

Trading Conduct Report

Market Monitoring Weekly Report

1. Overview for the week of 2-8 October

- 1.1. Wholesale spot prices between 2-8 October appear to be consistent with market conditions. Further analysis of two trading periods is underway.

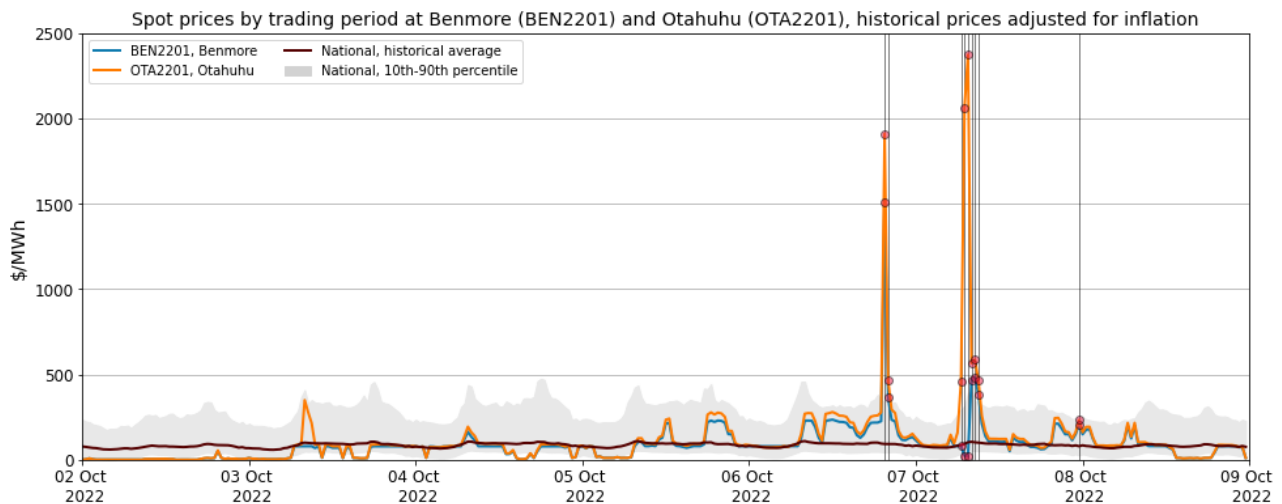
2. Spot Prices

- 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 2-8 October wholesale spot prices across all nodes the averaged \$90/MWh, with 95 per cent of prices falling between \$0.03/MWh and \$274/MWh.
- 2.3. Figure 1 shows spot prices at Benmore and Otahuhu alongside their historic median and historic 10th- 90th percentiles adjusted for inflation.
- 2.4. Prices between Sunday and Wednesday followed the pattern seen in previous weeks, with prices being very low during offpeak/overnight, then prices rise to roughly \$80 during the day.
- 2.5. Price separation occurred on Monday morning at 8 am, with prices in the North Island reaching \$340/MWh, while in the South Island prices were \$80/MWh. At this time the HVDC was one of the risk setters in the North Island, so transfer across the HVDC could not be increased without also increasing North Island reserve. This resulted in price separation between the North and South Island.
- 2.6. Other price spikes occurred on Tuesday and Wednesday during the morning and evening peaks. However, these were all within historic bounds. A Low Residual Situation was issued for Tuesday morning and spot prices stayed below \$200/MWh.
- 2.7. On Thursday evening, prices reached ~\$1500/MWh at Benmore, and ~\$1900/MWh at Otahuhu.
- 2.8. On Thursday afternoon a Low Residual Situation was issued for Friday morning, between 7:30 and 9:00 am.
- 2.9. A grid emergency was issued at 7:15 am on Friday morning, due to an unexpected outage at the Haywards substation on the HVDC. This limited the amount of electricity that could be transferred from the South to the North Island. As a result, North Island reserves were

dispatched as generation. Spot prices reached \$2,000/MWh in the North Island and were \$9/MWh in the South. The issue was resolved by 8:00 am.

- 2.10. The unexpected HVDV outage was unrelated to the low residual situation, however, the risk that it posed was exacerbated by high demand due to the cold weather.
- 2.11. Prices reached \$240/MWh at Otahuhu at 11:30 pm on Friday, which was just above the 90th percentile of historic ranges.

