

Trading Conduct Report

Market Monitoring Weekly Report

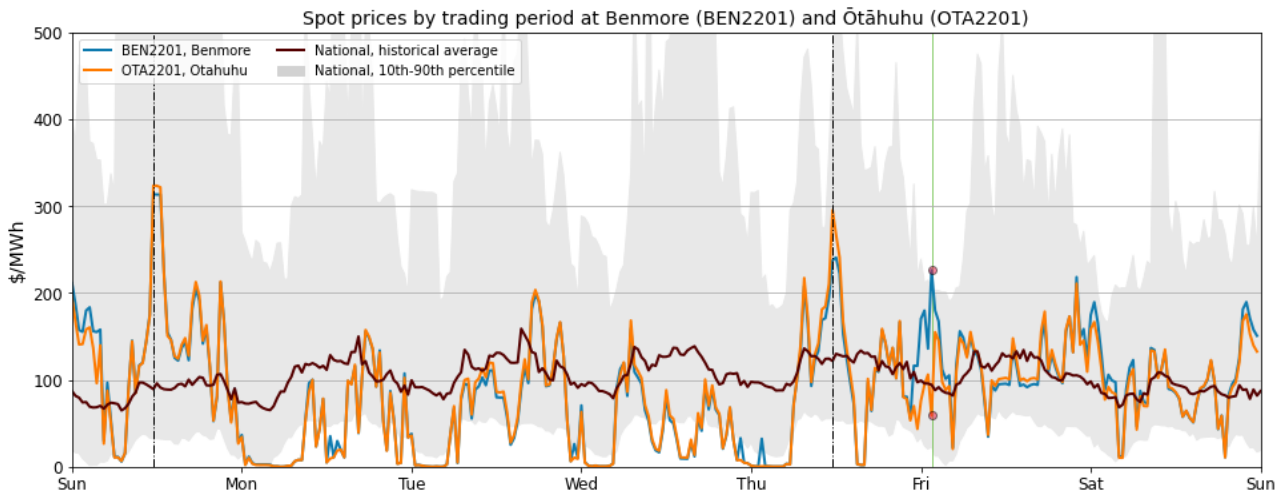
1. Overview for the week of 5-11 February 2023

- 1.1. Spot prices between 5-11 February 2023 appear to be consistent with market conditions.

2. Spot Prices

- 2.1. This report monitors underlying wholesale price drivers to assess whether there are trading periods that require further analysis for the purpose of considering 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 exceeds its historical 90th percentiles. Note that this week, prices above the historic 90th percentile are highlighted with a translucent green line. Other high prices, but which didn't exceed the 90th percentile, are highlighted with a black dotted line.
- 2.2. Between 5-11 February 2023:
 - (a) The average wholesale spot price across all nodes was \$86/MWh.
 - (b) 95 per cent of prices fell between \$0.24/MWh and \$219/MWh.
- 2.3. Figure 1 shows spot prices at Benmore and Ōtāhuhu alongside their historic median and historic 10th- 90th percentiles adjusted for inflation.
- 2.4. Peak and off-peak prices fell this week. There were more instances of prices below \$100/MWh, when compared to the previous week, mostly occurring overnight between Sunday and Thursday.
- 2.5. Spot prices breached the 90th percentile of historic prices at Benmore on Friday morning at 1:30am. Prices were separated, with higher prices in the South, between 11:00pm on Thursday evening until 1:30am Friday morning. This occurred as a line constraint limited Northern generation from travelling South over the HVDC, and more expensive Southern generation was dispatched to cover South Island load.
- 2.6. The highest price of the week occurred on Sunday at 11:30am. The price at Ōtāhuhu was \$323/MWh and at Benmore it was \$313/MWh.
- 2.7. Another high price occurred on Thursday at 11:30 am.

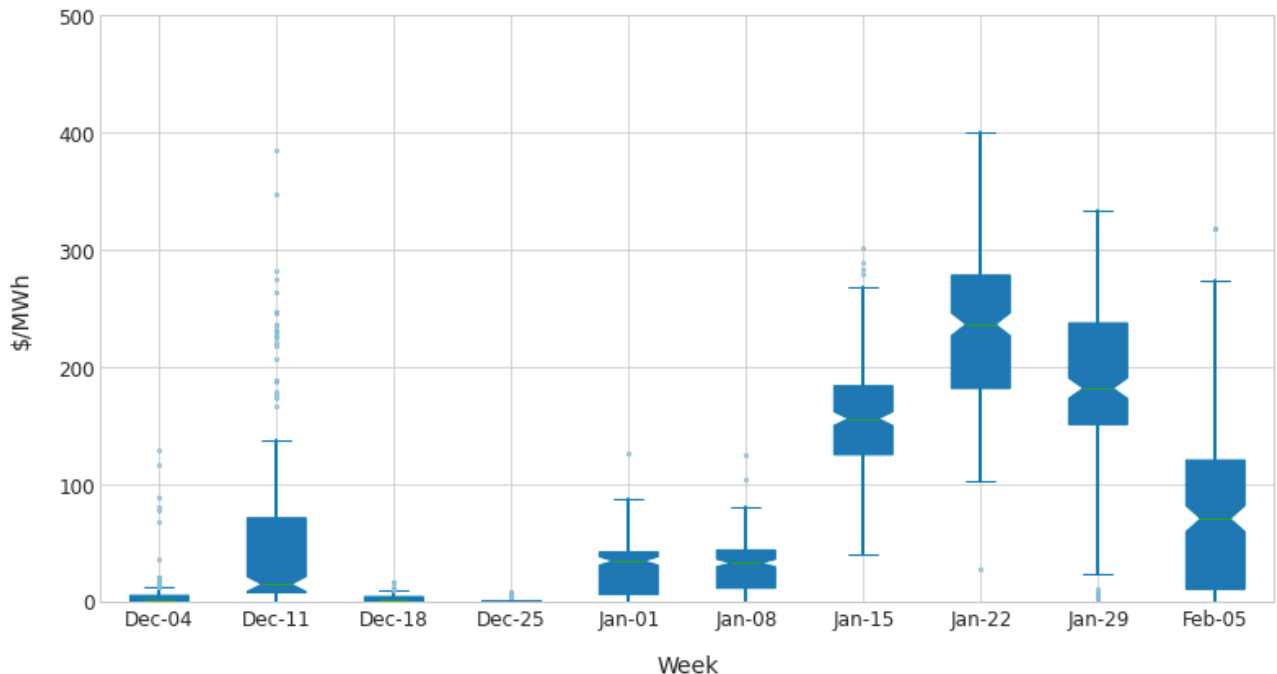
Figure 1: Wholesale Spot Prices between 5-11 February 2023



2.8. 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 per cent of prices fell). The “whiskers” extend to points that lie within 1.5 times the inter-quartile range (IQR)¹ of the lower and upper quartile, and then observations that fall outside this range are displayed independently. In mid-late January the median spot prices increased, as indicated by the higher green bars and larger boxes and whiskers. However, this week, prices have fallen compared to the prices seen in January.

