

Date: 25 September 2023



Trading conduct report

Market monitoring weekly report

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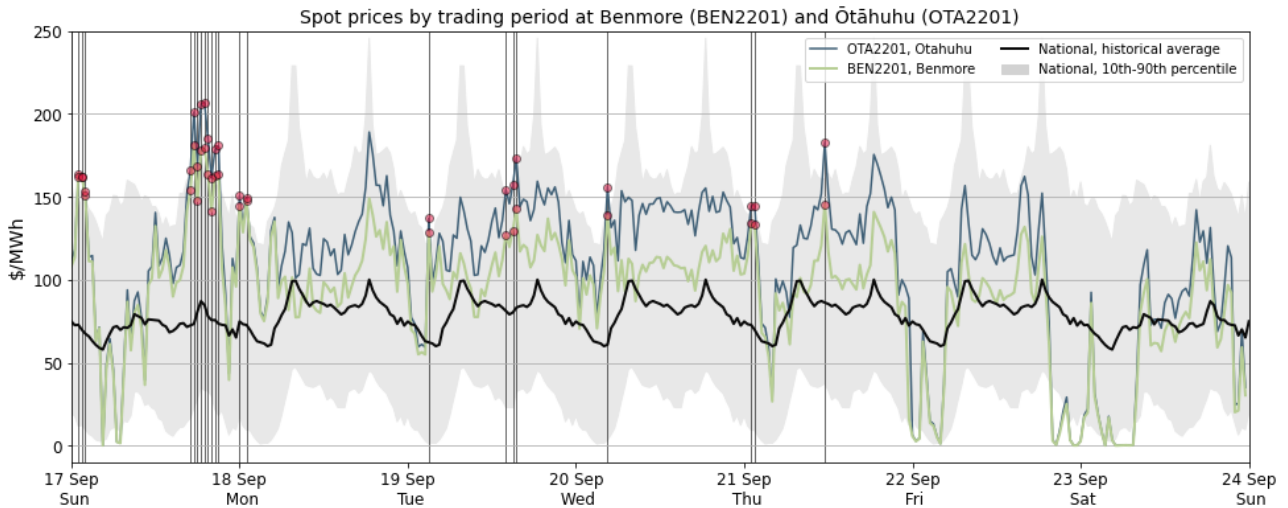
1. Overview for week of 17-23 September

- 1.1. Throughout the week, prices remained higher than the historical average. On Sunday the high prices were likely due to over-forecasted wind generation. National hydro storage levels increased significantly due to the recent rainfall. Due to the increase in hydro storage towards the end of the week, despite the low wind generation, increased hydro generation reduced overnight prices. Demand remained lower than the previous week, particularly during the peak periods, due to mild weather conditions across the country.

2. Spot prices

- 2.1. This report monitors underlying wholesale price drivers to assess whether trading periods require further analysis to identify 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 any node exceed their historical 90th percentiles.
- 2.2. Figure 1 shows the wholesale spot prices at Benmore and Ōtāhuhu alongside their historic average and historic 10th-90th percentiles adjusted for inflation. Prices above the historic 90th percentile are highlighted with a vertical black line. Other notable prices that did not exceed the 90th percentile, are marked with black dashed lines.
- 2.3. Between 17-23 September:
 - (a) The average wholesale spot price across all nodes was \$100/MWh.
 - (b) 95 percent of prices fell between \$0.30/MWh and \$166/MWh.
- 2.4. Overall, the majority of spot prices still sat above the historic average this week, although the average price decreased compared to the previous week by around \$50/MWh. There were multiple prices in the early half of the week above the historic 90th percentile of prices, and some price separation occurred during the middle part of the week that saw Ōtāhuhu prices around \$25-\$55/MWh higher than Benmore prices.
- 2.5. During the Sunday evening peak period prices consistently sat above the 90th percentile between 5:00pm and 9:00pm. The prices ranged between \$3/MWh-\$44/MWh above the 90th percentile. This peak period also saw the highest Benmore and Ōtāhuhu prices of the week. At 5:30pm on 17 September the price at Benmore was \$181/MWh and at Ōtāhuhu it was \$201/MWh. The highest Ōtāhuhu price of the week was \$207/MWh and occurred at 7:00pm, with the price at Benmore during the trading period \$180/MWh. These high prices were likely due to under forecast wind generation ranging between ~70MW-236MW over these trading periods. Furthermore, demand was under forecast as well.
- 2.6. In the afternoon on 19 September there were a few Ōtāhuhu prices between 2:00pm and 4:30pm that were above the 90th percentile by around \$17/MWh -24/MWh. Wind generation again was under forecast, this time by ~74MW-130MW which may have contributed to these higher prices during the shoulder period. This was also the case at 11:30am on 21 September when the Ōtāhuhu price was \$183/MWh and wind generation was around 52MW under forecast.

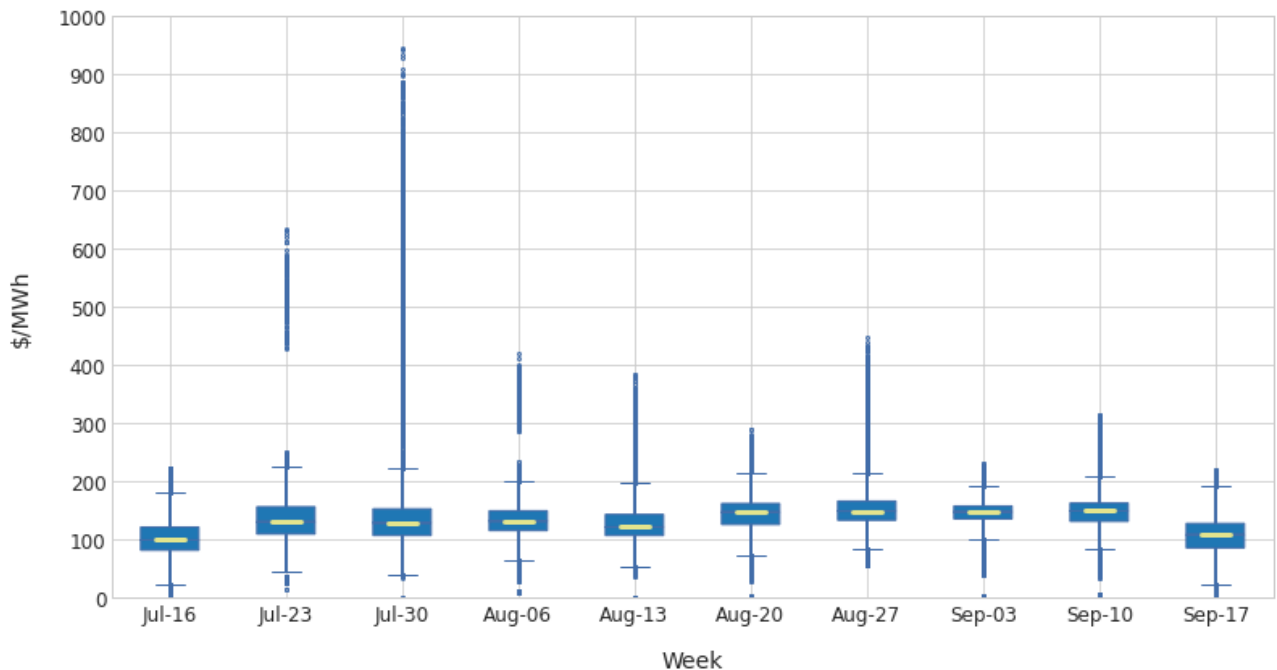
Figure 1: Wholesale spot prices between 17 September (Sunday) and 23 September (Saturday) 2023