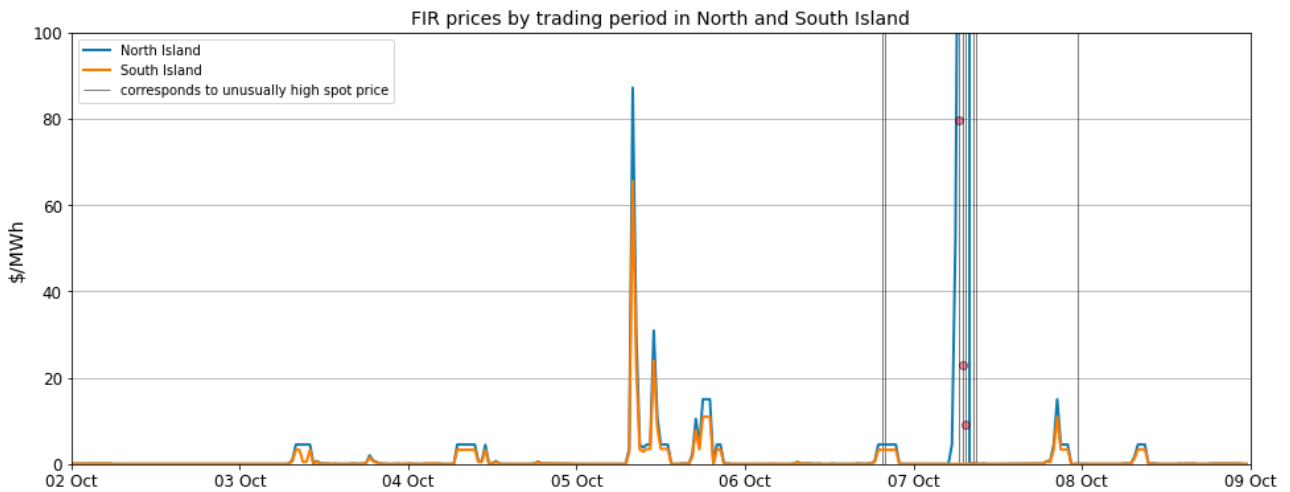
Figure 1: Wholesale Spot Prices



3. Reserve Prices

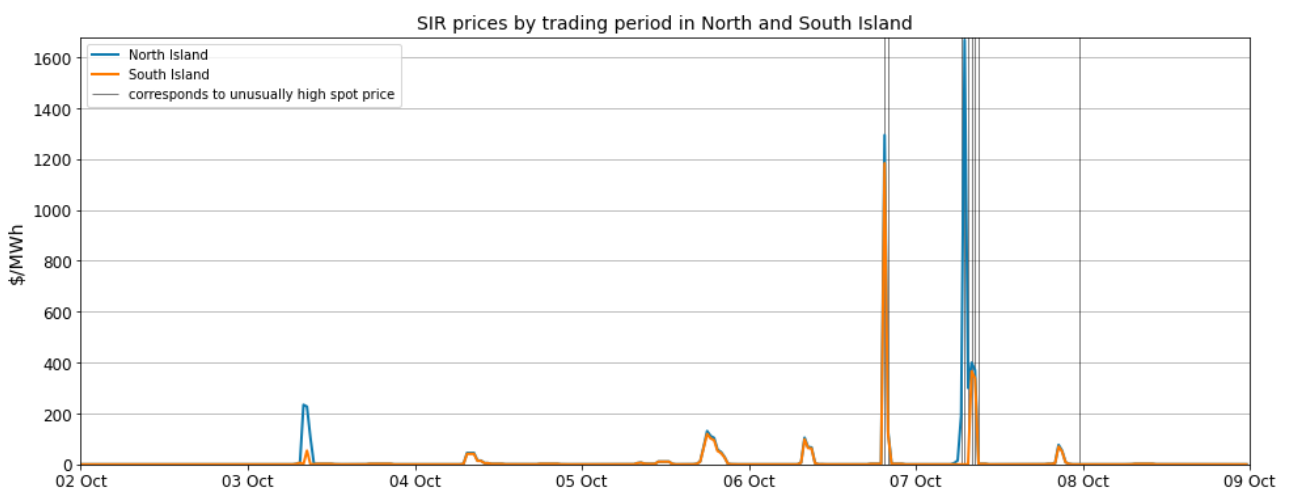
- 3.1. Fast instantaneous reserve (FIR) prices for the North and South Island are shown below in Figure 2. Most FIR prices fell within historical bounds this week, with the majority of trading periods below \$5/MWh.
- 3.2. Three FIR spikes occurred on Wednesday. The largest of these being in the morning, with North and South Island prices reaching around \$85/MWh and \$65/MWh respectively. These FIR spikes were likely due to a tight supply of reserves, as high amounts of outages occurred that day, especially North and South Island hydro. SPD co-optimisation could also have dispatched higher priced reserve in order to keep down energy price, if it resulted in lower costs overall.
- 3.3. North Island reserve reached ~\$2,000 MWh during the grid emergency on Friday morning, with reserves being dispatched as energy in the North Island. In the South Island prices stayed below \$5/MWh.

Figure 2: FIR prices by trading period and Island



- 3.4. Sustained instantaneous reserve (SIR) prices for the North and South Island are shown below in Figure 3.
- 3.5. Price separation for SIR occurred on Monday morning, with North Island prices reaching over \$200/MWh. This aligned with the North Island spot price spike and separation between islands and was likely a result of a tight supply of North Island SIR, which also constrained HVDC transfer.
- 3.6. Instances of SIR prices higher than \$20/MWh occurred in both islands occurred on Tuesday morning, Wednesday evening and Thursday morning. The tight supply of SIR may have resulted from a high number of outages.
- 3.7. SIR prices reached roughly \$1200/MWh in the South and \$1300/MWh in the North on Thursday evening. These coincided with the Thursday evening spot price spikes.
- 3.8. North Island SIR prices reached \$1700/MWh during the grid emergency on Friday morning, with most North Island reserves being dispatched as energy, while the corresponding South Island SIR price was under \$5/MWh.