2.9. The decrease in spot prices this week occurred as wind generation was high, demand was lower, and fewer thermal peakers ran. Instances of high prices this week occurred when wind was low and more thermal peakers ran. The price separation on Friday was the result of a line constraint.

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

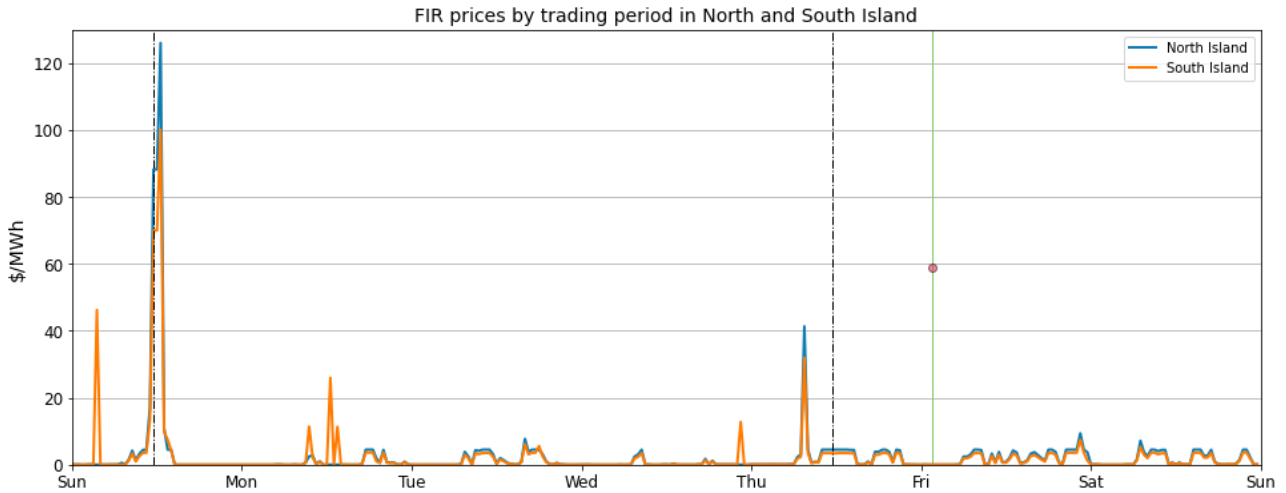


¹ Quartile - Wikipedia

3. Reserve Prices

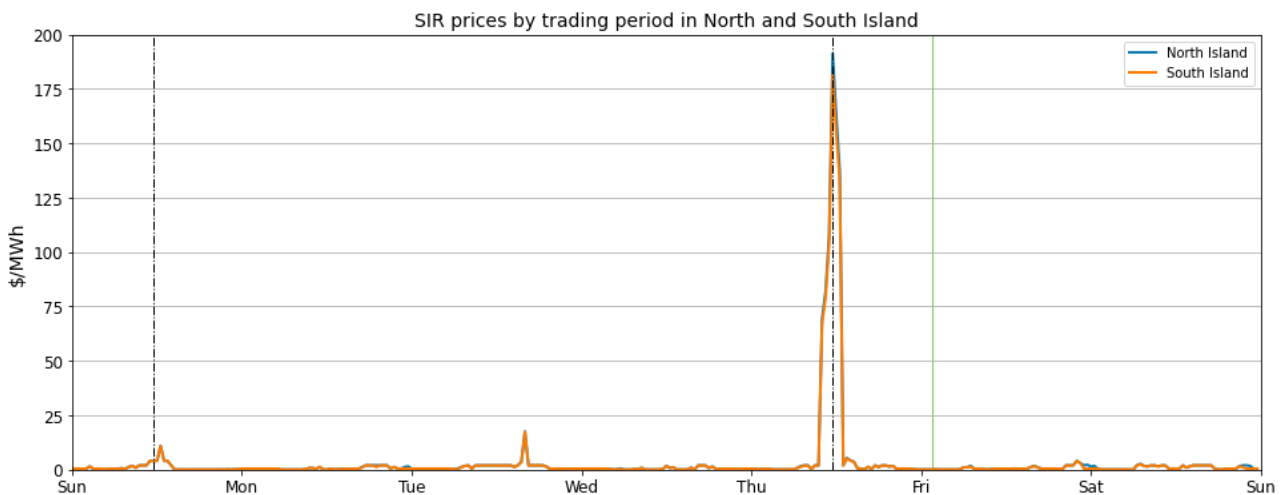
3.1. Fast instantaneous reserve (FIR) prices for the North and South Island are shown below in Figure 3. This week there were four instances where both North and South Island FIR prices were above \$20/MWh, with the highest of these occurring on Sunday in the North Island.

Figure 3: FIR prices by trading period and Island



3.2. Sustained instantaneous reserve (SIR) prices for the North and South Island are shown in Figure 4. There was a large SIR spike on Thursday morning, with North and South Island prices reaching \$191/MWh and \$181/MWh respectively at 11:30am.

Figure 4: SIR prices by trading period and Island

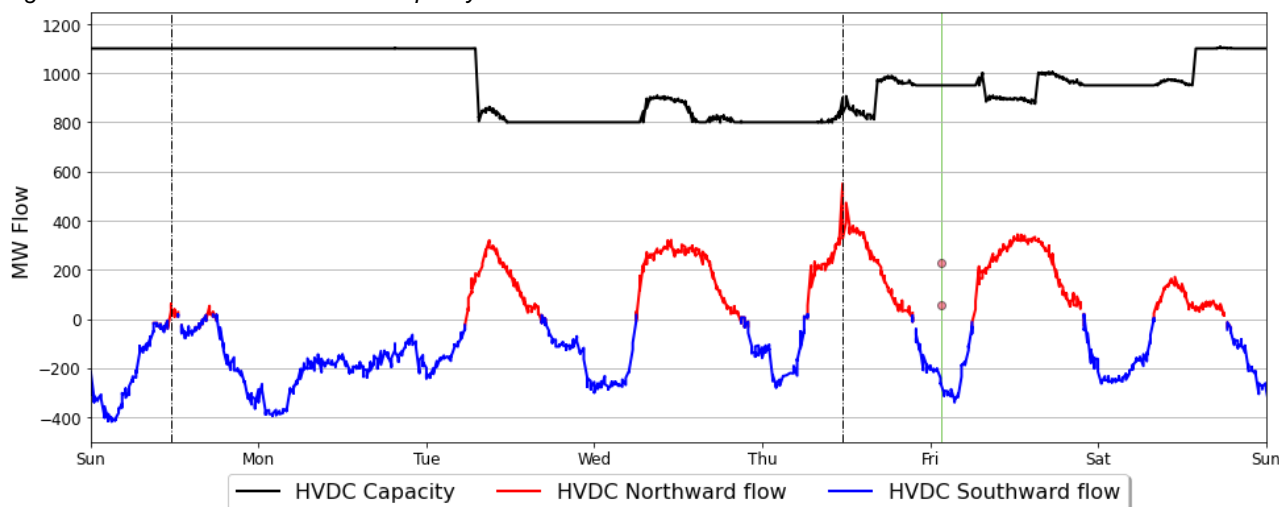


4. HVDC

4.1. Figure 5 shows northward HVDC flow between 5-11 February. Between Sunday and Monday, HVDC flow was Southward, reflecting high North Island wind and hydro generation. Then from Tuesday onwards, HVDC flows were Northward during the day, and

Southbound overnight. Note the spike in HVDC transfer co-occurred with the Thursday morning price spike.

