

Trading Conduct Report

Market Monitoring Weekly Report

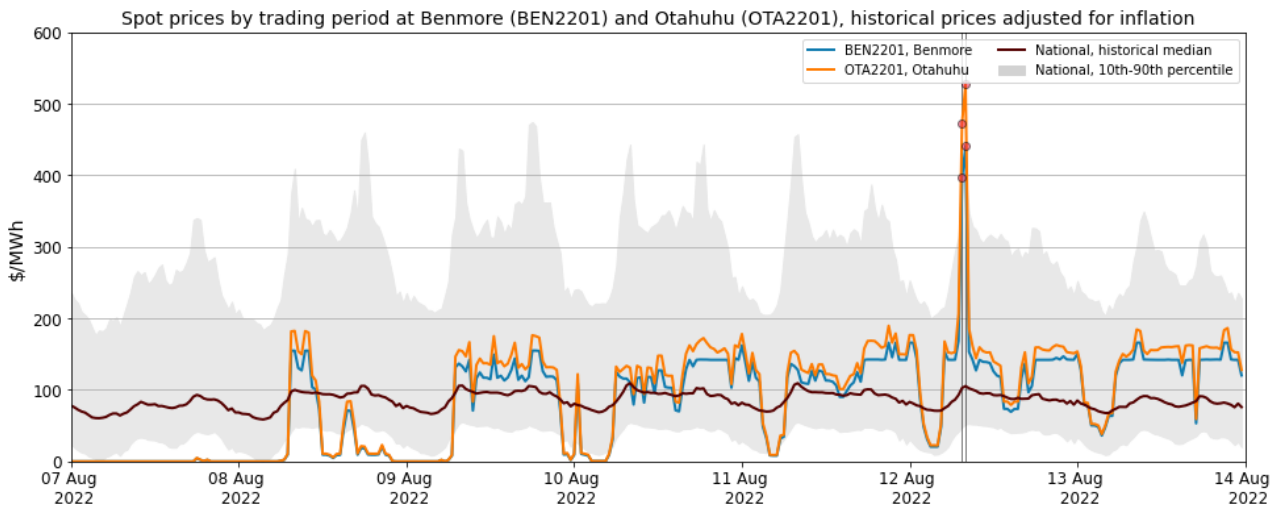
1. Overview for the week of 7 to 13 August

- 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 7 and 13 August at Benmore and Otahuhu alongside their historic median and historic 10th-90th percentiles adjusted for inflation. Between 7 and 13 August wholesale spot prices across all nodes averaged \$82.27/MWh with 95 per cent of prices falling between \$0.01/MWh and \$177.23/MWh.
- 2.3. High demand and low wind generation resulted in a spike in prices on the morning of Friday 12 August on trading periods 16 and 17 (7.30am-8.30am) as seen in Figure 1. The need for increased generation was anticipated by the System Operator who issued a Low Residual Situation CAN notice earlier in the week on Tuesday 9 August which advised of a potential shortfall in generation between 7.30am and 9.00am on Friday 12 August. The notice was based on weather forecasts which predicted calm weather which was likely to reduce wind generation availability and cold weather in the upper North Island (where the bulk of national demand is) which was likely to result in above average demand for Friday morning. Given the notice slow start thermal had the chance to assess whether it should offer into the market. On the morning of 12 August an improvement in weather resulted in higher than expected wind generation however that was offset by an unexpected outage at Stratford Peaker 1. The average resulting price across all nodes on Friday 12 trading period 17 (8.00am) was \$496.69/MWh.