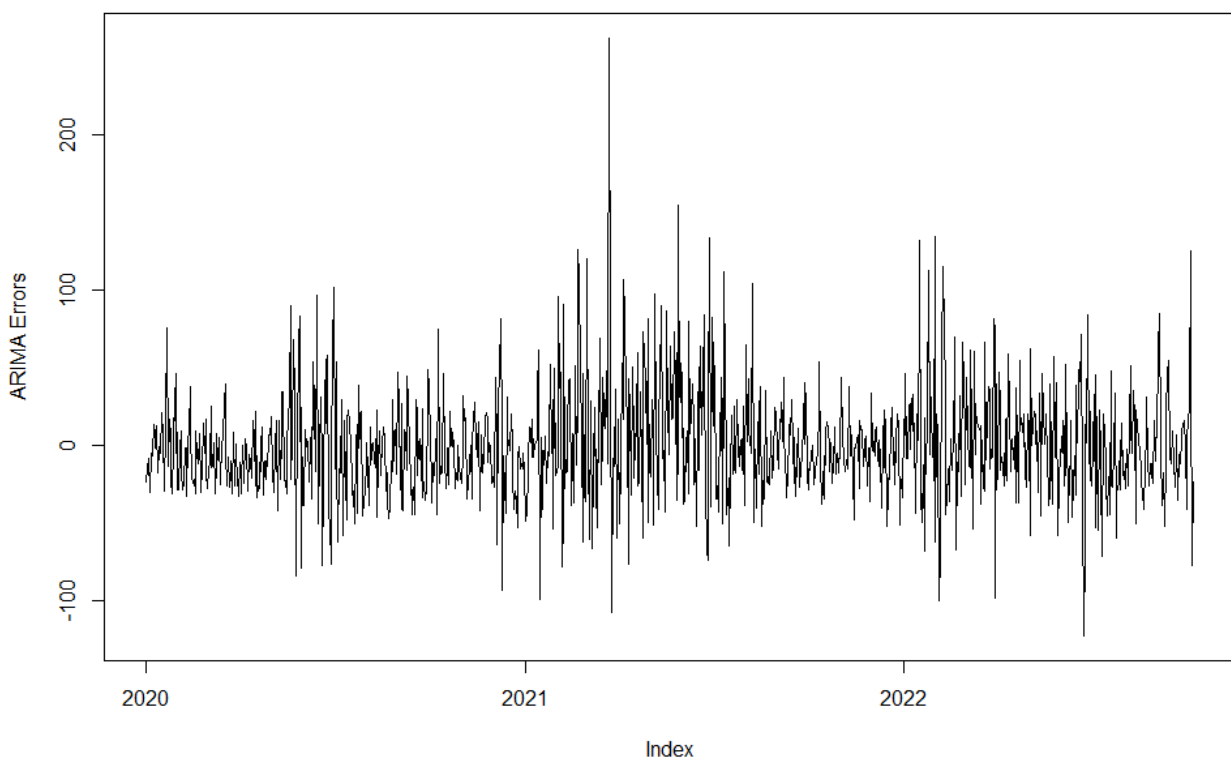
Figure 3: SIR prices by trading period and Island



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. Residuals for 2-8 October were relatively large. The model over estimated prices on the Wednesday and Thursday by over \$50, however, prices were underestimated on the Friday. This is not unexpected given the unplanned HVDC outage on Friday.

Figure 4: Residual plot of estimated daily average spot prices



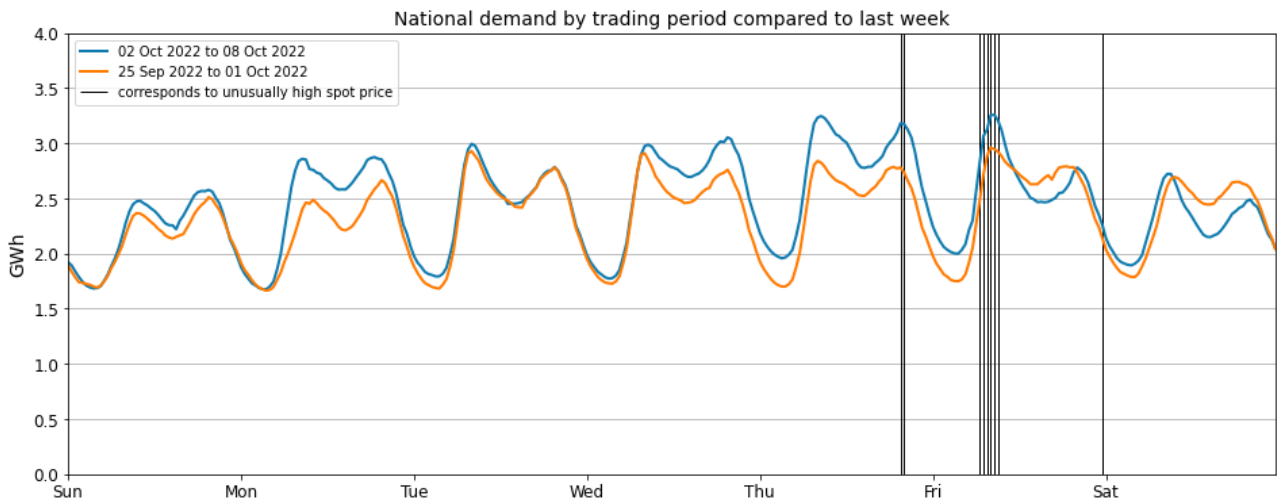
5. Demand

- 5.1. Figure 5 shows this week's national grid demand compared to the previous week.
- 5.2. Demand from 2-8 October was higher when compared to the previous week. The higher demand on Monday is due to the previous one² being a public holiday. Demand on Wednesday through to Friday morning was much higher than the previous week, especially during peak times. This increase in demand was likely due to unseasonably cold temperatures, as seen in Figure 6. Demand in the North Island was shed during the grid emergency on Friday morning.

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

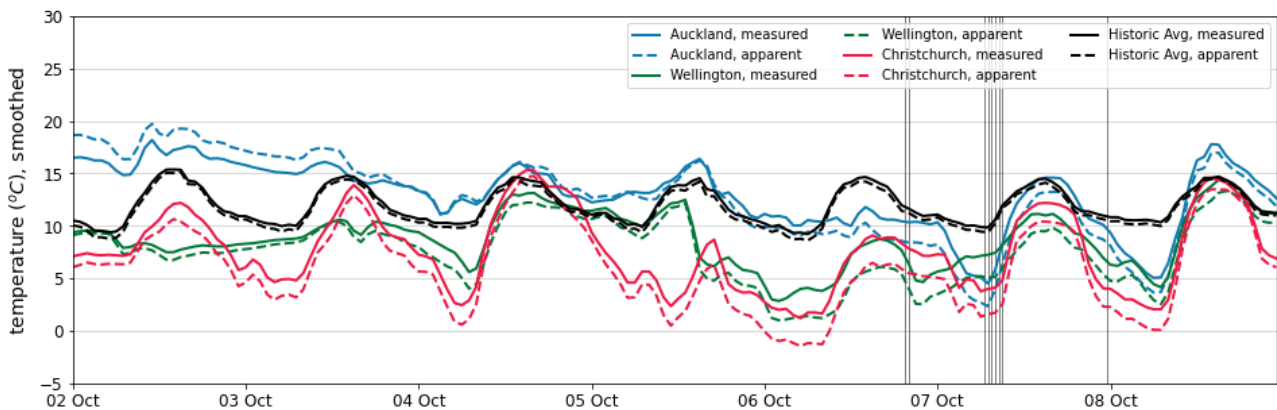
² Monday 26 September was the Queen Elizabeth II Memorial Day