Figure 5: HVDC northward flow and capacity

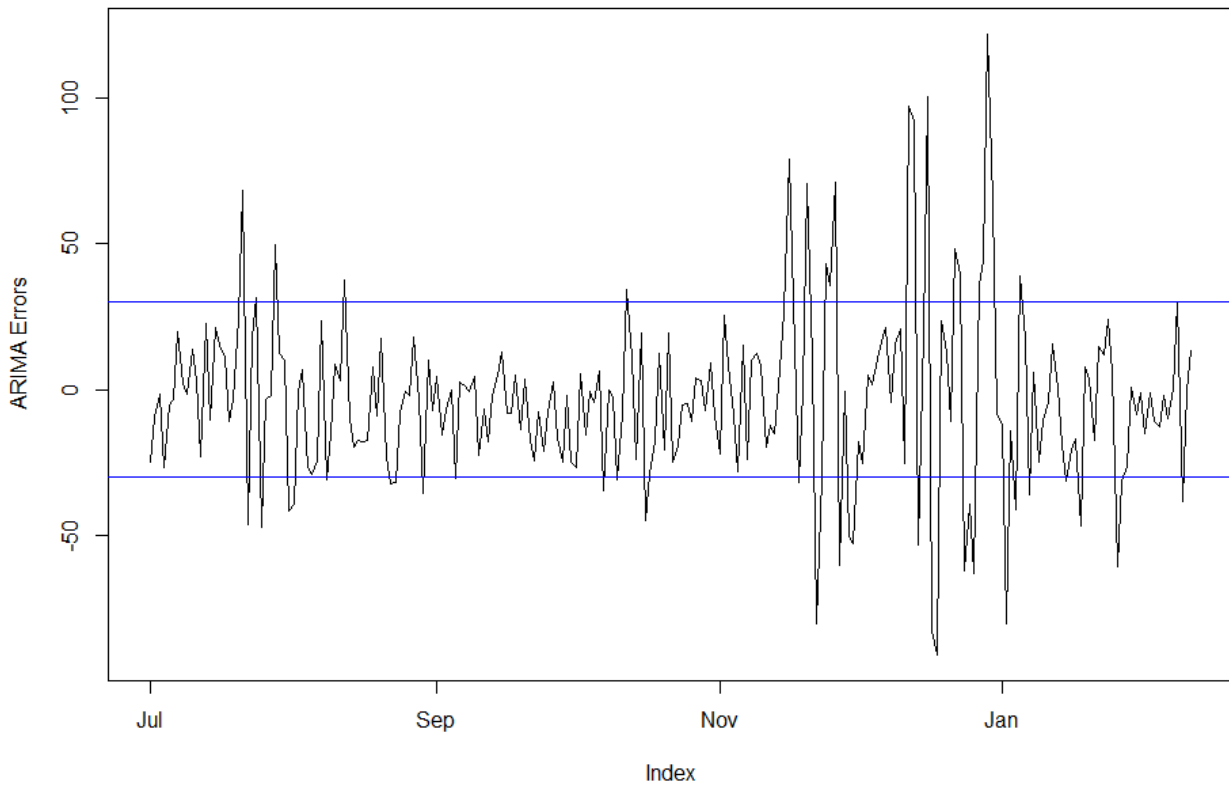


5. Regression Residuals

- 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 A² on the trading conduct webpage.
- 5.2. Figure 6 shows the residuals of autoregressive moving average (ARMA) errors from the daily model. Residuals were relatively small, suggesting that prices on those dates appear to be largely aligned with market conditions.

² <https://www.ea.govt.nz/assets/dms-assets/29/Appendix-A-Regression-Analysis.pdf>

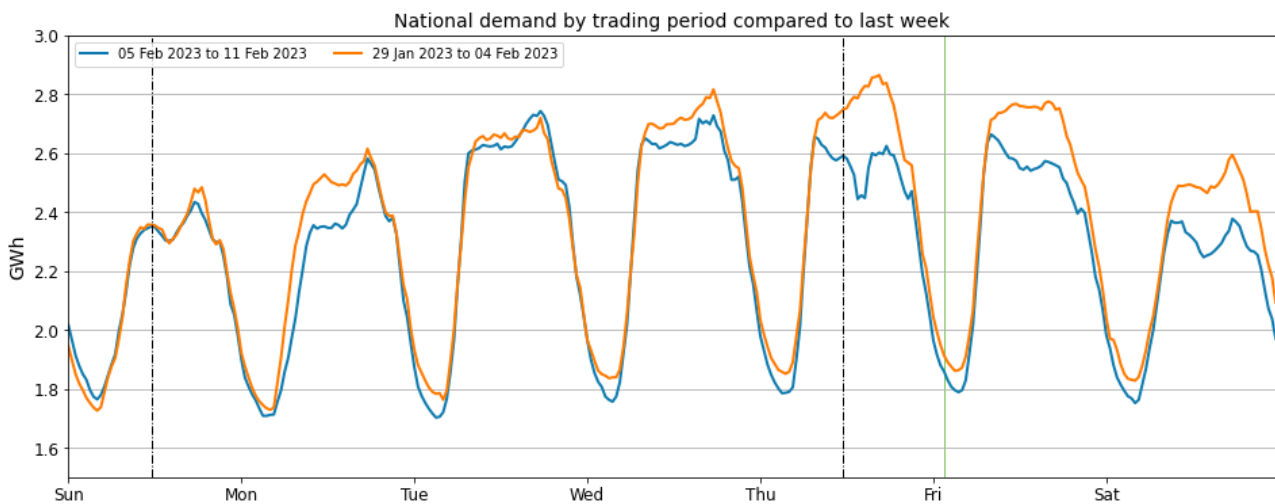
Figure 6: Residual plot of estimated daily average spot prices from 1 July 2022 – 11 February 2023. The blue lines show two standard deviations of the ARMA errors.



