

Date: 10 July 2023



TRADING CONDUCT REPORT

Market Monitoring Weekly Report

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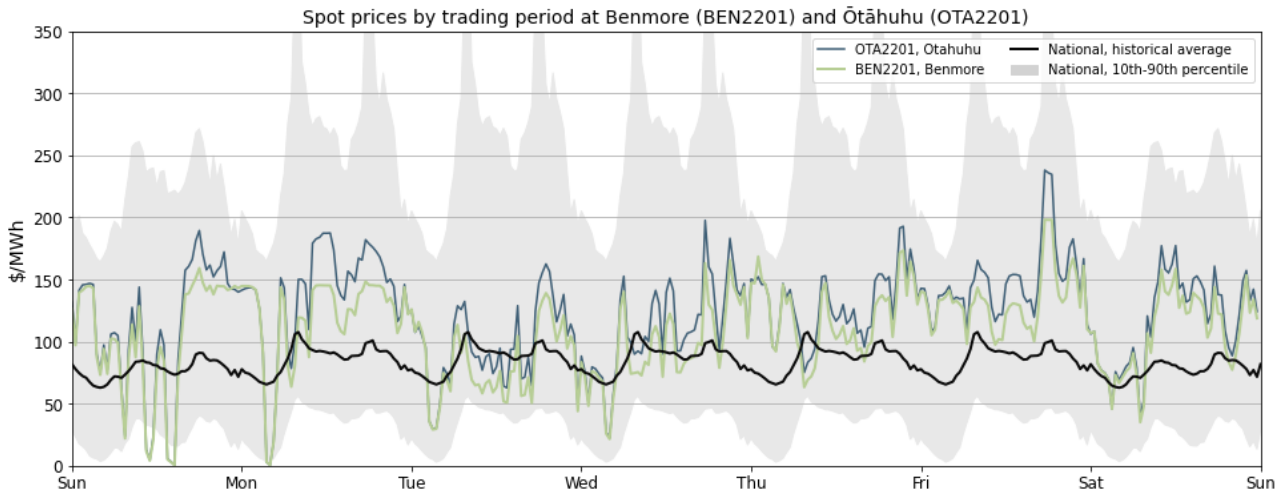
1. Overview for week of 2 – 8 July 2023

- 1.1. This week, prices remained close to the historical average, with similar volatility to the previous week and low reserve prices. The northward flow of HVDC remained well below its maximum limit, while some southward HVDC flows were observed overnight. Hydro generation declined from last week as storage continues to decrease. An unplanned outage of Huntly 5 (E3P) last Friday necessitated the support of three Rankines, and TCC also started generating to support baseload. At the beginning of the week, thermal peakers ran to meet the high demand resulting from low temperatures.

2. Spot Prices

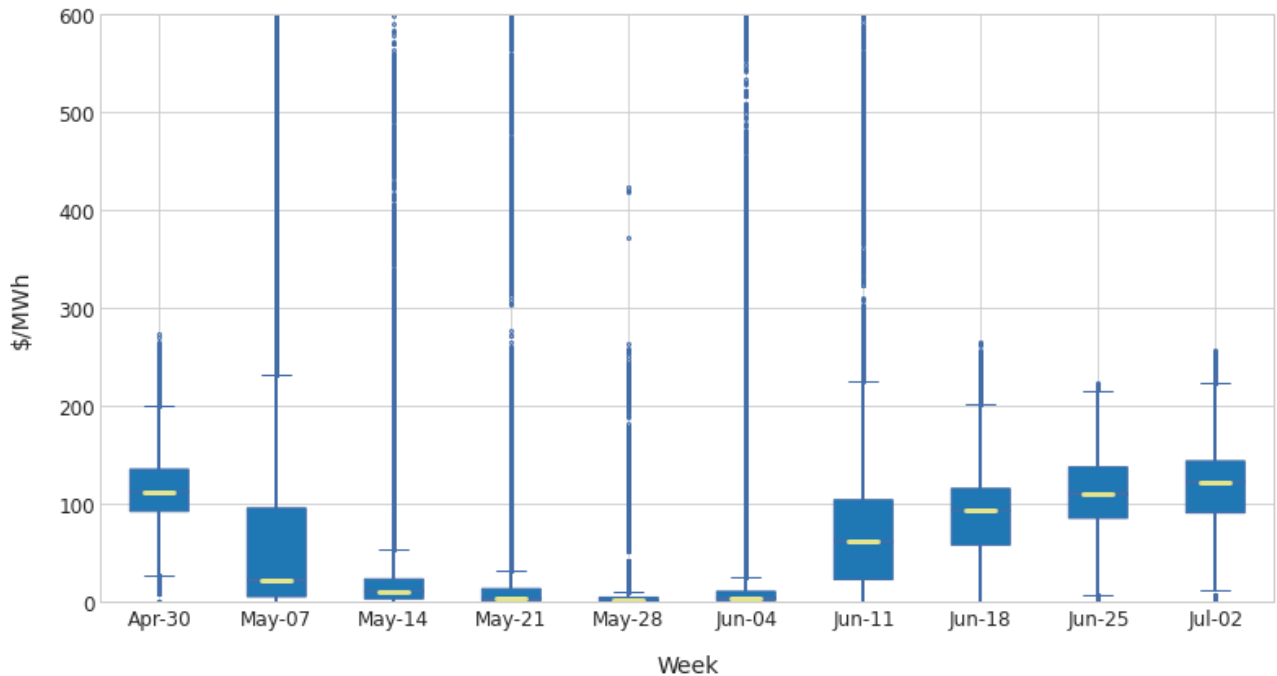
- 2.1. This report monitors underlying wholesale price drivers to assess whether trading periods require further analysis to identify potential non-compliance with the trading conduct rule. In addition to general monitoring, we also single out unusually high-priced individual trading periods for further analysis by identifying when wholesale electricity spot prices at any node exceed their historical 90th percentiles. Prices above the historic 90th percentile are highlighted with a black line. Other notable prices, but which did not exceed the 90th percentile, are marked with black dashed lines.
- 2.2. Between 2 – 8 July:
 - a) The average wholesale spot price across all nodes was \$116/MWh.
 - b) 95 percent of prices fell between \$21/MWh and \$180/MWh.
- 2.3. Figure 1 shows spot prices at Benmore and Ōtāhuhu alongside their historic average and historic 10th - 90th percentiles adjusted for inflation.
- 2.4. Prices hovered again this week around the historic average and price volatility was not significant compared to May and early June with no prices observed above the 90th percentile.
- 2.5. Overall, most spot prices ranged between \$100/MWh and \$150/MWh, with the exception of Friday evening between 5:30 pm and 6:00 pm at Ōtāhuhu, where prices exceeded \$200/MWh. The average prices are indicative of the decrease in hydro storage and reduced inflows observed during the last two weeks of June.
- 2.6. There were some low prices under \$5/MWh and below the historic 10th percentile during the shoulder period on Sunday, where demand was lower and wind generation was high. Overnight prices on Monday also dipped close to the 10th percentile when wind generation was over forecast.

