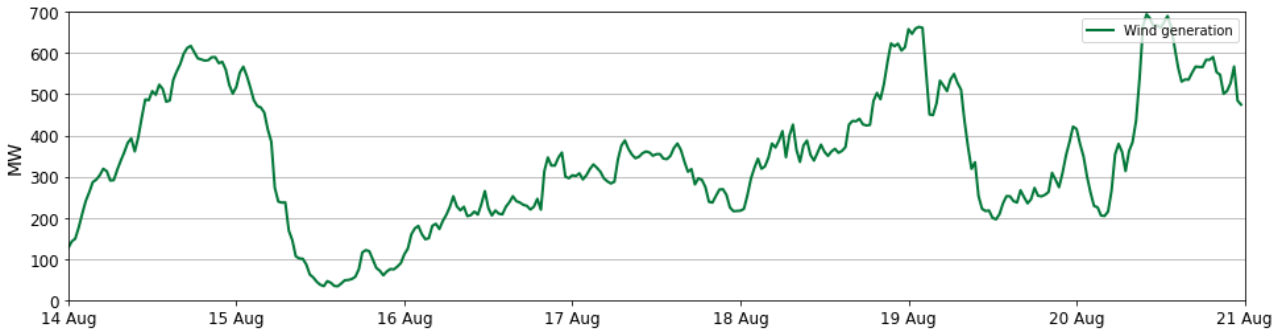
Figure 7: Total MW loss due to generation outages



7. Generation

7.1. Wind generation from the past week as seen below in Figure 8 was high on 14 August at around ~600 MW, dropping to ~50 MW on 15 August before gradually increasing over the remainder of the week. From early on 16 August wind generation did not drop below 200MW for the rest of the week. Periods of low wind generation coincided with high spot prices while periods of high wind generation coincided with low spot prices.

Figure 8: Wind Generation



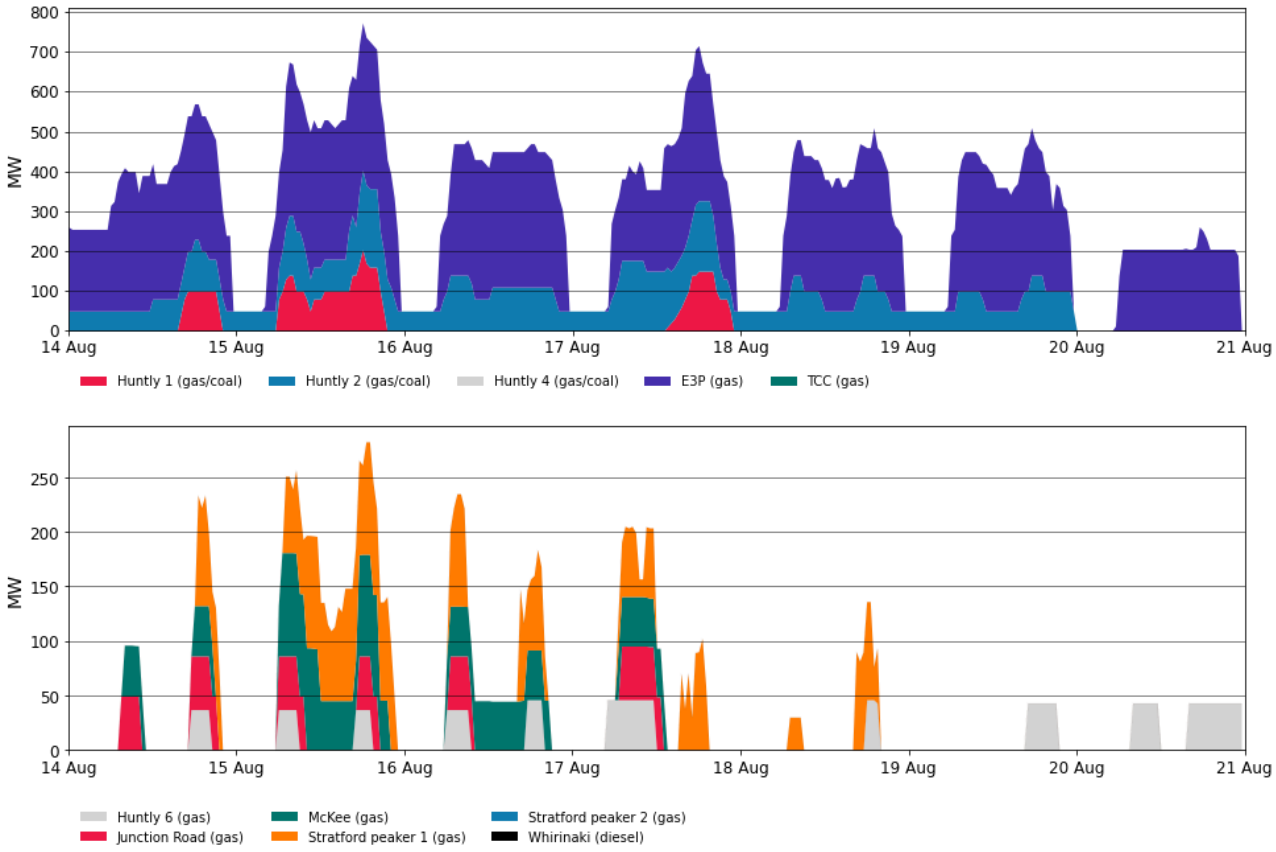
7.2. Figure 9 shows generation at thermal and thermal peaker plants from the past week. Thermal generation gradually decreased over the week from peaking at around ~750 MW on 15 August when wind generation was at its lowest to peaking at around ~200 MW on 20

