

Date: 3 July 2023



TRADING CONDUCT REPORT

Market Monitoring Weekly Report

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1. Overview for week of 25 June – 1 July 2023

1.1. Prices throughout the week remained close to the historical average and with reduced volatility compared to the first half of June. Hydro generation declined from last week as storage continues to decrease, though northward flow across the HVDC was still high. At the beginning of the week, thermal peakers ran to meet demand during periods of low wind. The high northward flow of HVDC remained well below its maximum limit. Furthermore, an unplanned outage of Huntly 5 (E3P) on Friday prompted increased utilization of peaker plants to support baseload.

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 25 June – 1 July:

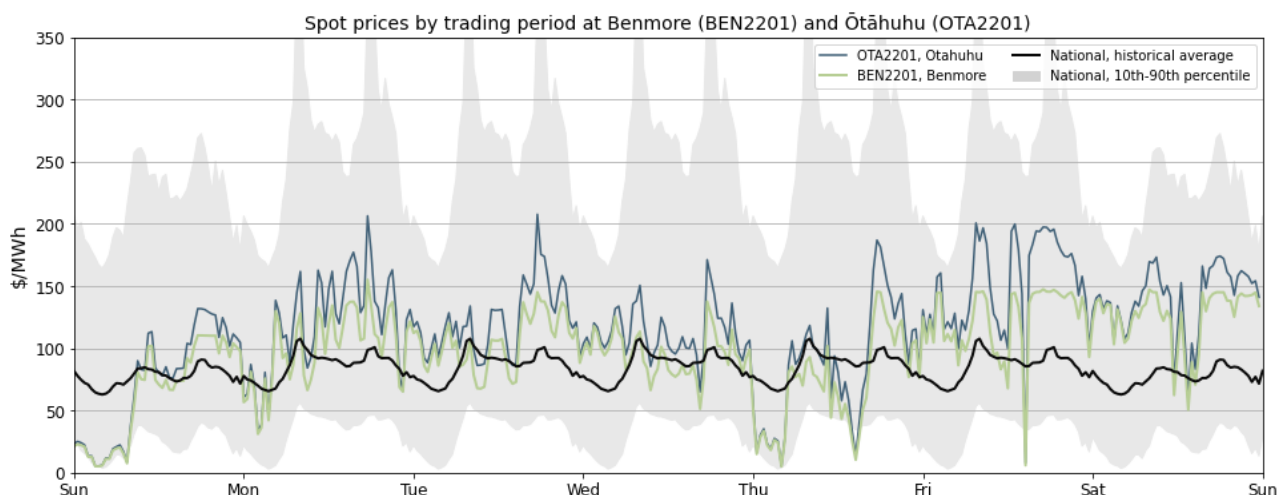
- a) The average wholesale spot price across all nodes was \$106/MWh.
- b) 95 percent of prices fell between \$12/MWh and \$175/MWh.

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 around the historic average and price volatility was not significant compared to May and early June with no prices observed above the 90th percentile.

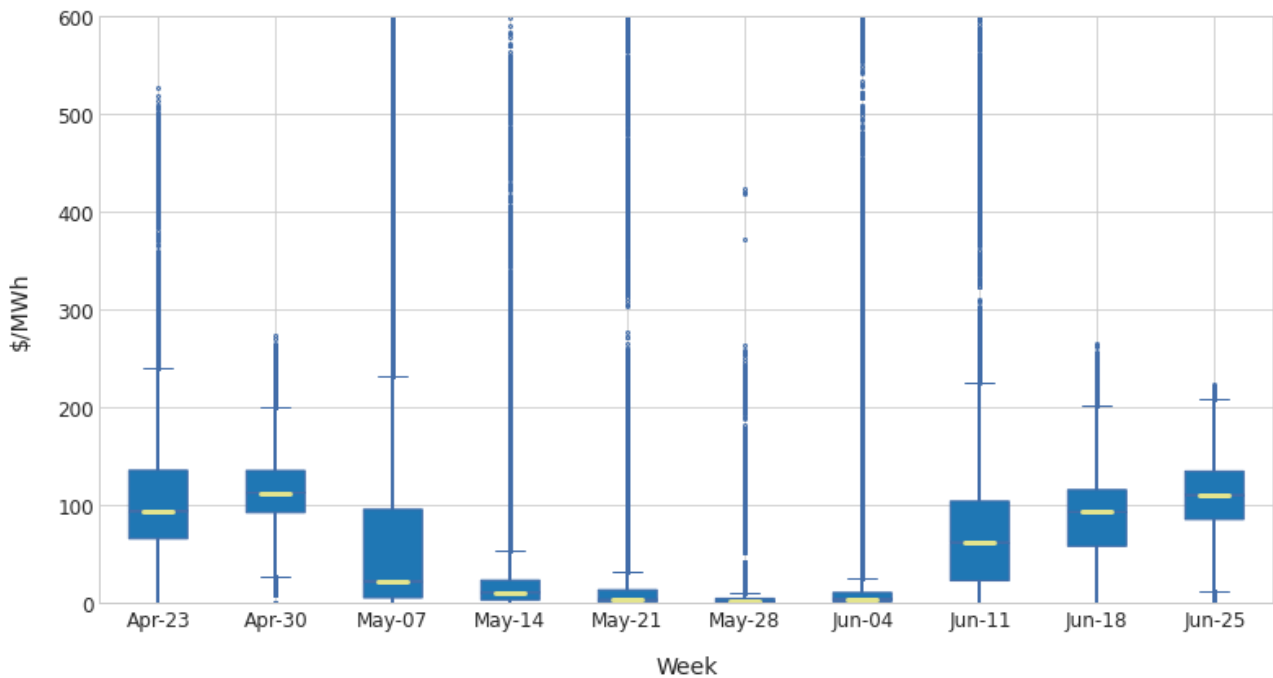
2.5. There were some price separations (mostly below \$60/MWh) though not as significant compared to the previous week. Overnight prices were mostly above \$50/MWh, due to a combination of low wind at the start of the week, hydro storage dropped, and high thermal generation.

Figure 1: Wholesale Spot Prices between 25 June (Sunday) – 1 July (Saturday) 2023.



- 2.6. 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.
- 2.7. This week, the median and quartile prices were 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.