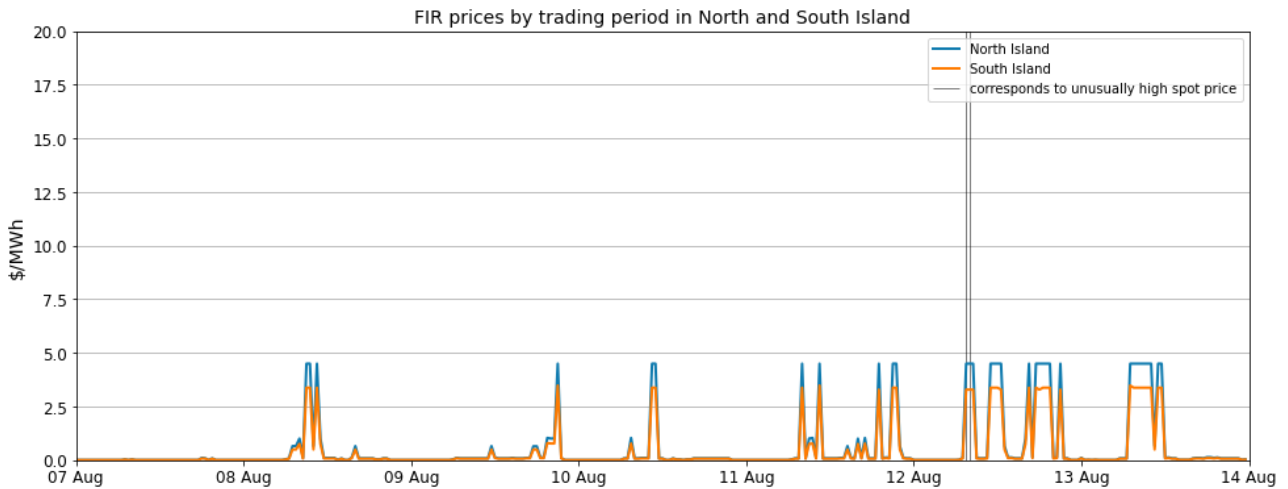
Figure 1: Wholesale Spot Prices



3. Reserve Prices

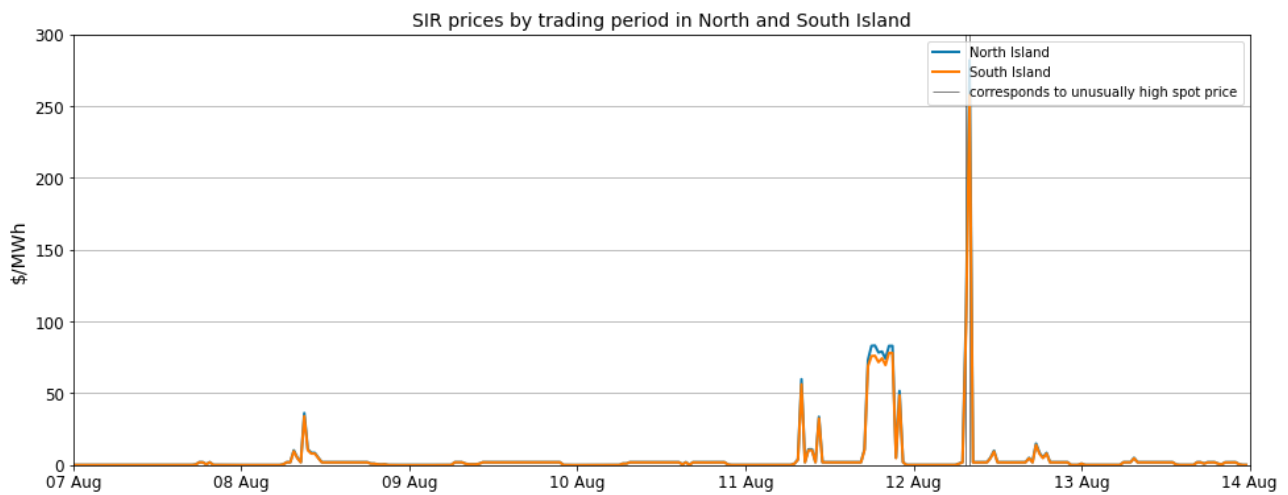
3.1. Fast instantaneous reserves (FIR) prices for the North and South Island are shown below in Figure 2. FIR prices fell within historical bounds this week with all prices below \$5/MWh.

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 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 \$257.67/MWh in the South Island and \$281.88/MWh in the North Island. 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