August when wind generation was it its highest. Thermal peakers followed the same pattern. Periods of high thermal generation coincided with high spot prices while periods of low thermal generation coincided with low spot prices.

7.3. Two Huntly Rankine units plus McKee and the one available Stratford peaker ran for most of the day on 15 August. Transpower had indicated that the supply/demand balance could potentially be tight on this day during an industry conference the previous week.

7.4. Thermal generation remains lowest during off peak hours over night.

Figure 9: Thermal Generation



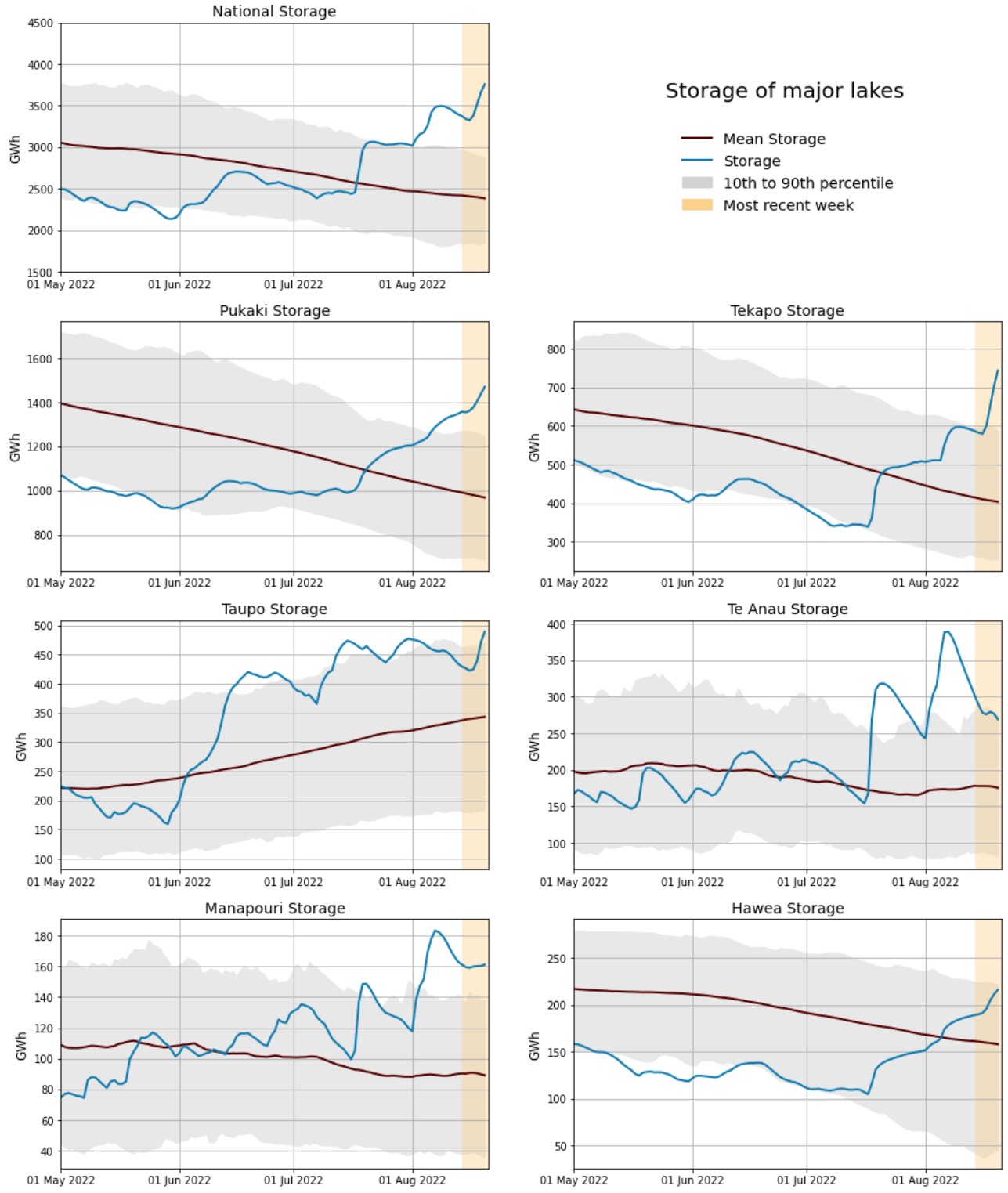
8. Storage/Fuel Supply

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

