

Trading Conduct Report

Market Monitoring Weekly Report

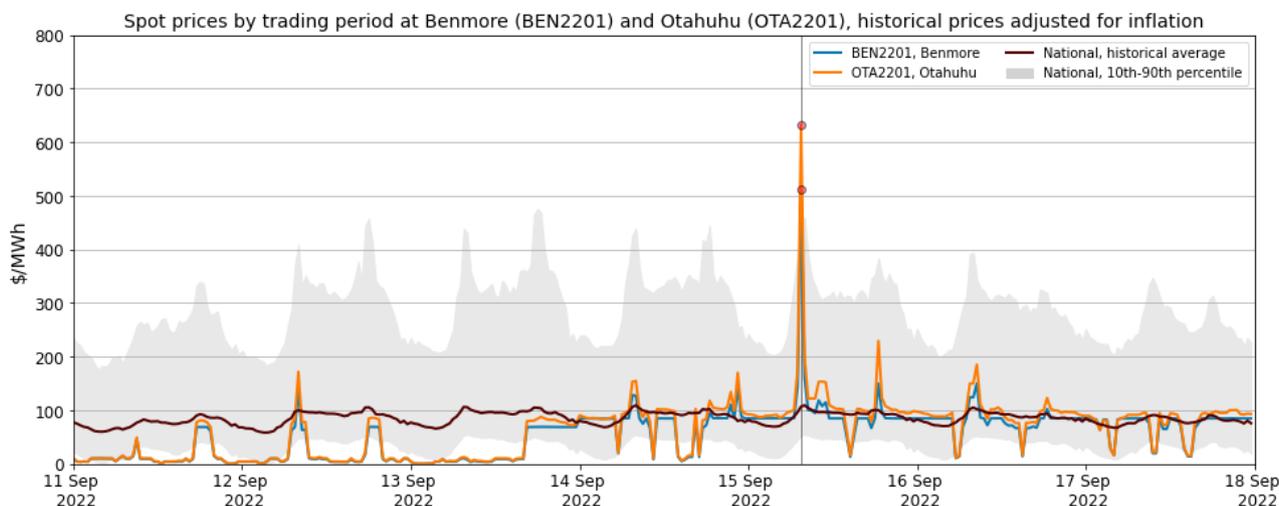
1. Overview for the week of 11 to 17 September

- 1.1. Wholesale spot prices between 11 and 17 September appear to be consistent with market conditions.

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. Between 11 and 17 September wholesale spot prices across all nodes averaged \$59/MWh, with 95 per cent of prices falling between \$0.8/MWh and \$146/MWh.
- 2.3. Figure 1 shows spot prices at Benmore and Otahuhu alongside their historic median and historic 10th- 90th percentiles adjusted for inflation. A price spike reaching ~\$640/MWh occurred on Thursday 15 September at 7:30 am. Other price spikes also occurred, but these were within the historical price bounds.
- 2.4. Outside of the spikes, prices were relatively low between Sunday and Tuesday, hovering around \$20/MWh, while from Wednesday onwards prices averaged closer to \$100/MWh.