2.7. Figure 2 shows a box plot with the distribution of spot prices during this week and the previous nine weeks. The green line shows each week’s median price, while the box part shows the lower and upper quartiles (where 50 percent of prices fell). The “whiskers” extend to points that lie within 1.5 times the inter-quartile range (IQR) of the lower and upper quartile, and then observations that fall outside this range are displayed independently.

2.8. The distribution of spot prices remains small with the middle 50% of prices are in the range of \$85/MWh to \$127/MWh. The average price decreased compared to the previous week by around \$50/MWh, which was likely due to the increase in hydro storage during the past week.

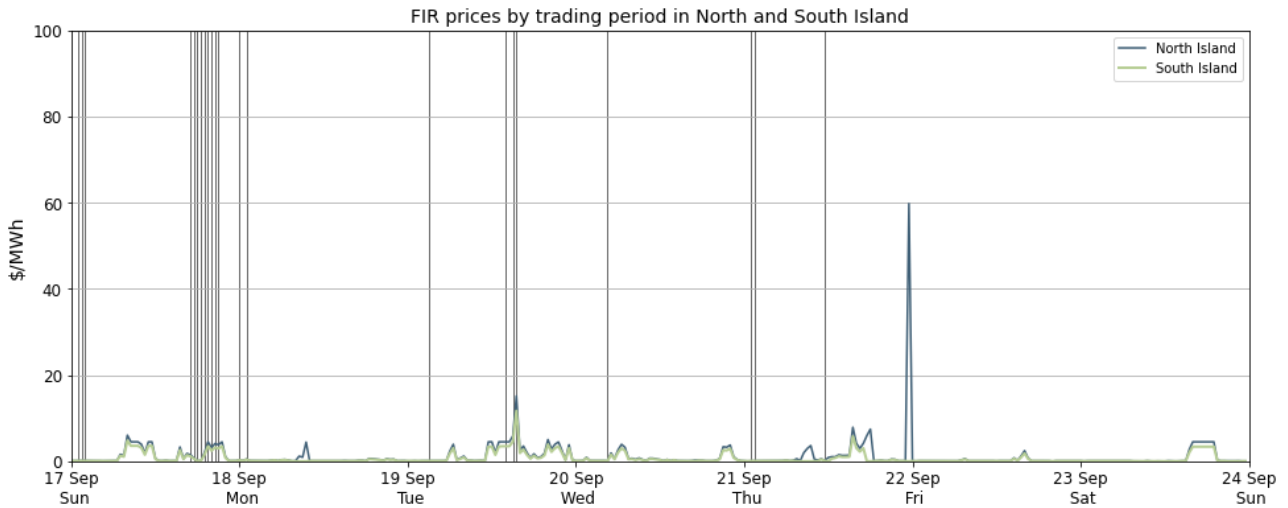
Figure 2: Boxplots showing the distribution of spot prices this week and the previous nine weeks



3. Reserve prices

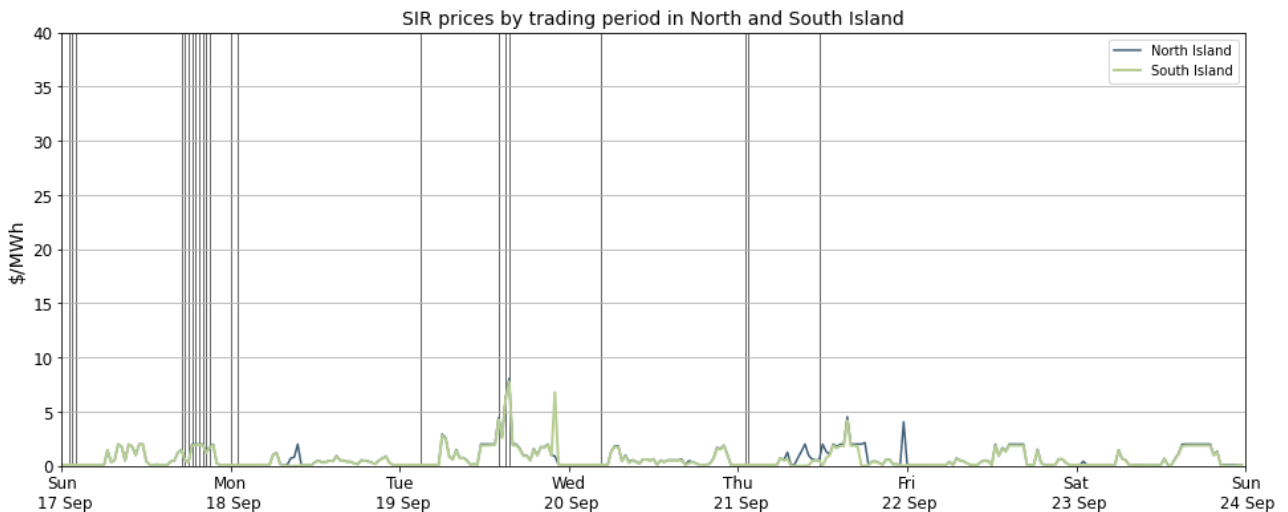
3.1. Fast Instantaneous Reserve (FIR) prices for the North and South Islands are shown below in Figure 3. This week FIR prices were mostly under \$10/MWh for both islands. The largest spike occurred at 11:30pm on Thursday in the North Island. The North Island price reached around \$60/MWh while the South Island price was \$0/MWh. At this time HVDC pole 1 was on outage, reducing reserve sharing between the islands.