8.2. National controlled hydro storage has reached its highest point since late Febuary 2022. Due to a month of heavy rain all major lakes are above their historical mean and are either above or near their 90th historical storage percentiles. Lake Manapouri remains above its maximum operating range.

8.3. High hydro storage continues to lower the opportunity cost of hydro generation increasing the amount of low priced hydro generation offers.

Figure 10: Hydro 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.

9.3. Figure 11 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.

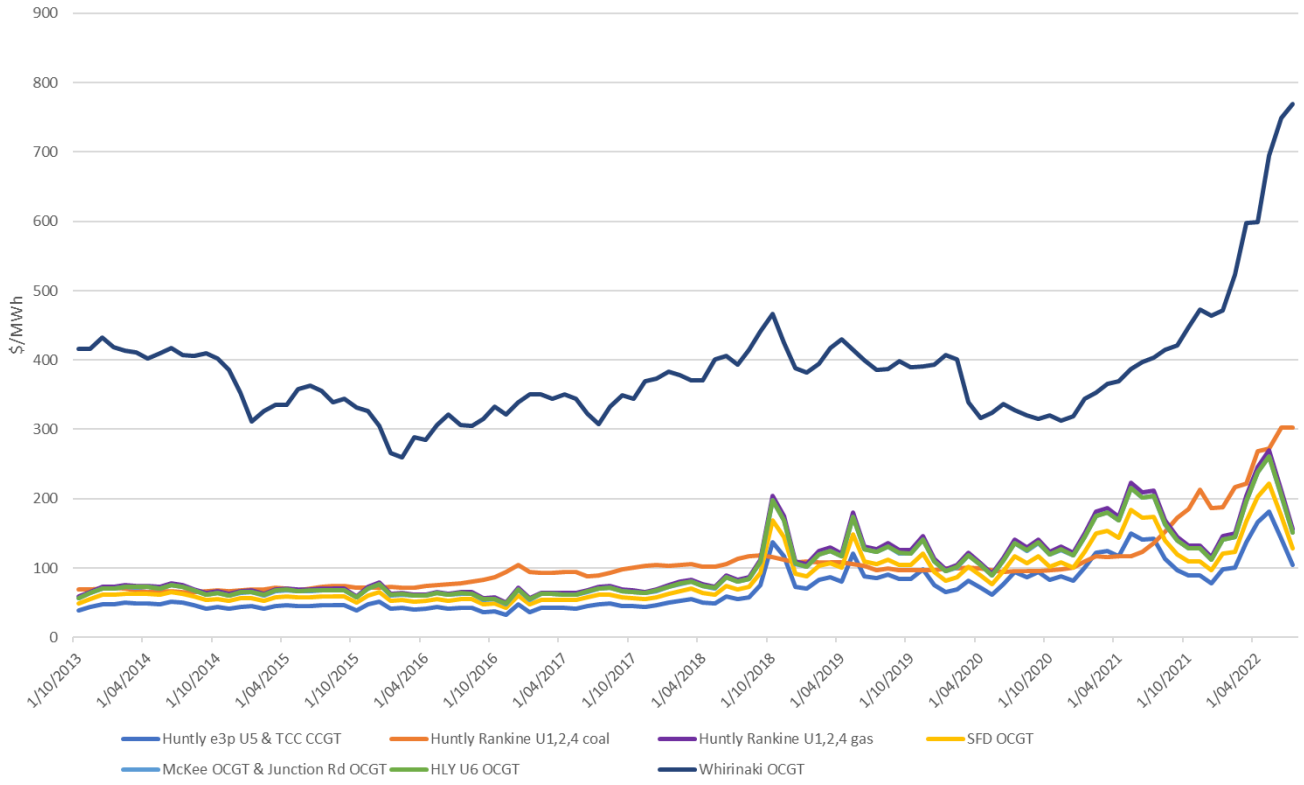
9.4. The SRMC of coal and diesel have remained largely unchanged due to global supply and demand conditions. As well as supply disruptions caused by Covid, the Russian-Ukraine conflict has increased the premium on all international coal due to sanctions placed on Russia.