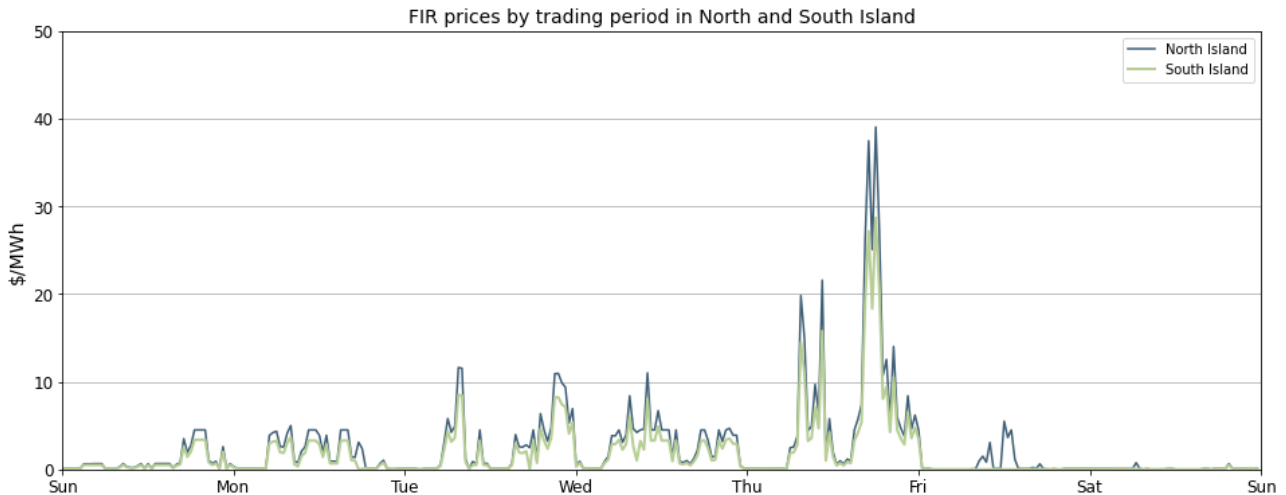
Figure 2: Boxplots showing the distribution of spot prices this week and the previous nine weeks.



3. Reserve Prices

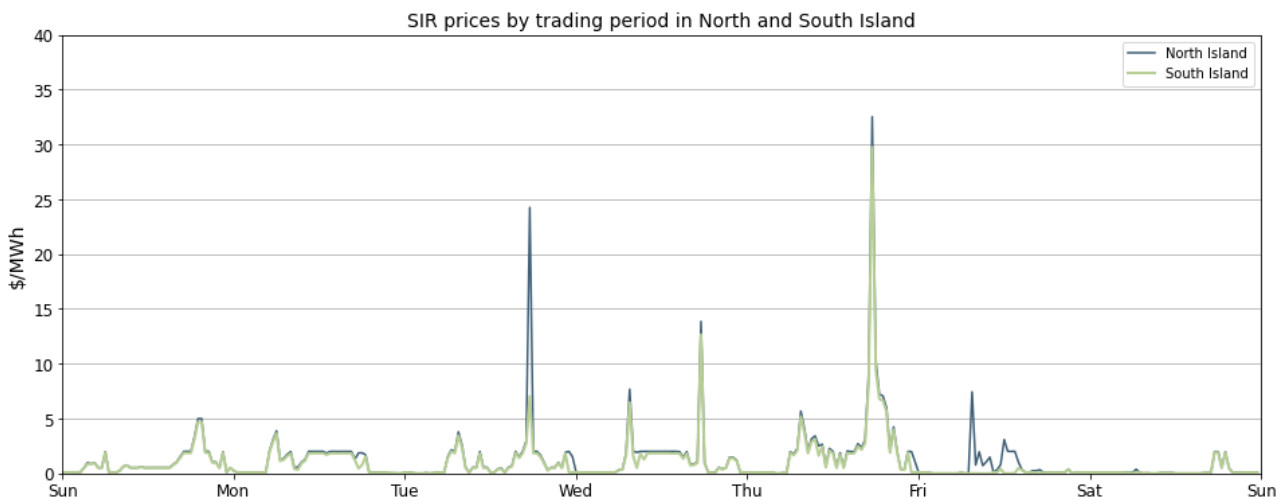
3.1. Fast Instantaneous Reserve (FIR) prices for the North and South Islands are shown below in Figure 3. This week the FIR prices were mostly below \$10/MWh for both islands with only a few instances of price spikes that still stayed below \$40/MWh. The highest price spike occurred on Thursday, 29 June between 5:00 pm and 6:00 pm, when the HVDC was ramped down. During this period, FIR prices in the North Island reached \$39/MWh, while the South Island experienced prices of \$29/MWh.

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 mostly below \$5/MWh this week, with occasional price spikes. The highest SIR price occurred on Thursday, 29 June at 5:30 pm, when the price reached \$32/MWh in the North Island and \$30/MWh in the South Island and coincided with high energy prices.

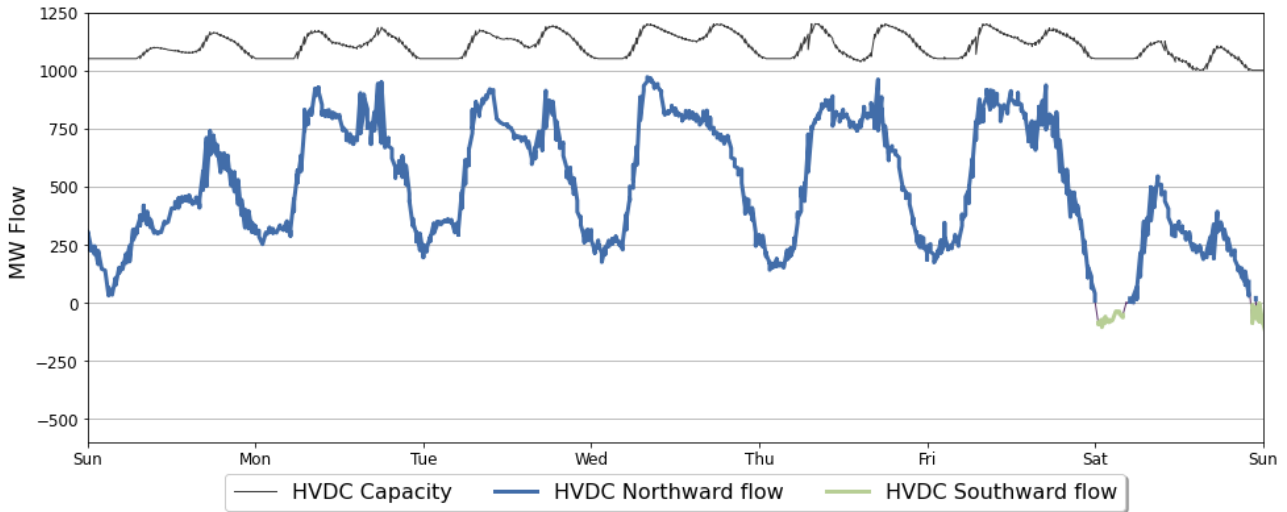
Figure 4: Sustained instantaneous reserve (SIR) prices by trading period and Island.