Figure 3: Fast Instantaneous Reserve (FIR) prices by trading period and island



3.2. Sustained Instantaneous Reserve (SIR) prices for the North and South Islands are shown in Figure 4. This week, SIR prices were under \$10/MWh for both islands, with no significant price spikes.

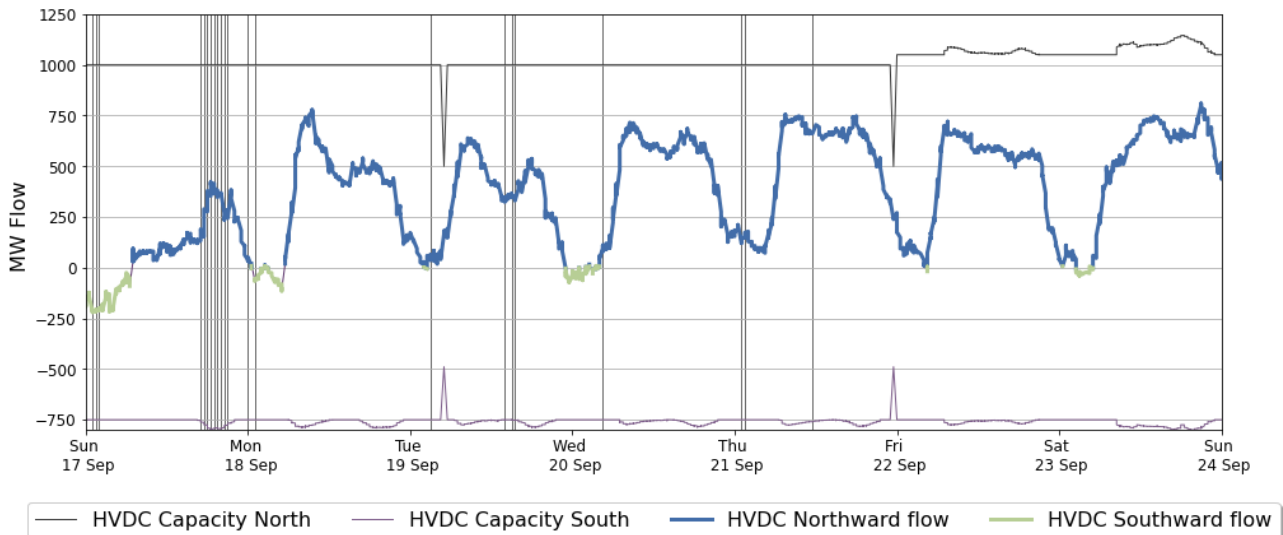
Figure 4: Sustained Instantaneous Reserve (SIR) prices by trading period and island



4. HVDC

- 4.1. Figure 5 shows HVDC flow between 17-23 September. HVDC flows were northwards during the day with some southward flow overnight. Northward flow was mostly below 750 MW and well below capacity limits, with the maximum southward flow of around 240 MW on Sunday. The HVDC limit was reduced due to outage on Tuesday at 5:00am, and on Thursday at 11:30pm.

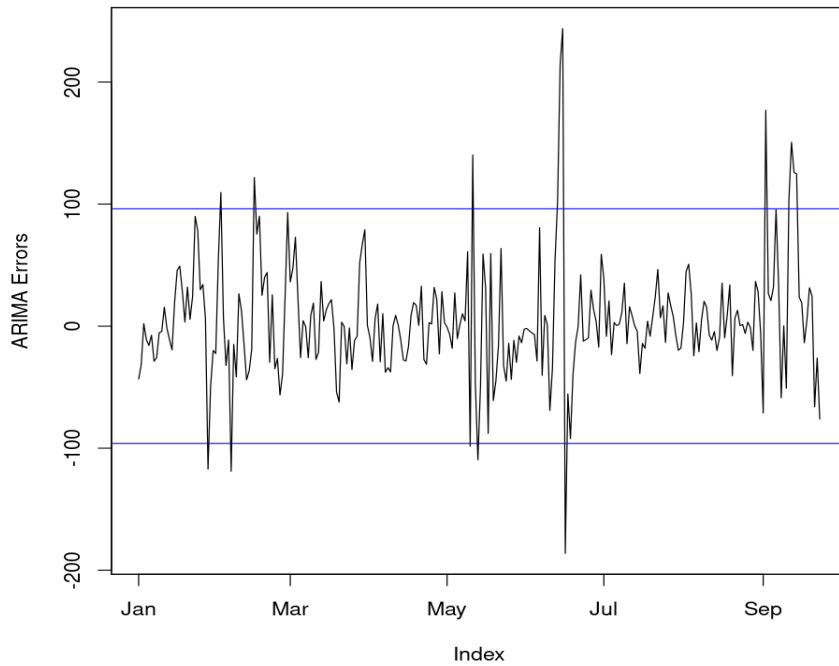
Figure 5: HVDC flow and capacity



5. Regression residuals

- 5.1. 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](#) on the trading conduct webpage.
- 5.2. Figure 6 shows the residuals of autoregressive moving average (ARMA) errors from the daily model. Positive residuals indicate that the modelled daily price is lower than actual average daily price and vice versa. When residuals are small this indicates that average daily prices are likely largely aligned with market conditions. These small deviations reflect market variations that may not be controlled for in the regression analysis.
- 5.3. This week, there was no residual above or below the two standard deviations of the data.