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. Temperatures in Auckland, Christchurch and Wellington began decreasing on Wednesday onwards, as a front of polar air hit the country. Wellington and Christchurch had a cold morning on Thursday, with both having apparent temperatures close to zero. All three cities awoke to chilly conditions on Friday, with apparent temperatures in Auckland and Christchurch both close to zero.

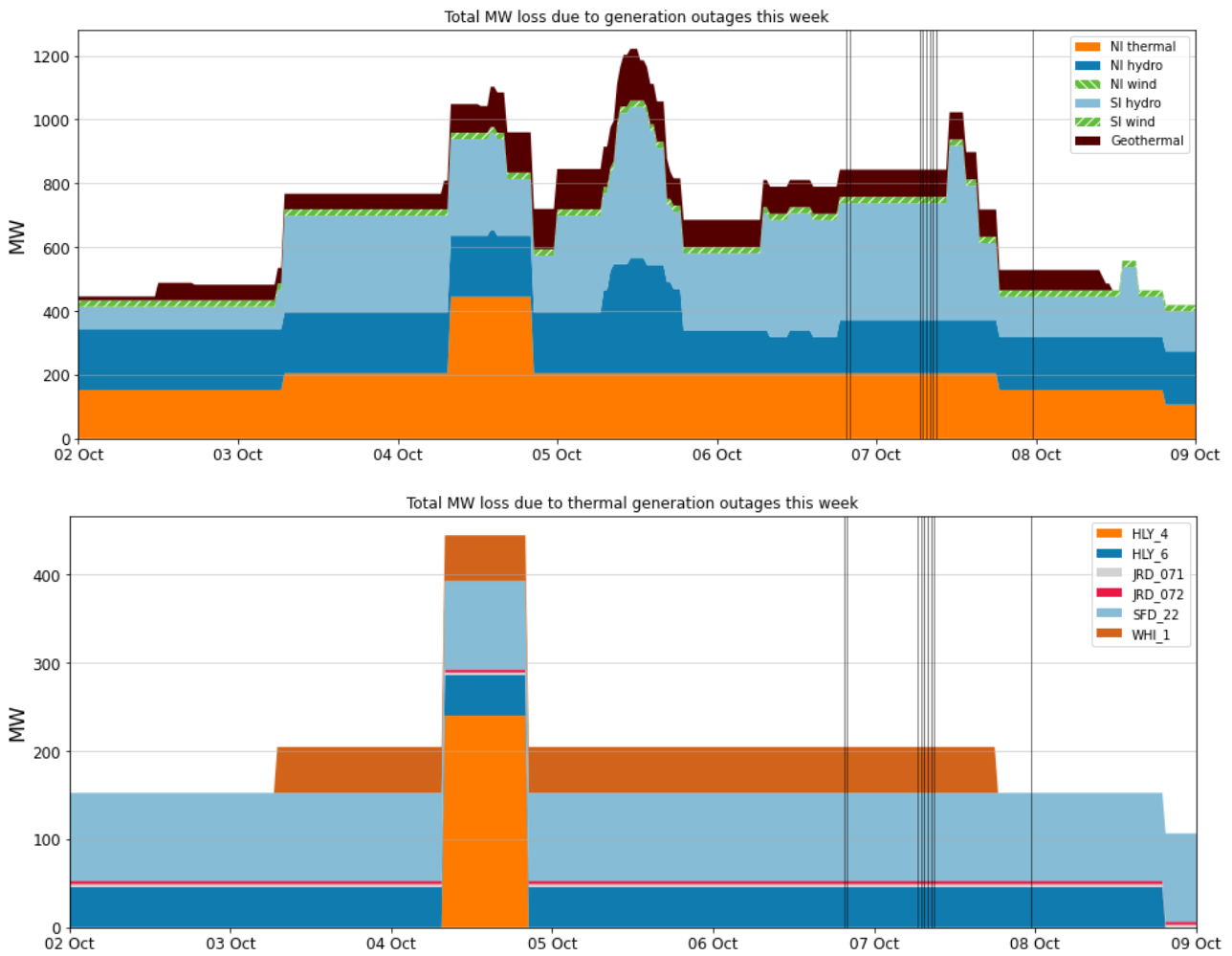
Figure 6: Temperatures across main centres



6. Outages

- 6.1. Figure 7 shows generation capacity on outages. Total capacity lost increased from ~450 MW on Sunday to ~1000MW during times on Tuesday and Wednesday, due to increased North Island thermal, hydro and geothermal outages. However, outages mostly decreased from Thursday onwards.
- 6.2. With regards to thermal outages, the second Stratford peaker remains on outage, and Huntly 6 was out all week, but returned on Saturday. Huntly 4 was on outage on Tuesday. One of the three Whirinaki units was on outage between Monday and Friday.