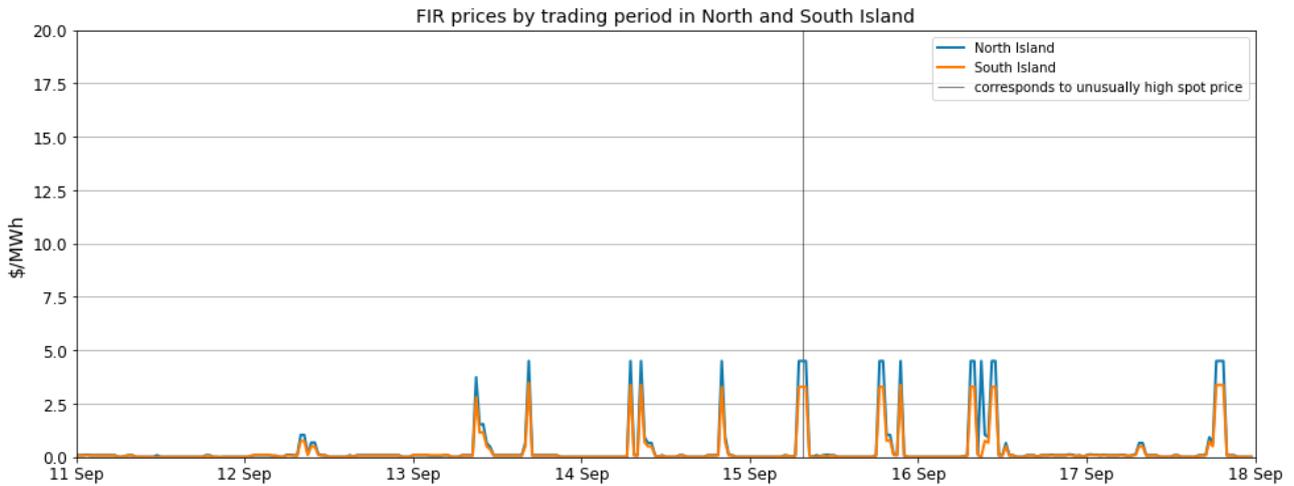
Figure 1: Wholesale Spot Prices



3. Reserve Prices

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

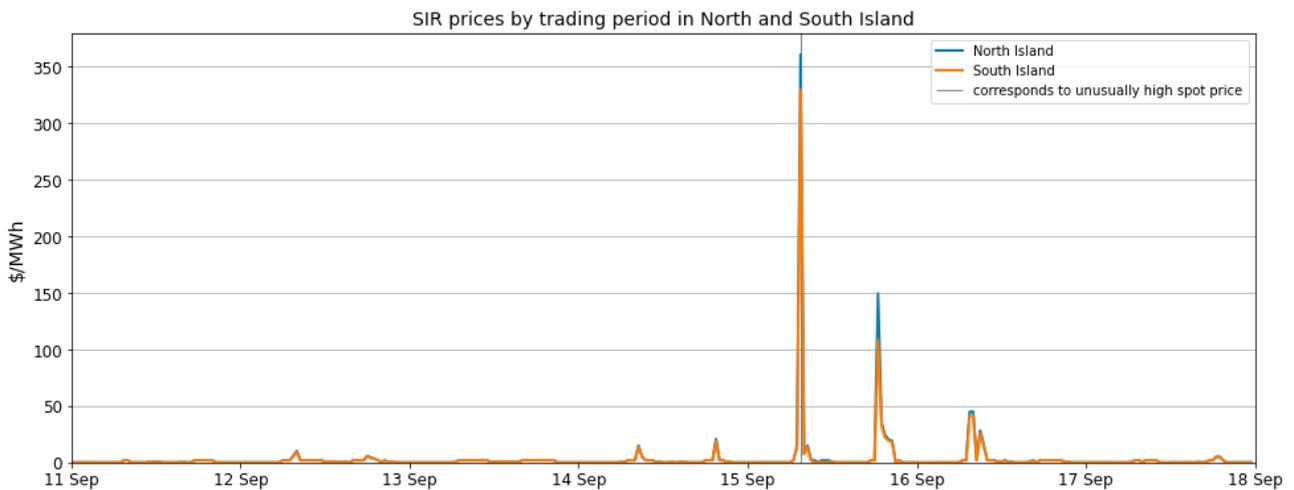
Figure 2: FIR prices by trading period and Island



3.2. Sustained instantaneous reserves (SIR) prices for the North and South Island are shown below in Figure 3. Aside from price spikes reaching \$350/MWh, \$150/MWh and \$50/MWh, respectively, most SIR prices this week remained within historical bounds at below \$20/MWh.

3.3. The spikes in SIR prices corresponded with spikes in wholesale spot prices. The \$350/MWh price spike on 15 September was due to tight supply of energy and reserves. The other high SIR prices may have been due to tight supply as well as co-optimisation by the system operator, with reserves being dispatched instead of higher priced energy offers.

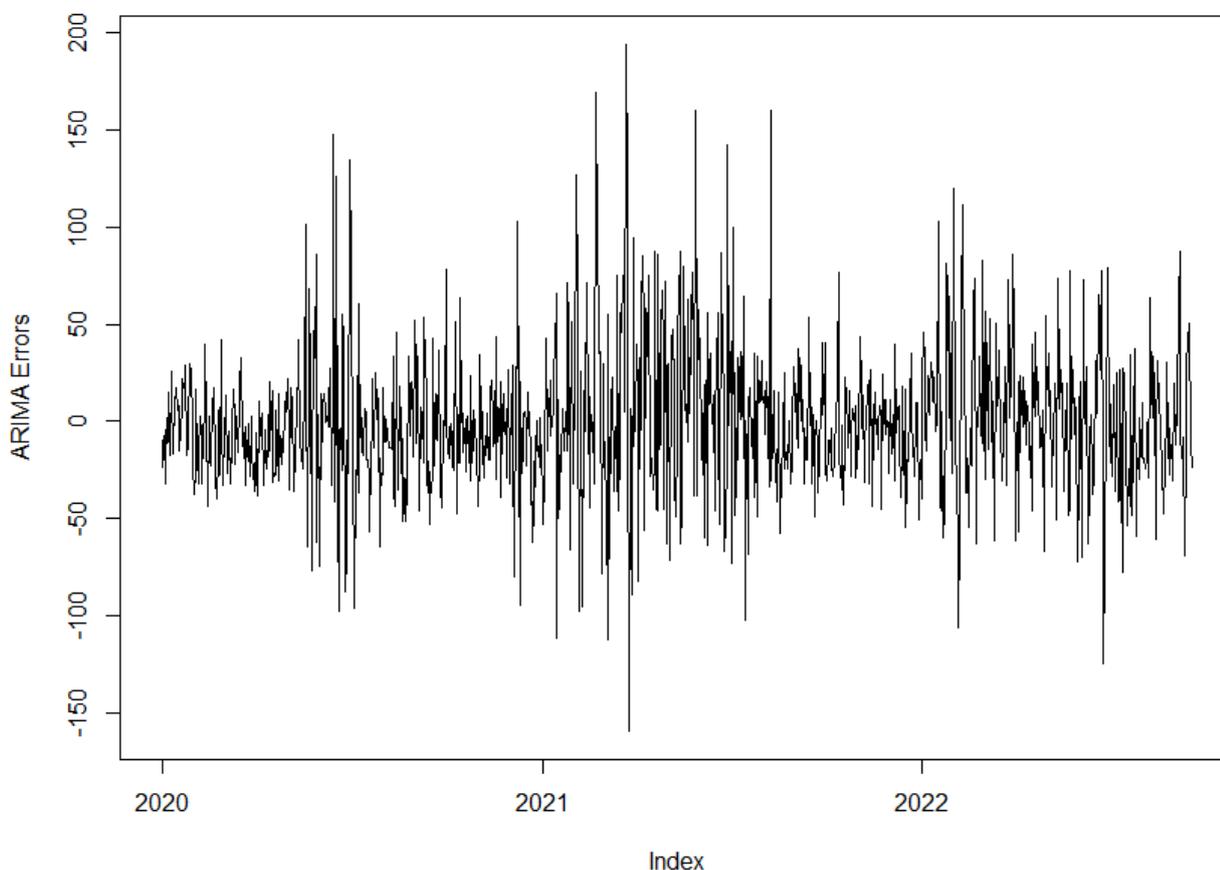
Figure 3: SIR prices by trading period and Island



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. Larger residuals occurred between 13 – 14 September. Residuals outside of those dates remained relatively small suggesting that prices on those dates appear to be largely aligned with market conditions.

