

Date: 2 October 2023



# Trading conduct report

Market monitoring weekly report

# Trading conduct report

## 1. Overview for week of 24-30 September

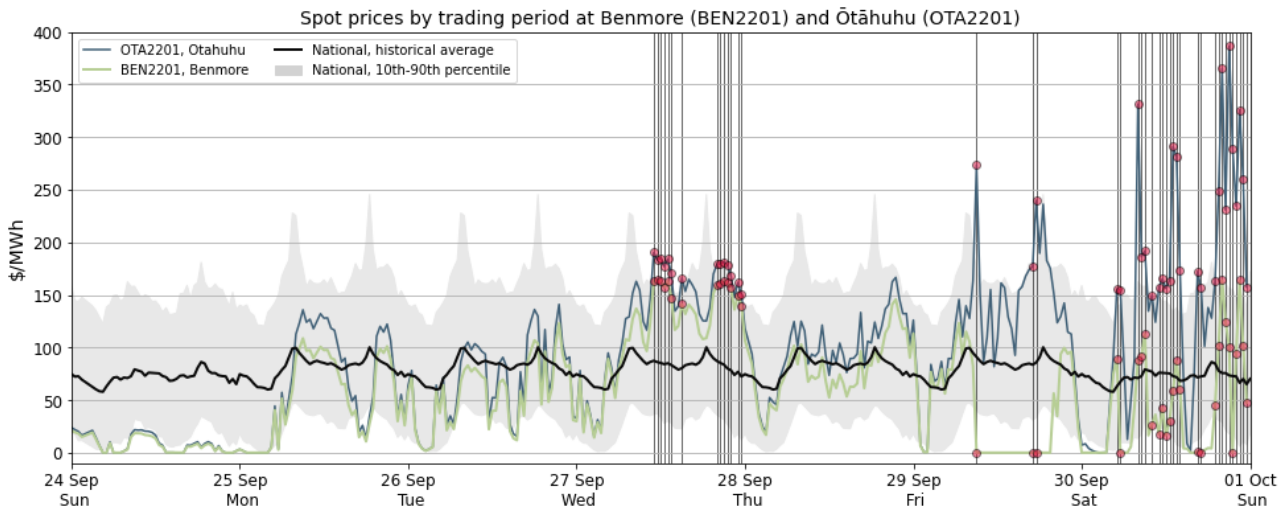
- 1.1. At the beginning of the week, spot prices stayed close to the historical average. Towards the end of the week, prices showed significant volatility, due to an HVDC outage. High prices on Wednesday were likely due to underestimated demand and over forecasted wind generation. Conversely, on Friday and Saturday, the outage of one HVDC pole constrained the northward flow, leading to higher prices in the North Island. Additionally, there was an increase in demand compared to the previous week, mainly because of colder weather conditions nationwide.

## 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 90<sup>th</sup> percentiles.
- 2.2. Figure 1 shows the wholesale spot prices at Benmore and Ōtāhuhu alongside their historic average and historic 10<sup>th</sup>-90<sup>th</sup> percentiles adjusted for inflation. Prices above the historic 90<sup>th</sup> percentile are highlighted with a vertical black line. Other notable prices that did not exceed the 90<sup>th</sup> percentile, are marked with black dashed lines.
- 2.3. Between 24-30 September:
  - (a) The average wholesale spot price across all nodes was \$76/MWh.
  - (b) 95 percent of prices fell between \$0.01/MWh and \$216/MWh.
- 2.4. Overall, the majority of spot prices sat closer to the historic average with an average price of \$76/MWh. The average price decreased again this week compared to last week by around \$24/MWh. There were more fluctuations in prices this week with prices in general sitting closer to the historic average and overnight prices sitting lower than previous weeks in September. This reduction in overnight prices is due to the increased inflow to various hydro schemes. At the end of the week, prices fluctuated and were above the 90<sup>th</sup> percentile at Ōtāhuhu due to the HVDC outage.
- 2.5. On Wednesday prices in general were above the historic average and higher compared to other weekdays, with a number of prices above the 90<sup>th</sup> percentile. During the 11:00am and 3:00pm trading periods, North Island demand was between ~46MW and ~135MW under forecasted. This saw higher priced thermal and hydro tranches being dispatched seeing some prices during these trading periods of between \$150-\$190/MWh. Ōtāhuhu prices were between \$2-\$30/MWh above the 90<sup>th</sup> percentile over this period, with only two Benmore trading periods with prices around \$3/MWh above the 90<sup>th</sup> percentile.
- 2.6. On Wednesday evening there were also a number of Ōtāhuhu prices above the 90<sup>th</sup> percentile between 8:00pm and 11:30pm. Wind was over forecasted and temperatures were in single digits. Both during the day and in the evening, there was higher thermal generation with 3 Rankines running alongside TCC.

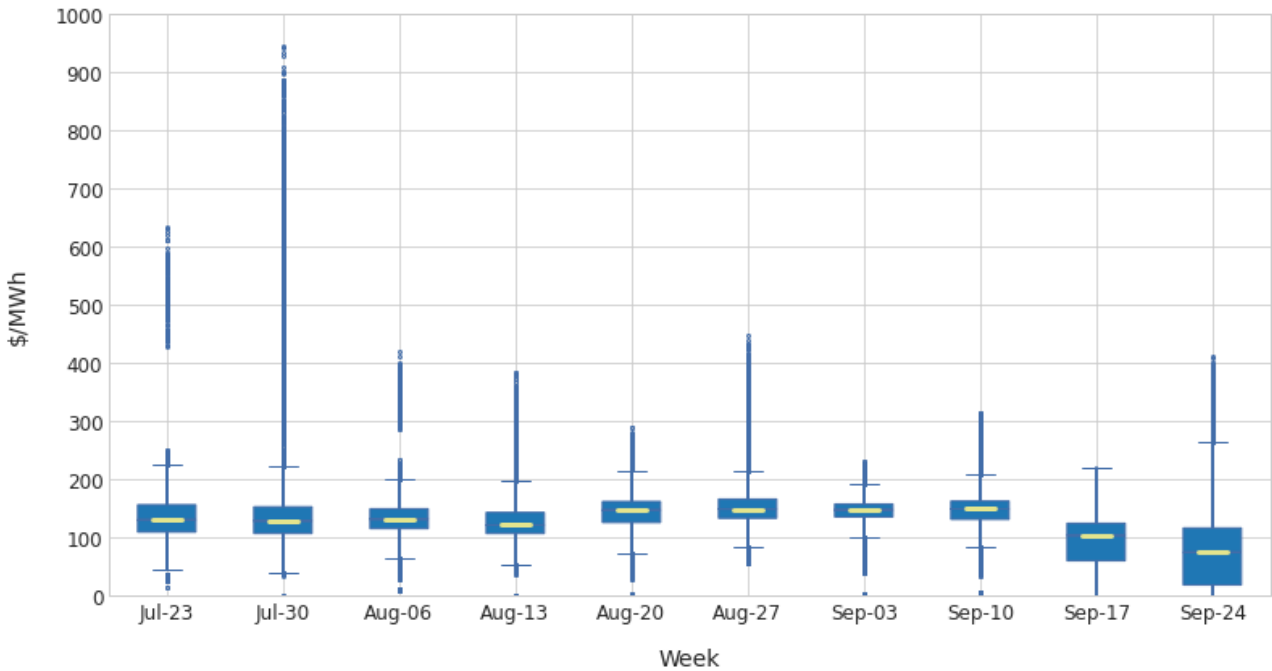
- 2.7. Friday morning saw a price spike during the 9:00am trading period as the HVDC Pole 2 went on outage leaving a single pole to transfer North on top of the significant thermal generation outages. 5-min prices reached around \$450/MWh which was lower than initial price forecasts. The price at Ōtāhuhu for this trading period was ~\$274/MWh with Benmore prices of \$0.03/MWh at this time. Prices remained separated across the time of the HVDC pole outage, with Benmore prices remaining around \$0.03/MWh and Ōtāhuhu prices ranging from \$100-\$155/MWh after the 9:00am price spike for most of the day.
- 2.8. On Saturday, there were many instances when prices were above the 90<sup>th</sup> percentile due to the HVDC pole outage which restricted the northward flow. Also, demand was higher compared to the previous week due to low temperatures.