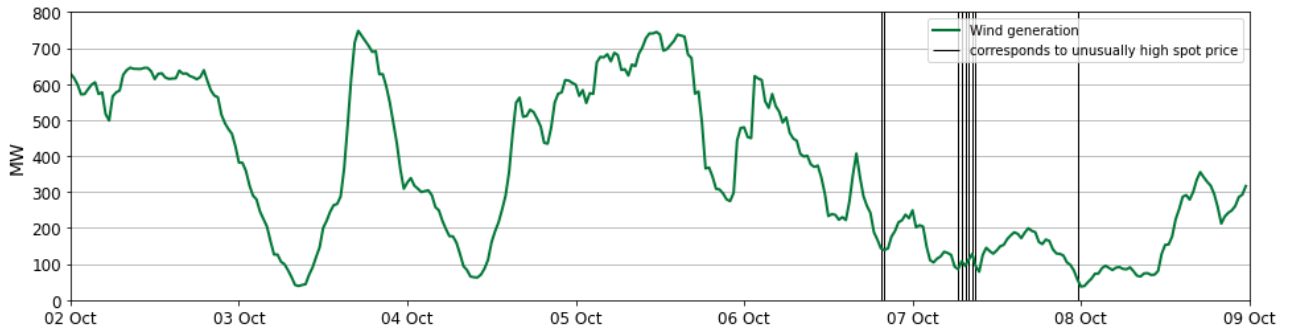
Figure 7: Total MW loss due to generation outages



7. Generation

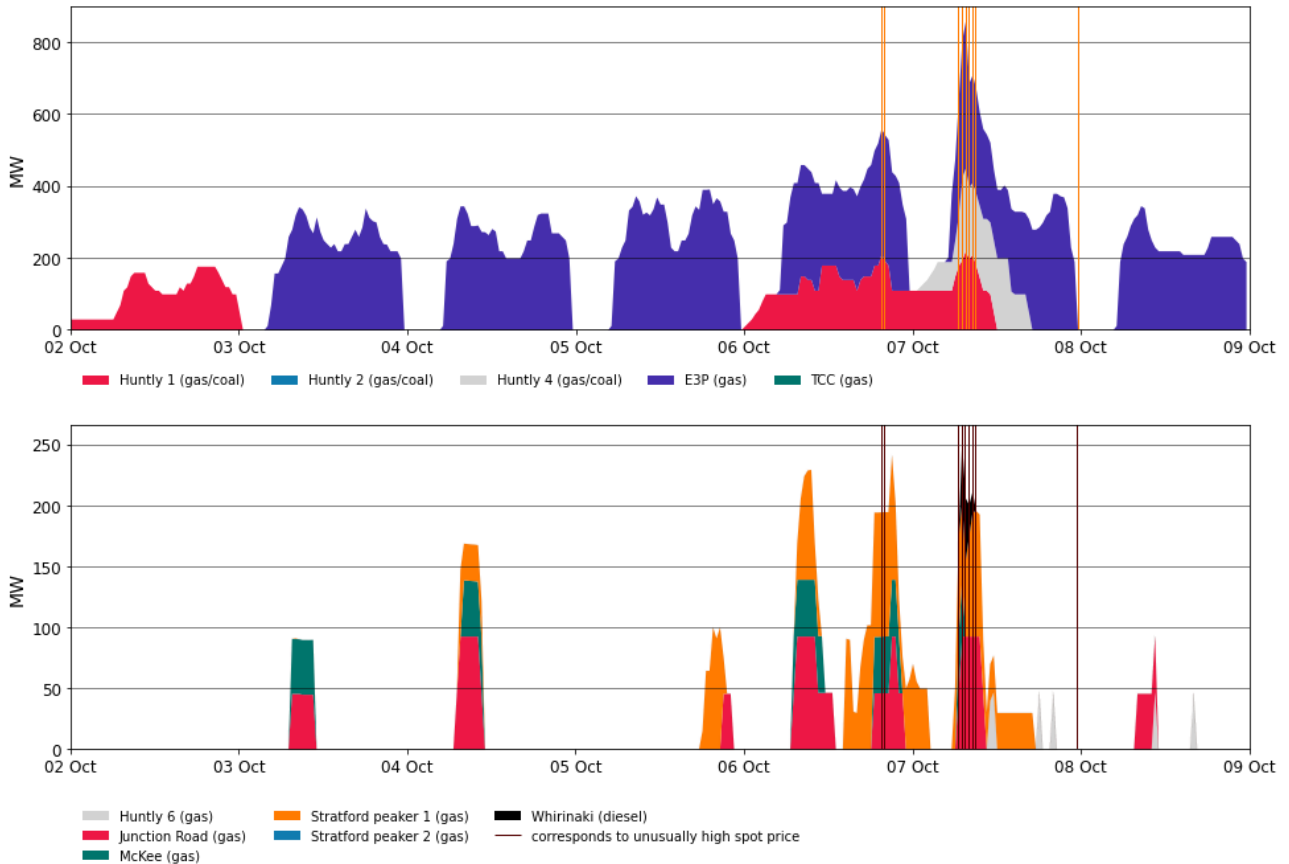
- 7.1. This week wind generation, as seen in Figure 8, varied between 50 and 750 MW. Wind generation hovered around 600 MW on Sunday, before decreasing to ~50 MW on Monday morning, which likely contributed to the price spike. Wind generation increased on Monday evening, before falling off again on Tuesday morning.
- 7.2. Wind was strong on Wednesday, as the polar front moved in, however, it began decreasing throughout Thursday. Wind hovered around 150 MW on Thursday evening and fell to roughly 100 MW on Friday morning during the grid emergency. Low wind likely contributed to the price spike on Thursday evening.

