

27 November 2023



Trading conduct report

Market monitoring weekly report

Trading conduct report

1. Overview for week of 19-25 November

- 1.1. This week spot prices remained higher than the historic average, with around 50% of prices above \$150/MWh likely influenced by minimal offers within the \$50-\$100/MWh range as well as overnight prices remaining high on most days. There were multiple price spikes above \$300/MWh this week mainly due to wind being over forecast by above 200MW at times. Additional hydro and thermal generation were needed to meet the demand when the wind generation fell. The commissioning of Kaitaia solar farm has started, generating the first megawatts of grid connected solar last week. Hydro storage has dropped just below the historic mean at 98.6% as of 25 November.

2. Spot prices

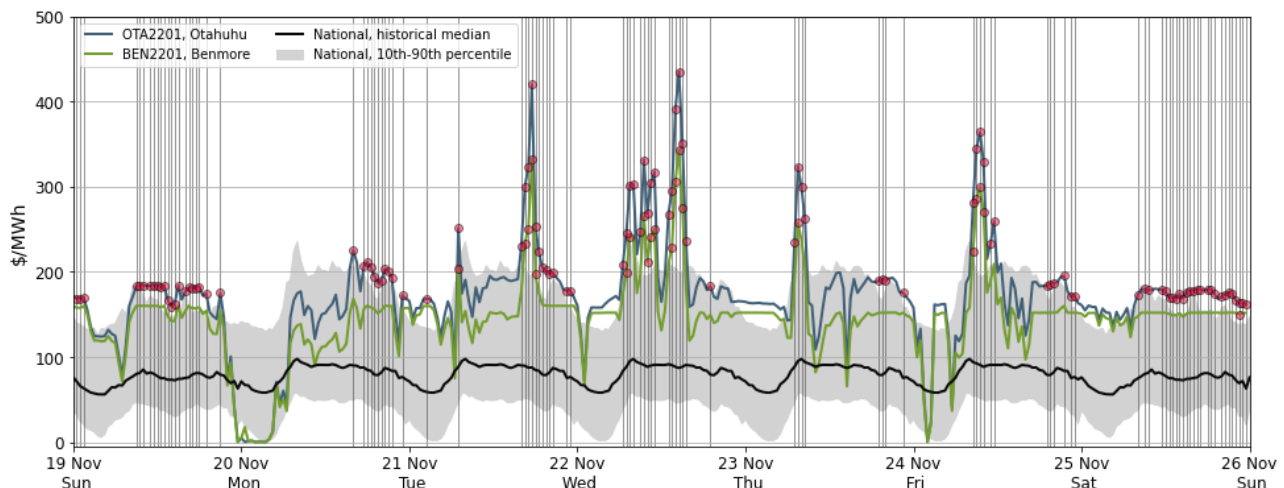
- 2.1. This report monitors underlying wholesale price drivers to assess whether trading periods require further analysis to identify potential non-compliance with the trading conduct rule. In addition to general monitoring, we also single out unusually high-priced individual trading periods for further analysis by identifying when wholesale electricity spot prices are outliers compared to historic prices for the same time of year.
- 2.2. Figure 1 shows the wholesale spot prices at Benmore and Ōtāhuhu alongside the national historic median and historic 10th-90th percentiles adjusted for inflation. Prices greater than quartile 3 (75th percentile) plus 1.5 times the inter-quartile range¹ of historic prices, are highlighted with a vertical black line. Other notable prices are marked with black dashed lines.
- 2.3. Between 19-25 November:
 - (a) The average wholesale spot price across all nodes was \$158/MWh.
 - (b) 95 percent of prices fell between ~\$2/MWh and \$299/MWh.
- 2.4. This week spot prices were mostly below \$200/MWh, however there were multiple spikes above \$300/MWh from Tuesday to Friday. The average weekly spot price was around \$27/MWh higher than the previous week driven by some of the price spikes as well as most prices sitting above the historic median.
- 2.5. The first significant price spikes of the week occurred on Tuesday between 4.30pm – 5.30pm. Prices at Ōtāhuhu were \$300/MWh, \$323/MWh, and \$420/MWh respectively, with Benmore prices at \$233/MWh, \$251/MWh, and \$333/MWh over these three trading periods. Wind generation was around 159-238MW less than forecast during this time which led to higher priced hydro and thermal being dispatched.
- 2.6. On Wednesday morning between 7.30am -11.00am Ōtāhuhu prices ranged ~\$220-\$331/MWh with 5 of those trading periods having prices above \$300/MWh. Benmore prices during this same period ranged from ~\$175-\$265/MWh. Wind generation between 7.30am -

¹ We are identifying any significantly high prices by using the historic distribution of prices depending on whether it is a weekday or weekend day, and looking for prices that lie 1.5 times the interquartile range above the 75th percentile of the distribution. This is using the outlier calculation $Q_3 + 1.5 \times IQR$, where Q_3 is the 75th percentile (or third quartile value) and IQR is your inter-quartile range.

11.00am around 81-168MW less than forecast again meaning higher priced thermal and hydro was dispatched to cover demand requirements.

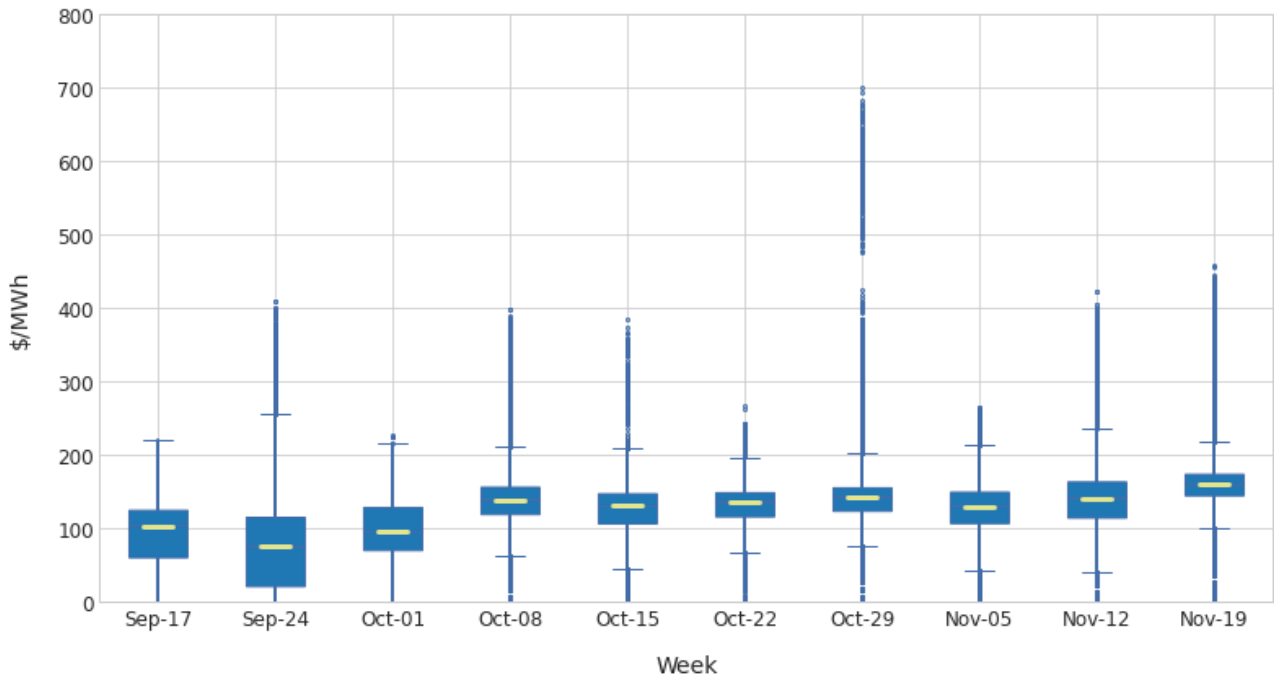
- 2.7. Wednesday afternoon between 1.30pm -3.30pm also saw some high prices over \$300/MWh. Prices during these trading periods at Ōtāhuhu ranged from \$295-\$435/MWh and between \$229-\$343/MWh at Benmore. Low wind generation saw more thermal and hydro being dispatched, although both demand and wind forecasts were closer to actual demand and generation.
- 2.8. During low wind generation on Thursday morning there was a price spike at 7.30am. The price at Ōtāhuhu was \$324/MWh and \$257/MWh at Benmore. Wind generation continued to be low on Thursday morning. Four peakers were running and the highest peak in hydro generation occurred during this morning peak driving up prices as higher priced hydro was dispatched.
- 2.9. From 8.30am -10.00am on Friday prices spiked again with Ōtāhuhu prices between \$280-\$364/MWh and Benmore prices between \$224-\$299/MWh. Demand was high on Friday in line with a cold snap across most of the country. Wind generation was around 138-233MW less than forecast which saw four peakers running and hydro generation ramped up. Again, inaccurate wind forecasts saw higher priced hydro tranches being dispatched.