Figure 1: Wholesale Spot Prices between 2 July (Sunday) – 8 July (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. This week, the median and quartile prices were slightly higher than last week, as hydro storage declined, and prices rose closer to the long-term average. Additionally, there were no exceptionally high prices this week.

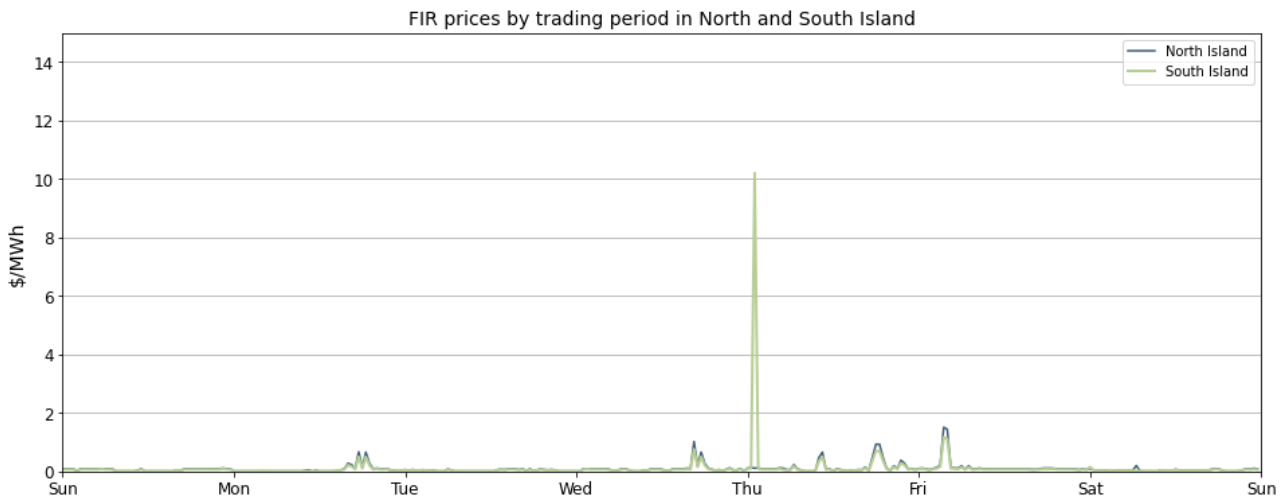
Figure 2: Boxplots showing the distribution of spot prices this week and the previous nine weeks.



3. Reserve Prices

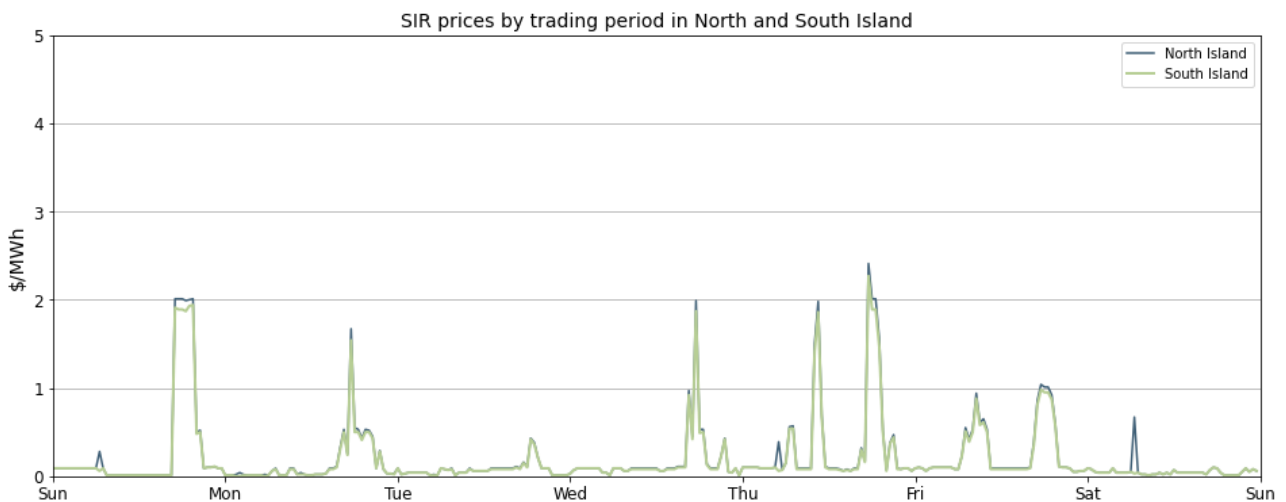
3.1. Fast Instantaneous Reserve (FIR) prices for the North and South Islands are shown below in Figure 3. This week the FIR prices were below \$2/MWh for both islands, except on Thursday, 6 July at 1:00 am when the North Island price was \$10/MWh, with the South Island price of \$0.1/MWh. In recent weeks, E3P was risk setter but as it is currently on outage the amount of reserve needed to cover the largest risk has been lower, which may have contributed to lower reserve prices.

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. SIR prices were below \$3/MWh this week, with no price spikes.

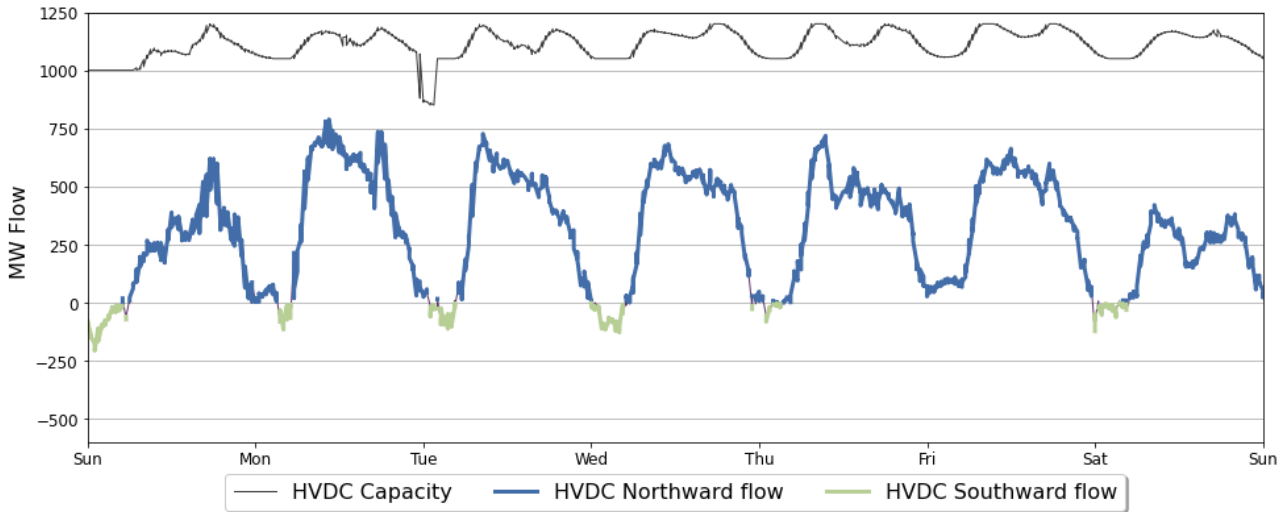
Figure 4: Sustained instantaneous reserve (SIR) prices by trading period and Island.