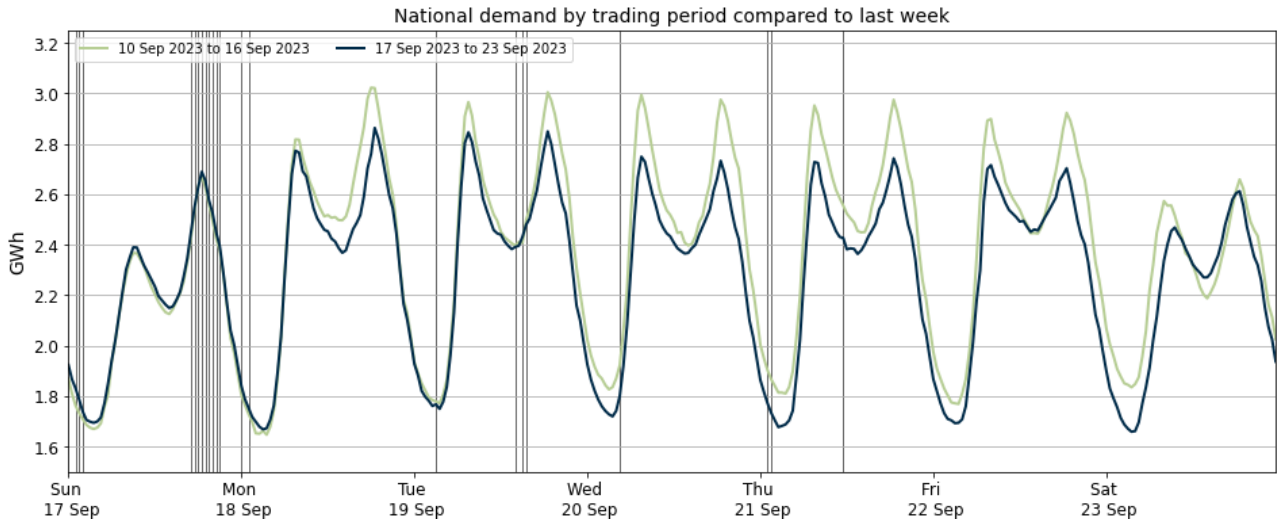
Figure 6: Residual plot of estimated daily average spot prices from 1 January 2023 - 16 September 2023



6. Demand

6.1. Figure 7 shows national demand between 17-23 September, compared to the previous week. Overall, demand during the week was significantly lower than the previous week apart from Sunday which saw slightly higher demand during the peak periods. Milder spring conditions are likely the reason for the drop in demand.

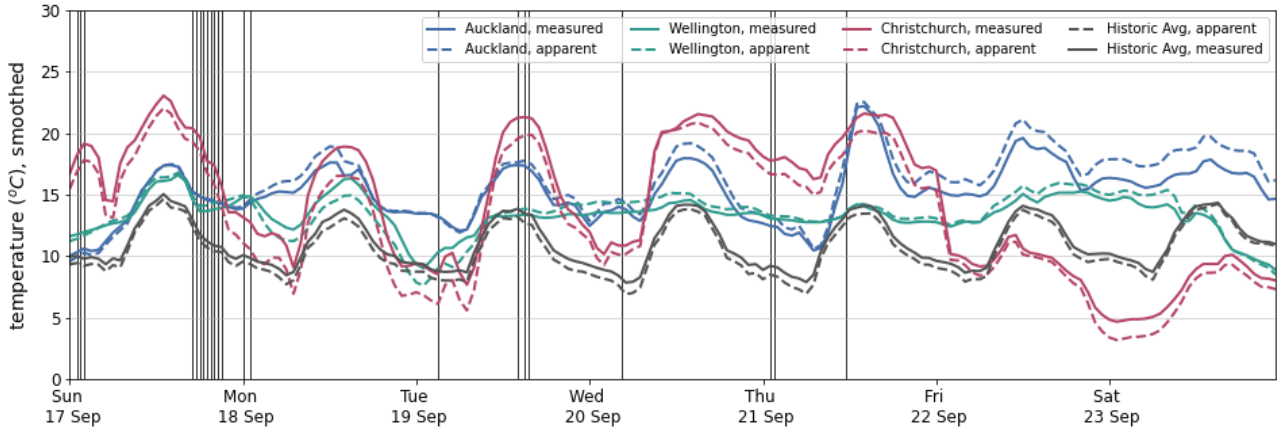
Figure 7: National demand by trading period compared to the previous week



6.2. Figure 8 shows the hourly temperature at main population centres between 17-23 September. 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.

- 6.3. Temperatures mainly sat above historic average this week with Auckland seeing temperatures mostly sitting above 15°C. Christchurch temperatures varied with some of the coldest temperatures of the week as morning apparent temperatures dropped to around 3-6°C. However, Christchurch maximum daily temperatures did go above 20°C on a few occasions. Wellington temperatures generally sat within 8-17°C.

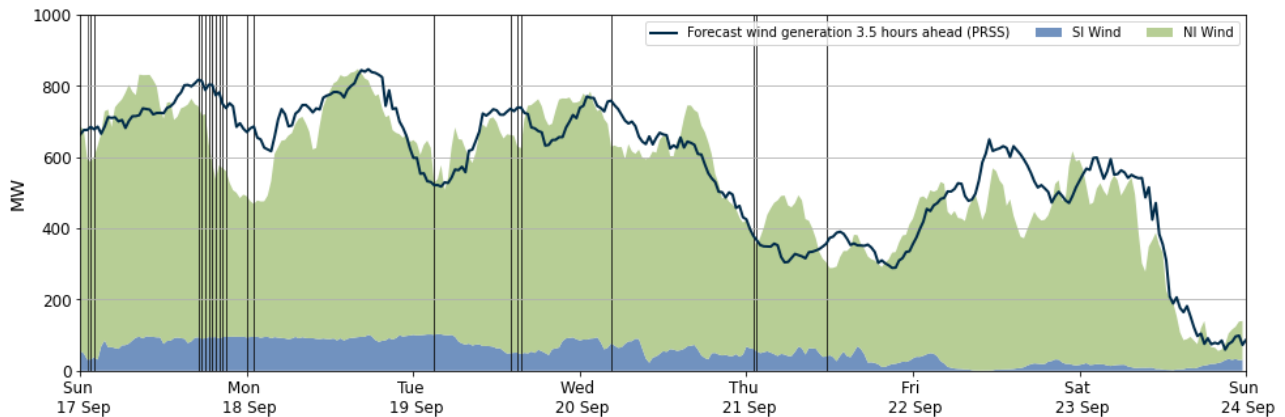
Figure 8: Temperatures across main centres