Figure 1: Wholesale spot prices at Benmore and Ōtāhuhu between 19-25 November



- 2.10. 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.
- 2.11. The box and whiskers section of the plot this week is more condensed. However, prices are slightly higher overall than the week before. The middle 50% of prices sat within \$144/MWh and \$173/MWh, with the median this week at \$159/MWh. There were multiple outliers this week with some 5 minute prices going above \$400/MWh.

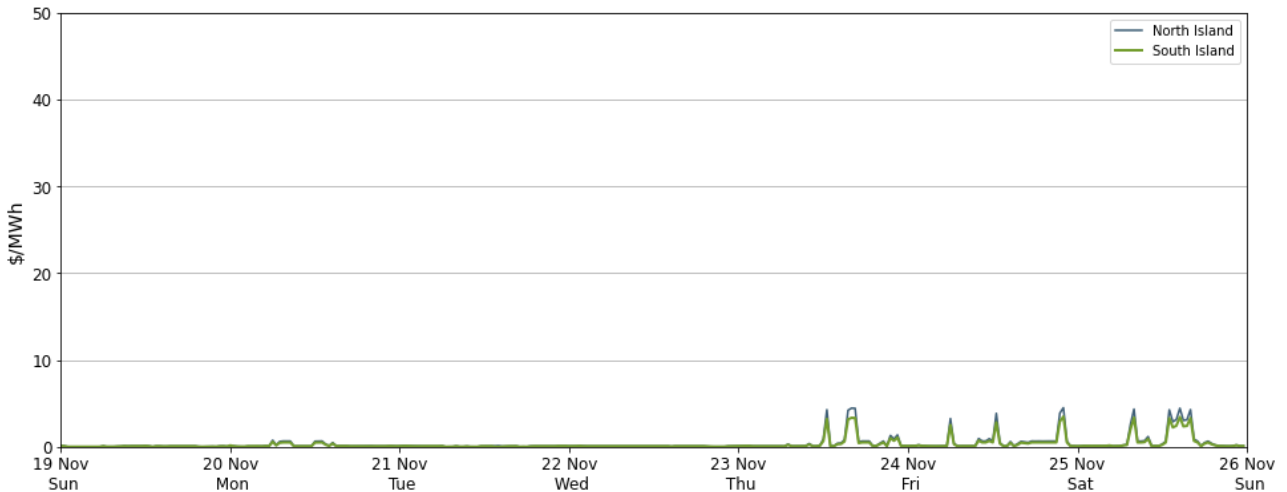
Figure 2: Boxplots showing the distribution of the spot prices this week and the previous nine weeks



3. Reserve prices

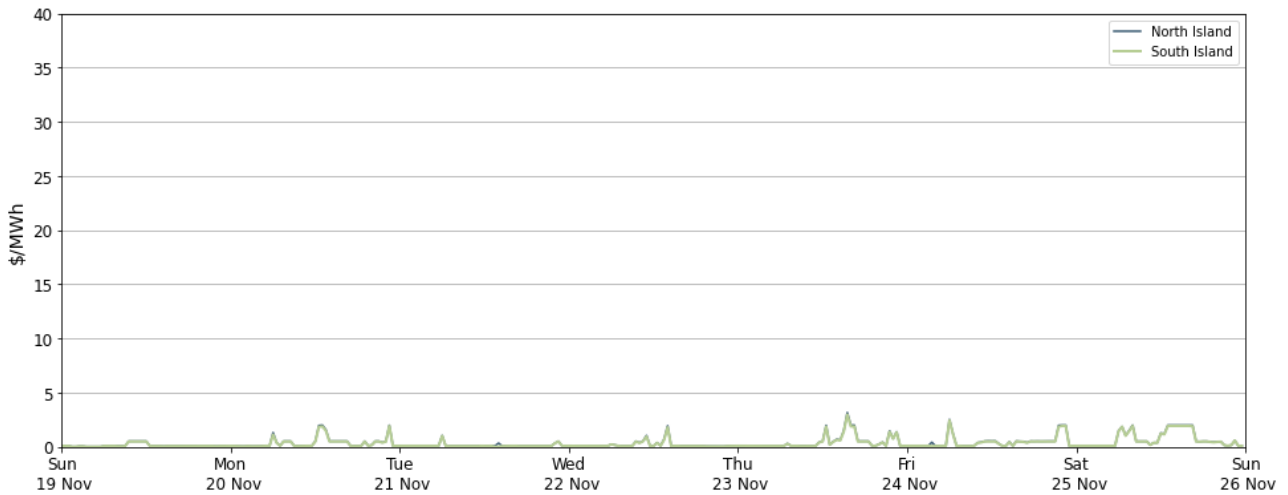
3.1. Fast Instantaneous Reserve (FIR) prices for the North and South Islands are shown below in Figure 3. This week FIR prices were all below \$5/MWh this week.

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 all below \$5/MWh this week.