4. HVDC

4.1. Figure 5 shows HVDC flow between 25 June – 1 July. HVDC flows were northward during both daytime and night-time until Friday, reaching up to 914 MW during the daytime. There was some small HVDC flow southward overnight on the weekend due to high wind generation in the North Island.

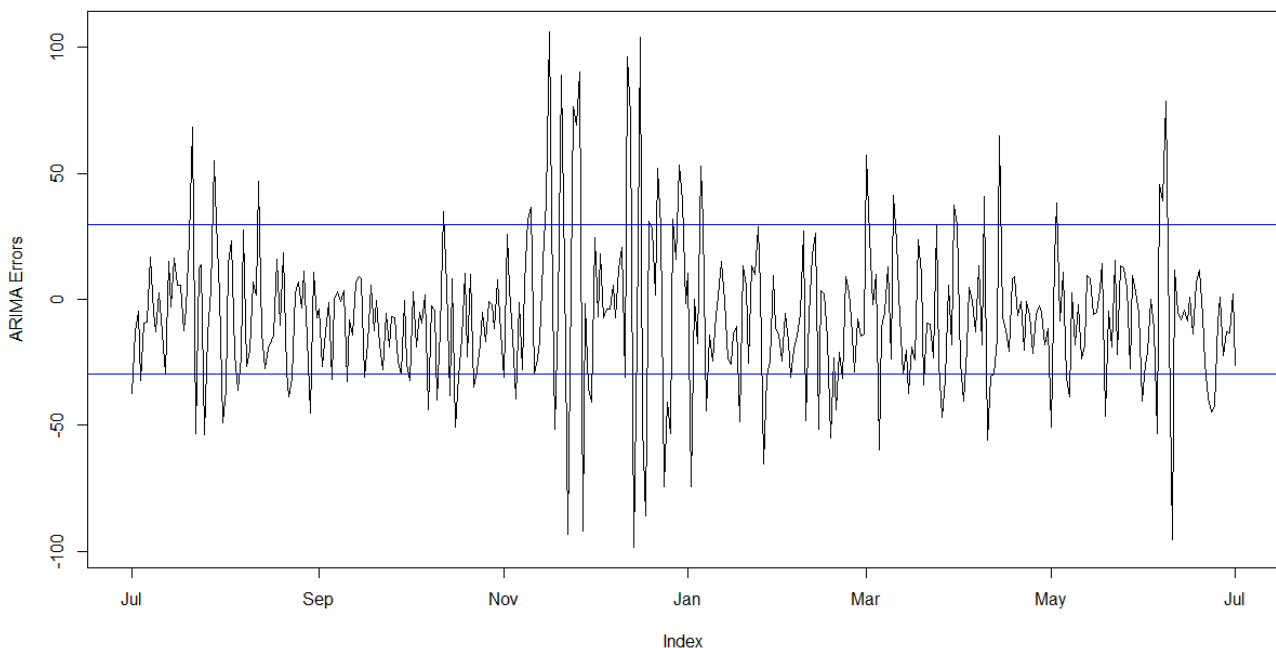
Figure 5: HVDC northward flow and capacity.



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 were no residuals above or below the one standard deviation of the data reflecting that daily average prices were close to the long-term average prices.

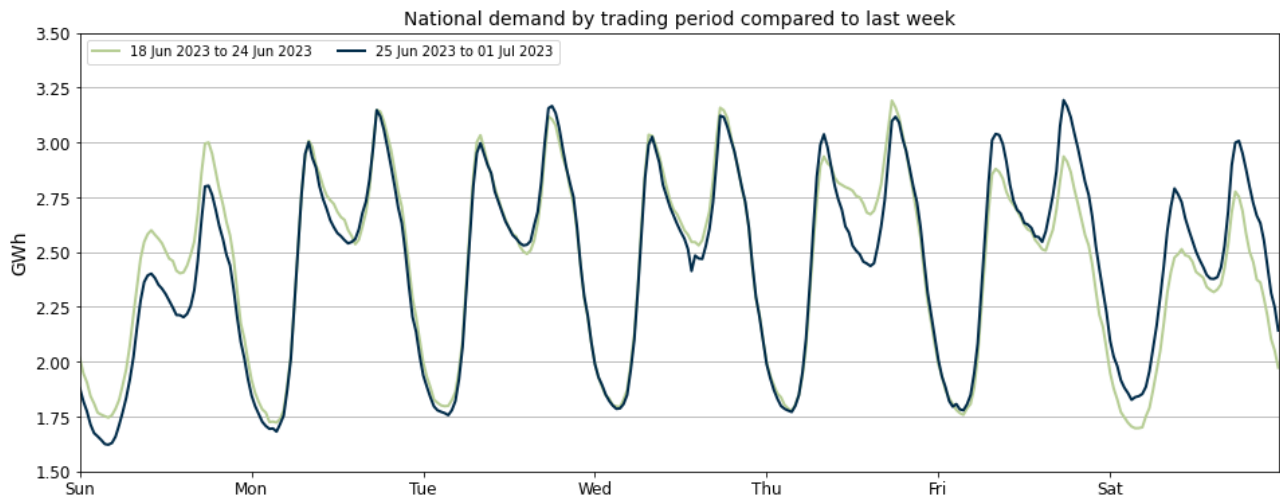
Figure 6: Residual plot of estimated daily average spot prices from 1 July 2022 – 1 July 2023. The blue lines show two standard deviations of the ARMA errors.