7. Generation

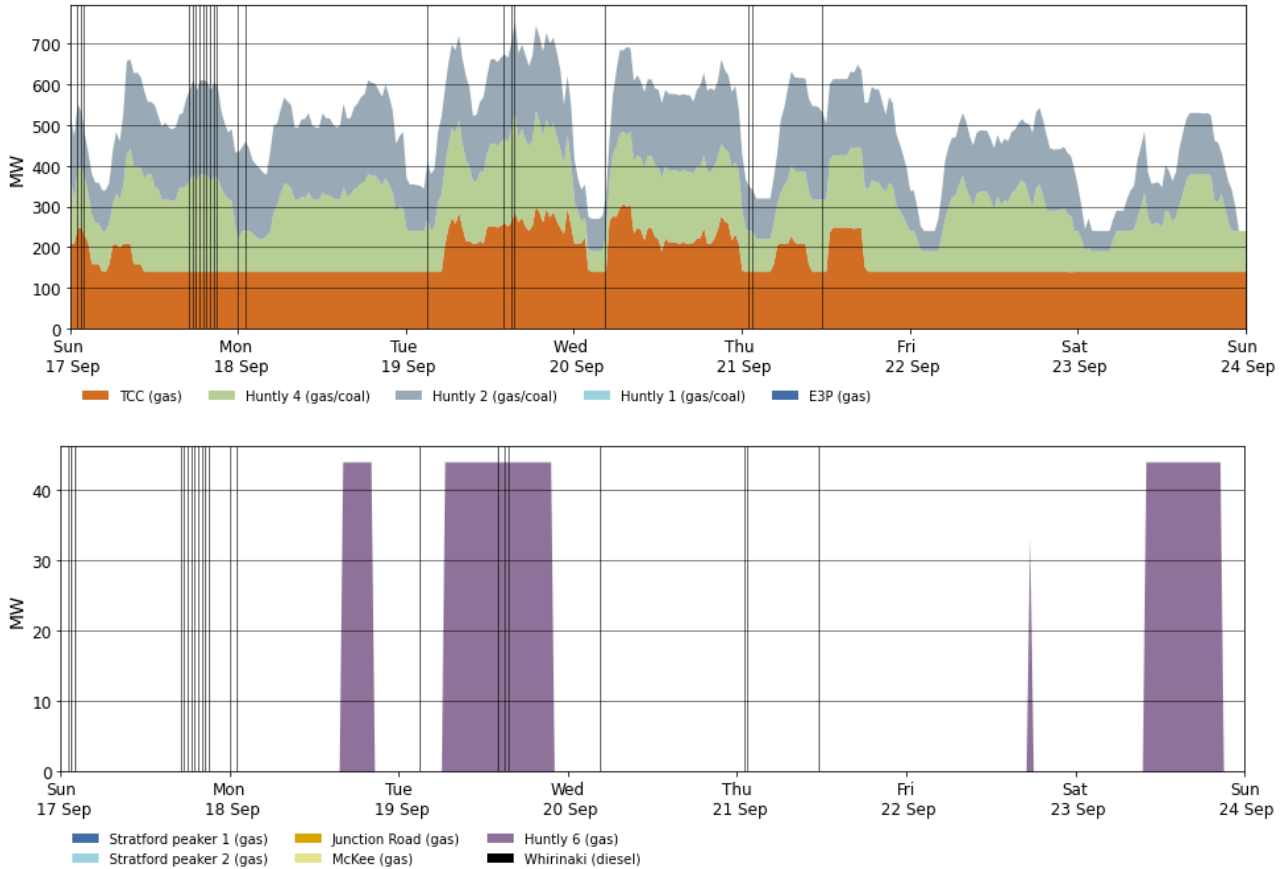
- 7.1. Figure 9 shows wind generation, from 17-23 September. This was another week of high wind generation with wind generation reaching over 800MW during some trading periods. Overall, the range of generation was between 55MW and ~850MW across the week. There were however a number of gaps in forecast and actual wind. A number of the highlighted prices this week occurred during times of under forecast wind generation.

Figure 9: Wind generation and forecast between 17-23 September



- 7.2. Figure 10 shows the generation of thermal baseload and thermal peaker plants between 17-23 September. There was lower baseload generation than the previous week with only 2 Rankines, Huntly 2 and Huntly 4, running alongside TCC.
- 7.3. Lower demand and higher wind generation saw less thermal peakers run this week with only Huntly 6 generating during the Monday evening peak, most of Tuesday, briefly on Friday, and on Saturday from around midday through the evening peak. Huntly 6 was also on outage for a couple of days this week.

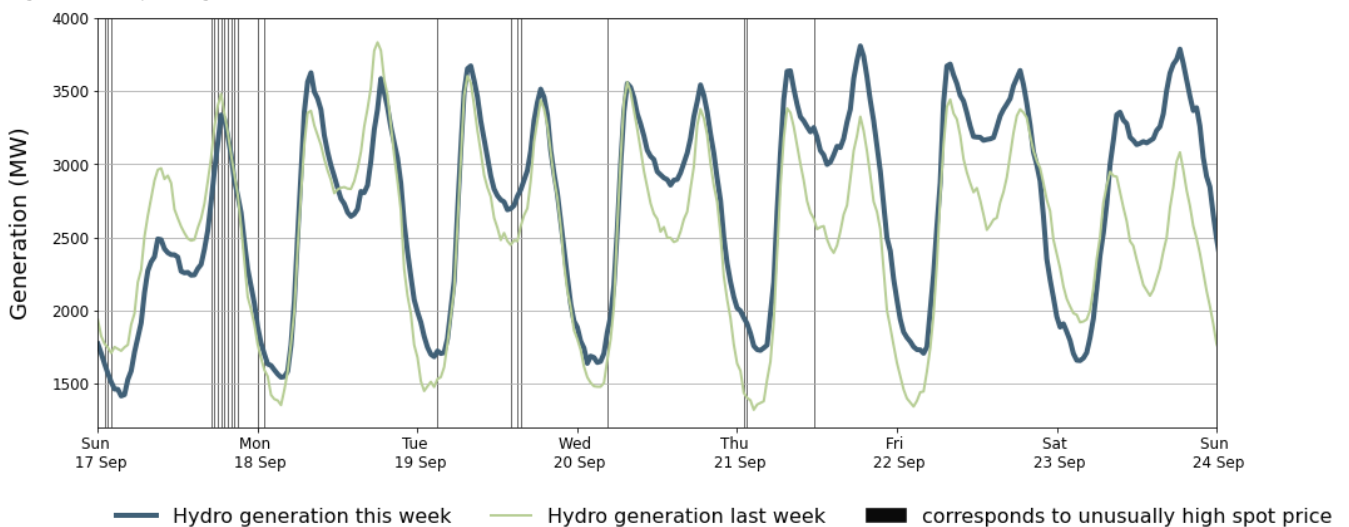
Figure 10: Thermal generation between 17-23 September



7.4. Figure 11 shows hydro generation between 17-23 September. Hydro generation was mostly similar at the beginning of the week to the previous week, with generation this week increasing from Thursday in line with some hydro generation reservoirs receiving much needed inflows (see Figure 14).