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



- 2.9. 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.
- 2.10. The distribution of spot prices this week had a larger range than we have seen in recent weeks. A smaller lower quartile of prices is due to the increase of hydro storage in the South Island which resulted in overnight prices dropping below average again. A bit more volatility was observed due to HVDC outages which restricted reserve sharing and increased North Island prices at specific trading periods.

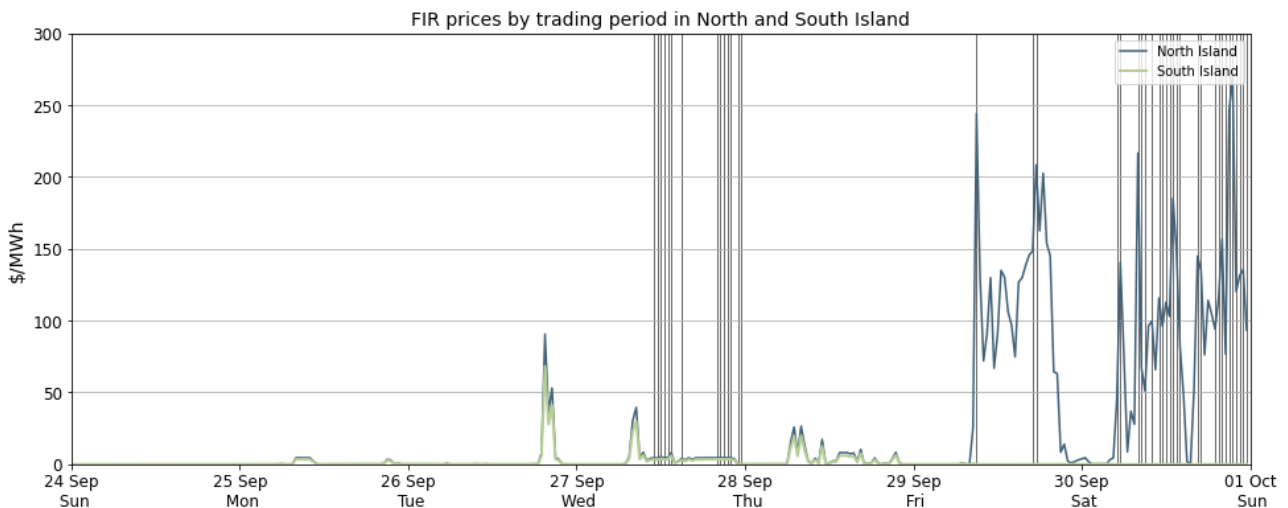
**Figure 2: Boxplots showing the distribution of spot prices this week and the previous nine weeks**



### 3. Reserve prices

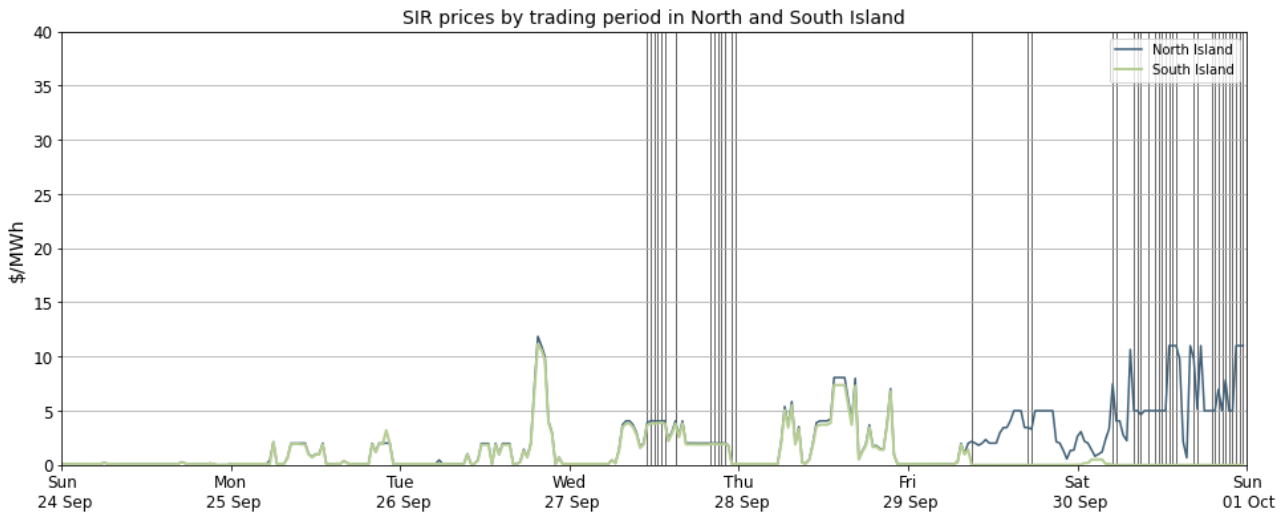
3.1. Fast Instantaneous Reserve (FIR) prices for the North and South Islands are shown below in Figure 3. This week FIR prices were mostly under \$10/MWh at the start of the week. The HVDC outage reduced reserve sharing between the islands, requiring more reserves in the North Island and causing high FIR prices. The largest spike occurred at 9:30pm on Saturday in the North Island. The North Island price reached around \$267/MWh while the South Island price was \$0/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. The majority of SIR prices were below \$10/MWh for both islands. At the end of the week, the South Island SIR prices were close to \$0/MWh with the North Island prices reaching up to \$11/MWh due to the HVDC outage.