Figure 8: Wind Generation



7.3. Figure 9 shows generation at thermal and thermal peaker plants between and 2-8 October. Huntly 1 ran on Sunday, after which E3P was switched on and ran during the day. Huntly 1 switched on again on between Thursday and Friday, likely as a reaction to anticipated higher demand due to the cold weather. Huntly 4 ran on Friday morning.

Figure 9: Thermal Generation



7.4. Peakers ran more often this week to assist with peak demand. Peakers running on Monday and Tuesday morning was likely a reaction to low wind. Peakers running from Wednesday onwards was likely a consequence of higher demand – due to low temperatures - coupled with lower wind.

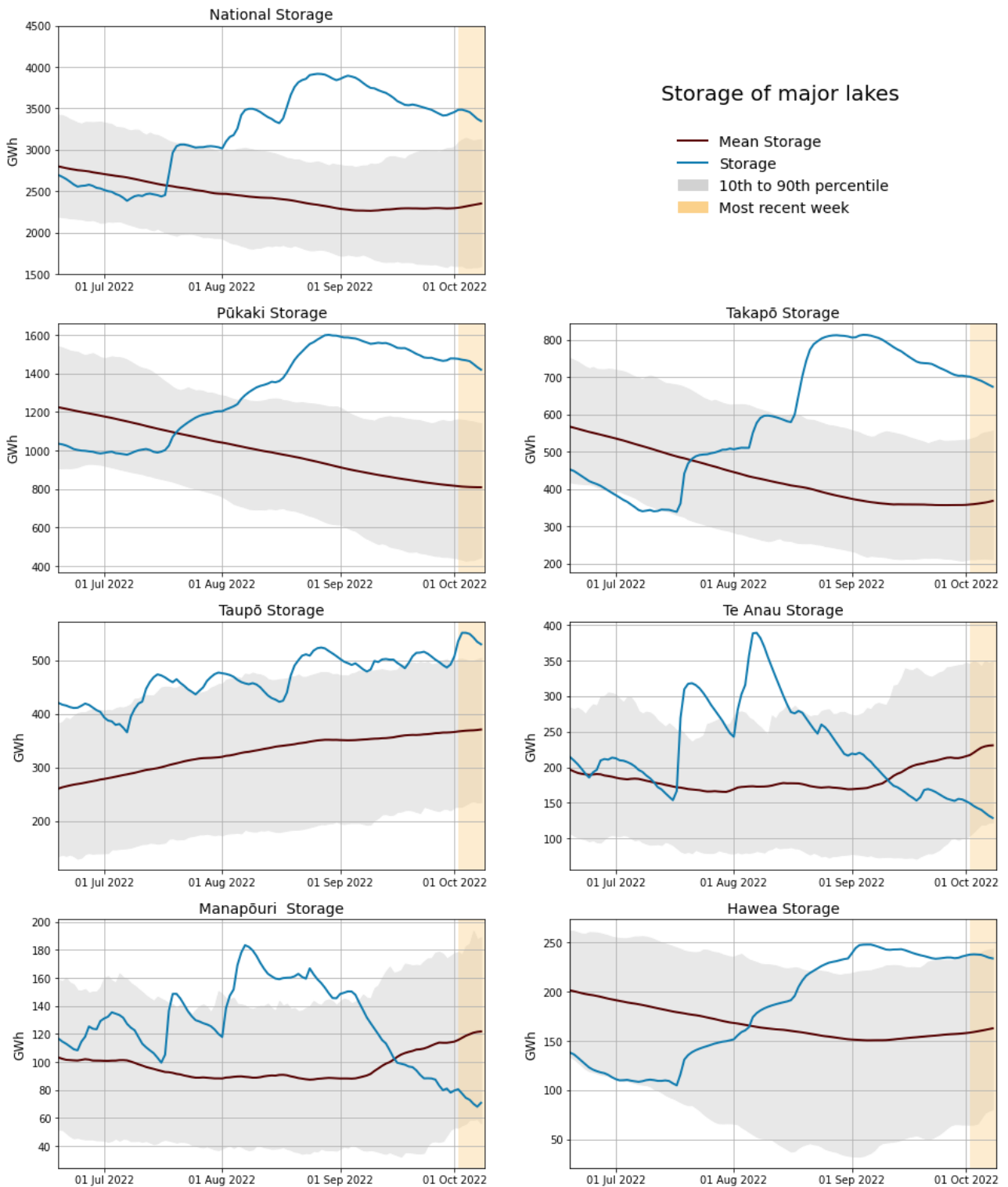
7.5. Peakers and baseload thermal running on early on Friday morning was a reaction to both the cold weather, low wind, and the sudden reduction of electricity transfer across the HVDC, with all available North Island generation being dispatched to prevent insufficient generation.

- 7.6. As a percentage of total generation, between 3-9 October, hydro generation totalled 70.8 per cent, geothermal 16.3 per cent, thermal 4.8 per cent and wind 6.9 per cent.

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 84 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 during the day, but southwards overnight, except for Thursday and Friday.