Figure 4: Residual plot of estimated daily average spot prices



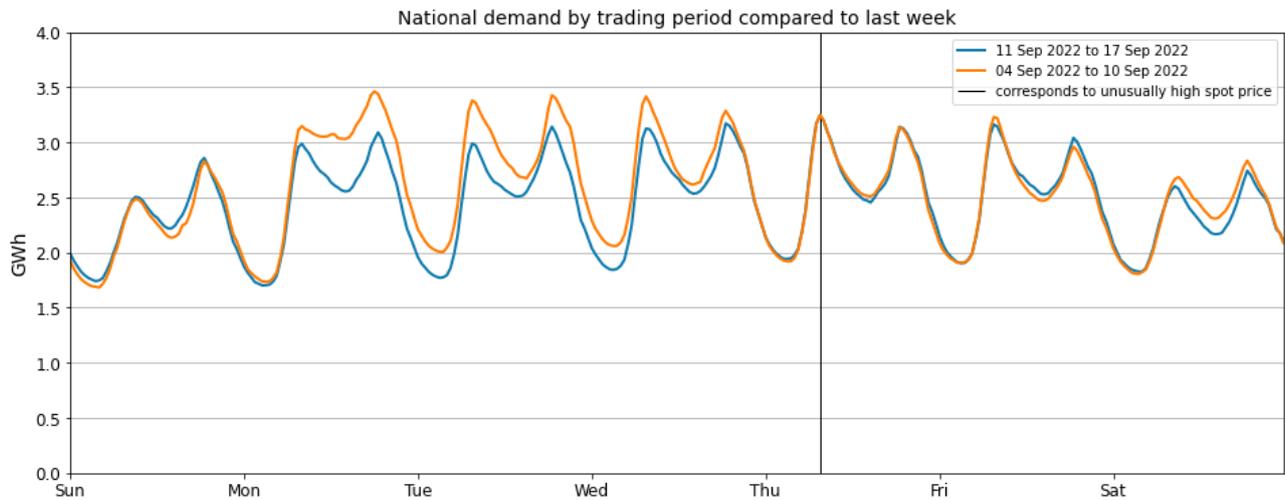
5. Demand

- 5.1. Figure 5 shows this week's national grid demand against national grid demand from the previous week.
- 5.2. Demand from 11 - 17 September was lower, especially between Monday and Wednesday, compared to the previous week. This decrease in demand was likely due to milder temperatures on those days, as seen in Figure 6.

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

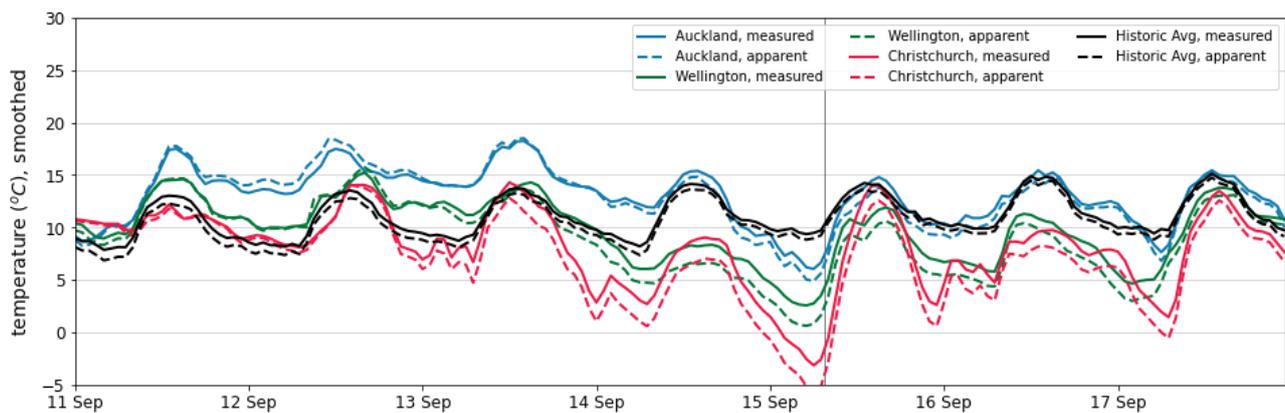
- 5.3. As marked by the vertical line, the Thursday morning price spike had a similar demand profile to the previous week, which also experienced a morning price spike. Hence, high peak demand was a likely contributor towards the Thursday price spike.

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. Auckland and Wellington temperatures were notably lower than average from Wednesday onwards. All main centres experienced a chilly Thursday morning, with all below 10 degrees Celsius, and Christchurch close to -5 degrees Celsius. The decline in temperatures from mid-week onwards was the likely cause of increased demand.
- 5.6.