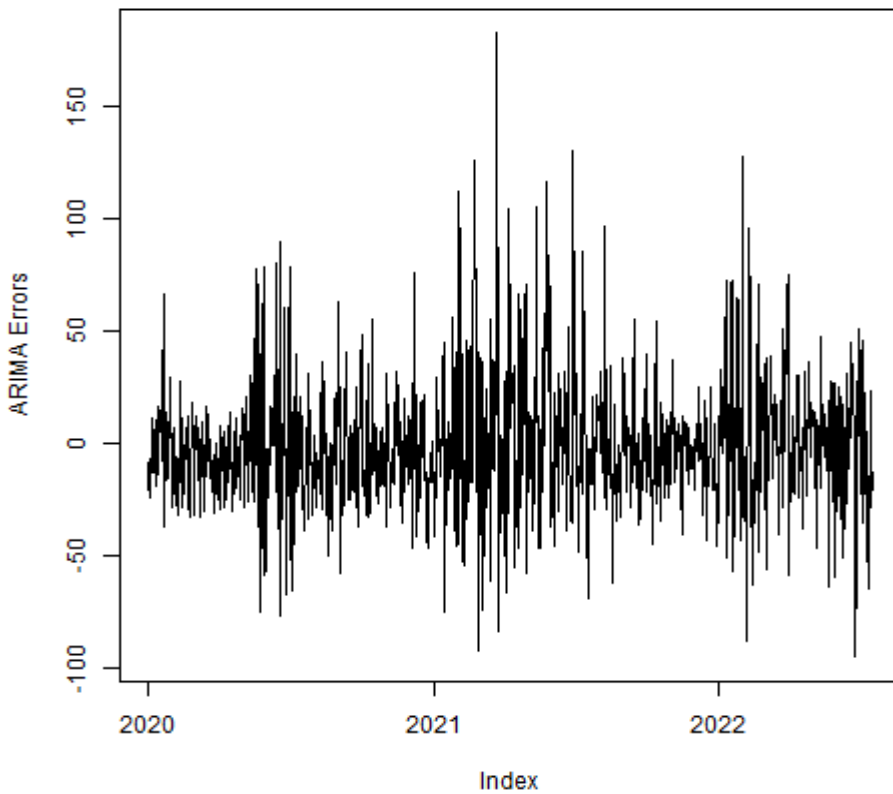


4. Regression Residuals

- 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 A¹ 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>

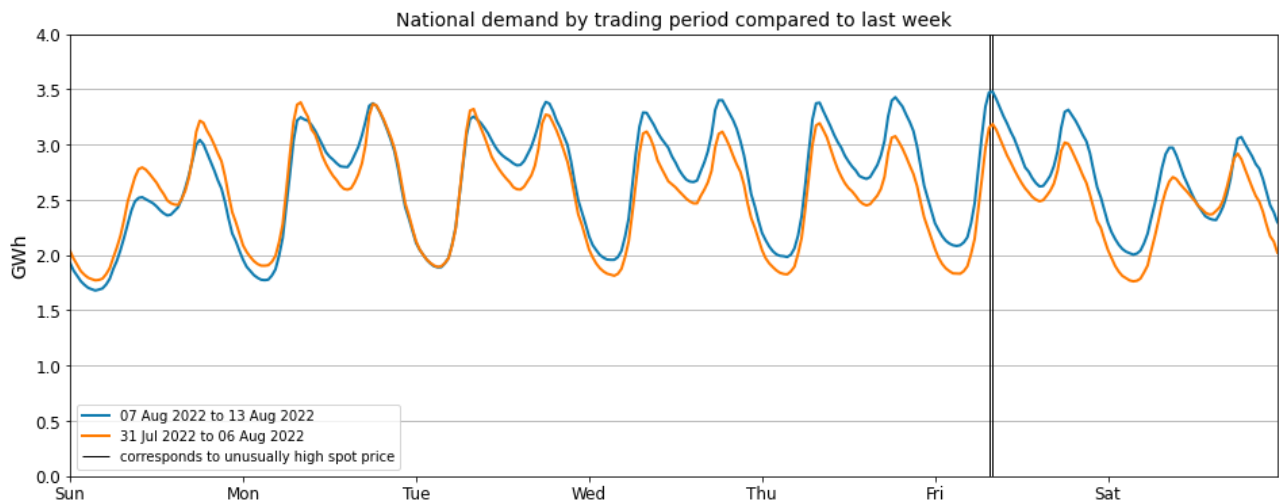
Figure 4: Residual plot of estimated daily average spot price



5. Demand

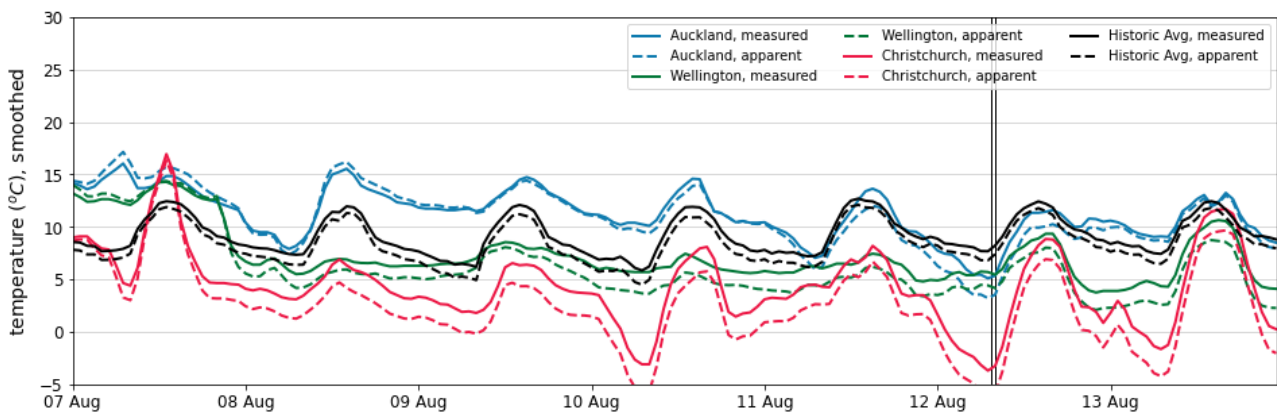
- 5.1. Figure 5 shows this week's national grid demand against national grid demand from the previous week.
- 5.2. Daily demand this week (7 to 13 August) was on average higher than daily demand last week (31 July to 6 August), likely due to declining temperatures as seen in Figure 6. As forecasted, the morning of Friday 12 August recorded the highest peak in demand for the week reaching 6,746 MW, the highest peak morning demand recorded so far this past month.