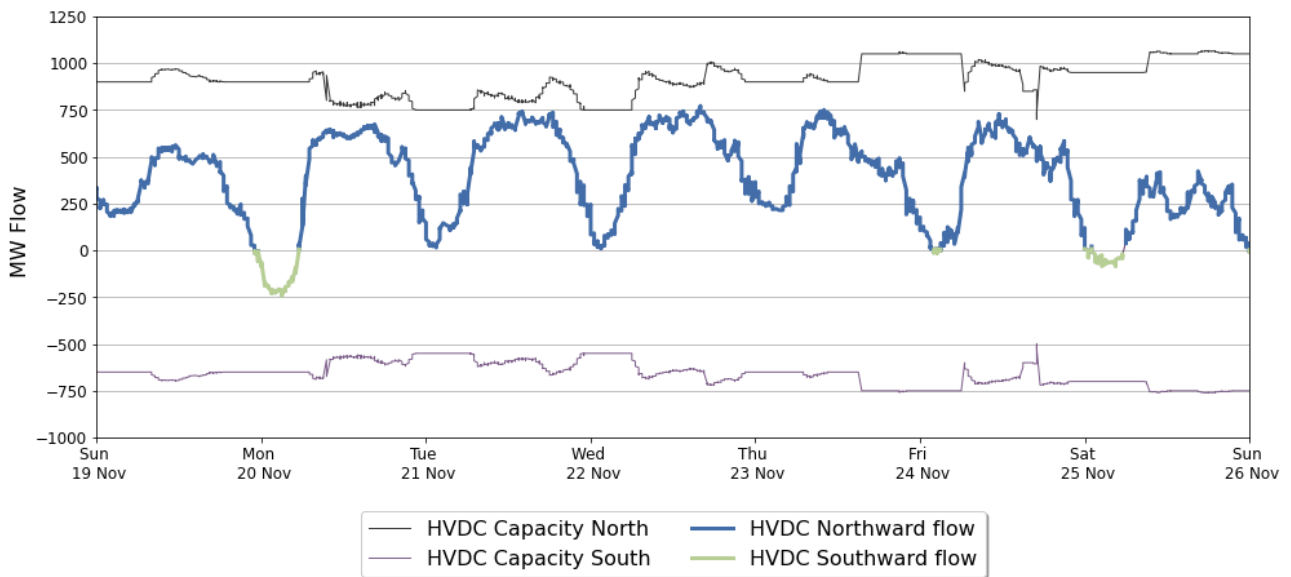
Figure 4: Sustained Instantaneous Reserve (SIR) prices by trading period and island



4. HVDC

4.1. Figure 5 shows HVDC flow between 19-25 November. HVDC flows were mainly northwards and under 750MW.

Figure 5: HVDC flow and capacity



5. Regression residuals

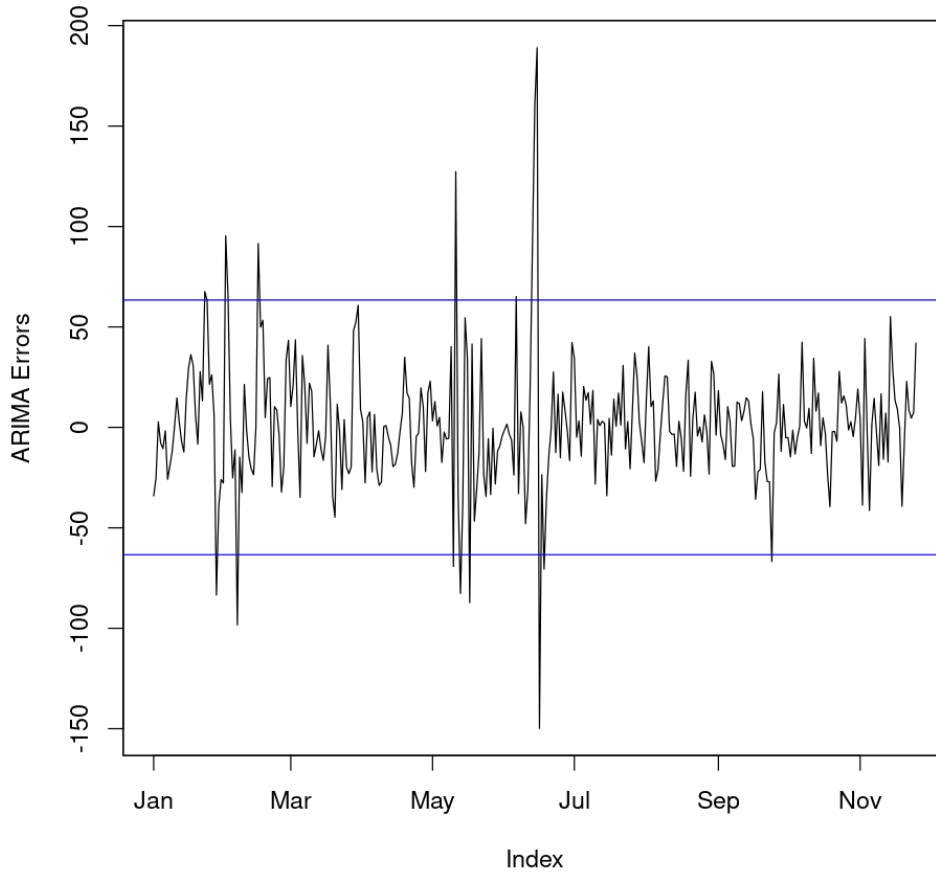
5.1. The Authority’s monitoring team uses a regression model to model spot price. The residuals show how close the predicted prices were to actual prices. Large residuals may indicate that prices do not reflect underlying supply and demand conditions. Details on the regression model and residuals can 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 no residuals were above or below 2 standard deviations, indicating actual and modelled prices were similar.

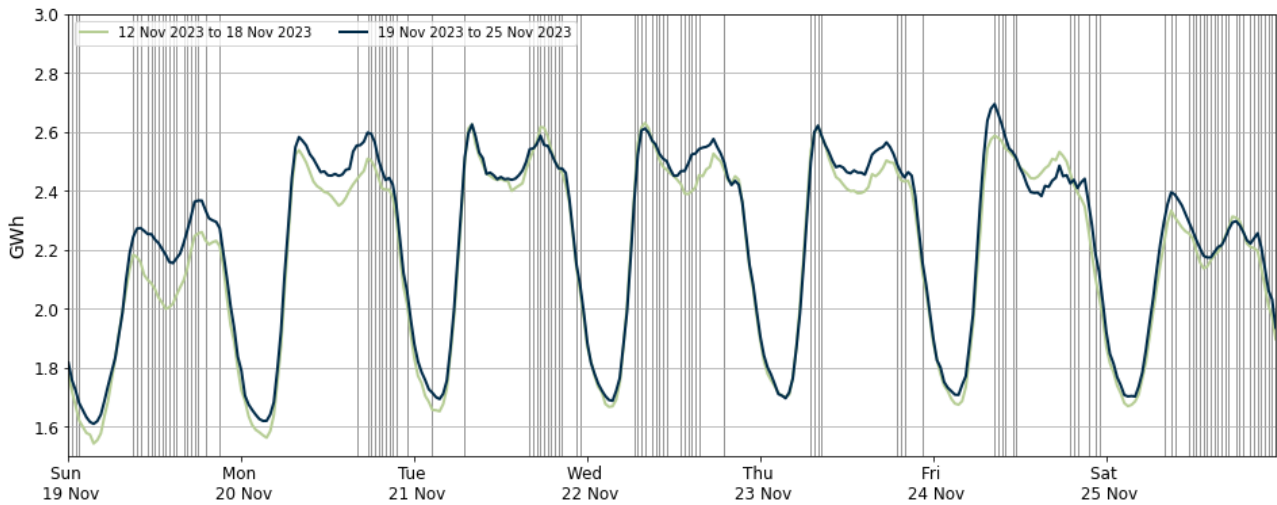
Figure 6: Residual plot of estimated daily average spot prices from 1 January 2023 - 25 November 2023