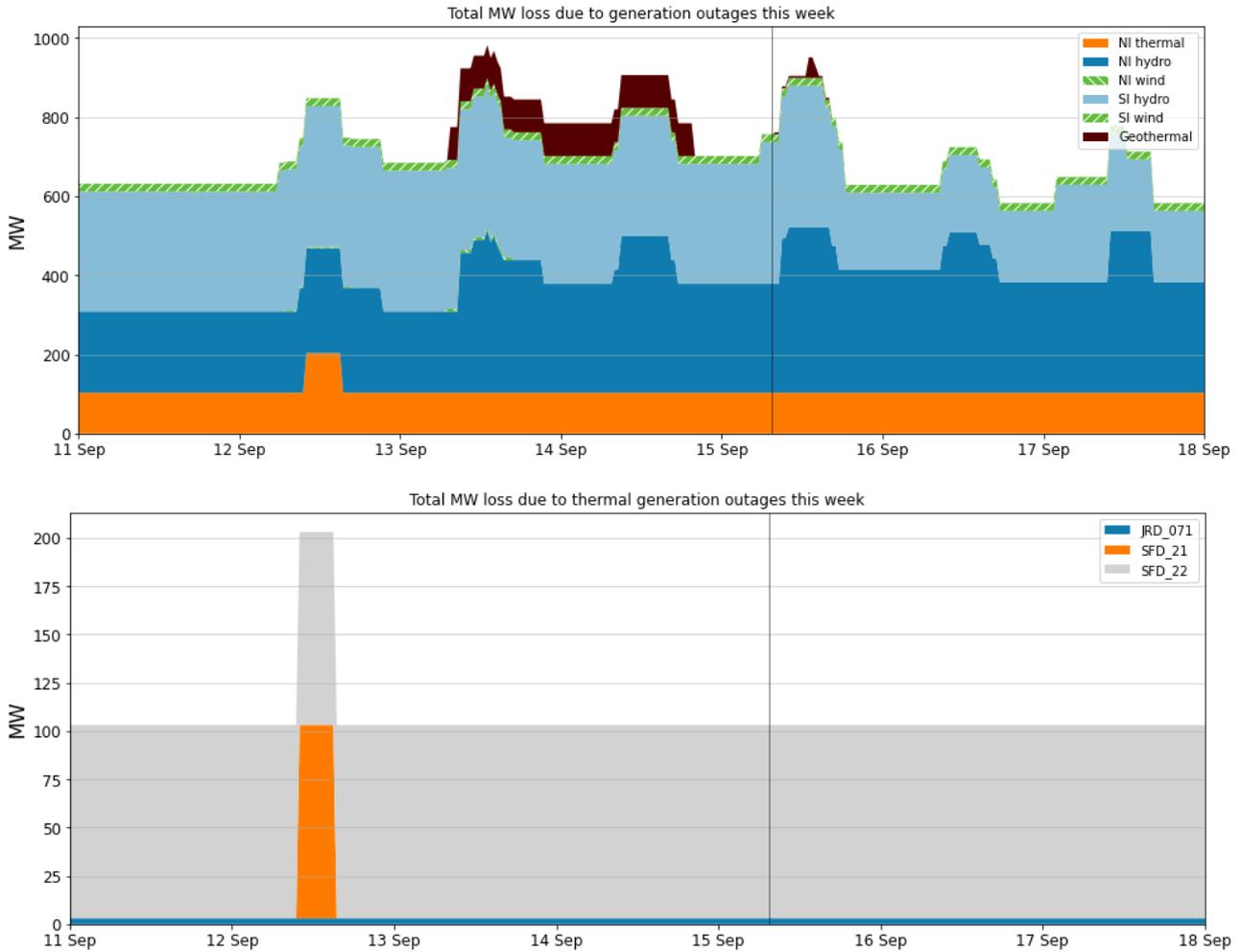
Figure 6: Temperatures across main centres



6. Outages

- 6.1. Figure 7 shows generation capacity lost due to outages. Total capacity lost between 11 and 17 September increased from ~600 MW on Sunday to ~800MW from Monday to Thursday, as North Island hydro periodically went on outage. Geothermal outages between Tuesday and Wednesday contributed to outages reaching almost ~900 MW on Tuesday. Compared to the previous week thermal outages have decreased, while North Island hydro outages have increased.

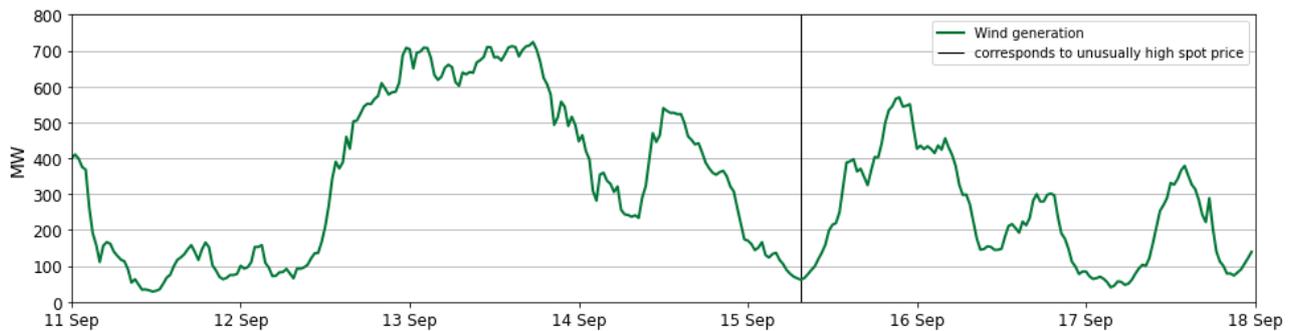
Figure 7: Total MW loss due to generation outages



7. Generation

- 7.1. Wind generation, as seen in Figure 8, varied from 50 MW to over 700 MW during the week. Wind generation was strong between the 12th – 13th, after which it began decreasing. It varied between ~100-500 MW throughout the rest of the week.
- 7.2. Notably wind generation was low (less than 100 MW) for the morning peak on Thursday, coinciding with the price spike. It is therefore likely that low wind generation contributed to the price spike.