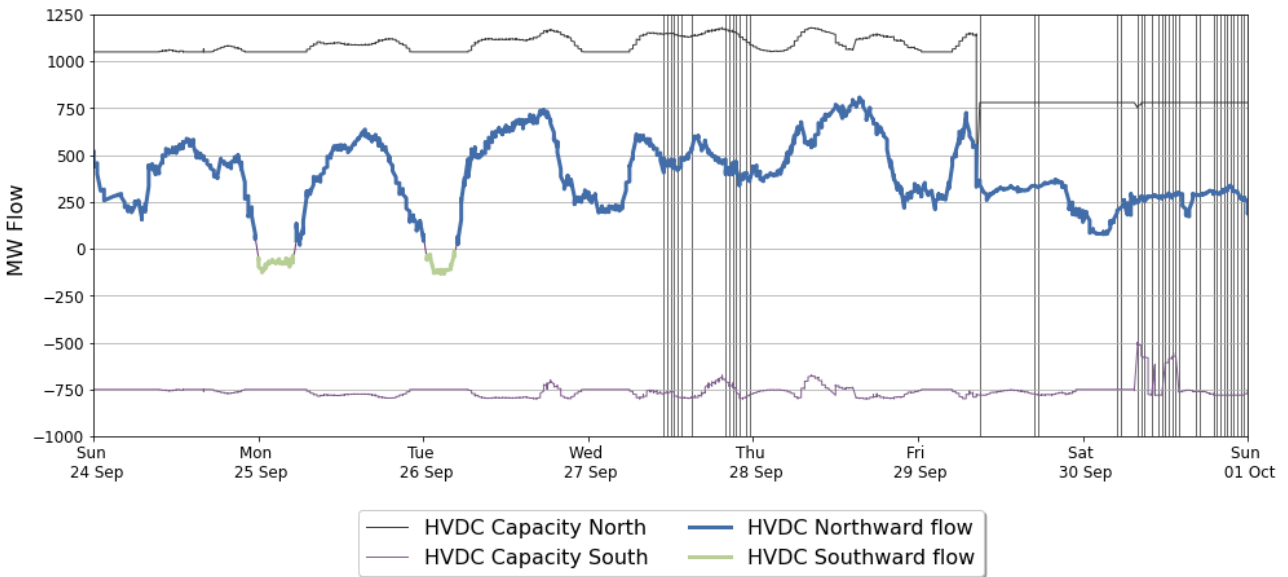
**Figure 4: Sustained Instantaneous Reserve (SIR) prices by trading period and island**



## 4. HVDC

4.1. Figure 5 shows HVDC flow between 24-30 September. HVDC flow was mainly northwards this week, with some overnight southwards flow on Monday and Tuesday. An HVDC pole was on outage between 29 September and 1 October which reduced the capacity as well as affected the reserve sharing between islands.

**Figure 5: HVDC flow and capacity**

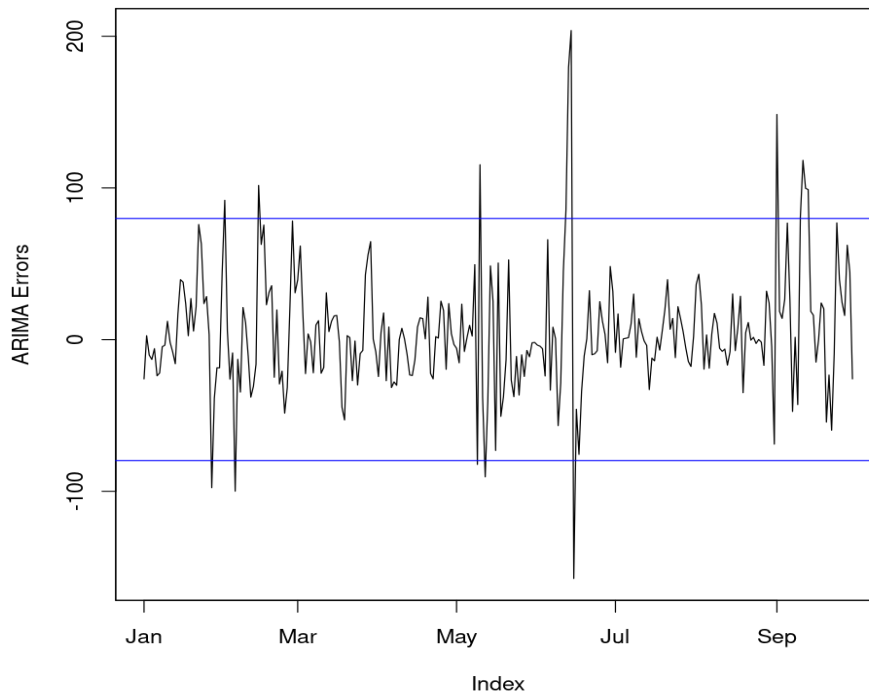


## 5. Regression residuals

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.

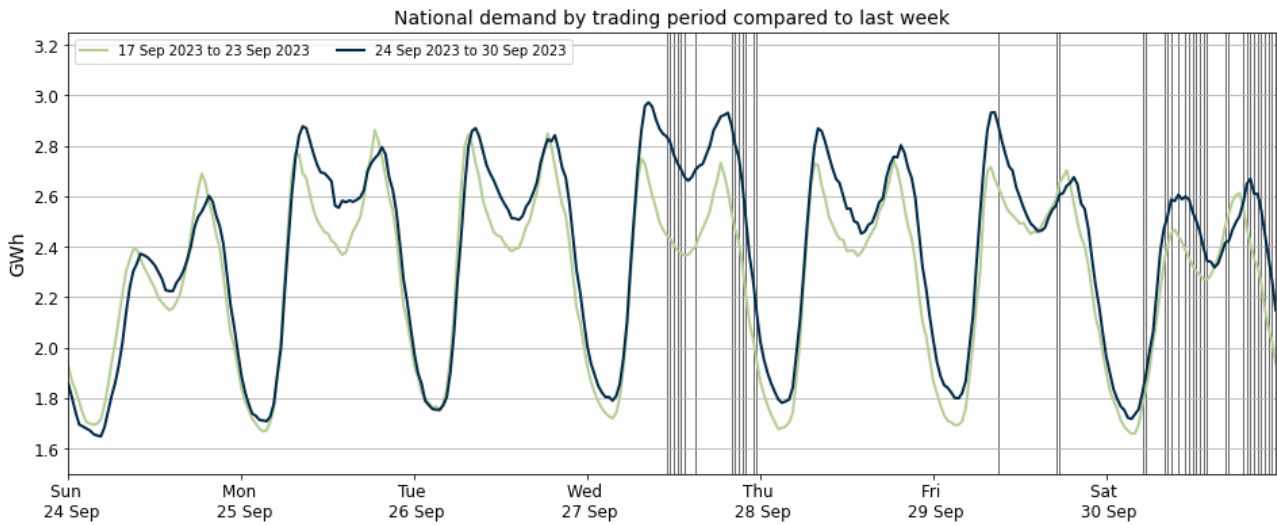
**Figure 6: Residual plot of estimated daily average spot prices from 1 January 2023 - 16 September 2023**