6. Demand

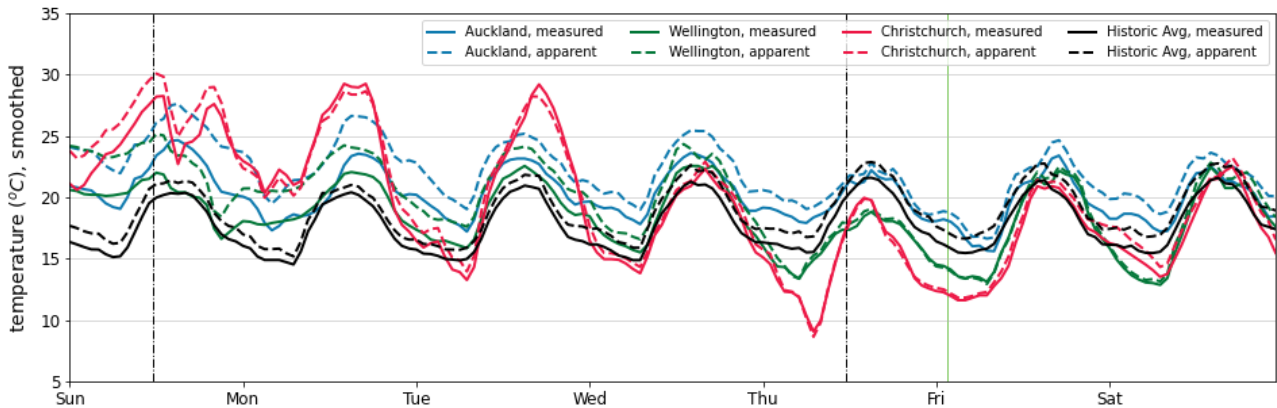
6.1. Figure 7 shows national grid demand between 5-11 February, compared to the previous week. Daily demand was lower than the previous week for all days, except Tuesday, which was similar. There were large differences between Thursday and Saturday. This likely occurred as temperatures across the country were milder this week compared to last, with less air conditioning demand. Note the large drop in demand on Thursday occurred at Tiwai Point.

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



- 6.2. Figure 8 shows hourly temperature at main population centres. 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. Between Sunday and Wednesday, temperatures across all main centres were mostly above the historic average. The price spike on Thursday occurred as temperatures across all main centres, were lower compared to earlier in the week. Between Thursday and Saturday temperatures were mostly at or below the historic average in all main centres.

Figure 8: Temperatures across main centres



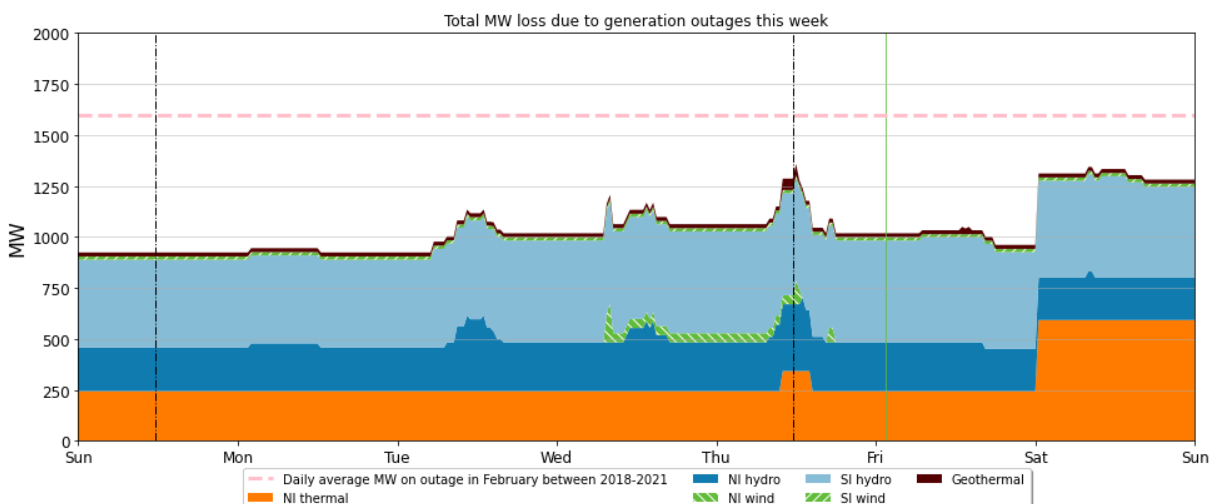
7. Outages

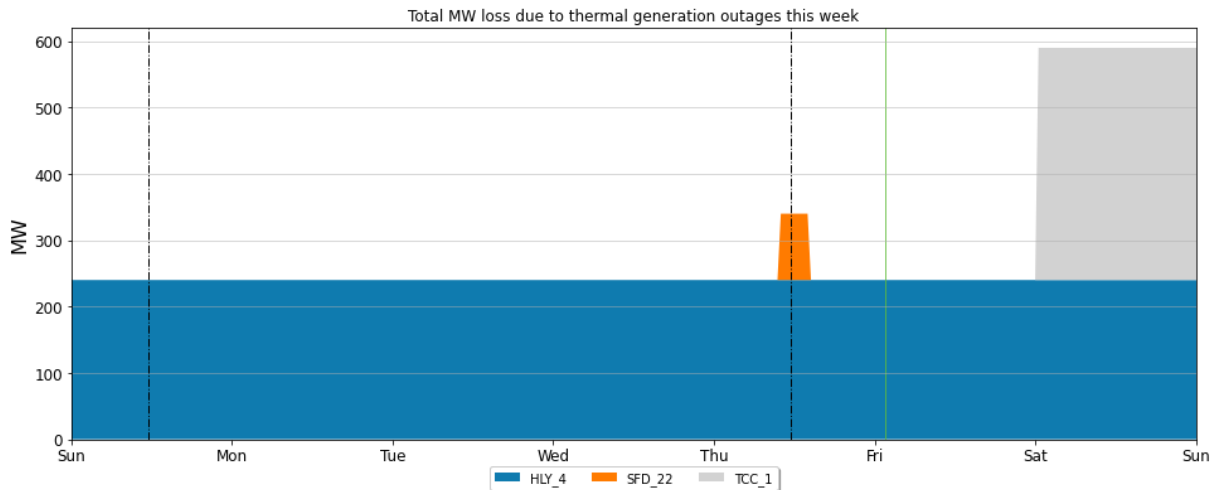
7.1. Figure 9 shows generation capacity on outage. Total capacity on outage 5-11 February ranged between ~900 – 1,250 MW. Outages were mostly between ~900 and ~1,100 MW between Sunday and Friday. Increasing during periodic North and South Island hydro outages and North Island wind outages. Outages increased to over ~1,250 MW on Saturday as TCC went on outage.

7.2. Notable outages include:

- (a) Huntly 4 remains on outage.
- (b) TCC began an outage on Saturday.