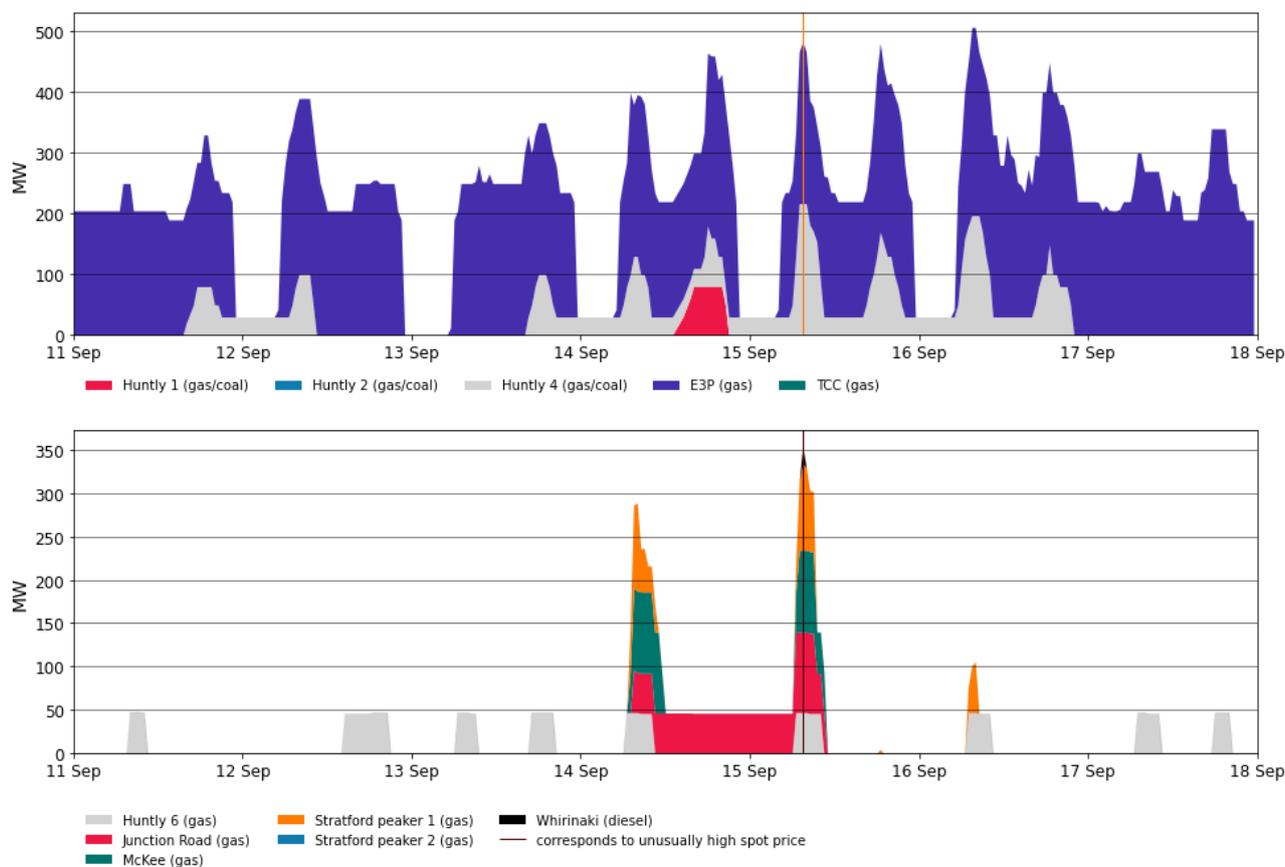
Figure 8: Wind Generation



- 7.3. Figure 9 shows generation at thermal and thermal peaker plants between 11 - 17 September. Similar to previous few weeks, E3P continues to only run during the day, with thermal off-peak generation fulfilled by Huntly 4.
- 7.4. Thermal generation was high when wind generation was low - reaching its highest points during peak demand periods. Thermal generation peaked for the week on the morning (7.30am) of 15 September at ~500 MW, the same period as the highest spike in spot prices (~\$640/MWh). Similar patterns apply to thermal peaker generation, which spiked on Wednesday and Thursday morning. It is therefore likely that high thermal and peaker generation contributed price spikes this week. Whirinaki ran on Thursday morning and was constrained on. This suggests the high the SIR price was due to tight supply, rather than just a high price from co-optimisation.

7.5.