6. Demand

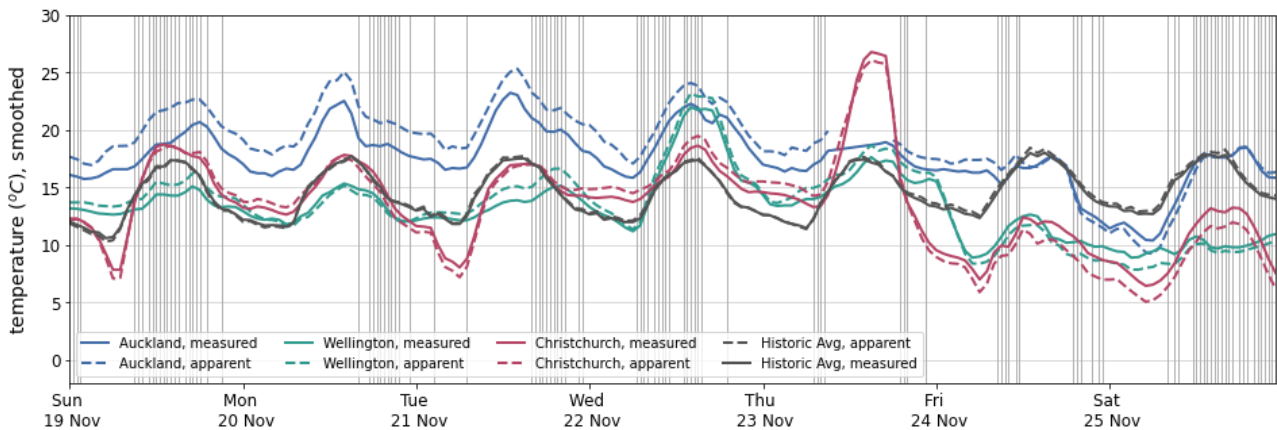
- 6.1. Figure 7 shows national demand between 19-25 November, compared to the previous week. Overall, demand was a bit higher than the previous week, particularly during some weekday shoulder and peak periods. Friday morning peak was close to 2.7GWh as cold weather hit the country.

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 19-25 November. 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 temperatures² were mainly above 15°C and above average apart from a small dip in temperatures on Friday night into Saturday morning. Wellington temperatures sat around historic mean for most of the week until Friday where temperatures dipped below 10°C and remained low throughout Saturday. Christchurch saw temperatures reach 26°C on Thursday but also saw apparent temperatures dip to around 5°C on Friday and Saturday morning.

Figure 8: Temperatures across main centres



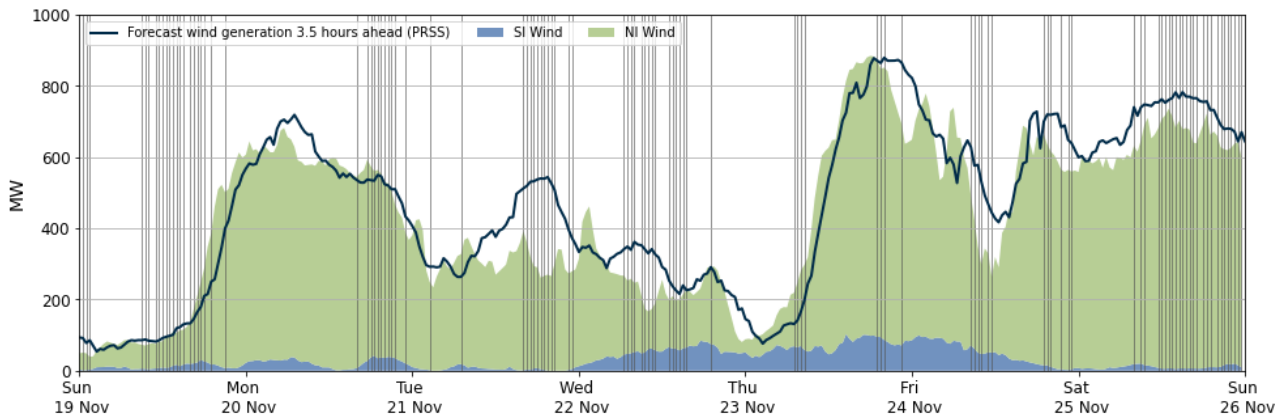
7. Generation

- 7.1. Figure 9 shows wind generation, from 19-25 November. Wind generation varied between 39MW and 884MW across the week. Lower than forecast wind generation saw some high prices occur with hydro and thermal filling the gaps to meet demand. Consecutive trading

² Note: some temperature data for Auckland was missing from 10.00am until 3.00pm on 23 November

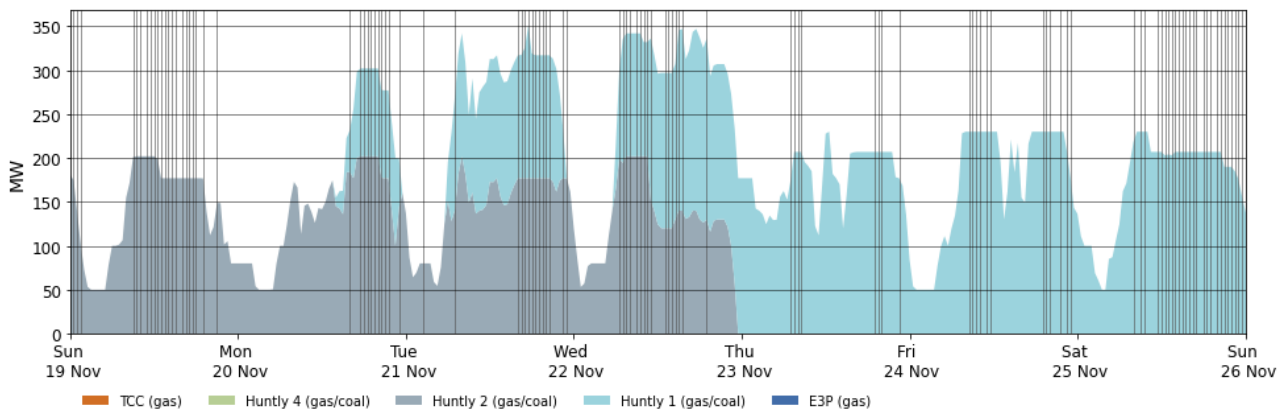
periods saw forecast discrepancies between 150-200MW on more than one occasion this week. Most of the high prices occurred when wind generation was low and/or over forecast.