## 6. Demand

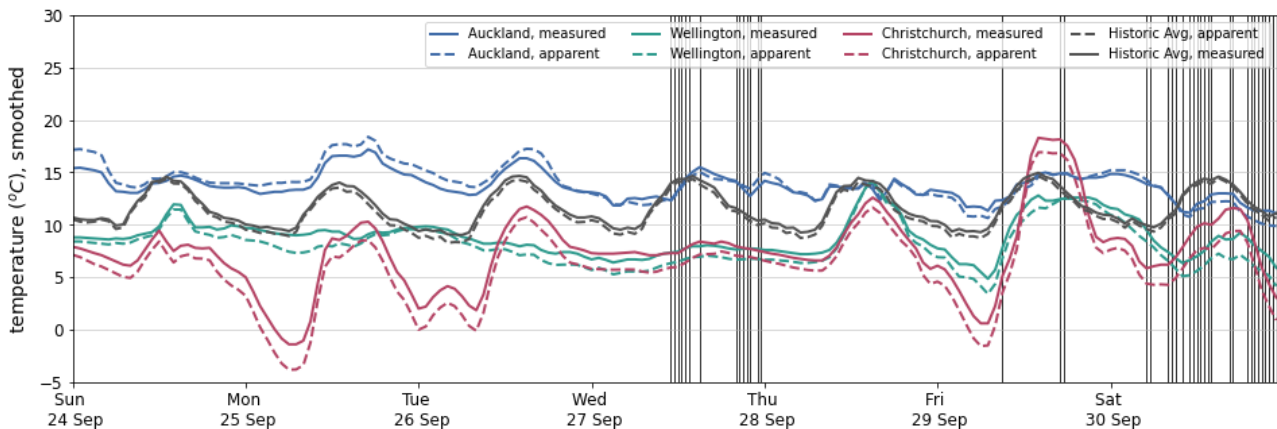
- 6.1. Figure 7 shows national demand between 24-30 September, compared to the previous week. Overall, demand was higher than the previous week. Demand was particularly high on Wednesday due to cold weather, coinciding with high prices. The Friday morning peak was significantly higher than the previous week when Christchurch's apparent temperature was below zero. Also, on Saturday the demand was much higher than the previous week due to low temperatures.

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



- 6.2. Figure 8 shows the hourly temperature at main population centres from 24-30 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. Auckland’s temperature sat above the historic average this week except on Saturday, ranging between 10-18°C. Christchurch temperatures varied with some of the coldest temperatures of the week as morning apparent temperatures dropped to below zero degrees. However, Wellington’s temperatures were mostly below the historic average, ranging between 3-14°C.

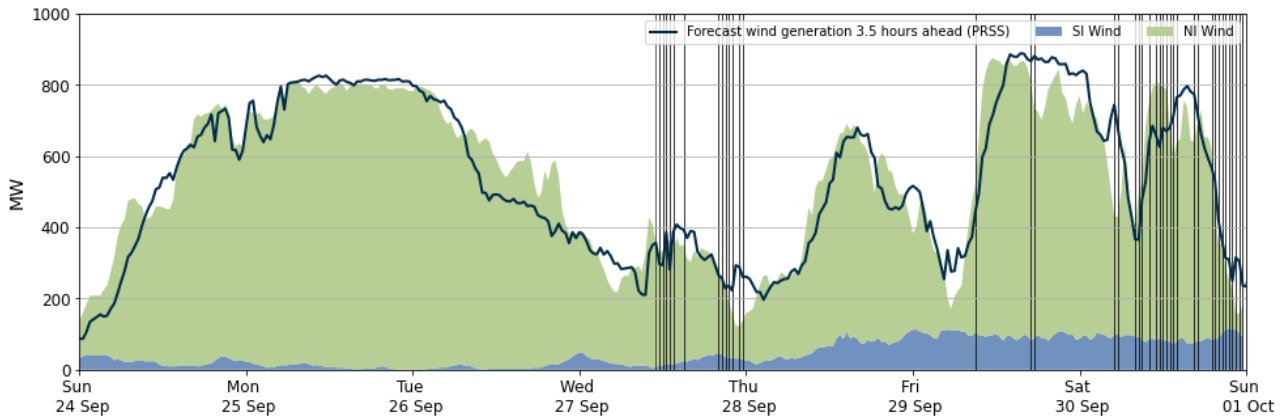
**Figure 8: Temperatures across main centres**