4. HVDC

4.1. Figure 5 shows HVDC flow between 2 – 8 July. HVDC flows were northward during daytime and southward during nighttime except on Friday due to low wind generation. The northward HVDC flow reached a peak of up to 790 MW during the daytime, while the southward flow during nighttime remained below 250 MW.

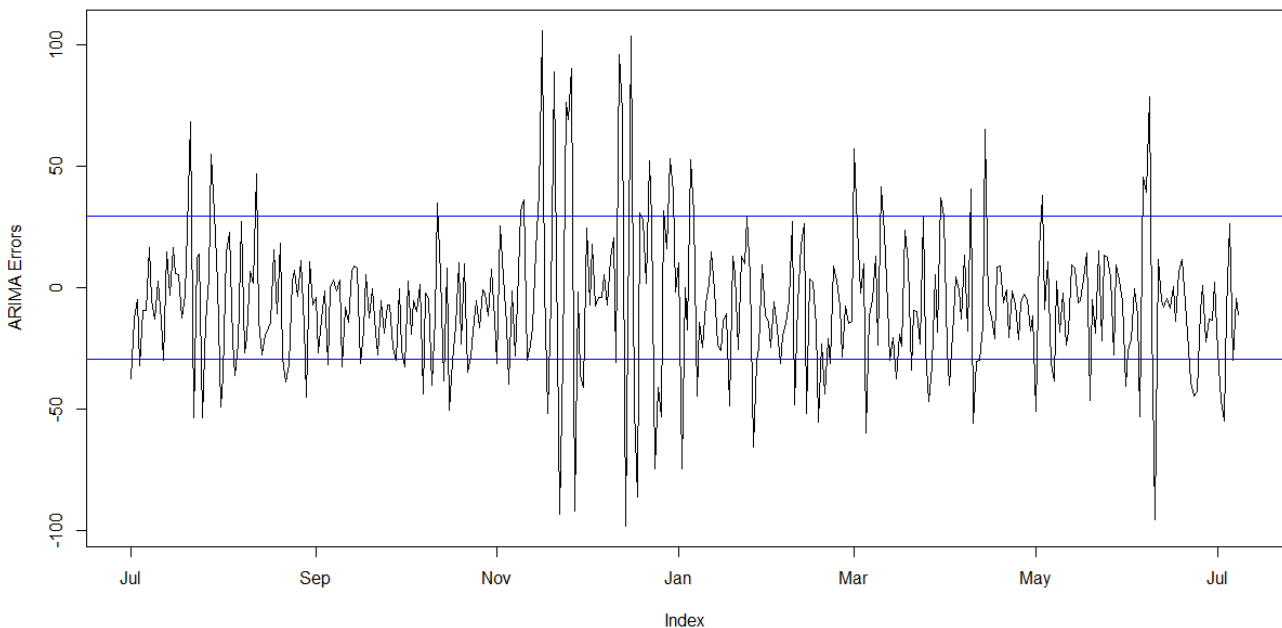
Figure 5: HVDC northward flow and capacity.



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. Residuals were mostly relatively small, suggesting that average daily prices on those dates appear to be largely aligned with market conditions. These small deviations reflect market variations that may not be controlled for in the regression analysis. This week, there was one residual below the one standard deviation on Sunday indicating that the modelled price was higher than the actual prices on that day.

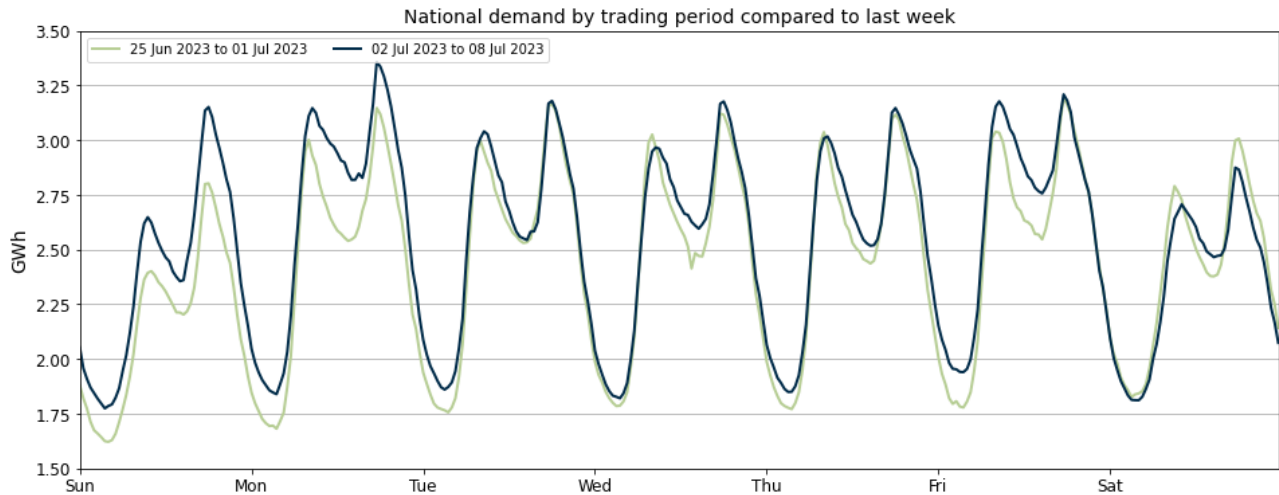
Figure 6: Residual plot of estimated daily average spot prices from 1 July 2022 – 8 July 2023. The blue lines show two standard deviations of the ARMA errors.