Figure 9: Wind generation and forecast between 19-25 November

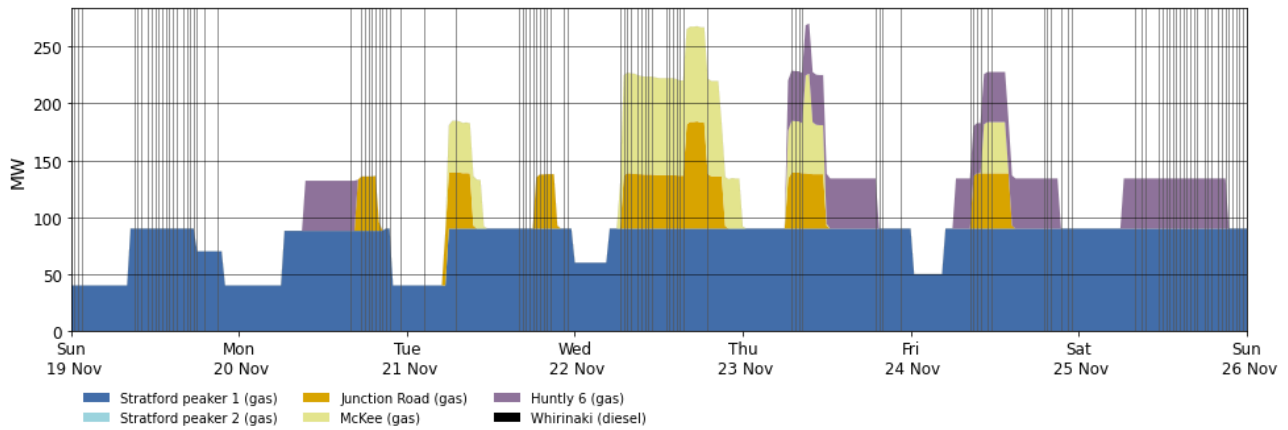


- 7.2. On 23 November, Kaitaia became the first grid connected solar farm, with output of up to 2MW. As the commissioning process continues, the maximum output is expected to reach 32MW³. At current volumes, utility solar is still less than 0.1% of total grid generation.
- 7.3. Figure 10 shows the generation of thermal baseload and thermal peaker plants between 19-25 November. Huntly 1 and Huntly 2 ran as baseload this week; Huntly 2 ran from Sunday through to Wednesday evening and Huntly 1 ran Monday to Saturday.
- 7.4. Stratford 1 ran continuously again this week with a maximum capacity currently of 90MW. Huntly 6 covered peak and/or shoulder periods on Monday and Thursday to Saturday. Junction Road and McKee ran on most weekday peak periods as well as over the shoulder period on Wednesday. Low wind generation on Tuesday and Wednesday saw three peakers and two Rankines running to meet demand requirements.

Figure 10: Thermal generation between 19-25 November

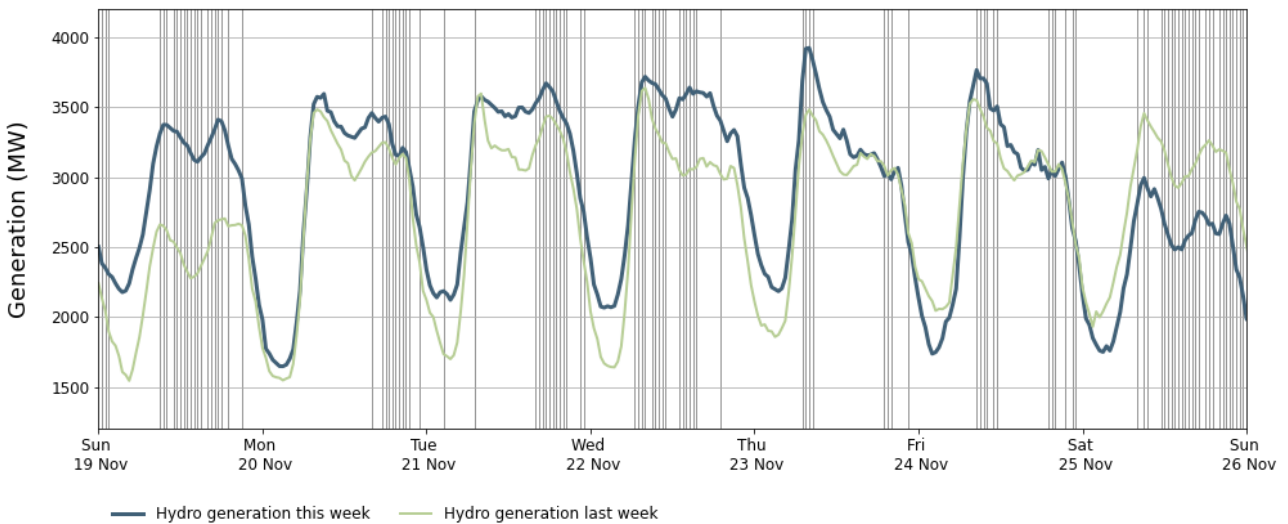


³ [MO Latest Daily Update.pdf \(transpower.co.nz\)](https://www.transpower.co.nz/MO-Latest-Daily-Update.pdf)



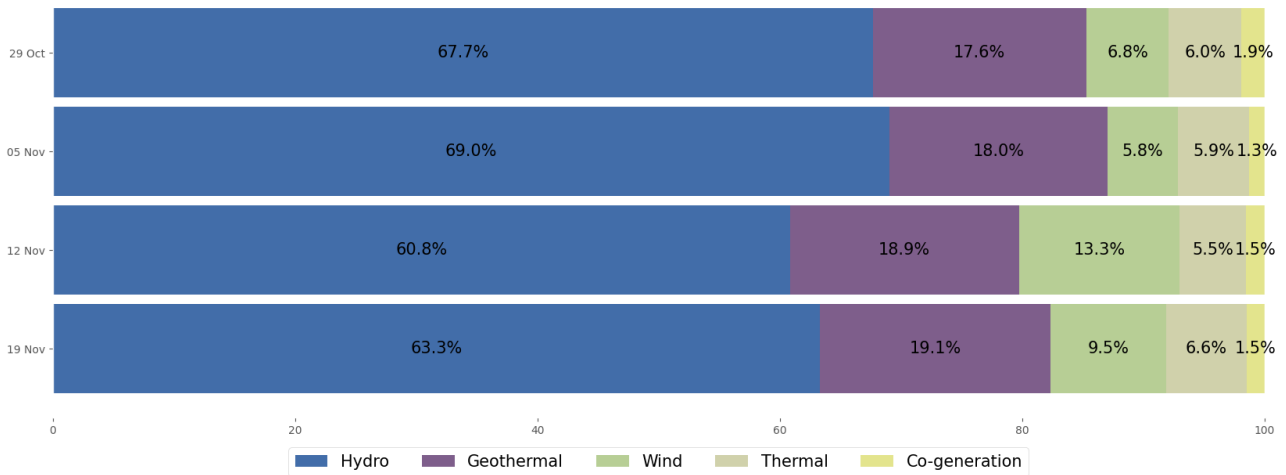
7.5. Figure 11 shows hydro generation between 19-25 November. Hydro generation was higher than the previous week with generation being ramped up to cover low or over forecast wind.