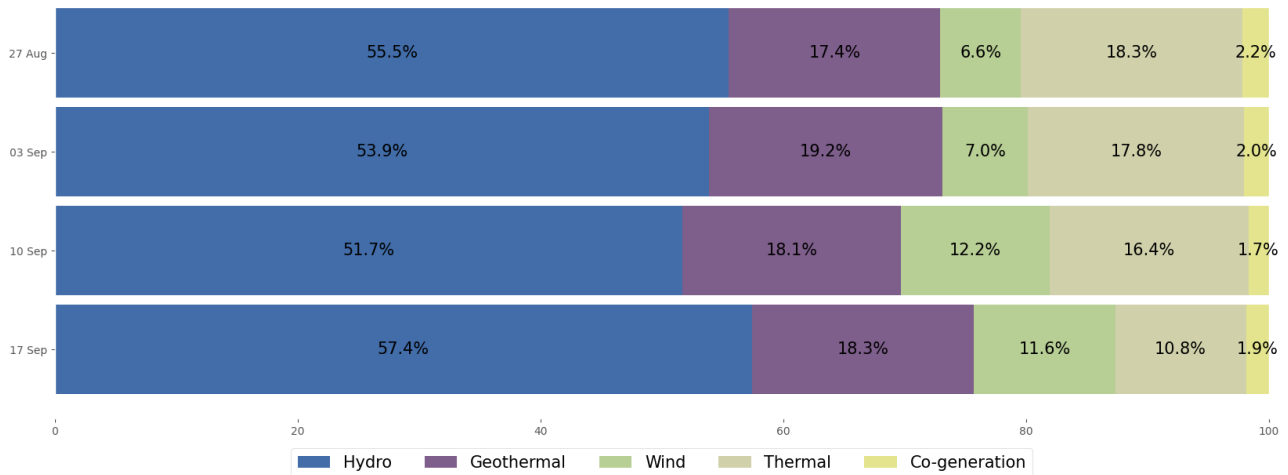
7.5. Meridian and Contact have both notified the Authority of the spill that was occurring in both Manapouri/Te Anau and Clutha areas last week due to the high volume of rainfall that fell in the South Island.

Figure 11: Hydro generation between 17-23 September compared to the previous week



7.6. As a percentage of total generation, between 17-23 September, total weekly hydro generation was 57.4%, geothermal 18.3%, thermal 10.8%, wind 11.6%, and co-generation 1.9%. High wind generation along with increased hydro saw a decrease in thermal generation this week.

Figure 12: Total generation by type as a percentage each week between 27 August and 23 September 2023



8. Outages

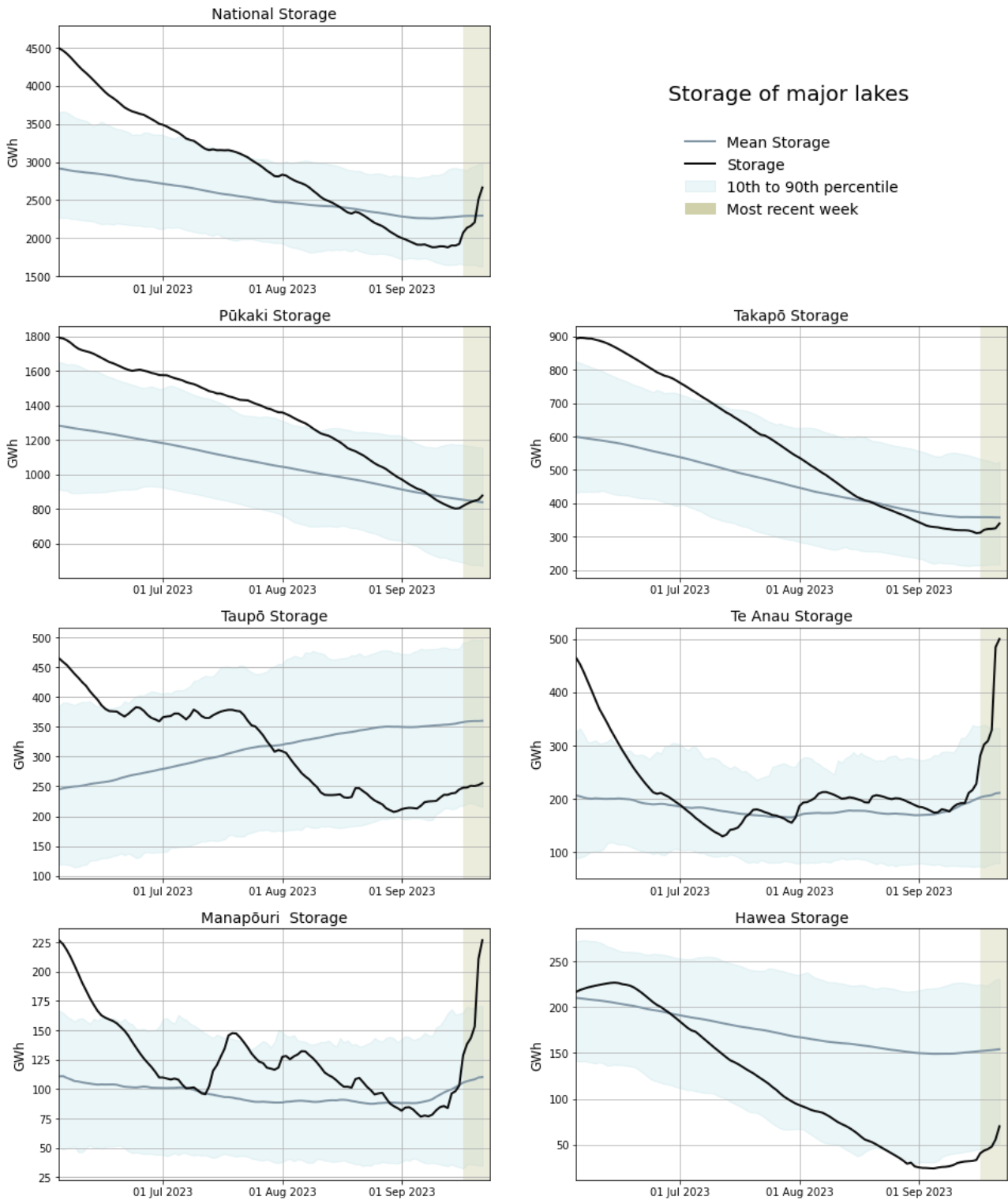
8.1. Figure 13 shows generation capacity on outage. Total capacity on outage between 17-23 September ranged between 1300MW and 1950MW.