6. Demand

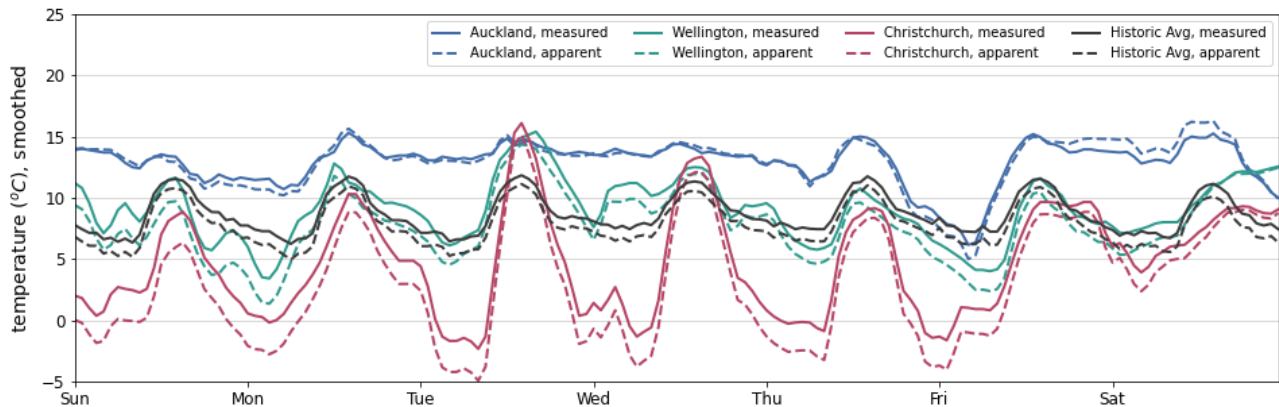
- 6.1. Figure 7 shows national grid demand between 2 – 8 July, compared to the previous week. Overall, demand was similar mid-week to the previous week. On Sunday and Monday, demand significantly rose in line with cooler weather conditions nationwide. The highest peak demand of the week was observed on Monday evening. On Friday, demand during the morning peak was higher compared to the previous week, as temperatures cooled especially in northern regions like Auckland, with temperatures reaching around 5 degrees. However, on Saturday, there was a slight decrease in demand.

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



- 6.1. Figure 8 shows hourly temperatures at the three main population centres between 2 – 8 July. 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.
- 6.2. Temperatures in Auckland were mainly above average and above 10 degrees except for Friday morning. Wellington temperatures were mostly around the historic average for most of the week with Monday and Friday morning dropping below 5 degrees. Christchurch saw the most variation in temperatures where most mornings dipped below 0 degrees with apparent temperatures ranging from -5 degrees to 16 degrees.

Figure 8: Temperatures across main centres.



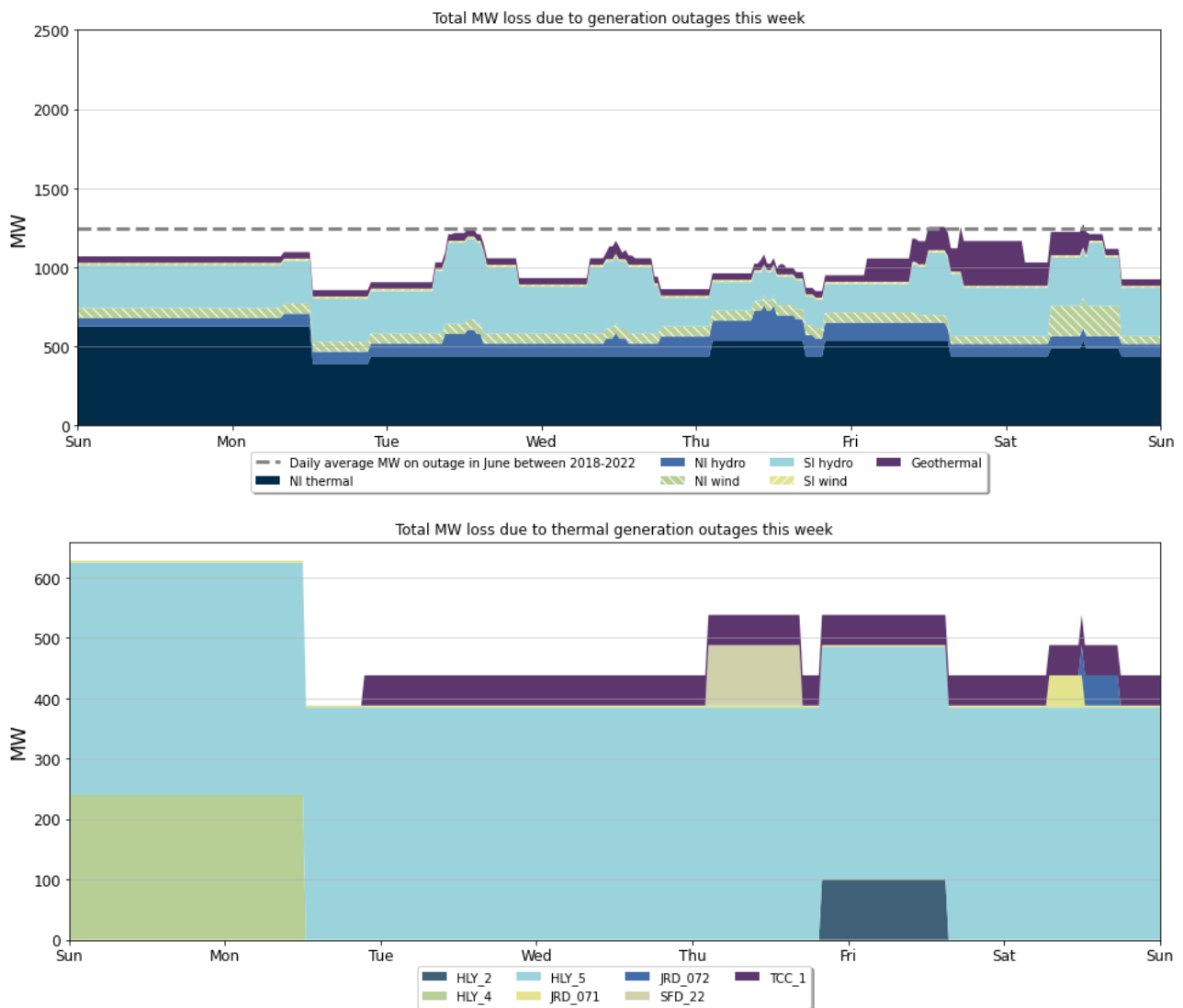
7. Outages

7.1. Figure 9 shows generation capacity on outage. Total capacity on outage between 2 – 8 July ranged between ~800 MW and 1250 MW.

7.2. Notable outages include:

- (a) Huntly 5 is on outage from 30 June to midnight 31 July.
- (b) Huntly 4 was on outage between 1-3 July.
- (c) Huntly 2 was on short outage between Thursday and Friday.
- (d) Kawerau geothermal was on outage between 7-8 July.
- (e) Various North and South Island hydro units remain on outage.
- (f) West Wind is partly on outage until 24 November.

Figure 9: Total MW loss due to generation outages.