Figure 9: Total MW loss due to generation outages

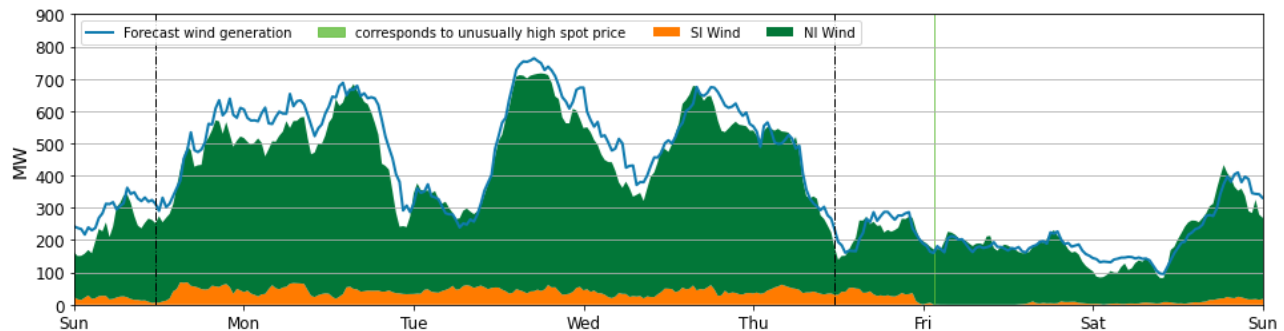




8. Generation

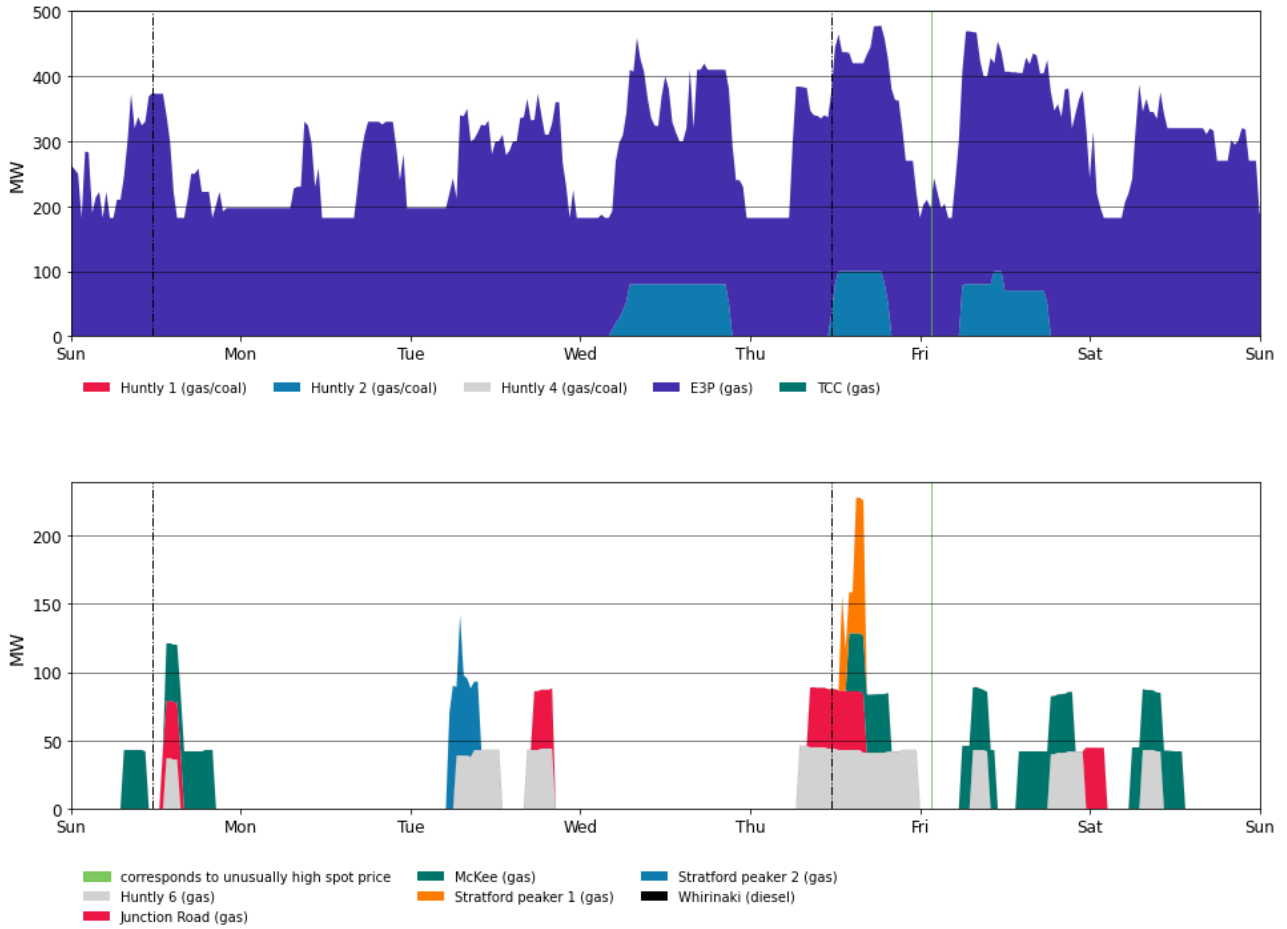
- 8.1. Wind generation, between 5-11 February, varied between ~100 and 700 MW. Wind generation increased on Sunday evening and was high and sustained on Monday. Wind dropped off on Monday night before ramping up the next morning and remained mostly high until Tuesday evening. Wind was between 100-400 MW between Thursday afternoon and Sunday. The higher wind earlier in the week likely kept prices low. High prices generally occurred when wind was below 300 MW.

Figure 10: Wind Generation and forecast.