## 7. Generation

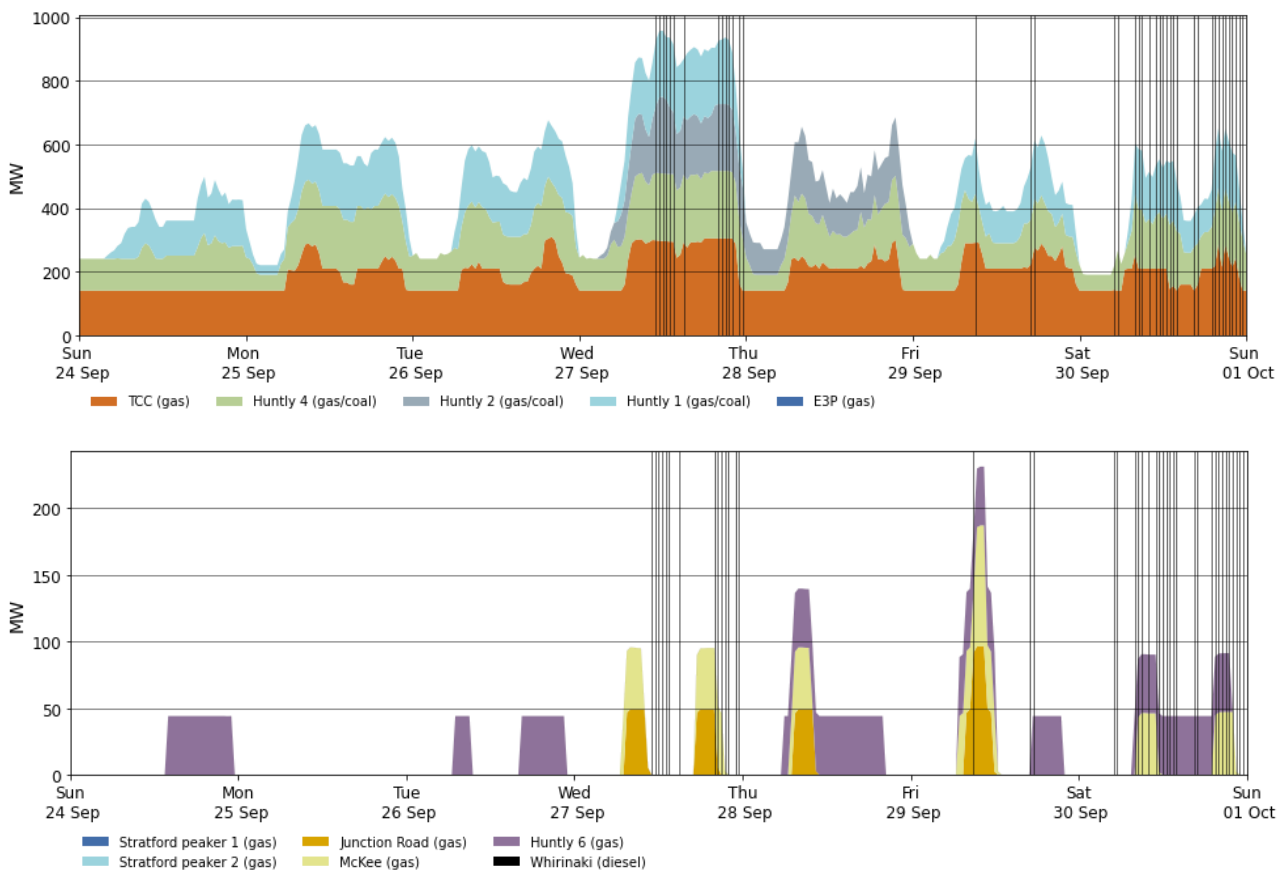
- 7.1. Figure 9 shows wind generation, from 24-30 September. Wind was variable during the week, with higher wind in the early part of the week helping keep prices lower and less thermal generation running. However, wind dropped on Wednesday coinciding with high prices. Wind generation was also higher at the end of the week as well.

**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 24-30 September. TCC along with two Rankines supplied baseload generation for the week. High demand on Wednesday saw higher thermal generation with the third Rankine also running.
- 7.3. Huntly 6 ran on Sunday evening, Tuesday and Friday morning and evening, as well as during the day on Thursday and Saturday. Mckee and Junction Road ran during Wednesday's high demand morning and evening peak times as well as the Thursday and Friday morning peak.

**Figure 10: Thermal generation between 17-23 September**

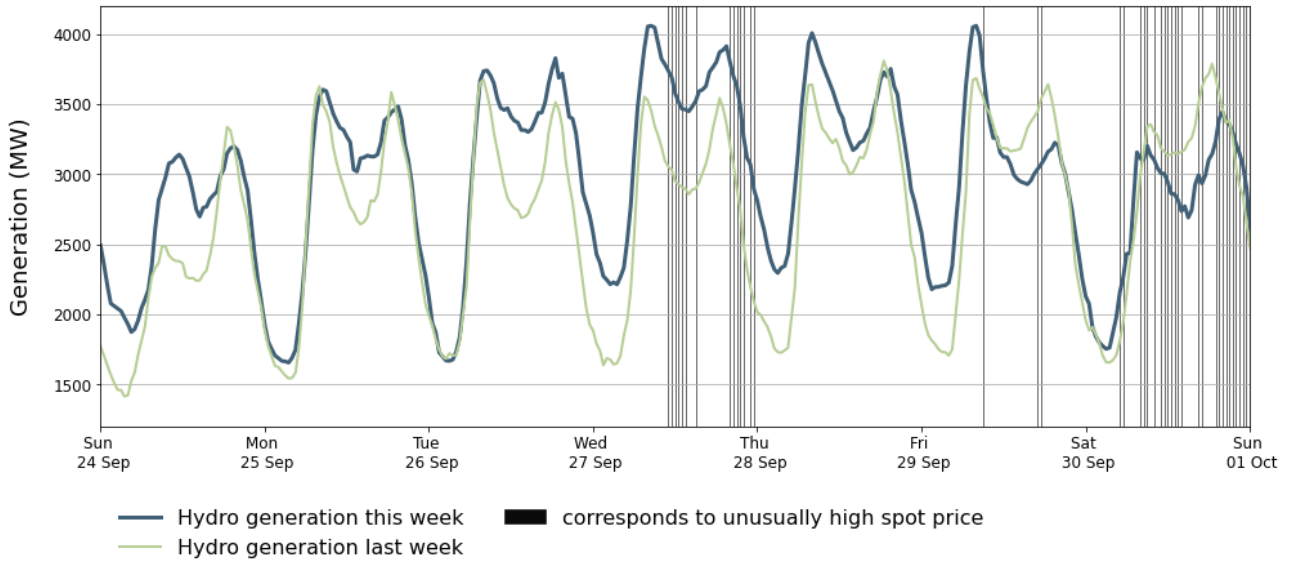


- 7.4. Figure 11 shows hydro generation between 24-30 September. Hydro generation was higher at the beginning of the week than the previous week, following increased inflows than the