Figure 9: Thermal Generation



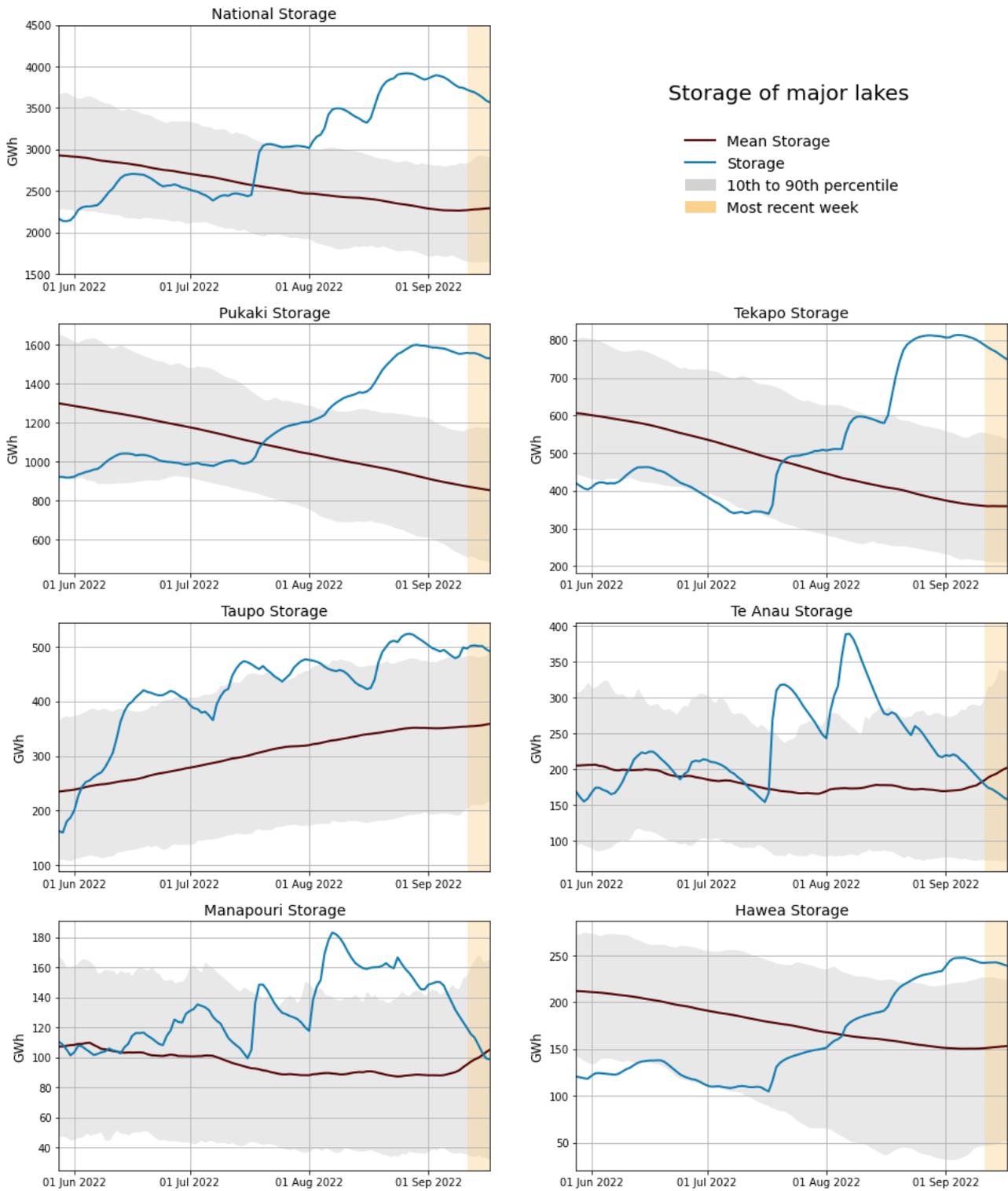
- 7.6. As a percentage of total generation, between 11 and 17 September, hydro generation totalled 71.1 per cent, geothermal 16.6 per cent, thermal 5.9 per cent and wind 5.2 per cent. Despite low wind generation the current abundance of hydro fuel would have contributed to keeping spot prices low outside of peak demand periods this week.

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 well above usual for this time of year at around 86 per cent of nominal full. Most major lakes continue to remain above their historic 90th storage percentile, except Te Anau and Manapōuri, which have fallen below their historic means.

- 8.3. The high level of hydro storage has been accompanied by an increase in lower priced hydro generation offers, contributing to the low average spot price seen during off peak periods.
- 8.4. With the abundance of low priced hydro generation in the South Island, the flow at the HVDC has been primarily northwards between 11 - 17 September.