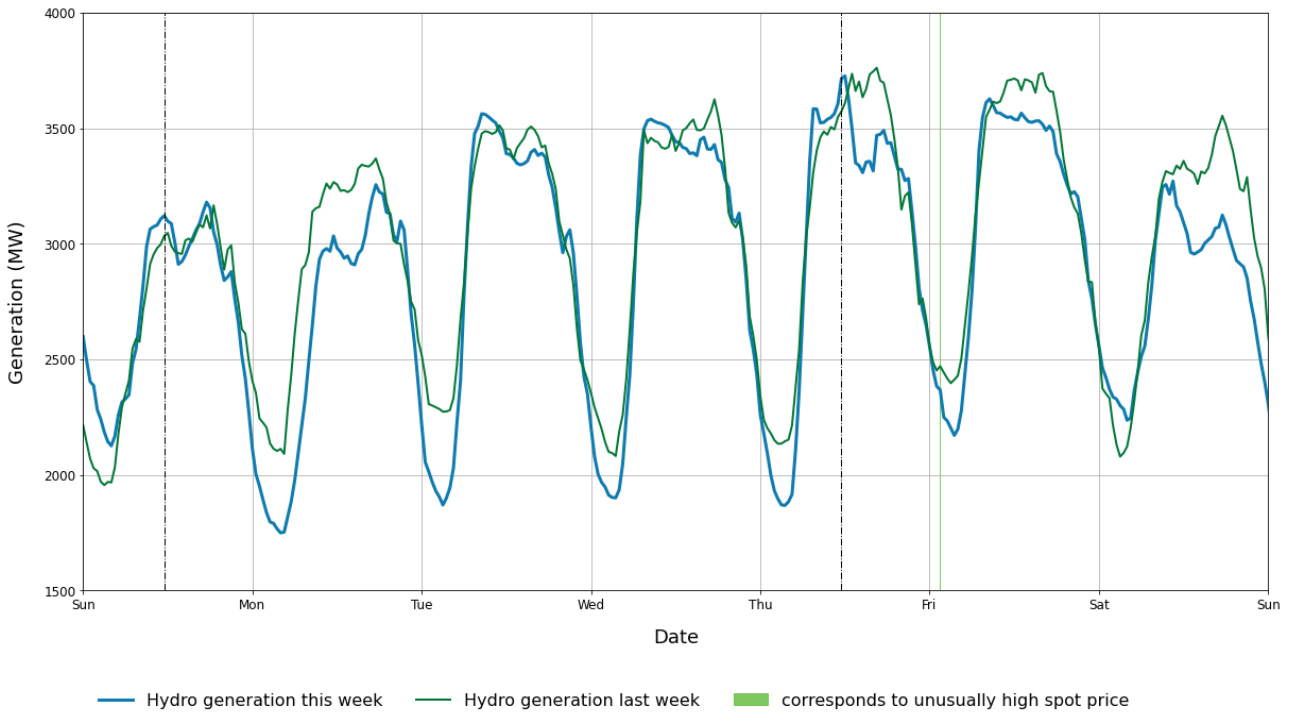
- 8.2. Figure 11 shows generation of thermal baseload and thermal peaker plants between 5-11 February. E3P (Huntly 5) ran all week, with it running close to capacity during the weekdays. Huntly 1 also ran between Wednesday and Friday.
- 8.3. Peakers ran less this week. With no peakers needed on Monday and Wednesday. Peakers ran more from Thursday onwards as wind dropped off.

Figure 11: Thermal Generation



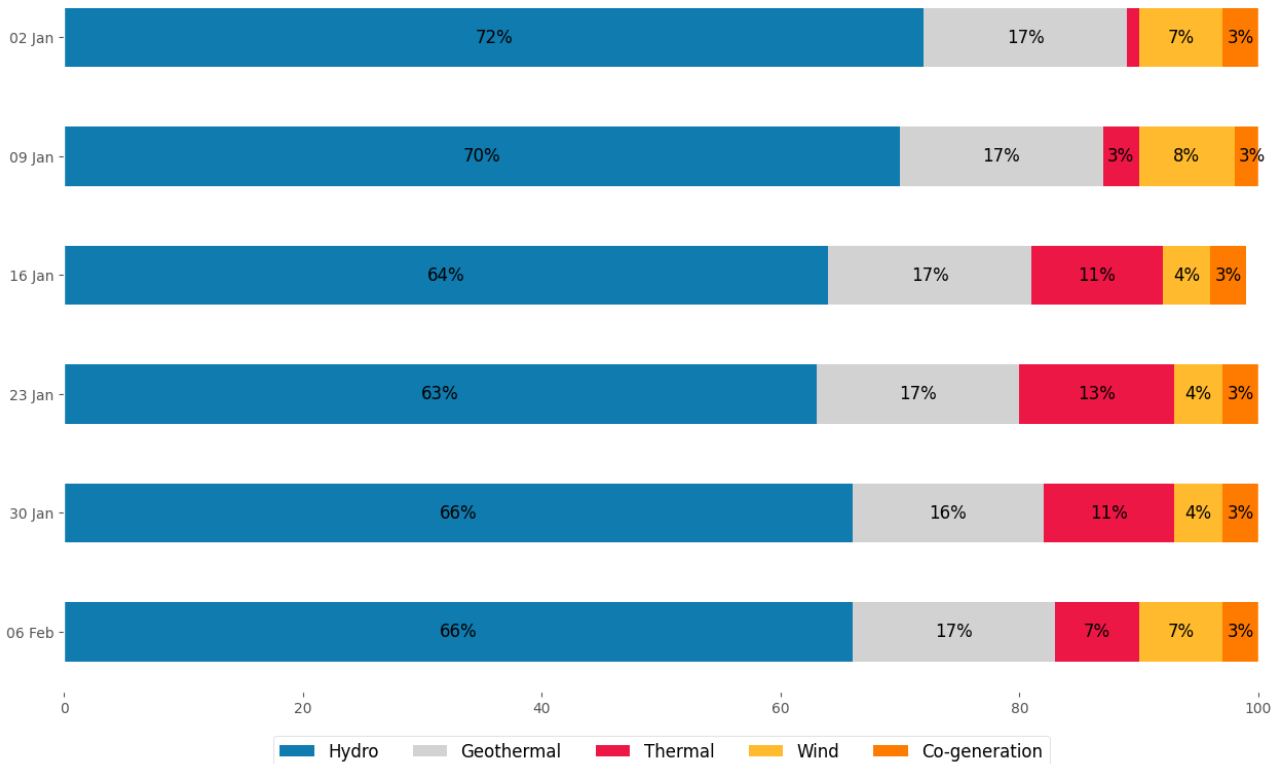
8.4. Figure 12 shows total hydro generation in MW produced each trading period, compared to the same time in the previous week. Hydro generation was lower than the previous week – largely due to, lower demand, higher North Island wind generation and continued low lake levels at Te Anau and Manapōuri, despite an increase in lake levels.

Figure 12: Hydro generation between 29 January – 4 February compared to the previous week



8.5. As a percentage of total generation, between 6-12 February, total weekly hydro generation totalled 65.5 percent, geothermal 17.4 percent, thermal 7.2 percent, wind 7.2 percent, and co-generation 2.8 percent.