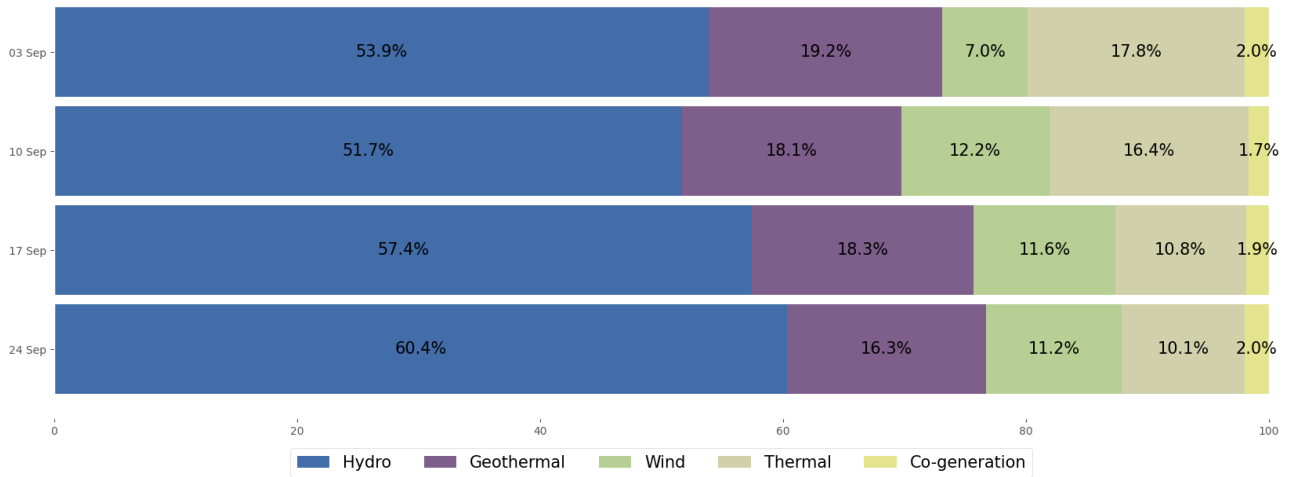
previous week. Hydro generation was lower on Saturday as the HVDC outage was limited the northward flow. Also, Tokaanu was on planned outage on Saturday.

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



7.5. As a percentage of total generation, between 24-30 September, total weekly hydro generation was 60.4%, geothermal 16.3%, thermal 10.1%, wind 11.2%, and co-generation 2%.

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



## 8. Outages

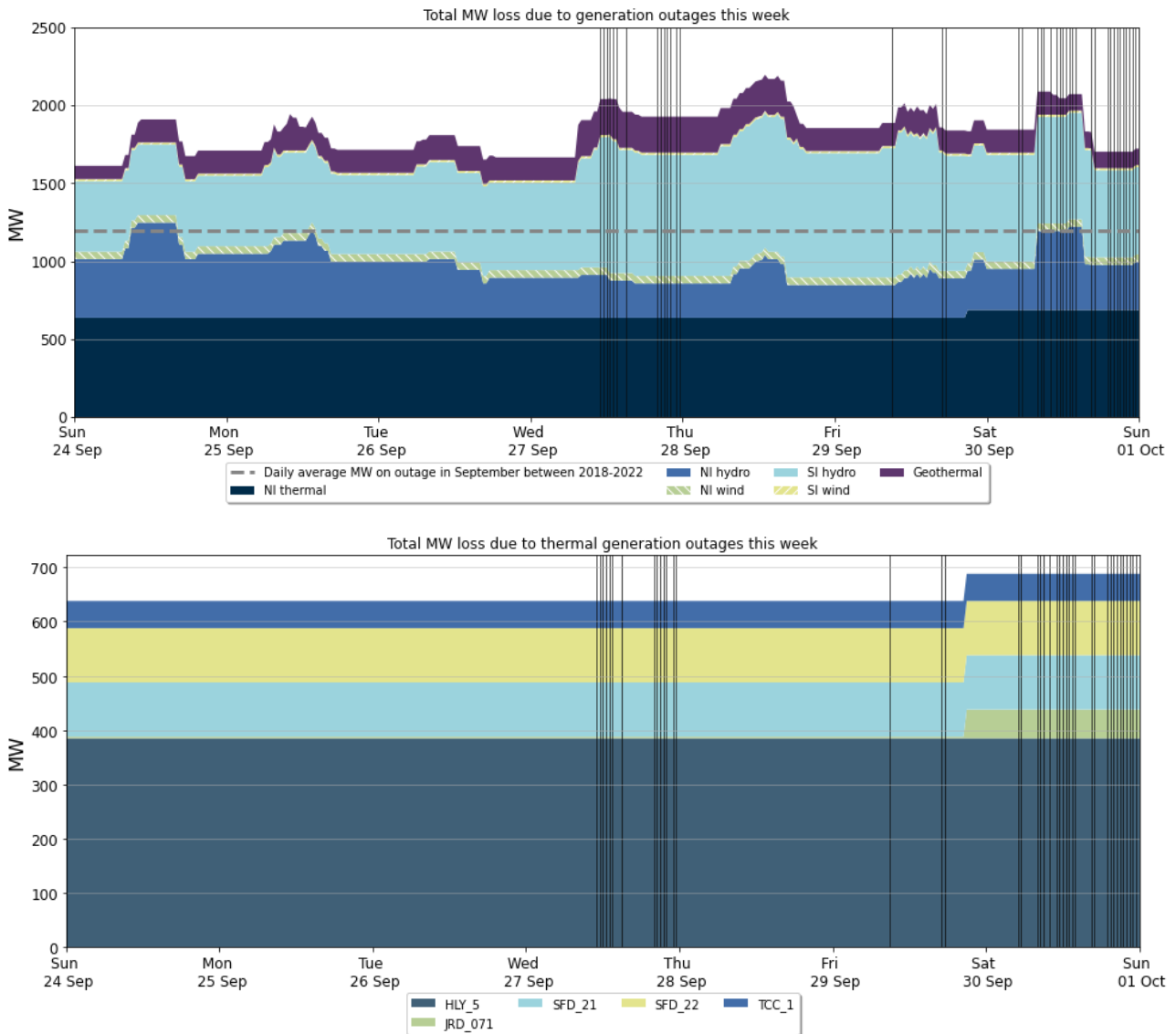
8.1. Figure 13 shows generation capacity on outage. Total capacity on outage between 24-30 September ranged from ~1600MW to ~2200MW.

8.2. Notable outages include:

- (a) Huntly 5 is on outage until 31 January 2024.
- (b) Stratford 1 is on outage until 2 October 2023.
- (c) Stratford 2 is on outage until 28 February 2025.

- (d) Junction Road is on outage between 29 September - 31 October 2023.
- (e) Ngā Awa Purua geothermal units on outage between 23 September - 1 October 2023.
- (f) West Wind Station was on outage between 30 May - 30 September 2023.
- (g) Tokaanu hydro generator was on outage on 30 September 2023.
- (h) Various North and South Island hydro units are on outage.