Figure 10: Hydro Storage



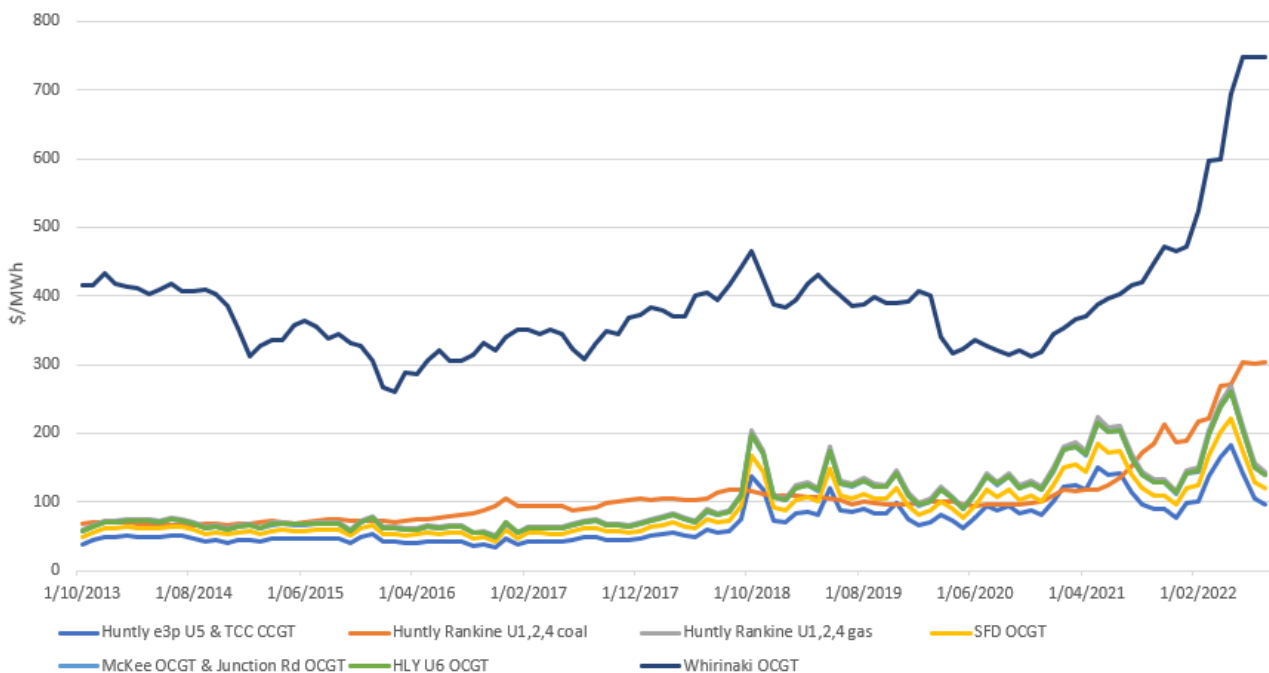
9. Price versus estimated costs

- 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. In early September Indonesian coal was around ~\$520/tonne putting the latest SRMC of coal fuelled Huntly generation at ~\$300/MWh, with the SRMC of Whirinaki also ~\$750/MWh. Coal prices have continued to increase in October.
- 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 C³ on the trading conduct webpage.

Figure 11: Estimated monthly SRMC for thermal fuels



10. Offer Behaviour

- 10.1. Figure 12 and Figure 13 shows this week's daily offer stacks, nationally and in North Island respectively, adjusted to take into account wind generation, transmission constraints, reserves and frequency keeping⁴. The black line shows cleared energy, indicating the range of the average final price.
- 10.2. The majority of cleared energy fell below in either the \$0-50/MWh or \$50-100/MWh bands. The unusual abundance of hydro has changed the offer stack with decreased mid-priced generation offers and increased lower priced generation offers.
- 10.3. Energy was cleared in the \$1000+/MWh band on Thursday evening. While on Friday morning energy in the North Island was cleared in the \$1000+/MWh band

³ <https://www.ea.govt.nz/assets/dms-assets/30/Appendix-C-Calculating-thermal-SRMCs.pdf>

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.

10.4. 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.