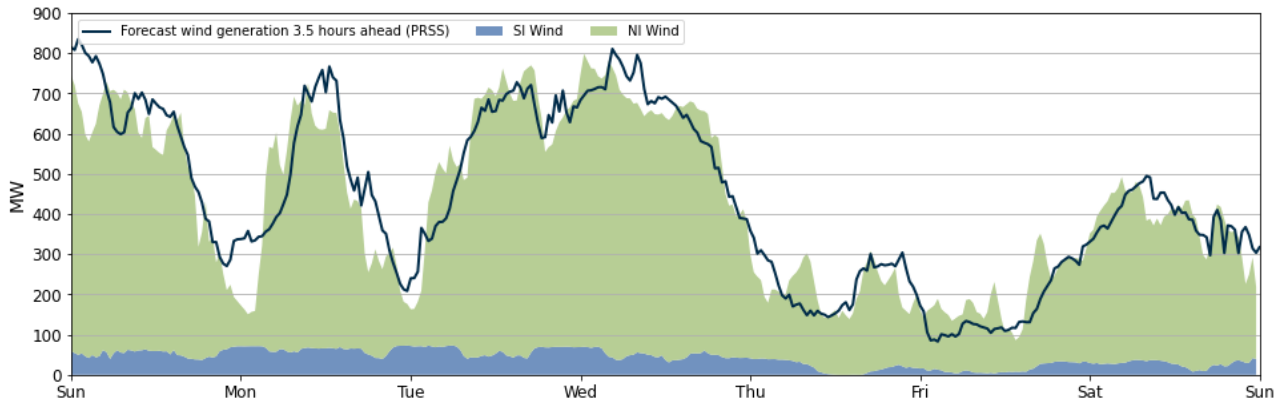


8. Generation

8.1. Figure 10 shows wind generation, from 2 – 8 July, ranged from 85 - 800 MW across the week. At the beginning of the week, wind generation reached a peak of approximately 700

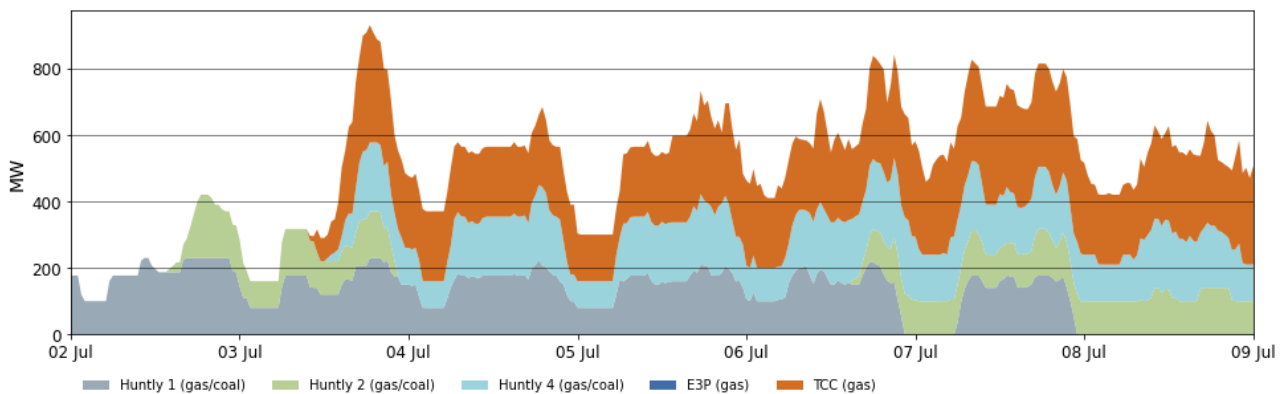
MW and then dropped to below 200 MW overnight on Monday and Tuesday. During daytime, wind generation picked up again and remained around 700 MW. As the week progressed, wind generation gradually decreased, reaching mostly below 300 MW on Thursday and Friday. However, on Saturday, wind generation stabilized around 400 MW.

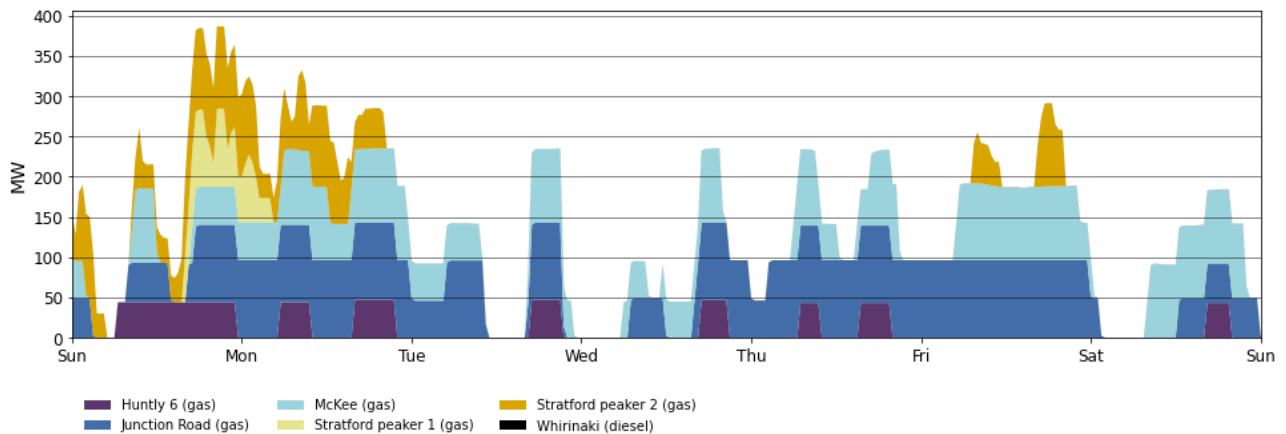
Figure 10: Wind Generation and forecast.



- 8.2. Figure 11 shows the generation of thermal baseload and thermal peaker plants between 2 – 8 July. E3P (Huntly 5) remains on outage, with Huntly cycling the three Rankine units on and off to support baseload requirements. TCC was brought online and has run continuously as baseload from late Monday morning.
- 8.3. Huntly 1 ran as a baseload from Sunday to Thursday, and on Friday to support the load as the wind generation was low. Furthermore, TCC and Huntly 4 run as a baseload from Monday to Saturday. Huntly 2 ran in support on Sunday afternoon and Monday, and from Thursday afternoon till Sunday as well.
- 8.4. Stratford 1 ran during the Sunday evening peak till the Monday morning peak, with Stratford 2 ran from Sunday to Monday and then again during the Friday peaks. Junction Road ran in some continuous blocks from Sunday afternoon to Tuesday around midday and then again from Wednesday afternoon through Friday. McKee has mainly covered the daily peaks, and also ran continuously on some days. Huntly 6 ran during the peak demand periods except on Friday.