6. Demand

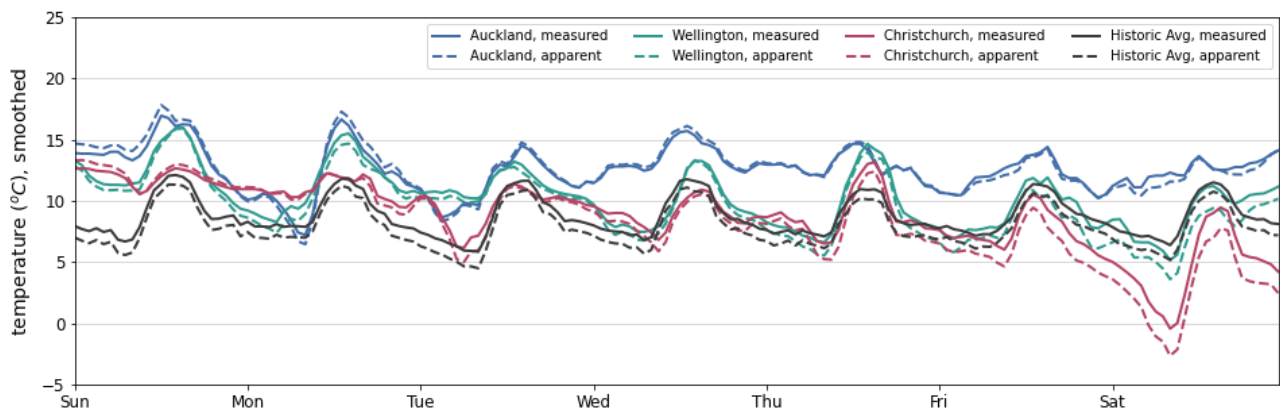
- 6.1. Figure 7 shows national grid demand between 25 June – 1 July, compared to the previous week. Demand was almost similar to the previous week from Monday to Wednesday. However, on Thursday, the evening peak demand was lower compared to the previous week, and also decreased during the off-peak times. Demand increased on Friday and Saturday compared to the previous week as temperatures shifted below or around the mean historic temperatures for Christchurch and Wellington.

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 25 June – 1 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 all three main centres were mostly above or around the historic average, ranging between 5 and 18 degrees. Nonetheless, Wellington and Christchurch saw temperatures dip below the historic average on Saturday, with Christchurch's temperature dropping below zero degrees. Temperatures in Auckland were mostly above average for the week with apparent temperatures around 12 degrees. Temperatures in Wellington were also above or around average for most of the week ranging between 4-15 degrees. Christchurch saw the coldest temperatures of the week ranging from -3 degrees to 13 degrees.

Figure 8: Temperatures across main centres.



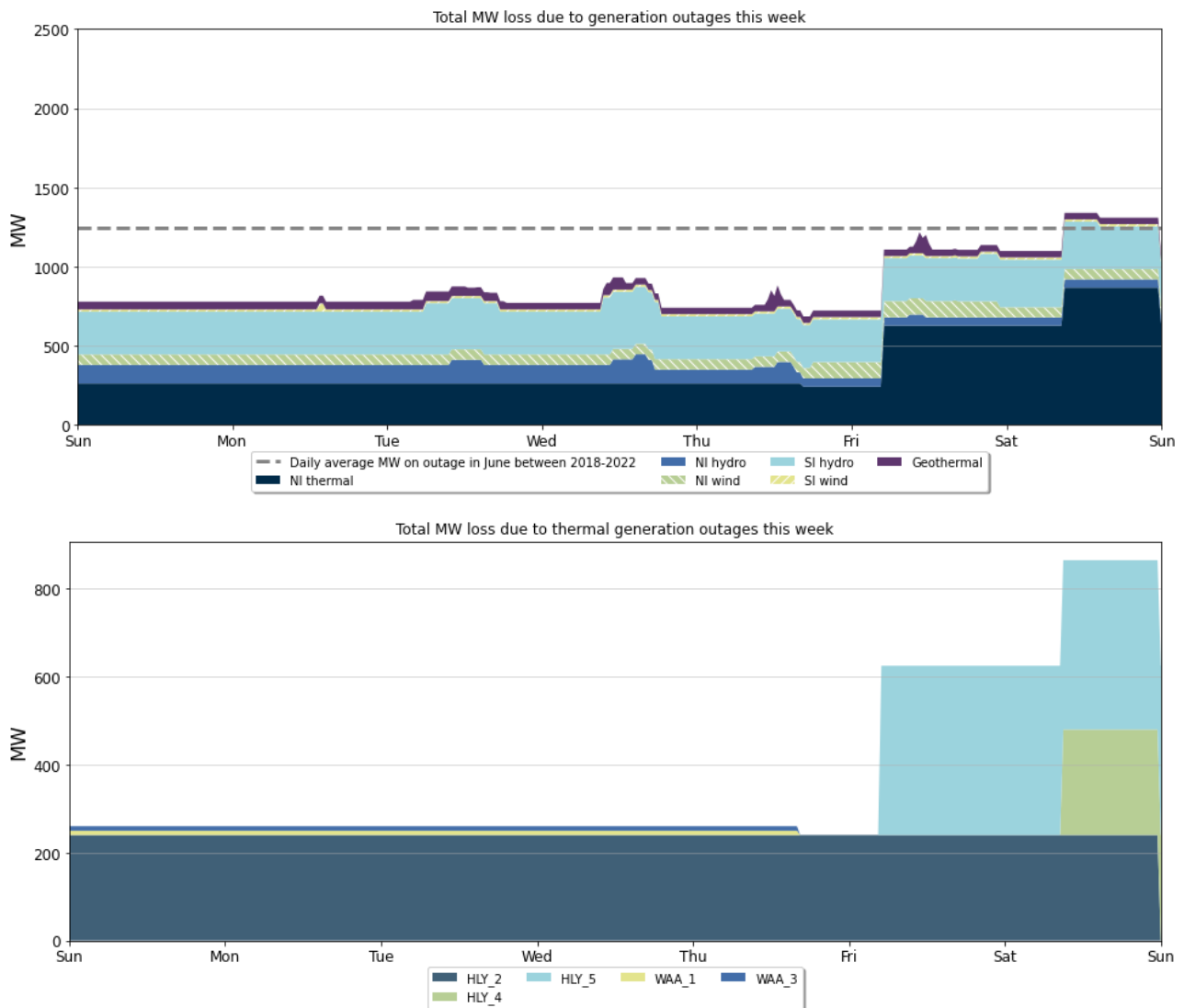
7. Outages

7.1. Figure 9 shows generation capacity on outage. Total capacity on outage between 25 June – 1 July ranged between ~750 MW and 1300 MW. There was an increase in thermal outages towards the end of the week due to the unplanned Huntly 5 (E3P) outage on Friday, and a scheduled outage at Huntly 4.

7.2. Notable outages include:

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

Figure 9: Total MW loss due to generation outages.