Figure 12: National daily offer stack

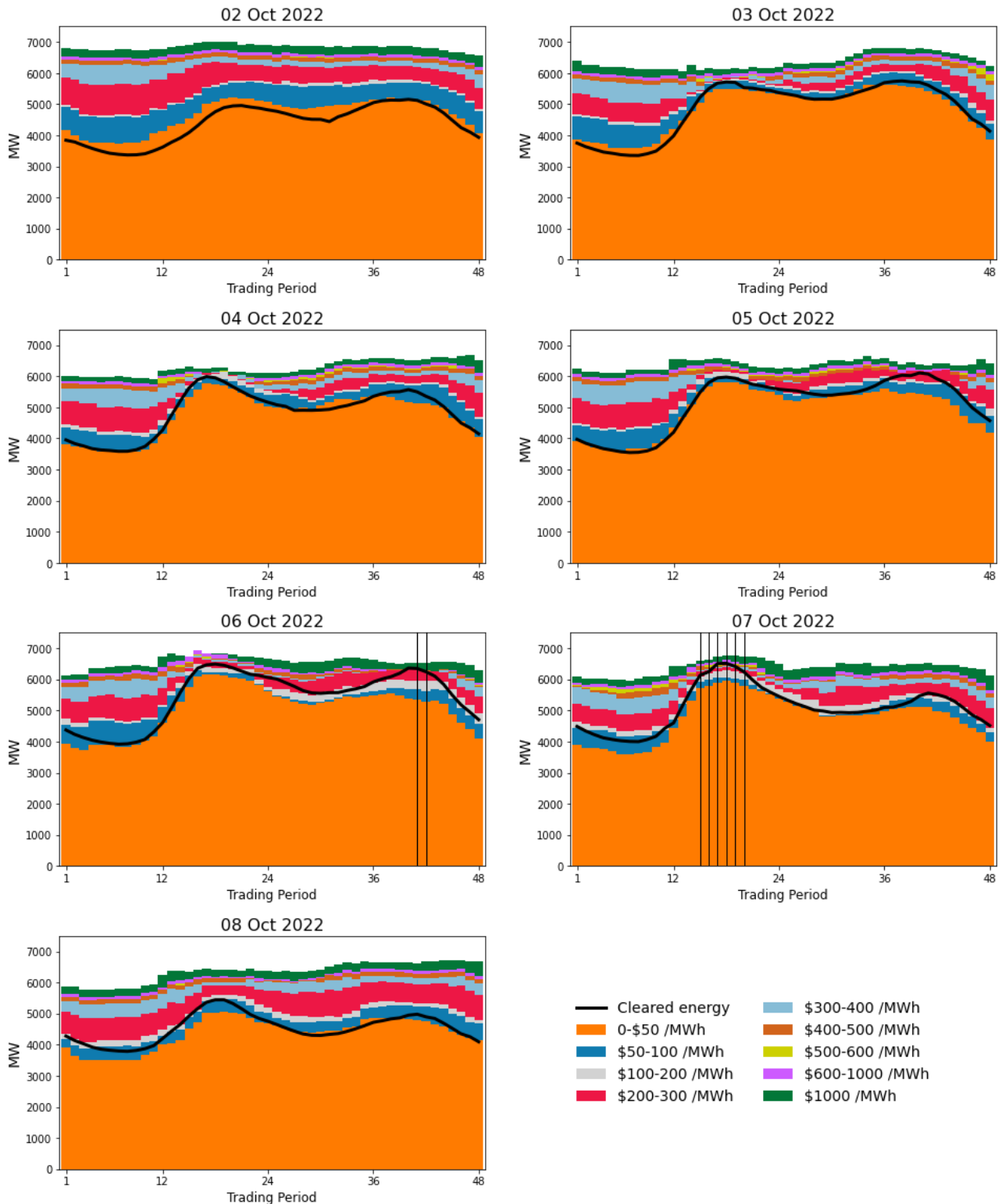
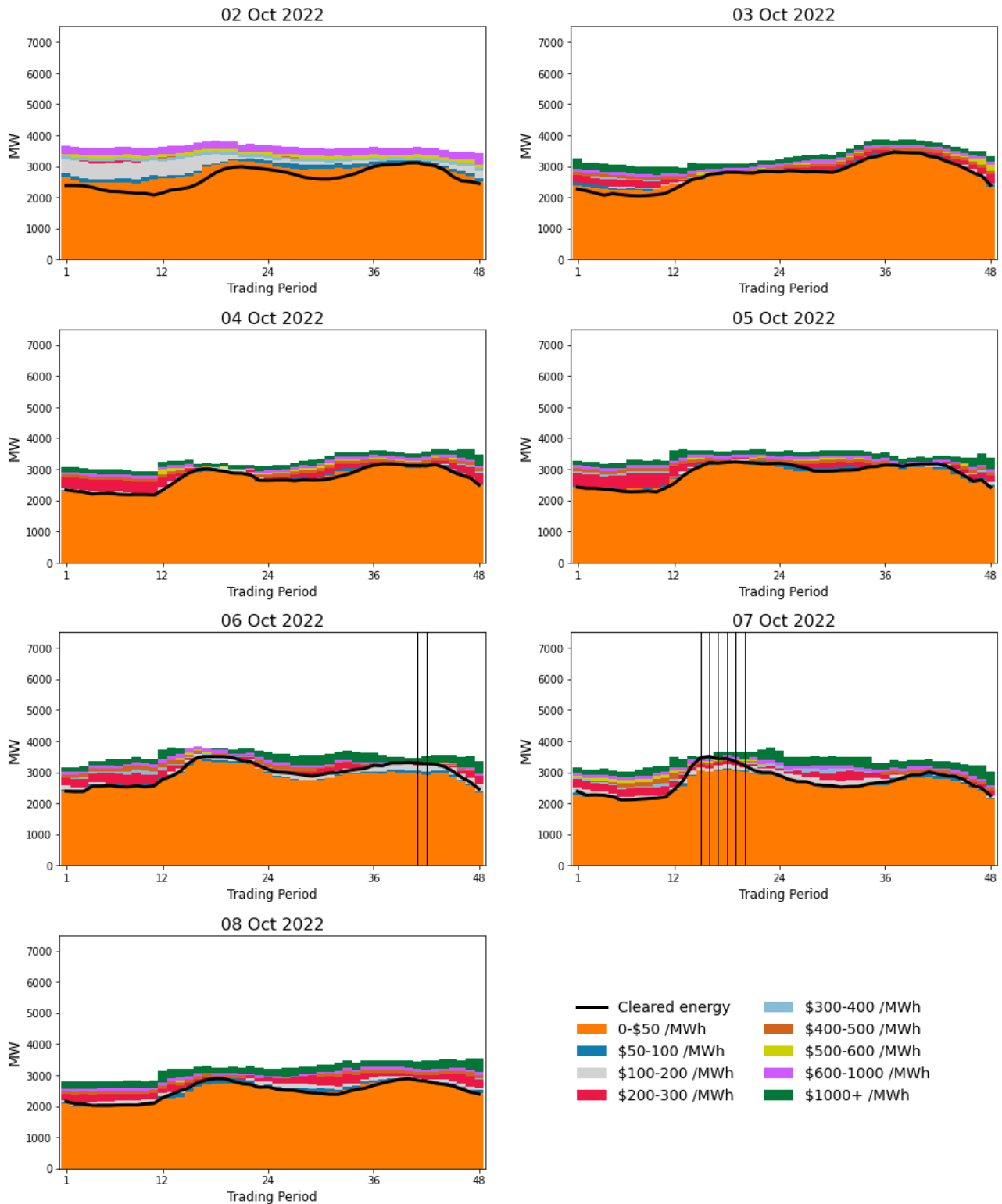


Figure 13: North Island daily offer stack



11. Ongoing Work in Trading Conduct

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

11.2. Further analysis is underway regarding the offers at Huntly 1,4,5 for trading periods 15-16 for Friday 7 October. Information is being requested from Genesis in order to understand why the prices of their final tranches were changed.

11.3. 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.
07/10/22	15-16	Further analysis	The Authority is making enquires with Genesis regarding offers changes to final tranche prices at Huntly 1,4 and 5 for trading period 15-16.