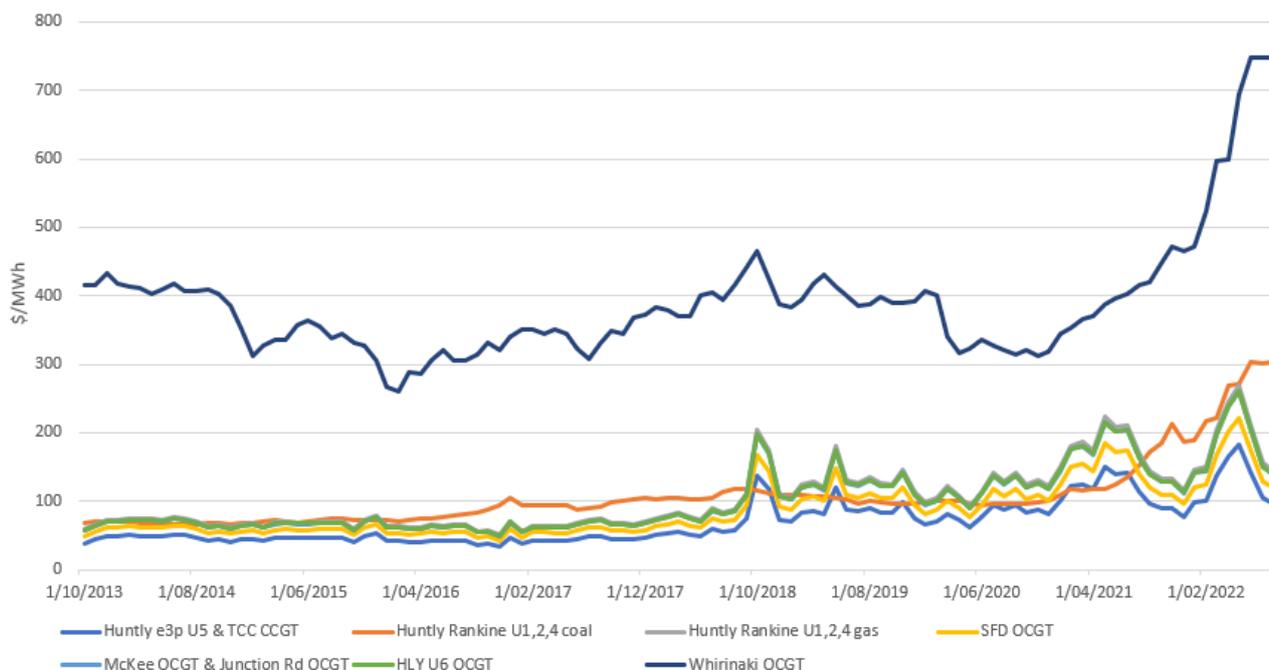
Figure 10: Hydro Storage



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 September 2022. The SRMC of gas fuelled plants continues to fall while the SRMC of diesel and coal fuelled plants appears to have plateaued.
- 9.4. The most recent price for Indonesian coal was around ~\$520/tonne putting the latest SRMC of Whirinaki and coal fuelled Huntly generation at around ~\$750/MWh and ~\$300/MWh respectively.
- 9.5. SRMCs of gas run thermal plants decreased to between \$96/MWh and \$144/MWh with the increase in gas fuel availability in the market.
- 9.6. 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 values are used to estimate marginal water value at the actual storage level. More details

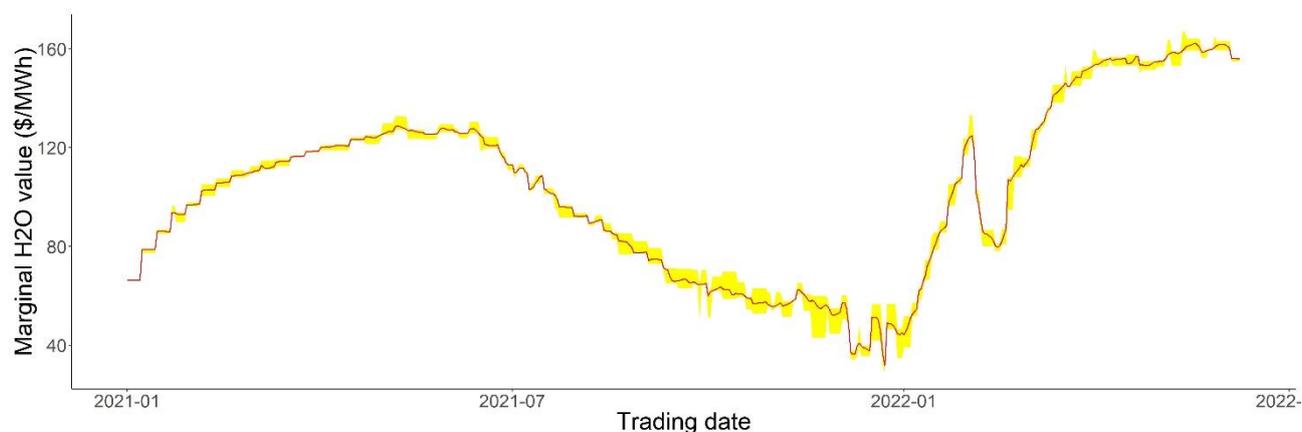
² <https://www.ea.govt.nz/assets/dms-assets/30/Appendix-C-Calculating-thermal-SRMCs.pdf>

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 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 keeping⁵. The black line shows cleared energy, indicating the range of the average final price.
- 11.2. The majority of cleared energy fell below \$50/MWh between Sunday and Tuesday, driven by high hydro generation and subsequent low-priced hydro generation offers. The majority of cleared prices rose into the \$50-\$100 band from Wednesday onwards, which was likely a product of higher demand and low wind generation.
- 11.3. The unusual abundance of hydro has changed the offer stack with decreased mid-priced generation offers and increased lower priced generation offers. Final tranche thermal generation offers are priced higher than usual, likely to recoup higher operating costs, with runtime costs, etc more likely to be condensed in shorter run time periods resulting in higher prices. The resulting offer curve means that small increases in demand or drops in wind generation can lead to quick advancement up the offer curve leading to jumps from \$100-200/MWh to \$600/MWh+ prices quite easily.
- 11.4. Figure 14 shows the offer curve of the trading period with the highest spot price this week, which was trading period 16 on 15 September. As described above, the steep growth at the upper end of the offer curve led to the sudden increase in price.