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 have fallen, with the average apparent temperature well below historic average. The cooler temperatures likely caused higher demand and higher average spot prices this week.
- 5.5. As seen below the lowest recorded temperatures for the week at Auckland and Christchurch coincided with above average peak morning demand on Friday 12 August. The fall in temperatures was likely a major contributing factor to the increase in demand on 12 August.

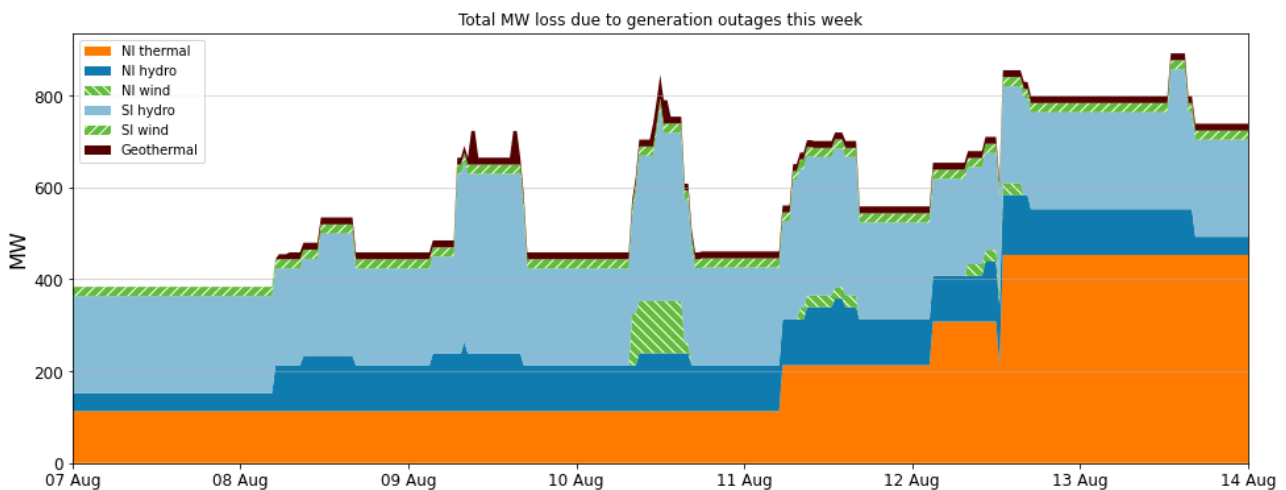
Figure 6: Temperatures across main centres



6. Outages

- 6.1. Figure 7 shows generation capacity lost due to outages between 7 and 13 August. Total capacity lost due to outages was around 400 MW at the beginning of the week, rising from 11 August to around 800 MW from an increase in thermal outages. The loss in capacity included 100 MW from Stratford Peaker 1 and 240 MW from Huntly 4 among others. The reduction in generation capacity would have added to the stress on the system, pushing spot prices further up from 11 August to 13 August.

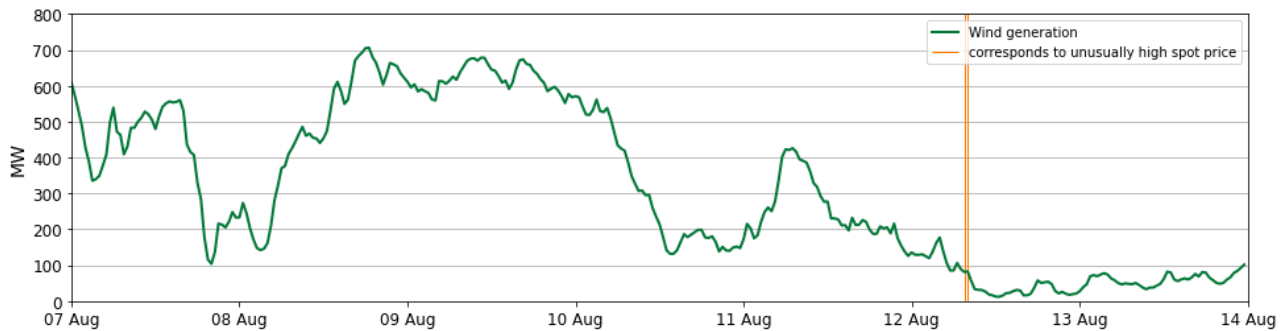
Figure 7: Total MW loss due to generation outages