Figure 11: Hydro generation between 19-25 November



7.6. As a percentage of total generation, between 19-25 November, total weekly hydro generation was 63.3%, geothermal 19.1%, wind 9.5%, thermal 6.6%, and co-generation 1.5%. Increases to the proportion of hydro and thermal this week are due to lower wind generation.

Figure 12: Total generation by type as a percentage each week between 22 October and 25 November



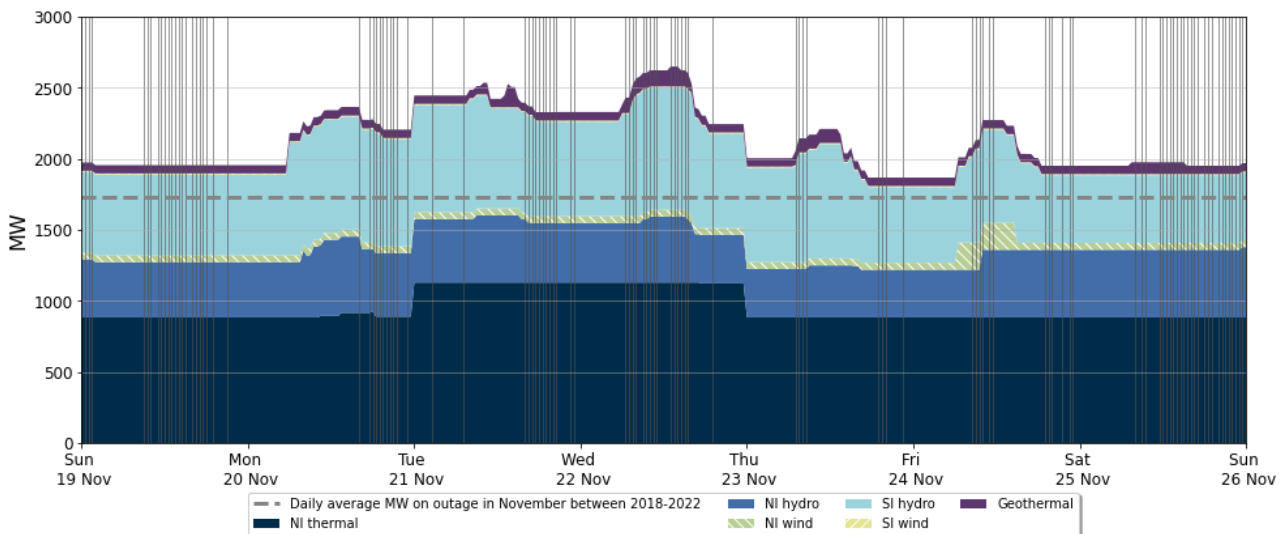
8. Outages

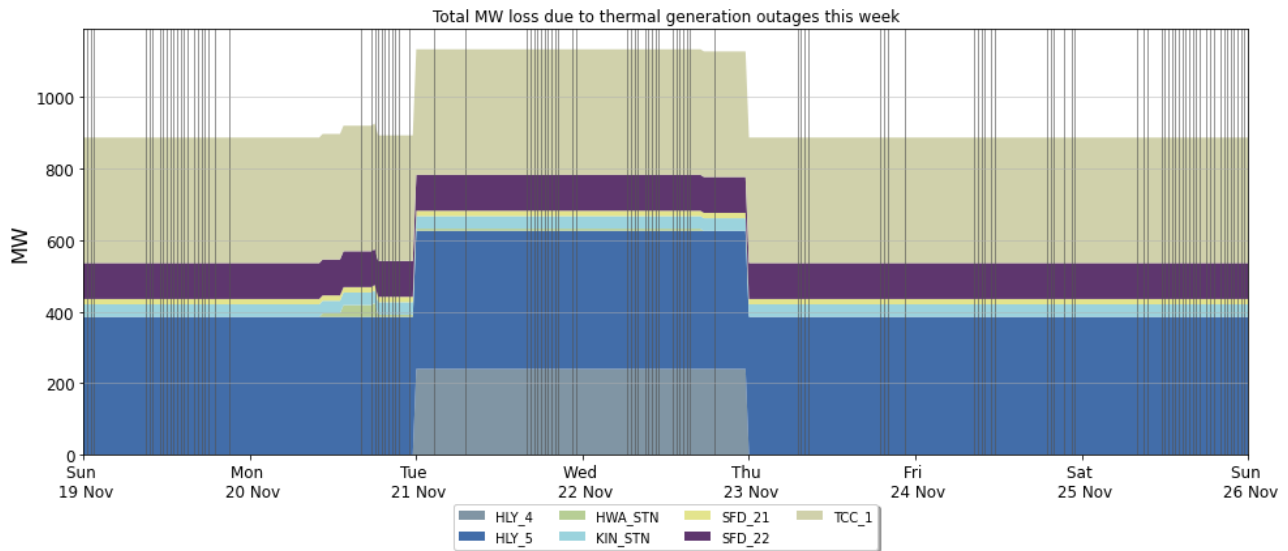
8.1. Figure 13 shows generation capacity on outage. Total capacity on outage between 19-25 November ranged from ~1900MW to 2600MW.

8.2. Notable outages include:

- (a) Huntly 5 on outage until 22 January 2024
- (b) TCC on outage until 22 December
- (c) Huntly 4 on outage 21-22 November and 24 November-10 December
- (d) Stratford 2 on outage until 28 February 2025
- (e) Poihipi geothermal unit was on outage during the day on 22 and 23 November
- (f) West Wind Station was on outage from 6.30am to 2.00pm on 24 November
- (g) Various North and South Island hydro units on outage.