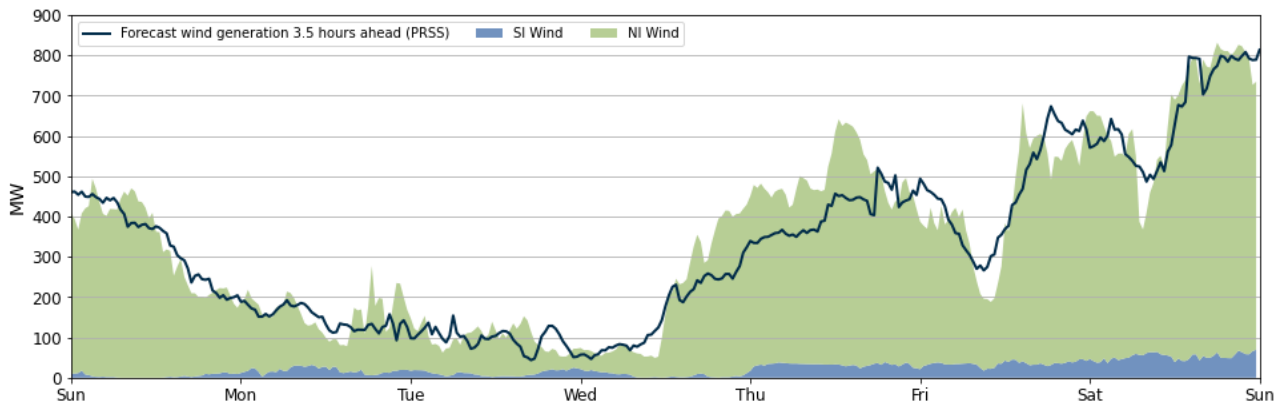


8. Generation

8.1. Figure 10 shows wind generation, from 25 June – 1 July, ranged from 50 - 830 MW across the week. Wind generation was around 400 MW at the start of the week and decreased to

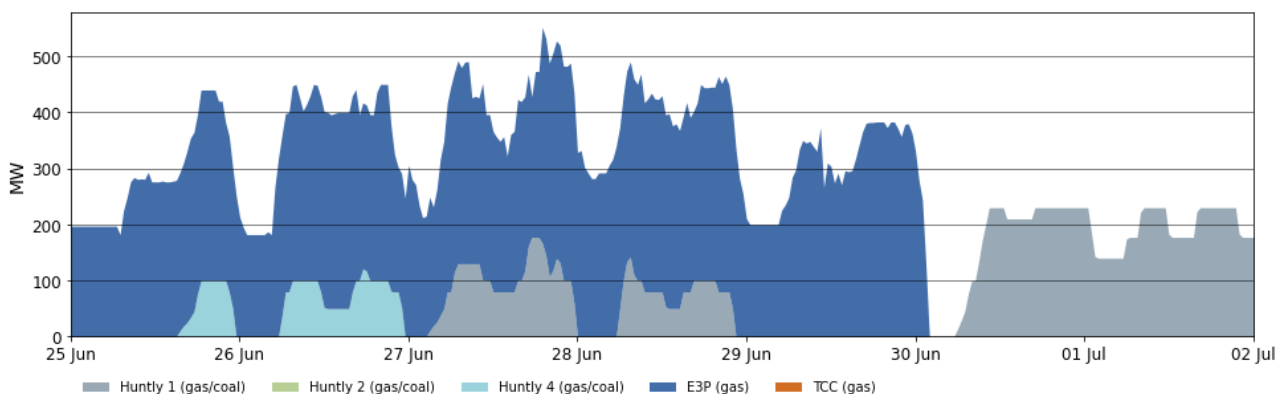
around 200 MW on Monday and further dropped to below 100 MW on Tuesday. Wind steadily increased from Wednesday and reached up to 620 MW on Thursday. On Friday afternoon, wind dropped to around 200 MW but increased gradually up to 830 MW on Saturday night.

Figure 10: Wind Generation and forecast.

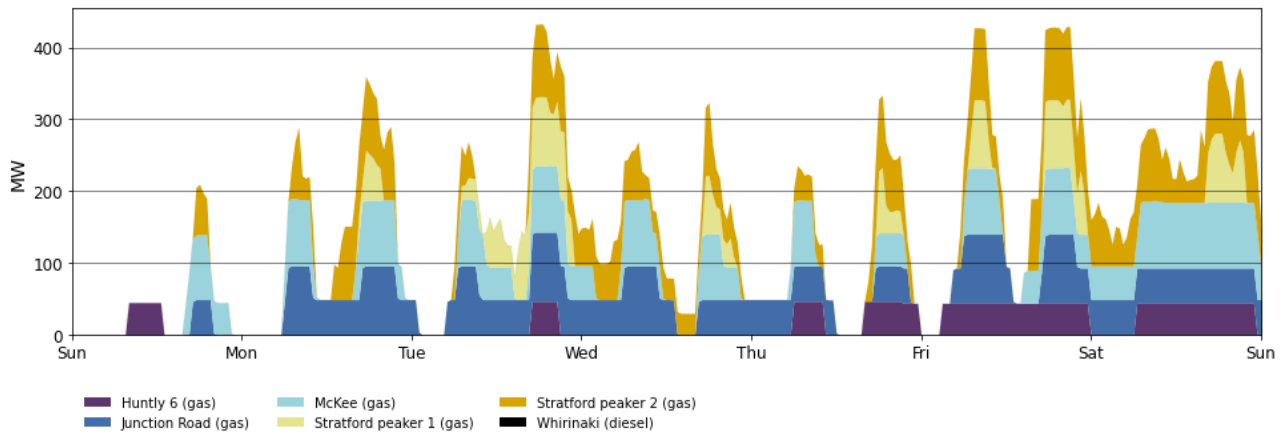


- 8.2. Figure 11 shows the generation of thermal baseload and thermal peaker plants between 25 June – 1 July. E3P (Huntly 5) ran as a baseload until Friday morning when the unit tripped¹ around 1:42am. Huntly 4 ran in support on Sunday afternoon and Monday, with Huntly 1 supported baseload on Tuesday and Wednesday. While E3P was on outage on Friday and Saturday, Huntly 1 ran as baseload, with several peakers running to support the load.
- 8.3. Most thermal peakers ran this week, and particularly on Friday and Saturday due to the E3P outage and only one Rankine was running. Junction Road ran over the shoulder period most days as well as running overnight on Tuesday and Friday. Stratford 2 also ran overnight on both of these days as well as running through the day on Wednesday and Saturday. McKee ran during all peak times except on Sunday morning and also ran overnight on Friday and throughout Saturday.
- 8.4. Huntly 6 ran in the middle of the day on Sunday, Tuesday evening, and Thursday's peak times. During Friday and Saturday, Huntly 6 ran through the day likely to support Huntly 1 with E3P being offline.

Figure 11: Thermal Generation.