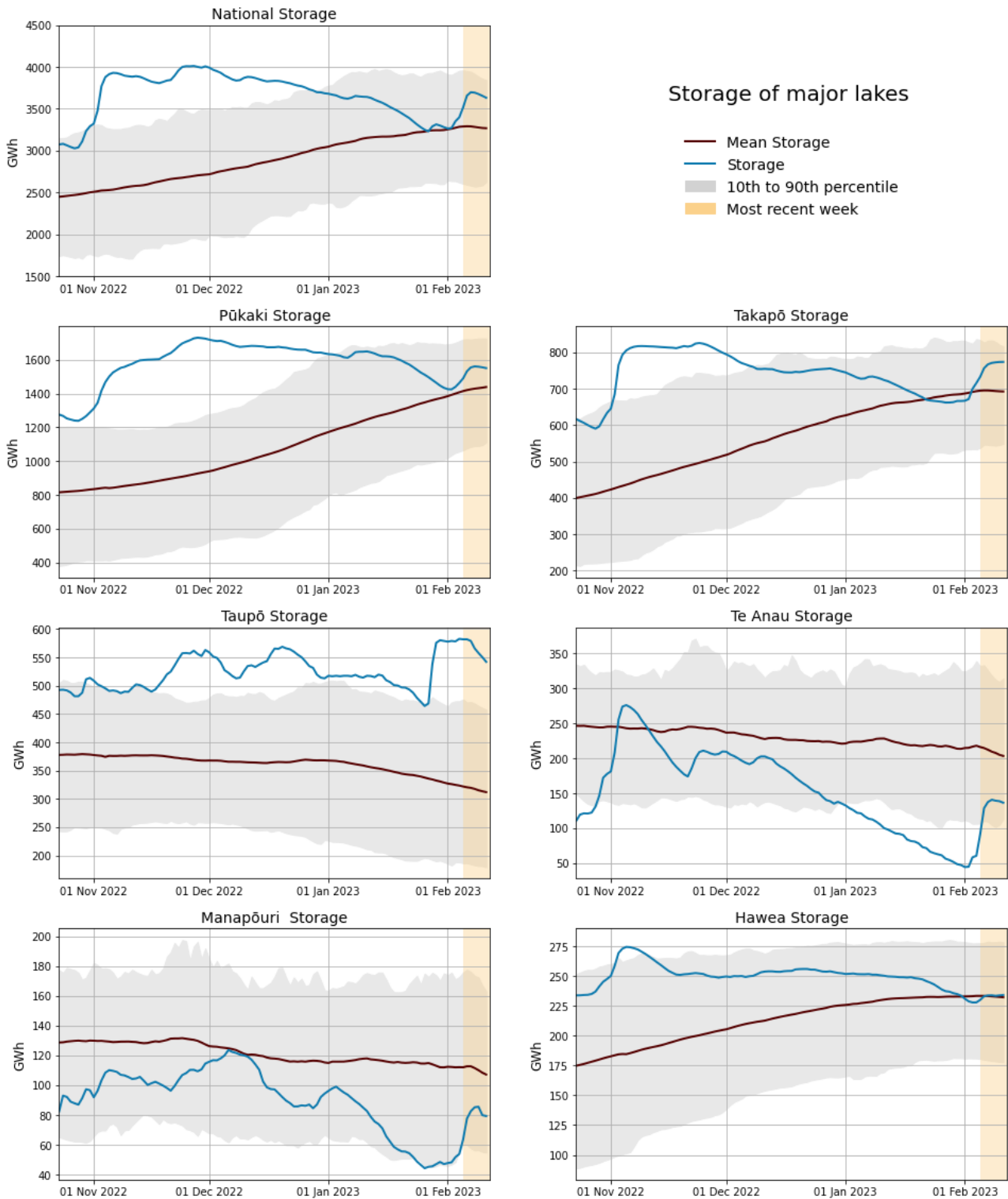
Figure 13: Total generation as a percentage each week between 19 December 2022 and 5 February 2023



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 increased overall this week. Taupō dropped from its very high level. Most South Island catchments have increased as rainfall fell across the region. Total storage has increased to around 89 percent of nominal full.
- 9.3. Storage at Lake Te Anau and Manapōuri increased this week, however overall storage at the catchment remains at below its historic mean. However, these inflows have brought the lakes above their minimum operating range.

Figure 14: Hydro Storage



10. JADE Water Values

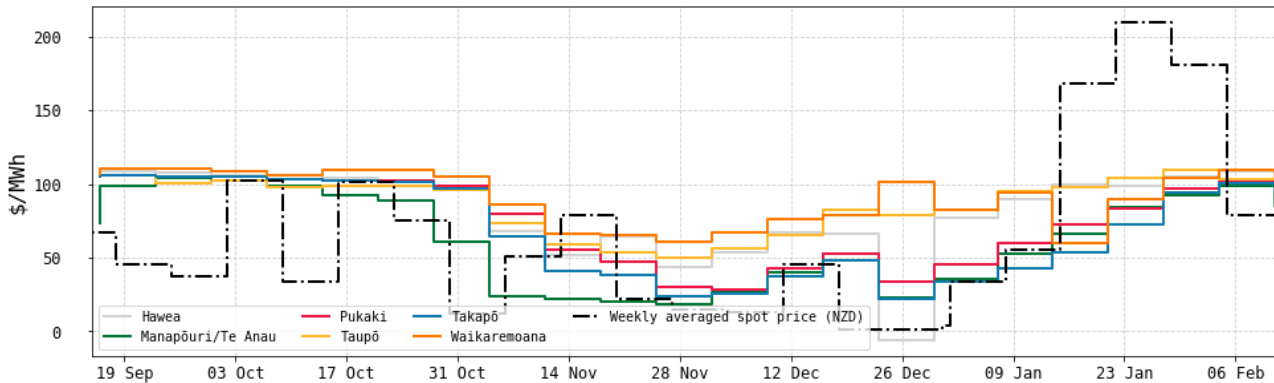
10.1. The JADE³ model gives a consistent measure of the opportunity cost of water, by seeking to minimise the expected fuel cost of thermal generation and the value of lost load and

³ 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.

provides an estimate of water values at a range of storage levels. Figure 15 shows the national water values between 15 September 2022 and 4 February 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 B⁴ on the trading conduct webpage.

- 10.2. Towards the end of 2022 water values were falling, reaching a low in mid to late November, when national storage was high. Water values across all lakes increased last week, with North and South Island water values converging. The weekly average spot price this week was less than the highest water values.