7. Generation

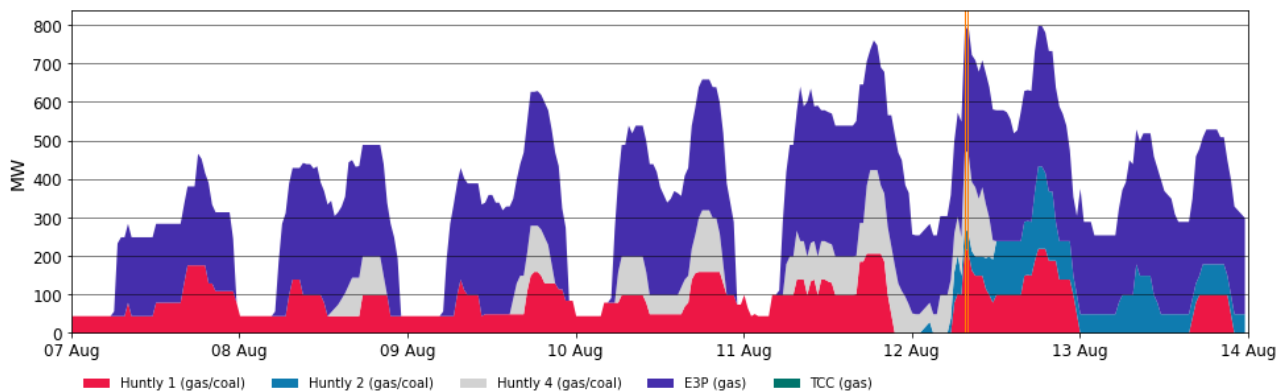
- 7.1. Wind generation from the past week as seen below in Figure 8 was reasonably high up to the middle of the week, dropping off from 10 August as predicted, resulting in only 100 MW of wind generation during peak morning demand on 12 August. The loss of wind generation would have played a large role in contributing to the spike in spot prices.
- 7.2. Spot prices continued to fall quite low during periods of low wind generation and low demand.

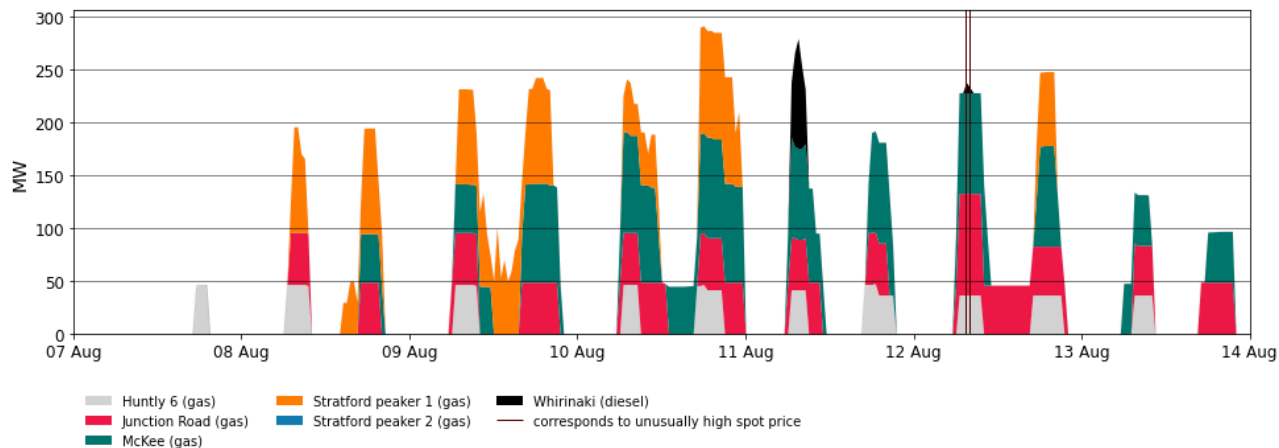
Figure 8: Wind Generation



- 7.3. Figure 9 shows generation at thermal and thermal peaker plants from the past week. Thermal generation was the inverse of wind generation, increasing when wind generation decreased.
- 7.4. Peak thermal generation gradually increased during the week to peak at around 800 MW on 12 August with thermal peakers being dispatched up to around a total of 250 MW. The unexpected loss of Stratford Peaker 1 resulted in Whirinaki being dispatched on 11 and 12 August. The increase in thermal generation would have contributed to the spike in spot prices on 12 August. Overall high periods of thermal generation corresponded to increases in spot prices this week.