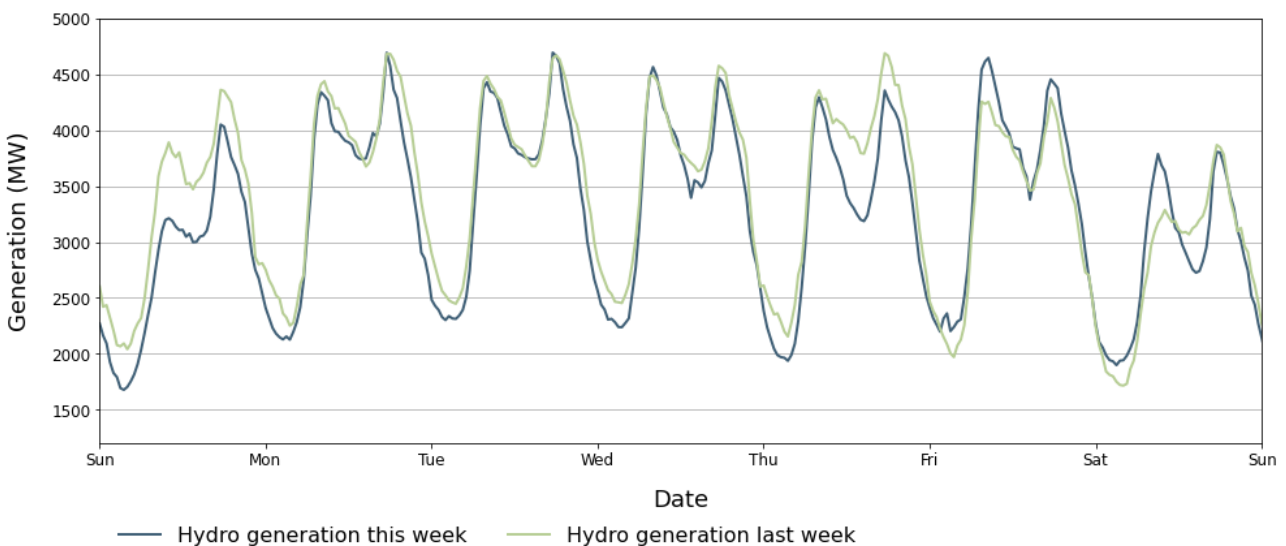


¹ [Genesis makes three Rankines available to cover Unit 5 outage | Genesis NZ \(genesisenergy.co.nz\)](https://www.genesisenergy.co.nz)



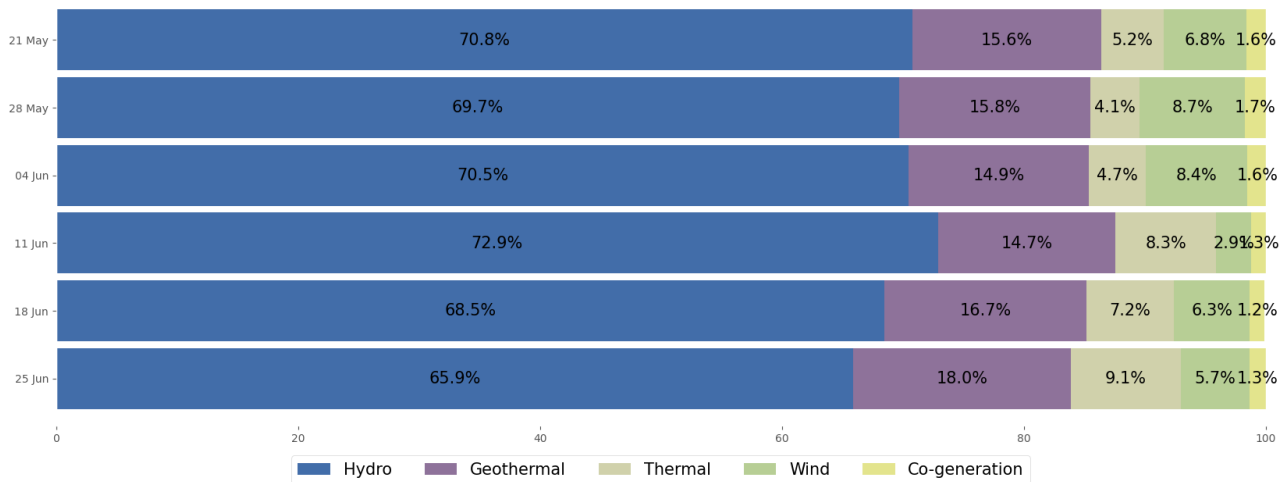
8.5. Figure 12 shows hydro generation between 25 June – 1 July. Overall, hydro generation decreased compared to the previous week in line with demand and decreased storage. However, generation was higher on Friday and Saturday peak periods, likely compensating for the loss of E3P.

Figure 12: Hydro generation between 25 June – 1 July compared to the previous week.



8.6. As a percentage of total generation, between 25 June – 1 July, total weekly hydro generation was 65.9 percent, geothermal 18 percent, thermal 9.1 percent, wind 5.7 percent, and co-generation 1.3 percent. Thermal generation was higher than last week, due to relatively low wind and hydro generation.