8.2. Notable outages include:

- (a) Huntly 5 is on outage until 31 January 2024.
- (b) Huntly 1 was on outage between 18-19 September.
- (c) Stratford 1 is on outage until 1 October.
- (d) Stratford 2 is on outage until 28 February 2025.
- (e) McKee was on outage between 17-19 September.
- (f) Huntly 6 was on outage between 19-23 September.
- (g) Te Mihi geothermal unit was on outage between 19-20 September.
- (h) Various North and South Island hydro units are on outage.

9.5. High inflows into the Clutha River have also resulted in spilling from the 20 September at Roxburgh and from the 21 September at Clyde.

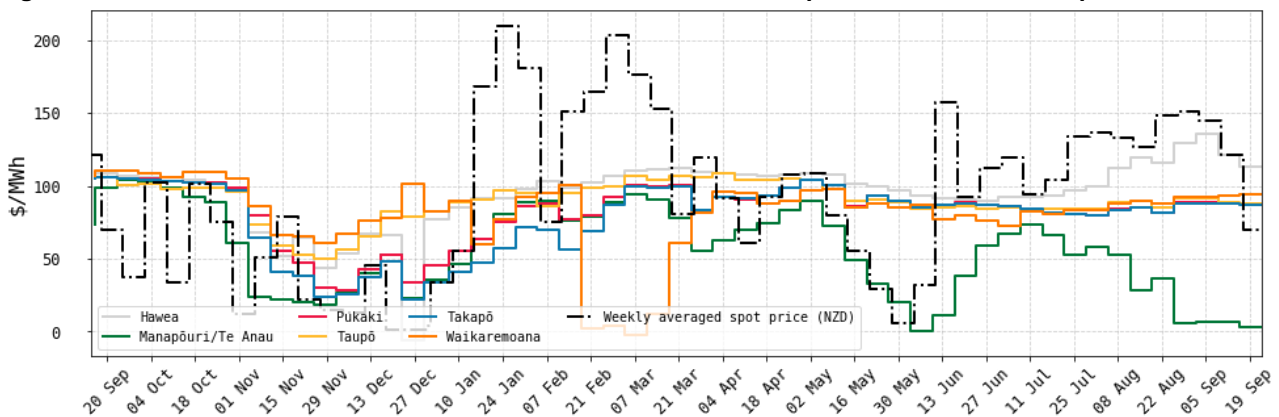
Figure 14: Hydro Storage



10. JADE water values

- 10.1. The JADE¹ 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 15 shows the national water values between 15 September 2022 and 23 September 2023 obtained from JADE calculated as at the start of the week. These values are used to estimate the marginal water value at the actual storage level. More details on how water values are calculated can be found in [Appendix B](#).
- 10.2. Manapōuri/Te Anau values remain low at ~\$3/MWh with increased inflows over the last couple of weeks. Hawea has had some inflows over the last week and its water values have decreased to ~\$113/MWh. All other water values remained relatively steady.

Figure 15: JADE water values across various reservoirs between 15 September 2022 and 16 September 2023



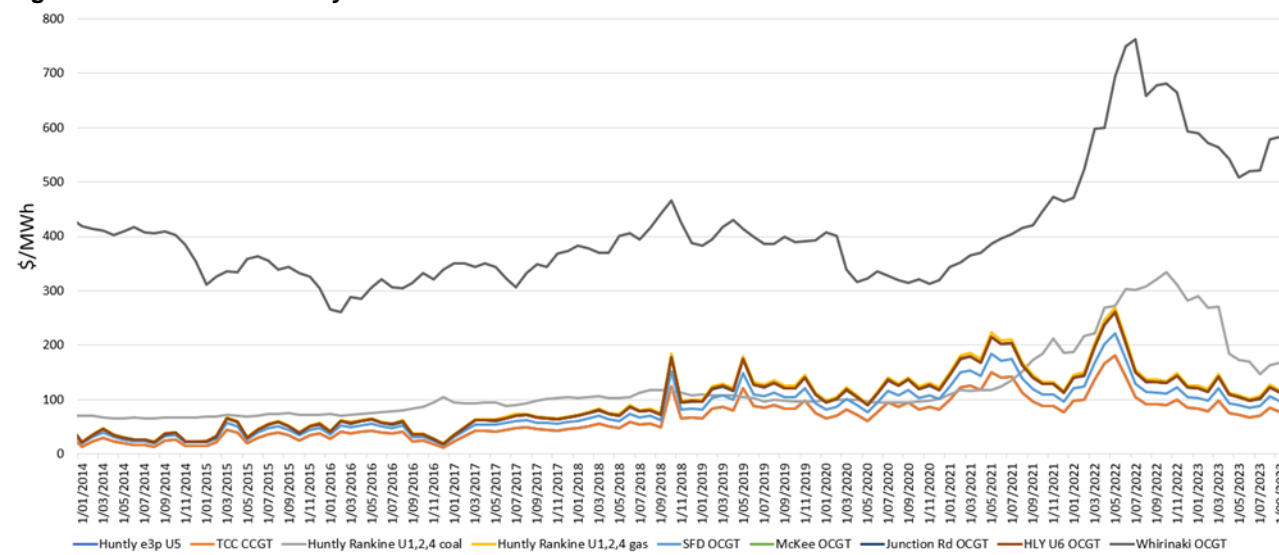
11. Prices versus estimated costs

- 11.1. 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).
- 11.2. The SRMC (excluding opportunity cost of storage) for thermal fuels is 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.
- 11.3. Figure 16 shows an estimate of thermal SRMCs as a monthly average up to 1 September 2023. The SRMC of diesel plants has been increasing since May, and the SRMC of coal-fuelled plants has started to increase again, with gas-fuelled plants continuing to decrease slightly. An increase in carbon prices has contributed to the increase in the diesel and coal fired plant SRMCs, while a reduction in gas prices has curtailed this increase in gas plant SRMCs.
- 11.4. The latest SRMC of coal-fuelled Huntly generation is ~\$168/MWh. With two or three Rankines often running simultaneously this winter, Genesis has been using more coal recently.