Figure 9: Thermal Generation

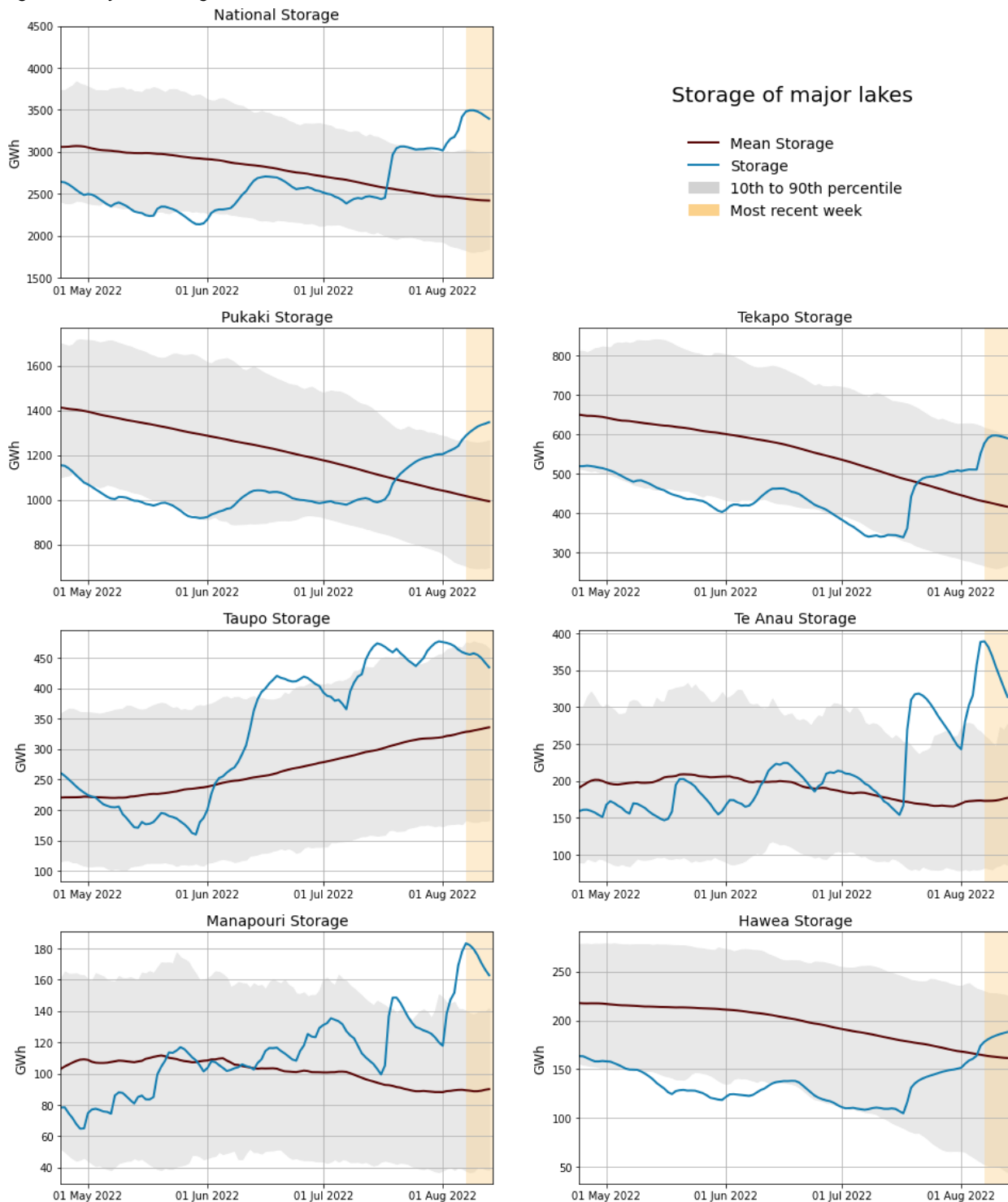




8. Storage/Fuel Supply

- 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. Hydro storage levels continue to remain high at most major lakes with Lakes Pukaki, Taupo, Tekapo, Te Anau and Manapouri close to their historic 90th percentiles. Lakes Te Anau and Manapouri were spilling for a brief period of time.
- 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