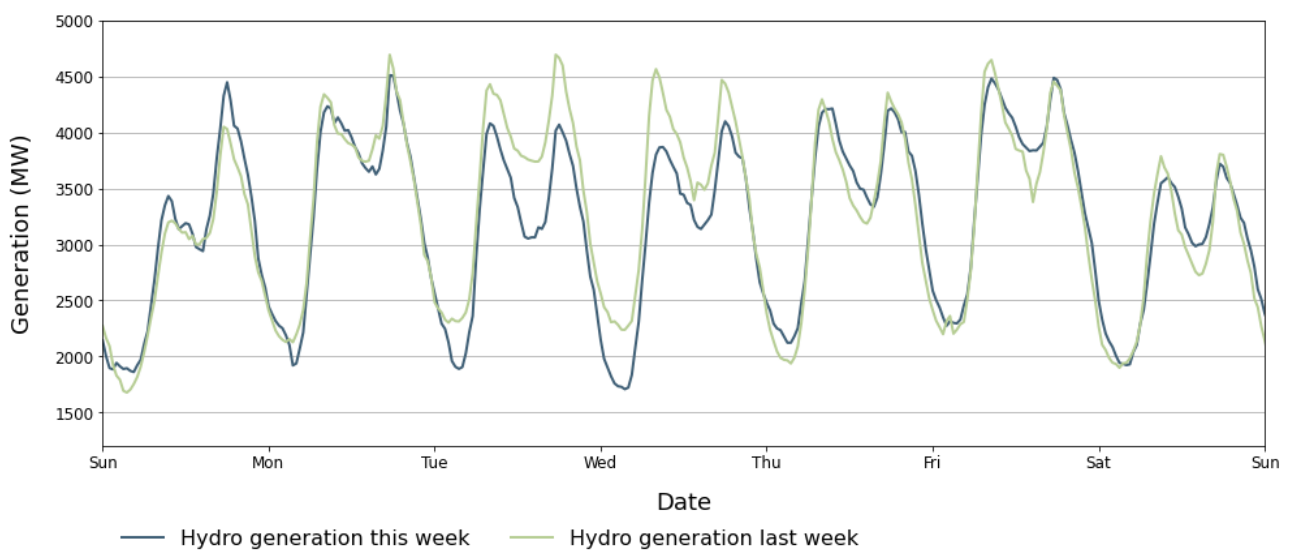
Figure 11: Thermal Generation.





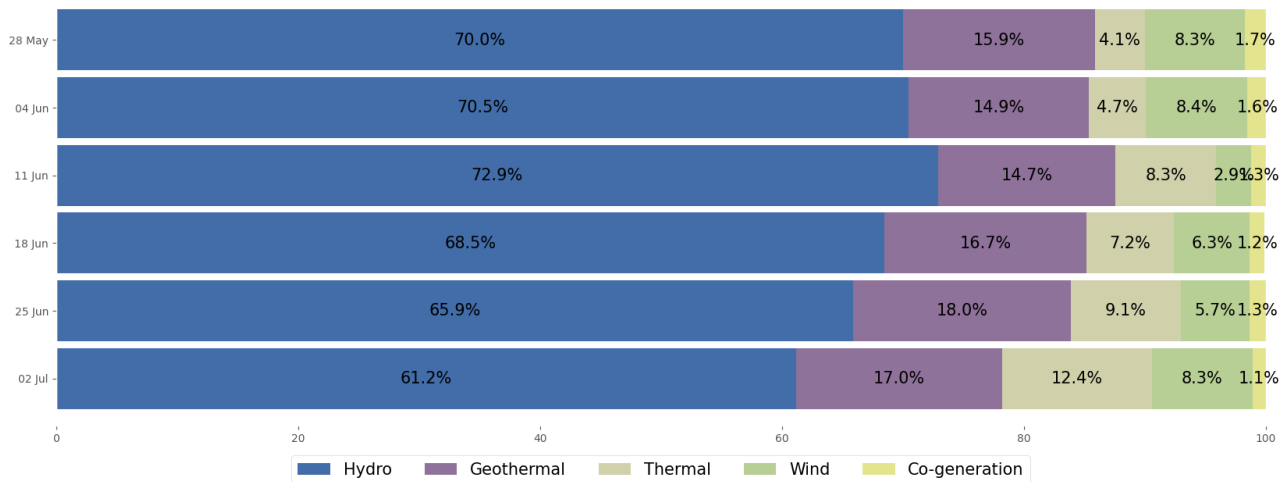
8.5. Figure 12 shows hydro generation between 2 – 8 July. Overall, hydro generation decreased compared to the previous week due to decreased storage. On Sunday evening, hydro generation was notably high due to increased demand. However, hydro generation experienced a significant decrease between Tuesday and Wednesday, most likely due to the presence of high wind generation. From Thursday to Saturday, hydro generation remained relatively constant, with a slight decrease during the morning peak periods.

Figure 12: Hydro generation between 2 – 8 July compared to the previous week.



8.6. As a percentage of total generation, between 2 – 8 July, total weekly hydro generation was 61.2 percent, geothermal 17 percent, thermal 12.4 percent, wind 8.3 percent, and co-generation 1.1 percent. There has been a notable increase in thermal generation compared to the previous few weeks. This rise can be attributed to relatively lower hydro generation and an increase in demand.