¹ 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.

- 11.5. The SRMC of Whirinaki has increased to ~\$583/MWh.
- 11.6. The SRMC of gas fuelled thermal plants is currently between \$78/MWh and \$116/MWh.
- 11.7. More information on how the SRMC of thermal plants is calculated can be found in [Appendix C](#) on the trading conduct webpage. This appendix was recently updated to reflect the changes made to coal price indices by the Indonesian government. These changes have had the effect of decreasing the coal SRMC from April 2023.

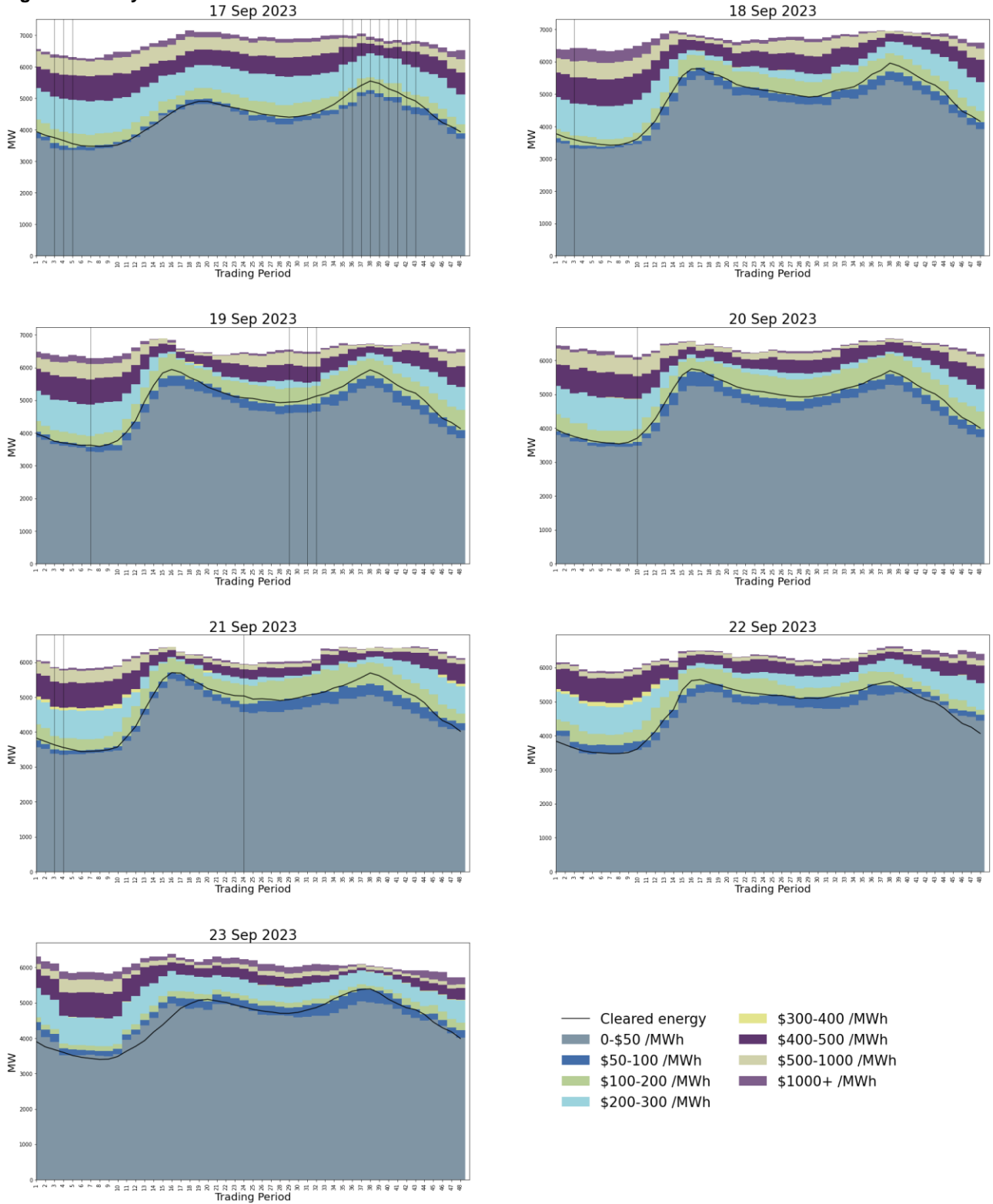
Figure 16: Estimated monthly SRMC for thermal fuels



12. Offer behaviour

- 12.1. Figure 17 shows this week's national daily offer stacks. The black line shows cleared energy, indicating the range of the average final price.
- 12.2. Currently the \$50-\$100/MWh offer band is thin compared to the \$100-\$200/MWh offer band. Therefore, the majority of offers cleared in the \$100-\$200/MWh price range.
- 12.3. On Sunday, wind generation was over forecasted, and as a result high offer tranches were dispatched. However, on Saturday, despite low wind generation which was also over forecasted, high hydro generation kept prices low.
- 12.4. The Authority's monitoring team is looking further into some high hydro offers during spilling in the South Island.

Figure 17: Daily offer stacks



13. Ongoing work in trading conduct

13.1. This week, prices generally appeared to be consistent with supply and demand conditions.

13.2. 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	Participant	Location	Enquiry topic
07/10/2022	15-16	Further analysis	Genesis	Huntly 5	Prices change for final energy tranche.
15/1/2023 - 4/2/2023	Several	Further analysis	N.A.	Multiple	High energy prices associated with high hydro offers.
13/06/2023	14-16	Further Analysis	Genesis	Takapō	Offer changes.
14/06/2023	15-17	Further Analysis	Genesis	Multiple	High energy prices associated with high energy offers.
15/06/2023	15-19	Further Analysis	Genesis and Contact	Multiple	High energy prices associated with high energy offers.
22/09/2023-(ongoing)	Several	Further analysis	Contact	Multiple	High hydro offers.