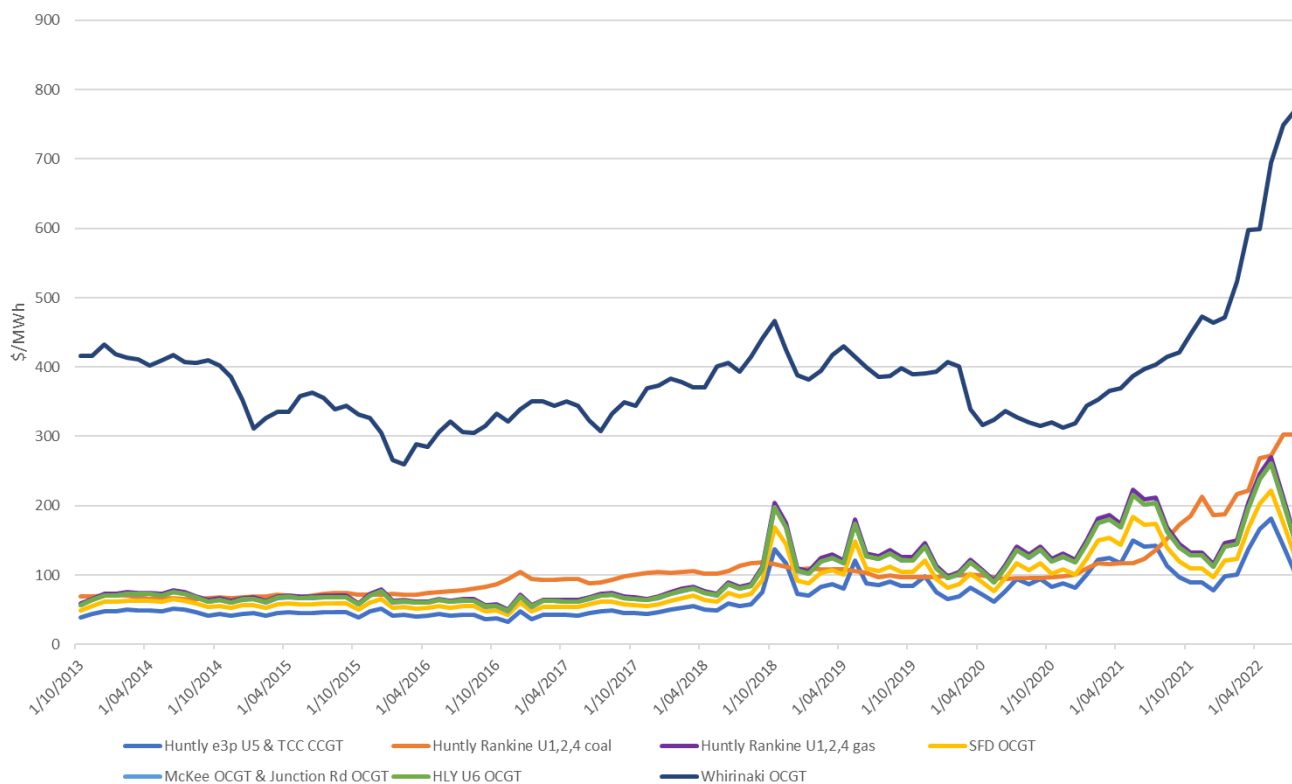


9. Price versus estimated costs

- 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 C² on the trading conduct webpage.

Figure 11: Estimated monthly SRMC for thermal fuels



10. JADE Water values

- 10.1. The JADE³ 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

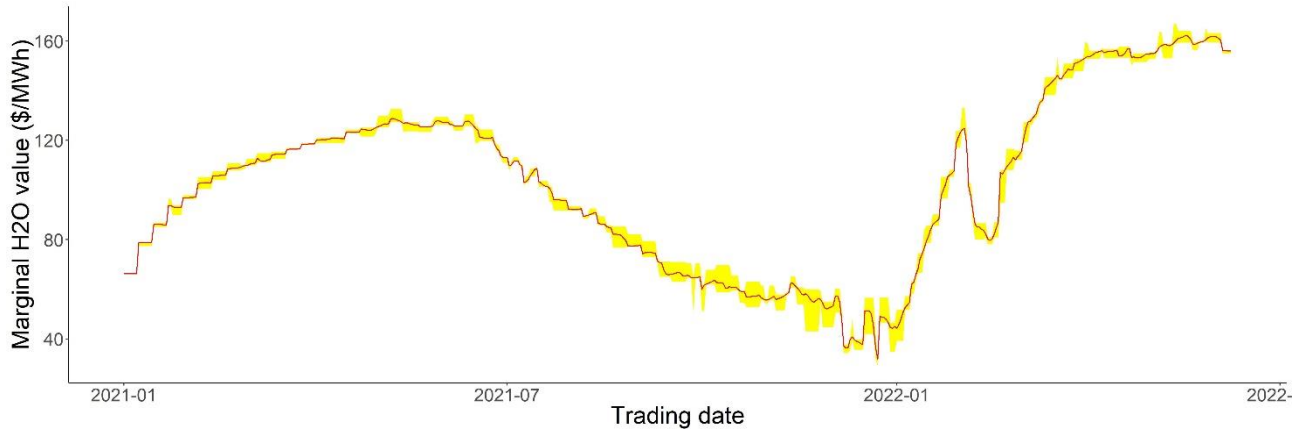
² <https://www.ea.govt.nz/assets/dms-assets/30/Appendix-C-Calculating-thermal-SRMCs.pdf>

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.