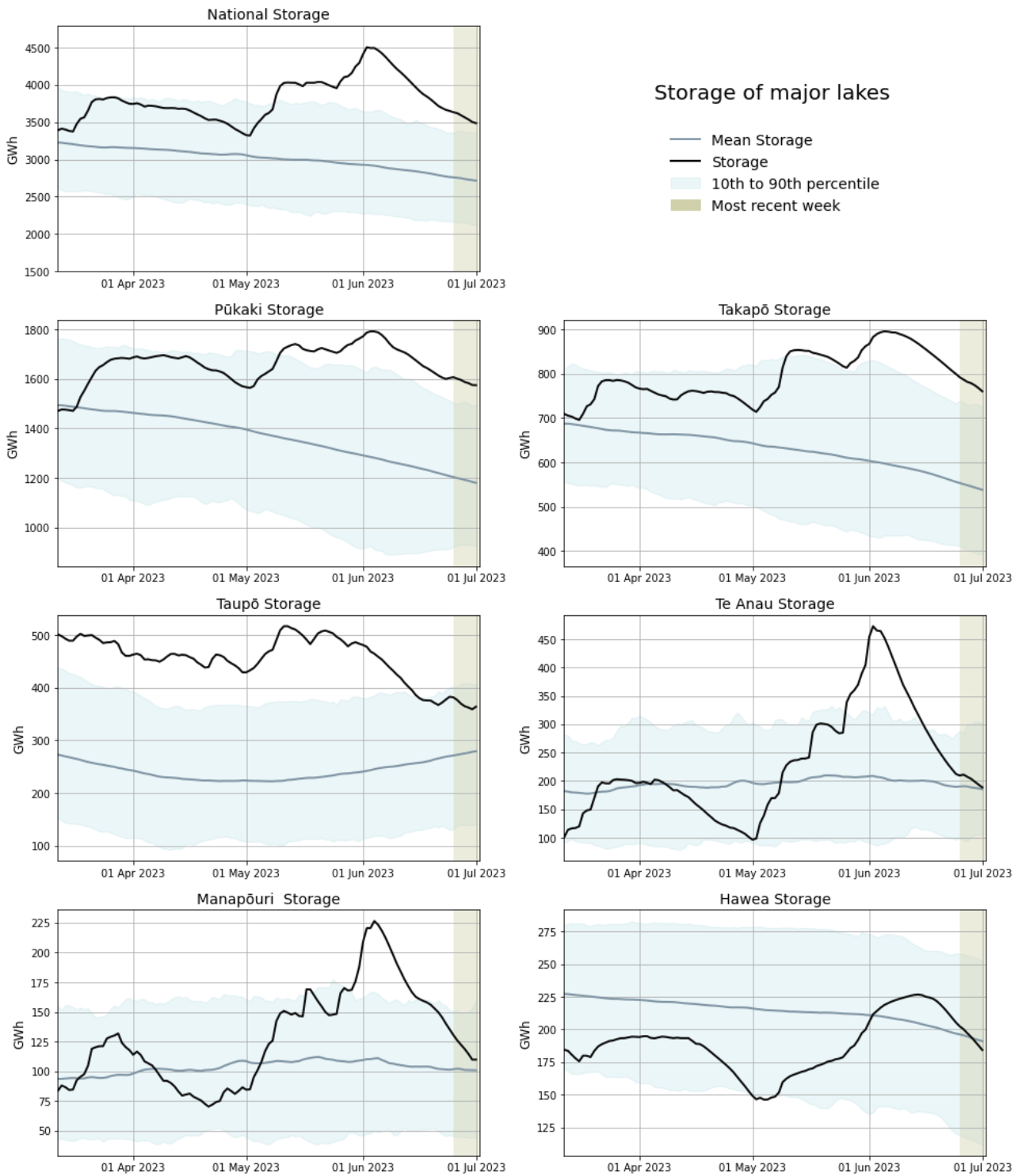
Figure 13: Total generation as a percentage each week between 21 May and 1 July 2023.



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 83.3 percent of nominal full as of 1 July. However national controlled storage is still high at 123 percent of the historic mean for this time of year.
- 9.3. Most lakes levels decreased this week. Lakes Pūkaki and Takapō have been steadily decreasing but still remain above their 90th percentiles. The steepest drop in lake levels was at Manapōuri and Te Anau, with Te Anau reaching its historic mean. Storage level at Taupō is slightly below its historic 90th percentile. Hawea storage also decreased and is slightly below its historic mean for this time of year.

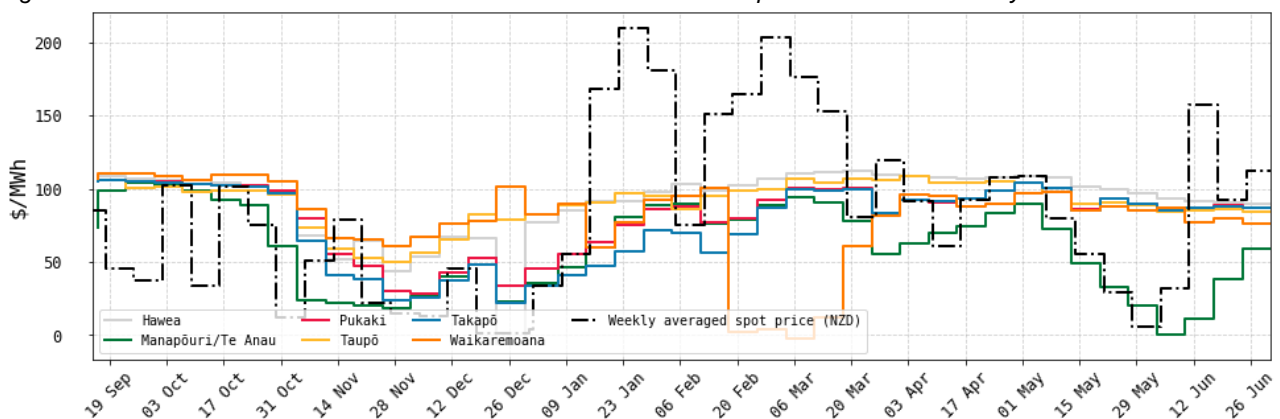
Figure 14: Hydro Storage.



10. JADE Water Values

- 10.1. The JADE² 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 1 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. Since the beginning of February, the water values at most lakes have been relatively steady, with a small drop in March as lake levels rose. This week water values in most of the lakes remains steady. Water values at Te Anau and Manapōuri experienced a drastic drop during May but increased over the last few weeks as storage substantially dropped.

Figure 15: JADE water values across various reservoirs between 15 September 2022 and 1 July 2023.