**Figure 13: Total MW loss due to generation outages**



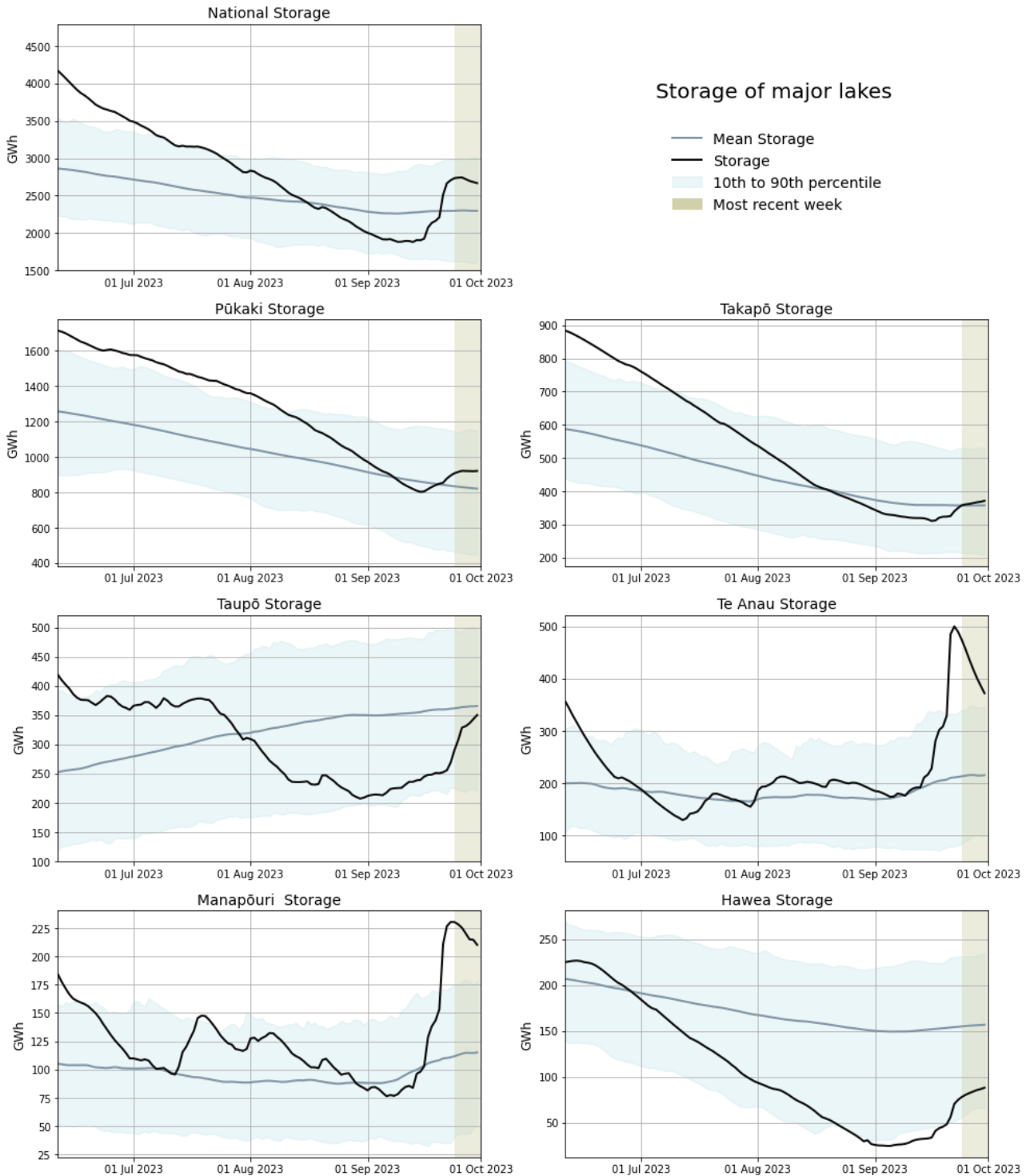
## 9. Storage/fuel supply

- 9.1. Figure 14 shows the total controlled national hydro storage as well as the storage of major catchment lakes including their historical mean and 10<sup>th</sup> to 90<sup>th</sup> percentiles.
- 9.2. National hydro storage levels slightly increased with national controlled storage from 2,901GWh on 23 September to 2,928GWh on 30 September. Controlled storage is now 66.3% nominally full and 110.8% of historic mean as of 30 September.

9.3. Currently, lakes Pūkaki and Takapō are above their respective historic mean. Taupō saw a steady increase in storage but still remains below its historic mean. Hawea saw an uptick and is now back above its historic 10<sup>th</sup> percentile but remains below its mean.

9.4. After the sharpest increase, the storage at lakes Manapōuri and Te Anau decreased but both lakes are well above their 90<sup>th</sup> percentile and still in the high operating ranges.

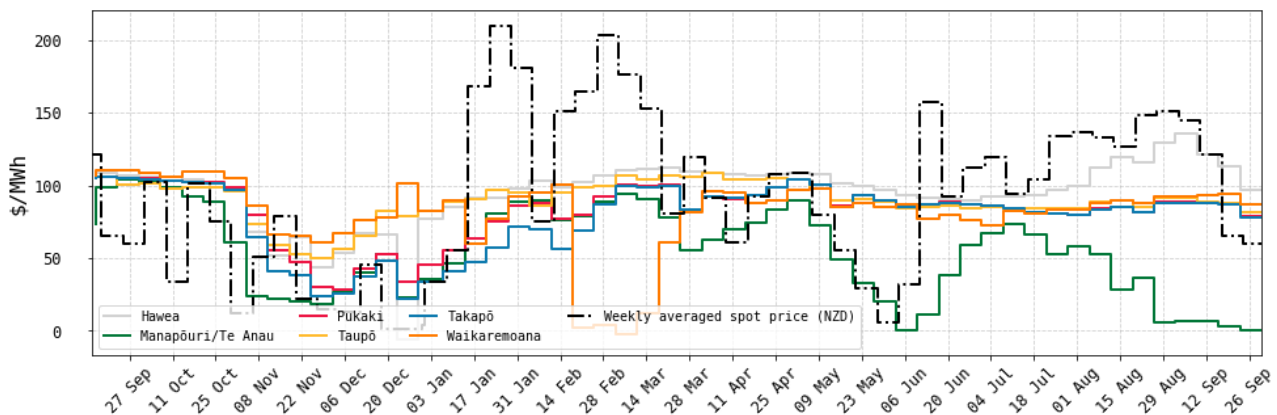
**Figure 14: Hydro Storage**



## 10. JADE water values

- 10.1. The JADE<sup>1</sup> 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 30 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 ~\$0/MWh due to high lake levels which require spilling. Hawea has had some inflows over the last week and its water values have decreased to ~\$97/MWh. All other water values decreased between \$6/MWh-\$9/MWh.