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 B⁴ 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



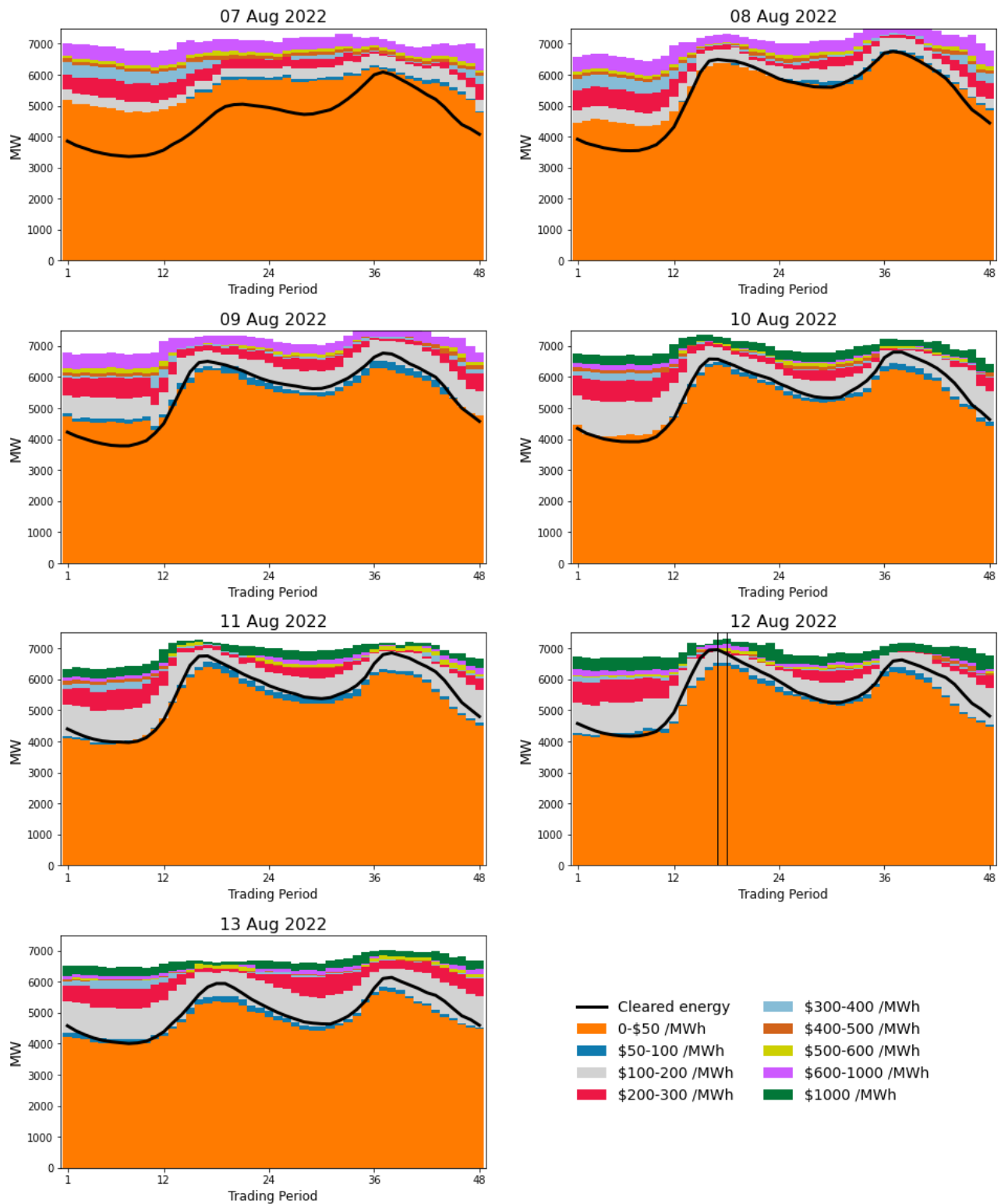
11. Offer Behaviour

- 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 remained primarily within the \$100-200/MWh price range this week, with increased demand and increased thermal generation pushing up prices despite increased hydro levels. With the SRMC of thermals at between \$100-200/MWh this is 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 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 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.