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

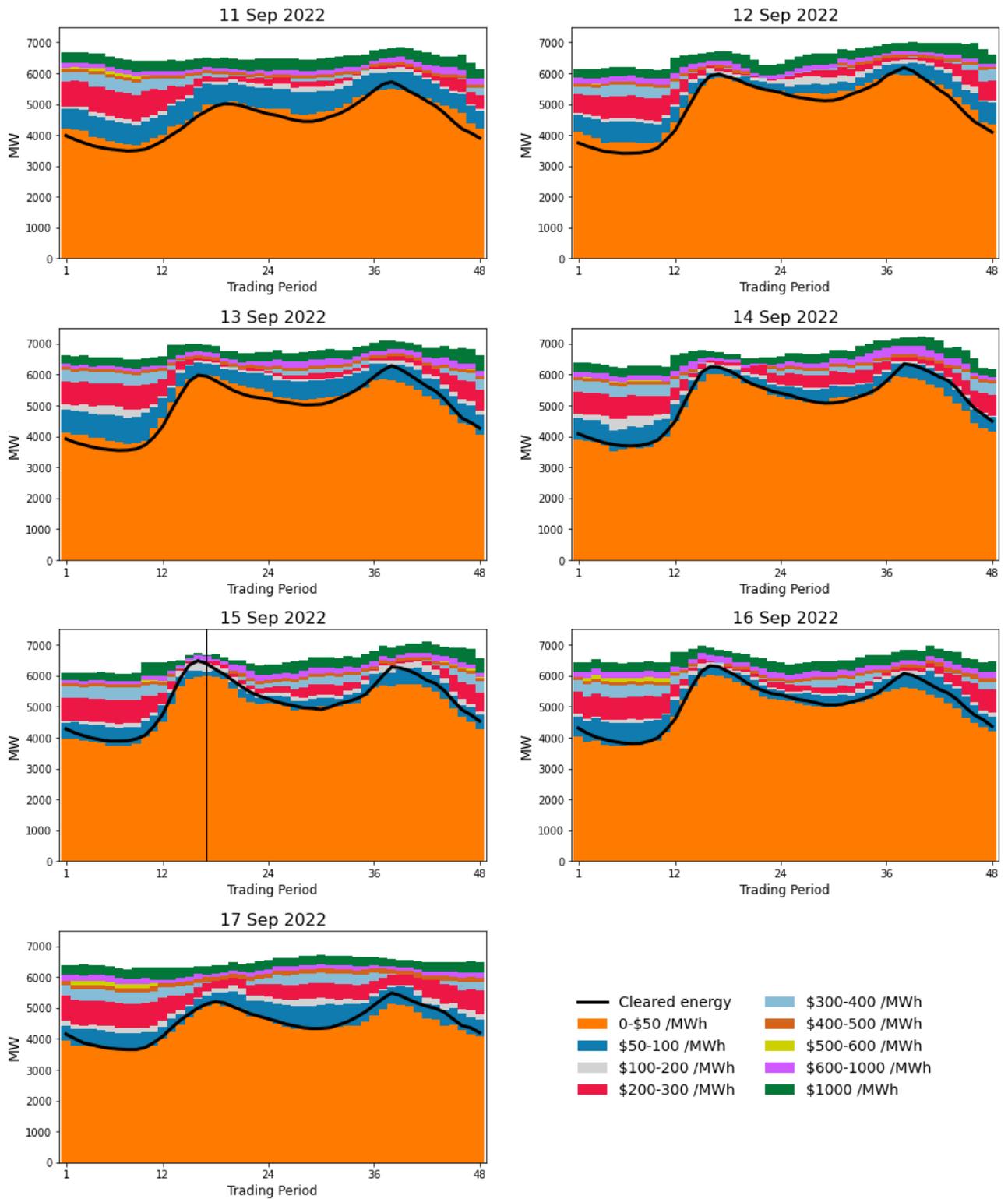
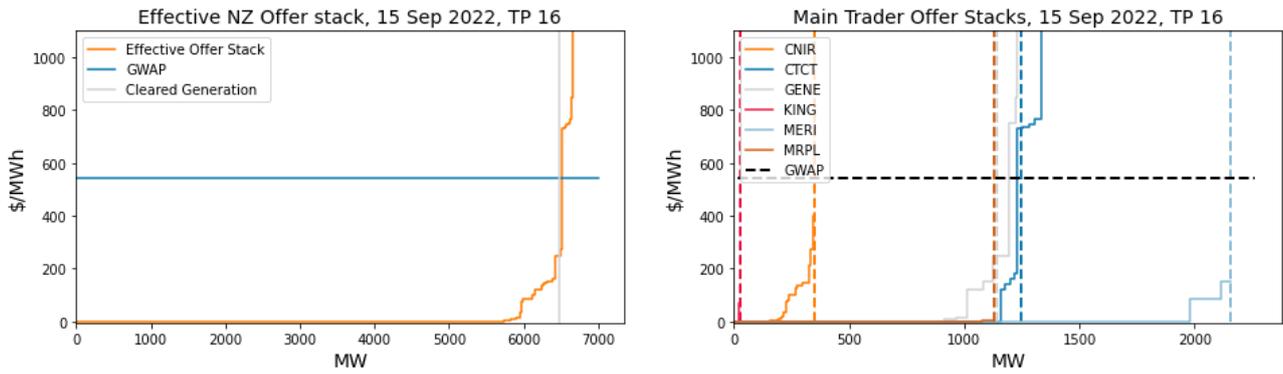


Figure 14: Offer stack at TP 16, 15 September



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.