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



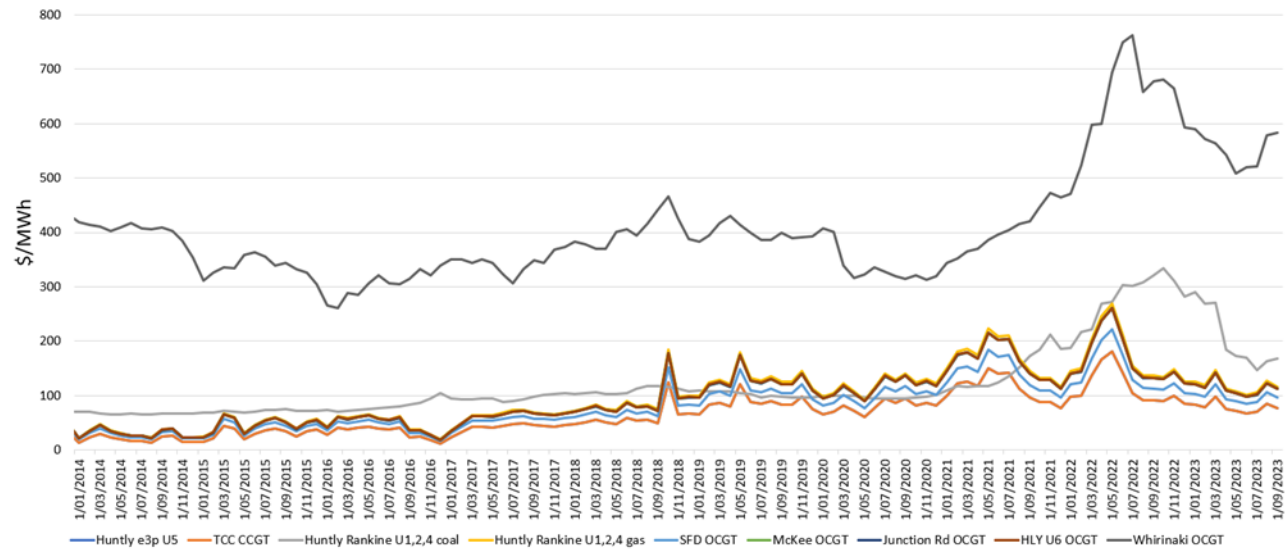
## 11. Prices versus estimated costs

- 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.

<sup>1</sup> 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.

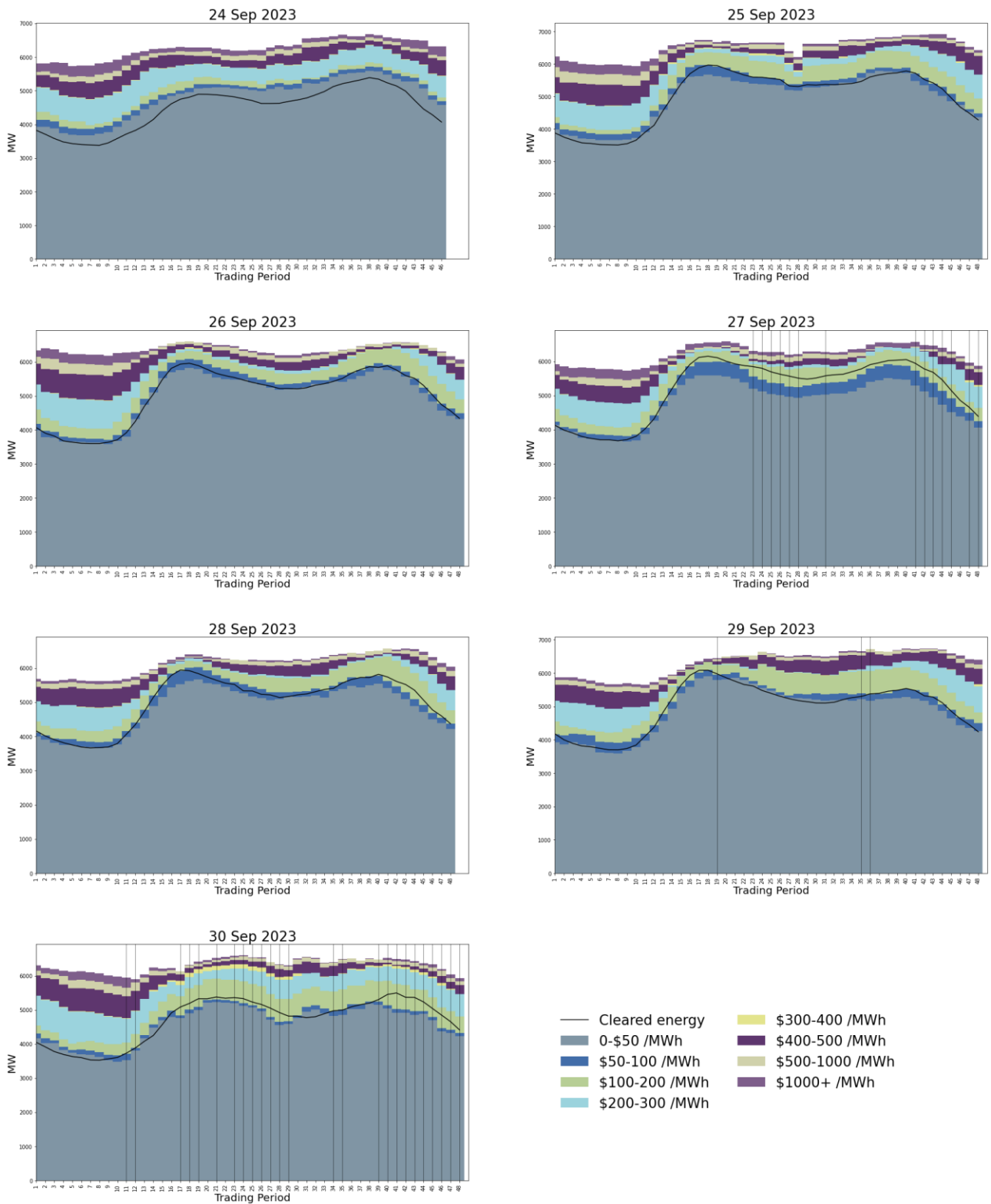
**Figure 16: Estimated monthly SRMC for thermal fuels**



## 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, the energy cleared in the lowest band due to high wind and low demand. However, on Monday and Tuesday, the cleared energy moved into the next band of \$100-\$200/MWh due to increase in demand.
- 12.4. On Wednesday, wind generation was over forecasted, and as a result high offer tranches were dispatched. However, on Saturday, the HVDC outage was limiting the flow and contributed to the increase of energy cleared in the \$100-\$200/MWh. The demand was also high on Saturday due to low temperatures.

**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**

<b>Date</b>	<b>TP</b>	<b>Status</b>	<b>Participant</b>	<b>Location</b>	<b>Enquiry topic</b>
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.