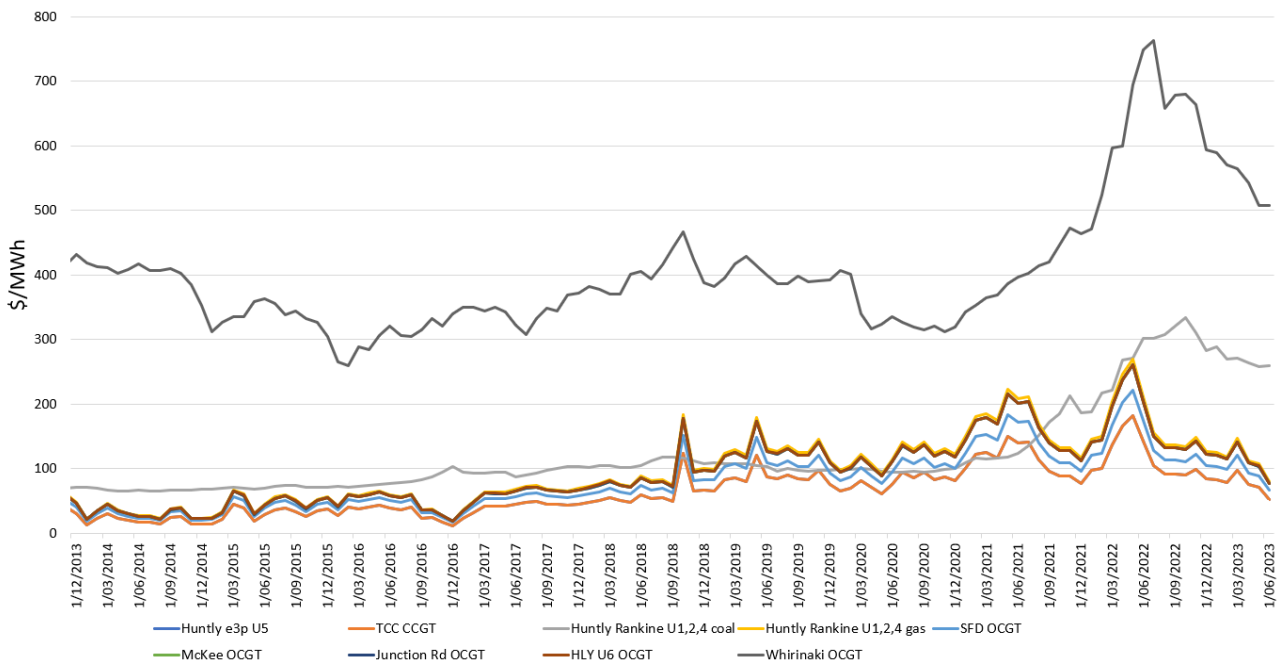
11. Prices versus estimated costs

- 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 June 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 June, Indonesian coal stayed at around ~\$466/tonne (NZD) putting the latest SRMC of coal-fuelled Huntly generation at ~\$260/MWh.
- 11.5. The SRMC of Whirinaki has decreased to ~\$508/MWh.
- 11.6. The SRMC of gas fuelled thermal plants decreased and is between \$53/MWh and \$80/MWh, likely due to a decrease in gas demand as well as carbon prices.

² 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.

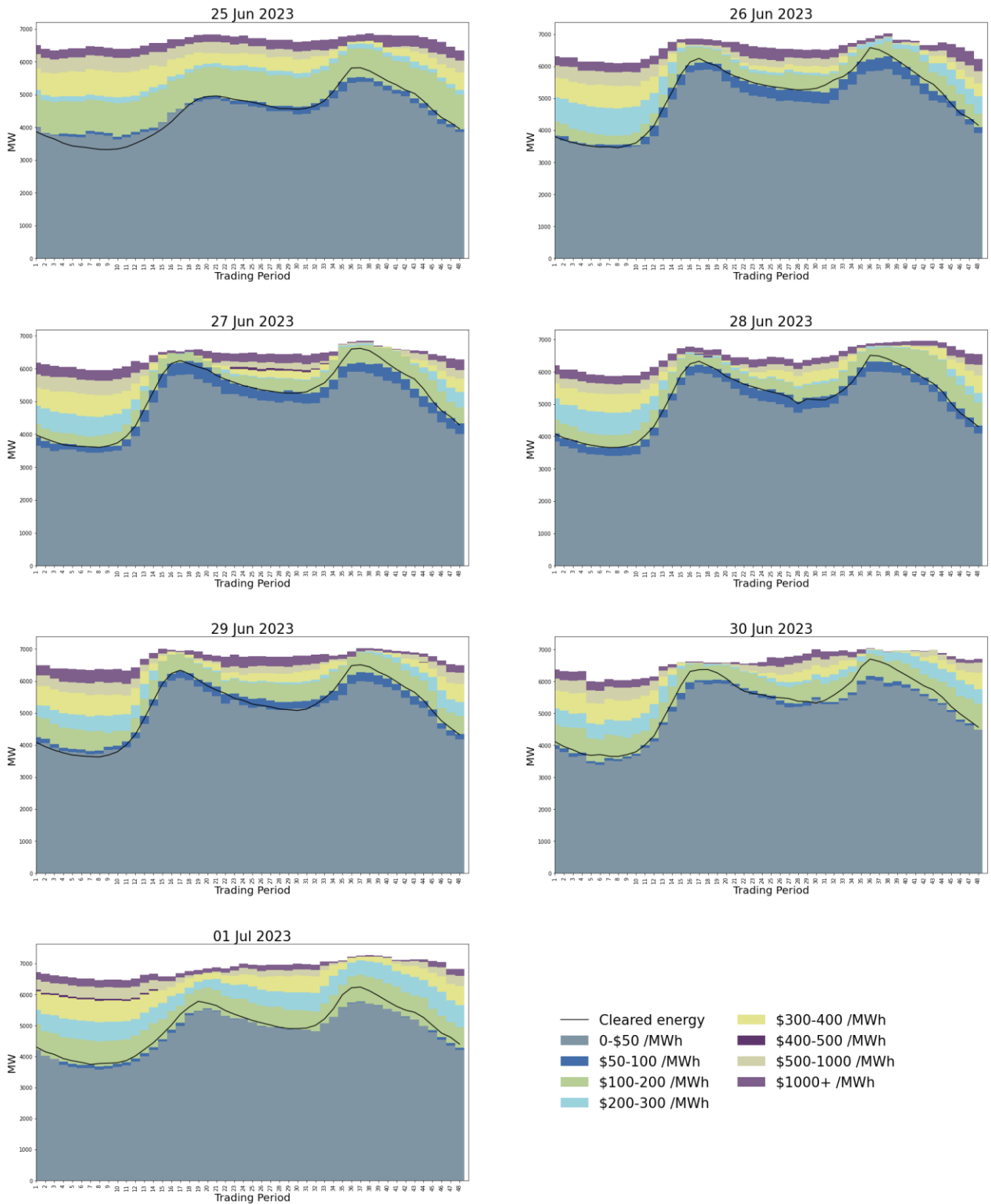
Figure 16: Estimated monthly SRMC for thermal fuels.



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. This week there continued to be an increase in generation offered between \$50-\$200/MWh compared to May and early June. However, over the week the amount offered between \$50-100/MWh declined with more generation offered between \$100-\$200/MWh. The increase in generation offered at higher price bands is likely due to a decline in hydro storage with the offer change most noticeable in the South Island. On Friday, due to the Huntly 5 unplanned outage, there was a notable drop in the amount of generation offered into the market.
- 12.3. On Sunday, prices mostly cleared between \$0 and \$100/MWh, but during the evening peak, energy also cleared in the \$100 to \$200/MWh band. However, between Monday and Wednesday, there was an increase in generation cleared between the \$50-\$200/MWh range, which could be attributed to a decrease in wind generation. On Thursday, increased wind generation saw more offers cleared between \$50-100/MWh, with higher prices in the evening peak. On Friday and Saturday, prices usually cleared between \$100-200/MWh, this may have been impacted by Huntly 5 going on outage.

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.
11/5/2023	37-40	Further analysis	Genesis	Huntly 4	Offer changes.
15/5/2023	36-37	Further Analysis	Genesis	Huntly 2,4,5	Offer changes.
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.