Figure 13: Total MW loss due to generation outages

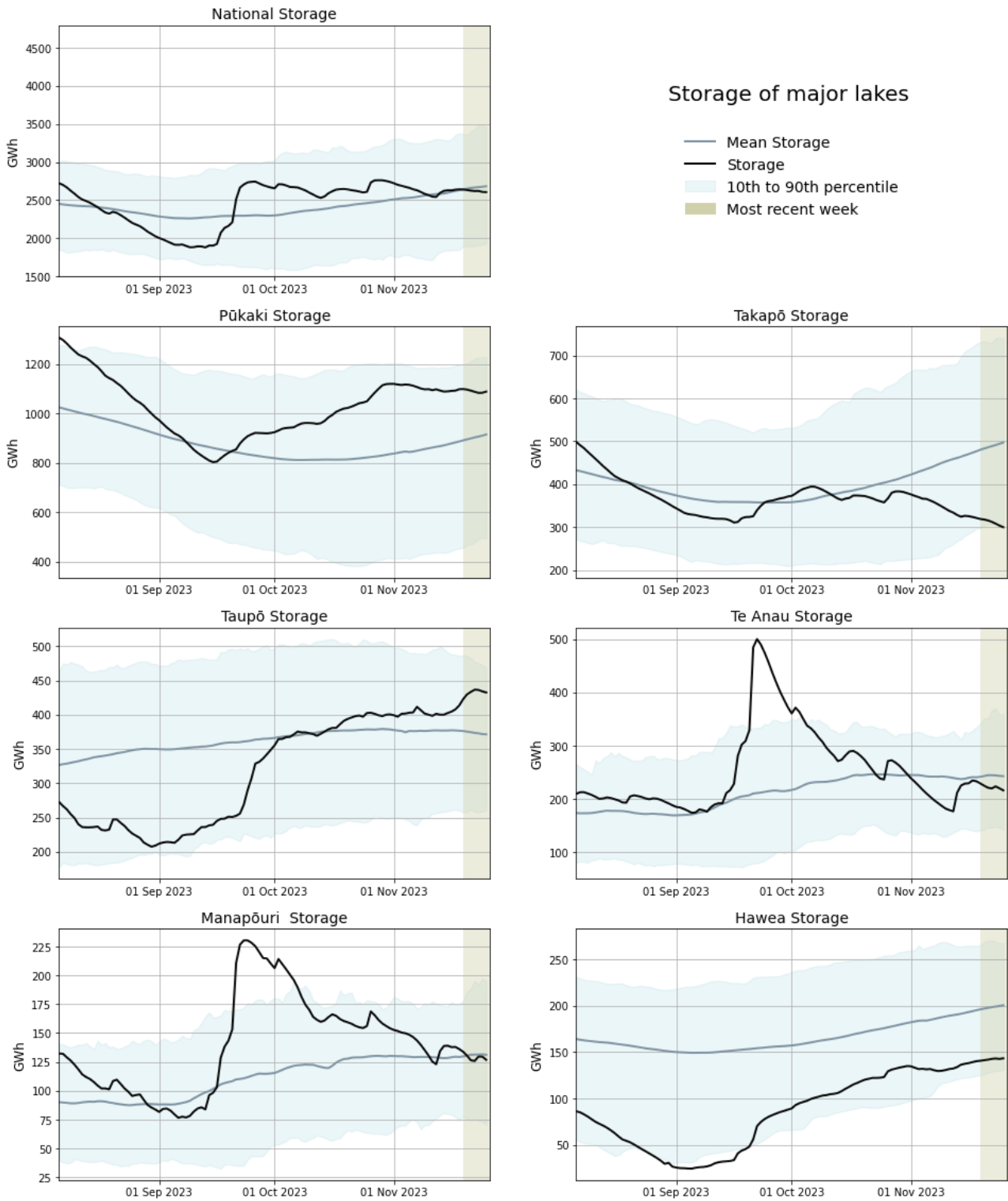




9. Storage/fuel supply

- 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 10th to 90th percentiles.
- 9.2. National hydro storage levels decreased over the week and are 66% nominally full and 98.6% of historic mean as of 25 November.
- 9.3. Pūkaki storage was steady and remains close to its historic 90th percentile. Takapō lake levels have declined over the week with its storage now around its historic 90th percentile. Taupō storage increased over the beginning of the week before starting to dip again, with the lake level above its historic mean. Manapōuri and Te Anau lake levels decreased and are both close to but below their historic mean. Hawea storage had a small increase but remains close to its historic 10th percentile range.

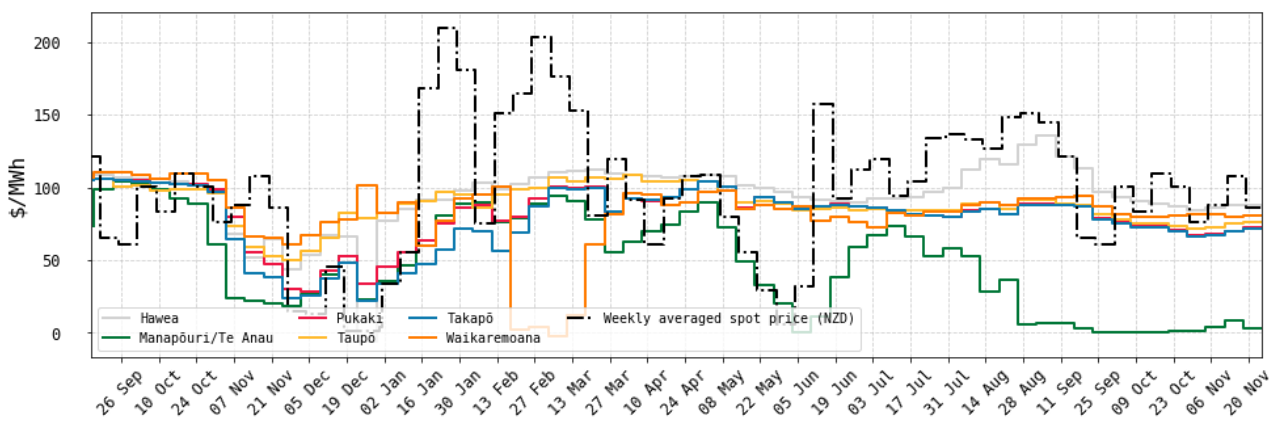
Figure 14: Hydro storage



10. JADE water values

- 10.1. The JADE⁴ 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 25 November 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. There was little change in water values for most lakes this week with the largest change in value at Manapōuri/Te Anau dropping around \$5/MWh compared to the previous week.

Figure 15: JADE water values across various reservoirs between 15 September 2022 and 25 November 2023