9.5. The most recent price for Indonesian coal was around ~495/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.

9.6. SRMCs of gas run thermal plants have decreased to between $100/MWh and $200/MWh with the recent downturn at Methanex freeing up gas supply and successful well tie-ins at Pohokura gas field also increasing supply.

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

Figure 11: Estimated monthly SRMC for thermal fuels



10. JADE Water values

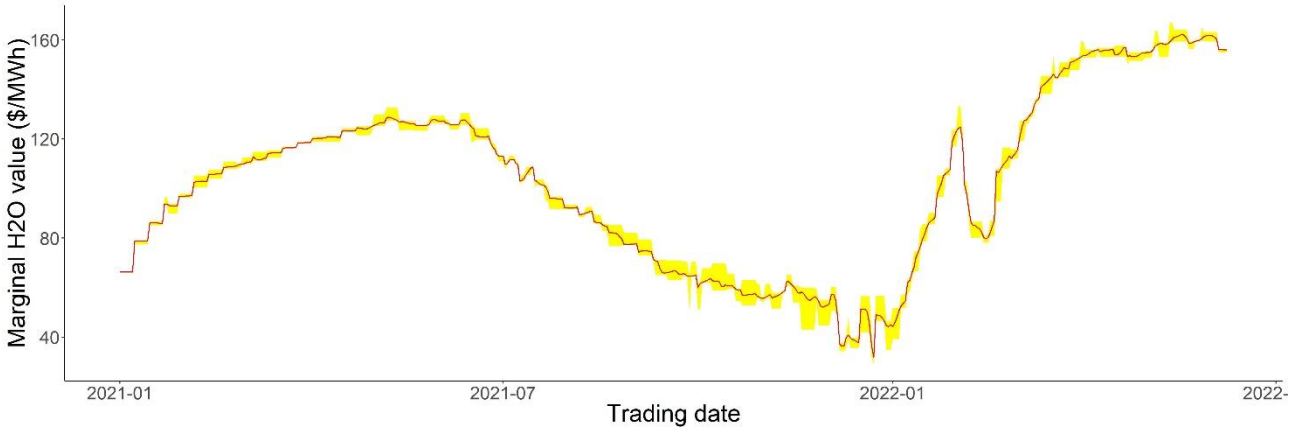
10.1. The JADE[3] model gives a consistent measure of the opportunity cost of water, by seeking to minimise the expected fuel cost of thermal generation and the value of lost load and provides an estimate of water values at a range of storage levels. Figure 12 shows the national water values to 8 June 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.

10.2. In general, marginal water values have increased when total national hydro storage has decreased and decreased when total national hydro storage has increased.

Figure 12: Water Values



11. Offer Behaviour

11.1. Figure 13 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.

11.2. Cleared energy on weekdays remained primarily within the $100-200/MWh price range this week, with moderate wind and higher priced thermal generation driving spot prices up at times, though decreased demand and high hydro storage (with associated low priced offers) prevented prices from rising too far. There were also very low prices overnight. With the SRMC of thermals between $100-200/MWh these prices during the day are consistent with what we would expect prices to be at current market conditions.