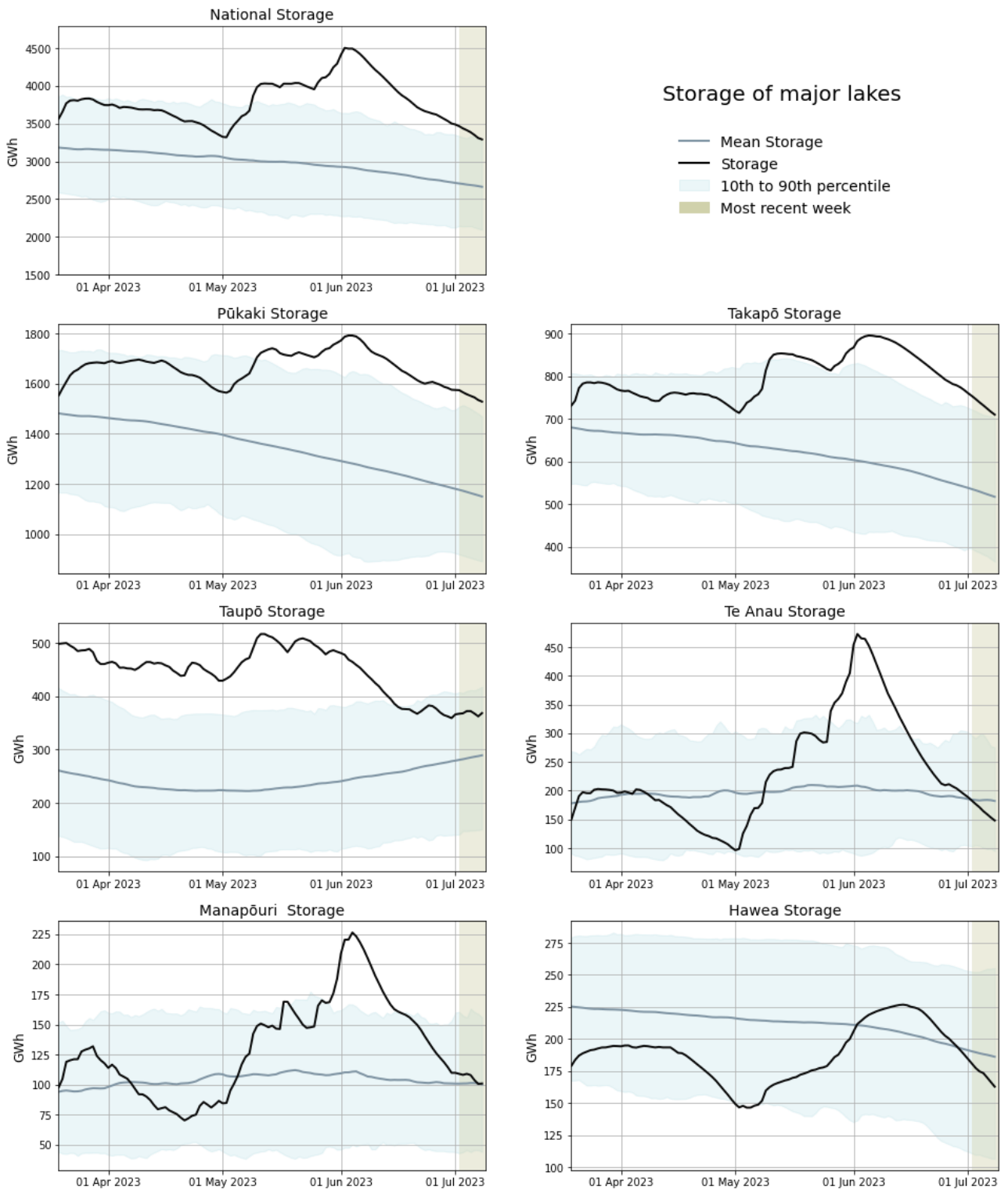
Figure 13: Total generation as a percentage each week between 28 May and 8 July 2023.



9. Storage/Fuel Supply

- 9.1. Figure 14 shows total controlled national hydro storage as well as the storage of major catchment lakes including their historical mean and 10th to 90th percentiles.
- 9.2. National hydro storage levels have decreased this week to 79.7 percent of nominal full as of 8 July. However national controlled storage is still high at 119.5 percent of the historic mean for this time of year.
- 9.3. During this week, the majority of lake levels experienced a decline. Lakes Pūkaki and Takapō have been steadily decreasing, although they still remain above their 90th percentiles. The most significant drop in lake levels was observed at Manapōuri and Te Anau, with Te Anau falling below its historical average. The storage level at Taupō is slightly below its historical 90th percentile. Furthermore, Hawea storage also decreased and is currently below its historic mean for this time of year.

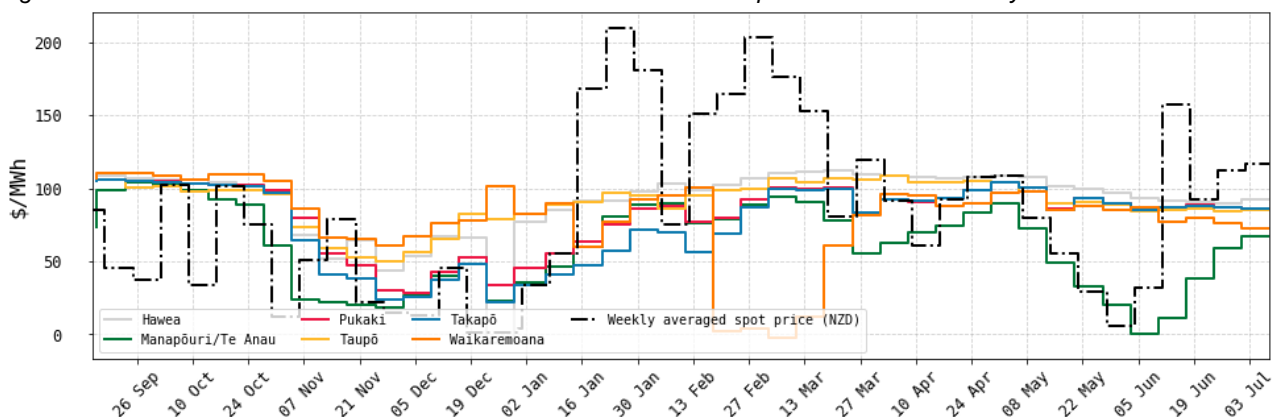
Figure 14: Hydro Storage.



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 8 July 2023 using values obtained from JADE. 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. Recently the water values in most of the lakes remained relatively steady. Water values at Lake Waikaremoana have been decreasing over the past few weeks as storage increased. Conversely, the water values at Te Anau and Manapōuri have been increasing in recent weeks due to a substantial decrease in storage.

Figure 15: JADE water values across various reservoirs between 15 September 2022 and 8 July 2023.