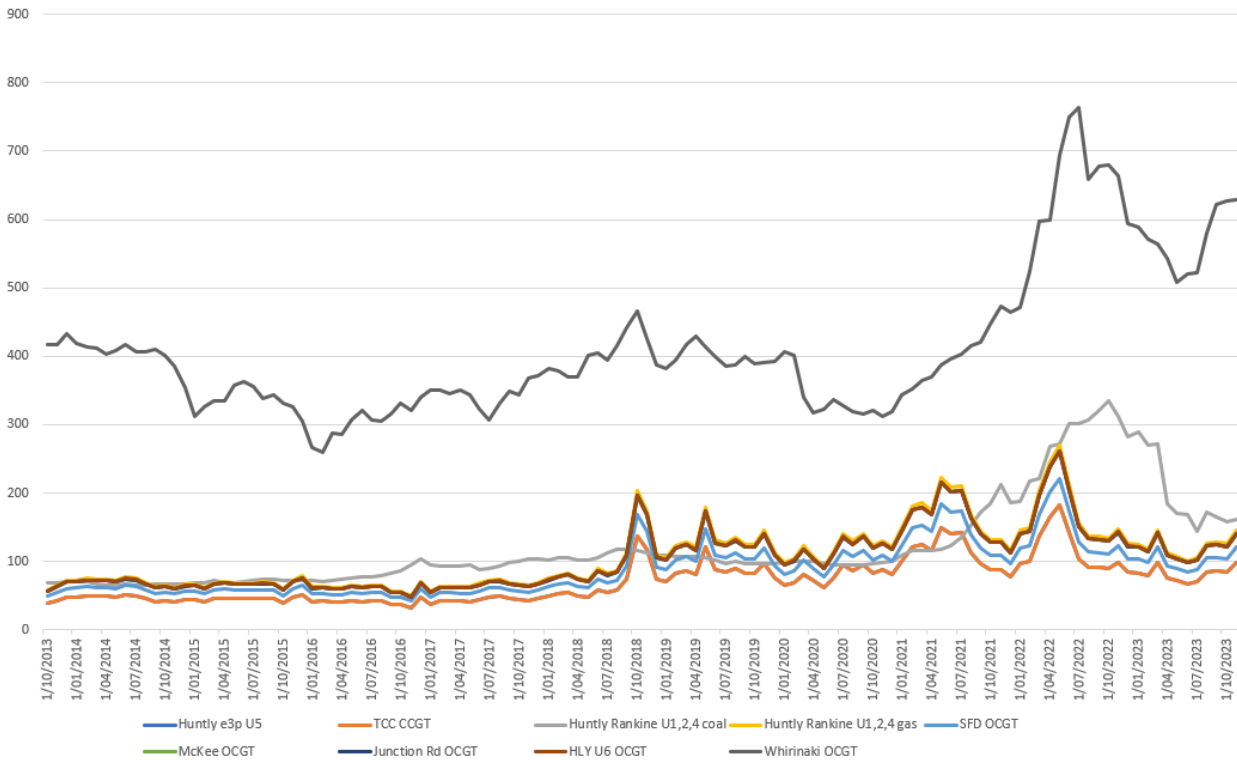
11. Prices versus estimated costs

- 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 November 2023. The SRMC of diesel plants has been increasing since May, and the SRMC of coal-fuelled and gas-fuelled plants has started to increase again. The recent increase in the SRMC of gas likely reflects increased production at Methanex, as well as gas production outages.
- 11.4. The latest SRMC of coal-fuelled Rankine generation is ~\$161/MWh. This is now only slightly higher than the cost of running the Rankines on gas at \$141/MWh, with Genesis continuing to run the Rankines on a combination of both fuels.

⁴ 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 gas fuelled thermal plants is currently between \$98/MWh and \$141/MWh. The SRMC of Whirinaki has increased to ~\$629/MWh.
- 11.6. More information on how the SRMC of thermal plants is calculated can be found in [Appendix C](#) on the trading conduct webpage.

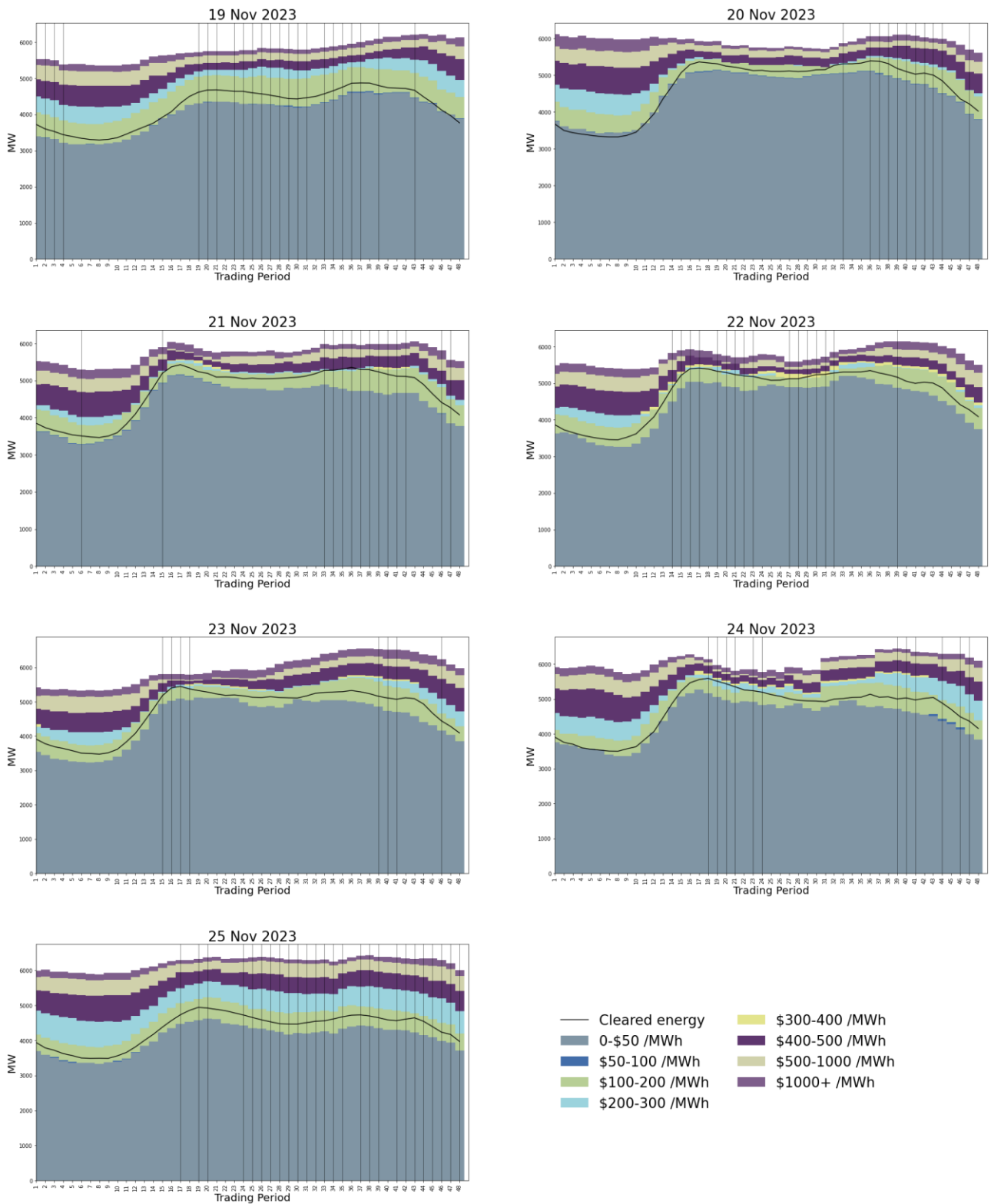
Figure 16: Estimated monthly SRMC for thermal fuels



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. There were minimal offers in the \$50-\$100/MWh price range. Low wind generation and outages also reduced total generation offered at times, particularly on 22 and 23 November
- 12.3. Most offers cleared within the \$100-\$200/MWh band. However, some very thin \$200-\$300/MWh bands, particularly during some of the weekday morning peaks, saw some prices clear in the \$300-\$400/MWh price range.

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	Resolved	Genesis	Huntly 5	No further analysis required.
14/06/2023	15-17	Passed to Compliance	Genesis	Multiple	High energy prices associated with high energy offers.
15/06/2023	15-19	Passed to Compliance	Genesis and Contact	Multiple	High energy prices associated with high energy offers.
22/09/2023-30/09/2023	Several	Further analysis	Contact	Multiple	High hydro offers.
11/10/2023	21	Further Analysis	Genesis	Tokaanu	High prices during off-peak time.