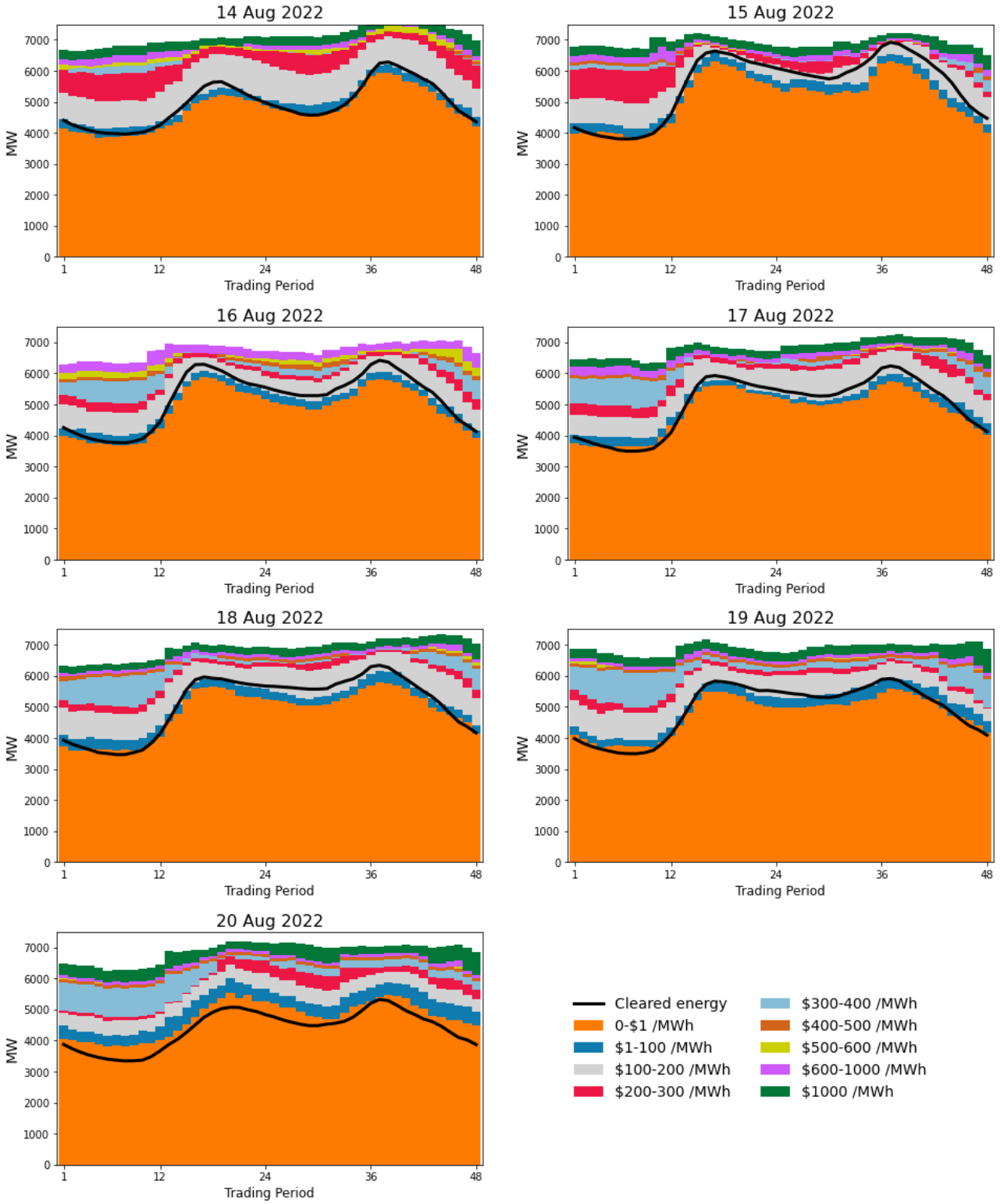
11.3. The upper end of the offer curve remains steep meaning above average peak demand can easily result in spikes in spot prices.

11.4. The pre-dispatch offers in the short term leading 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 13: Daily offer stack



12. Ongoing Work in Trading Conduct

12.1. This week prices appeared to be consistent with supply and demand conditions.

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
19/02/22-24/02/22	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.