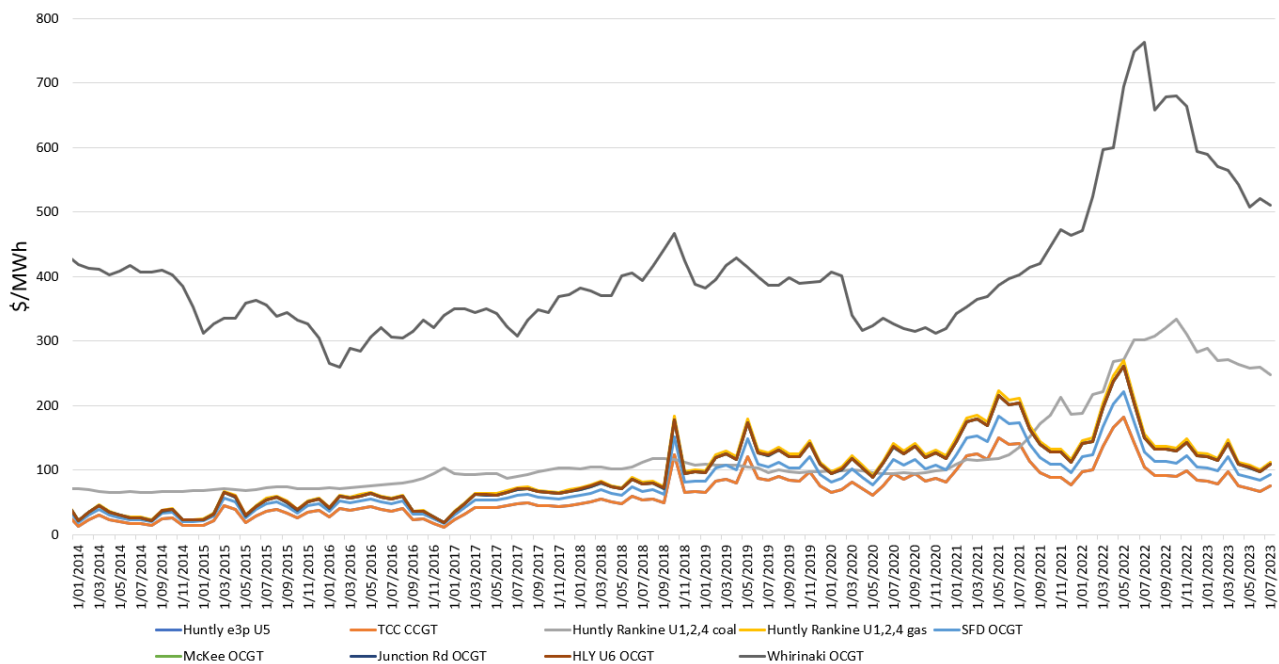
11. Prices versus estimated costs

- 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 July 2023. The SRMC of diesel plants has significantly decreased from March, and the SRMC of gas-fuelled and coal plants has also slightly decreased. A reduction in carbon prices has contributed to the decline in SRMCs.
- 11.4. In early July, Indonesian coal at around ~\$456/tonne (NZD) putting the latest SRMC of coal-fuelled Huntly generation at ~\$247/MWh.
- 11.5. The SRMC of Whirinaki has decreased to ~\$511/MWh.
- 11.6. The SRMC of gas fuelled thermal plants increased slightly and is between \$75/MWh and \$113/MWh, likely due to an increase in thermal generation.

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.

11.7. More information on how the SRMC of thermal plants is calculated can be found in [Appendix C](#) on the trading conduct webpage.

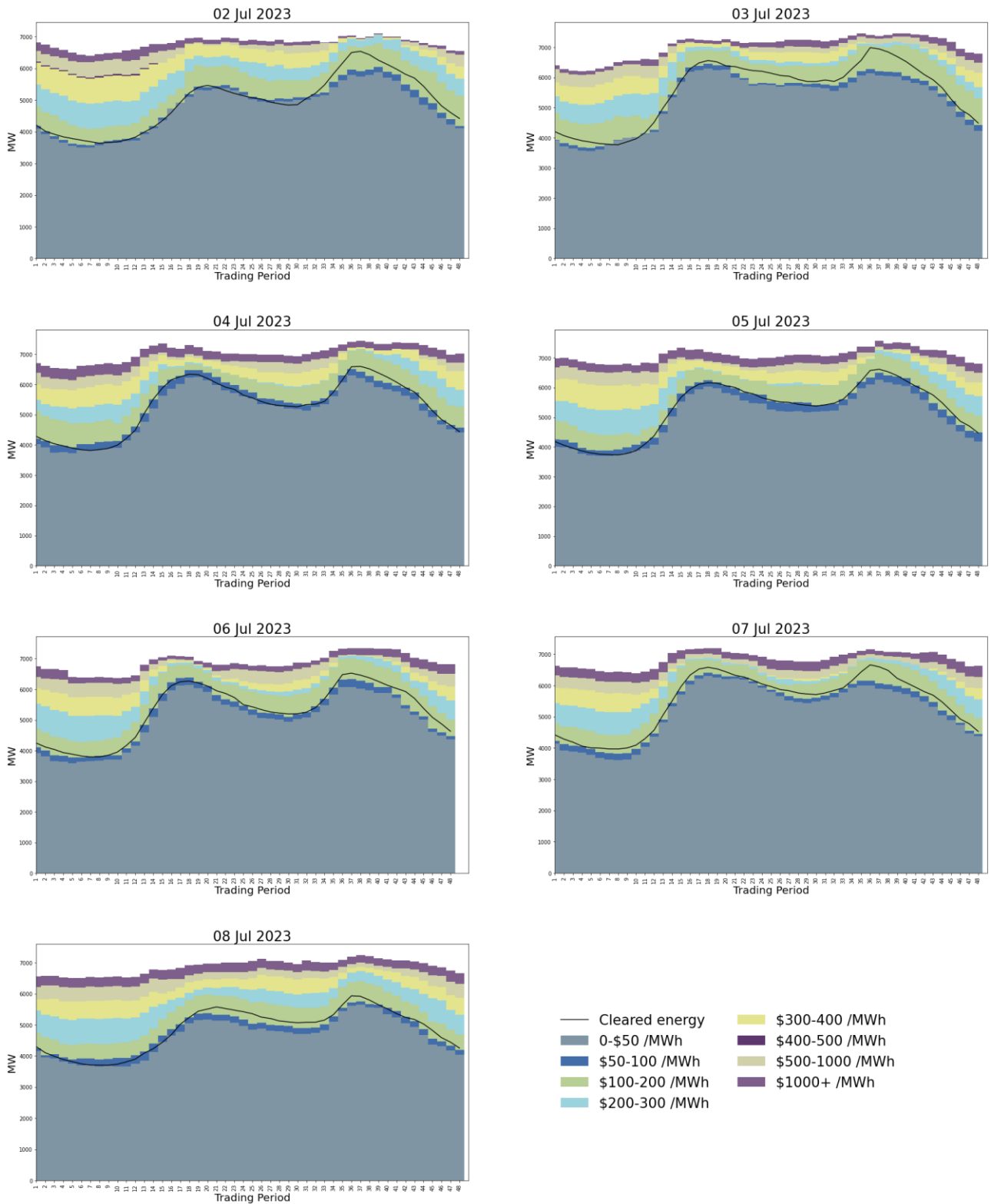
Figure 16: Estimated monthly SRMC for thermal fuels.



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. Throughout this week, the generation offered in the price range of \$100-\$200/MWh continued to rise, as compared to early June. However, the amount of generation offered between \$50-\$100/MWh decreased over the week, while more generation was made available in the \$100-\$200/MWh range. This increase in generation at higher price bands is probably a result of a decline in hydro storage. On Monday evening, due to the high demand, a significant amount of generation was offered between \$100-\$200/MWh into the market.
- 12.3. On Sunday, the majority of energy cleared within the range of \$0 to \$100/MWh. However, during the evening peak, energy also cleared in the \$100 to \$200/MWh band. Between Tuesday and Wednesday, there was an uptick in the generation cleared within the \$50-\$200/MWh range, which can be attributed to a decline in wind generation. On Thursday, the increased wind generation led to more offers being cleared between \$50-100/MWh, with higher prices observed during the evening peak. On Saturday, prices typically cleared within the range of \$100-200/MWh.

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.
18/05/2023	Several	Further Analysis	Contact	Multiple	Market conditions which led to higher off-peak prices.
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.