Figure 15: JADE water values across various reservoirs between 15 September and 2022 and 11 February 2023



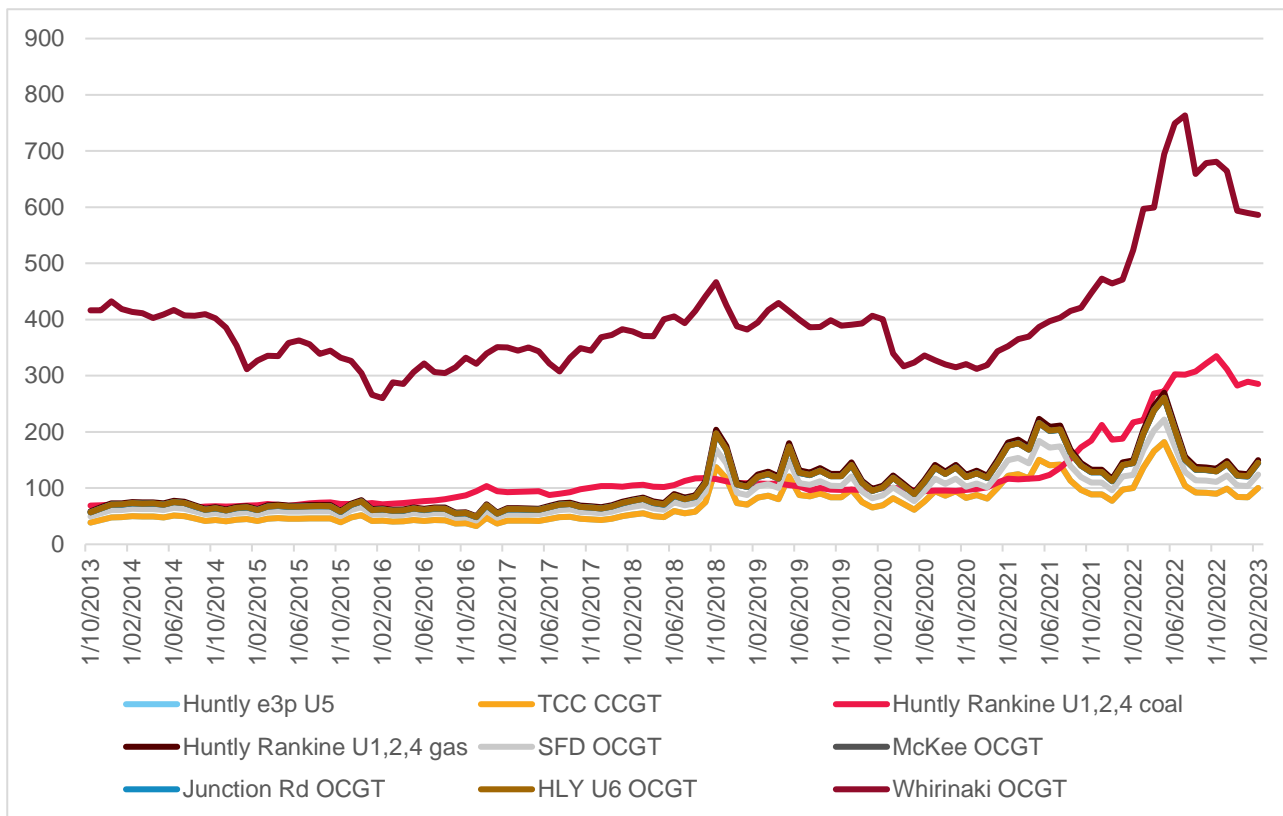
11. Price versus estimated costs

- 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 February 2023. The SRMC of gas fuelled plants has increased, while the SRMC of diesel and coal has remained relatively flat.
- 11.4. In early February Indonesian coal remained around ~\$480/tonne (NZD) putting the latest SRMC of coal fuelled Huntly generation at ~\$290/MWh. The SRMC of Whirinaki has increased slightly to ~\$590/MWh.
- 11.5. The SRMC of gas run thermal plants increased to between \$90/MWh and \$130/MWh, likely due to the increase in gas demand.
- 11.6. More information on how the SRMC of thermal plants is calculated can be found in Appendix C⁵ on the trading conduct webpage.

⁴ <https://www.ea.govt.nz/assets/dms-assets/29/Appendix-B-JADE-water-value-model.pdf>

⁵ <https://www.ea.govt.nz/assets/dms-assets/30/Appendix-C-Calculating-thermal-SRMCs.pdf>

Figure 16: Estimated monthly SRMC for thermal fuels.



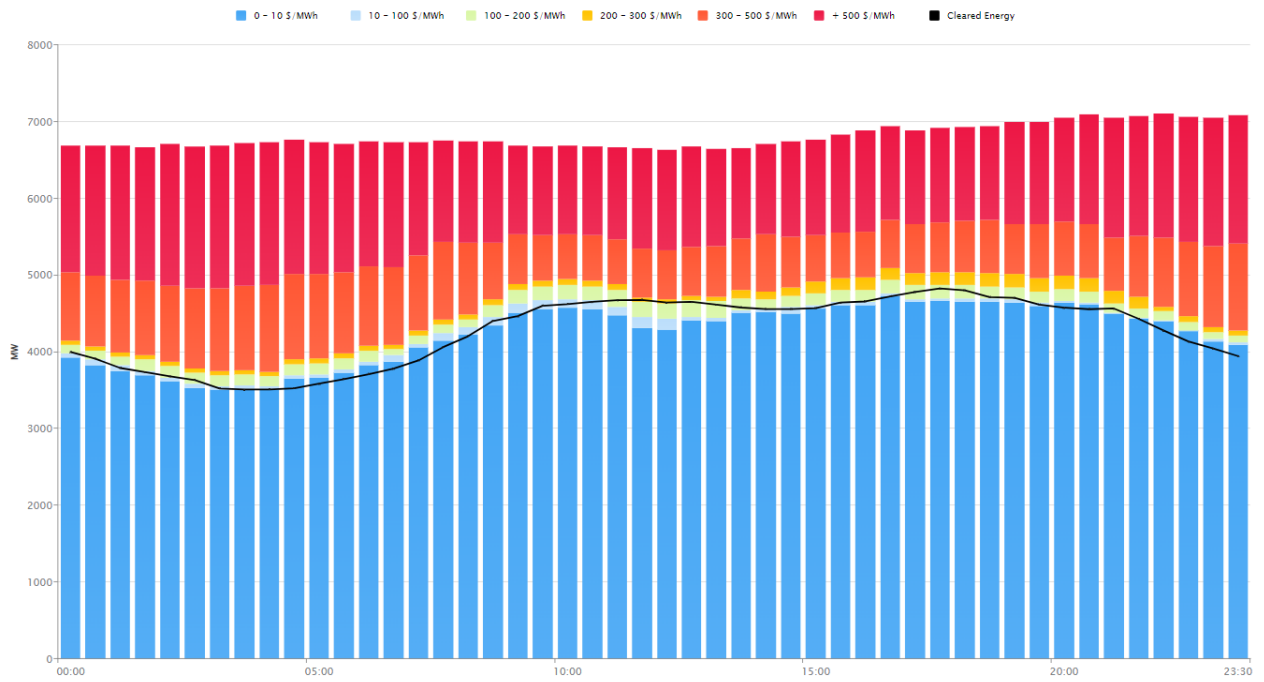
12. Offer Behaviour

12.1. Figure 17 shows this week’s national daily offer stacks from WITS⁶. The black line shows cleared energy, indicating the range of the average final price. From Monday onwards, the majority of energy, was cleared in the \$0-10/MWh or \$10-100/MWh band. On Friday and Saturday some energy cleared in the \$100-200/MWh band. This shift to clearing in the lower priced bands reflects the higher amount of wind generation experienced this week.

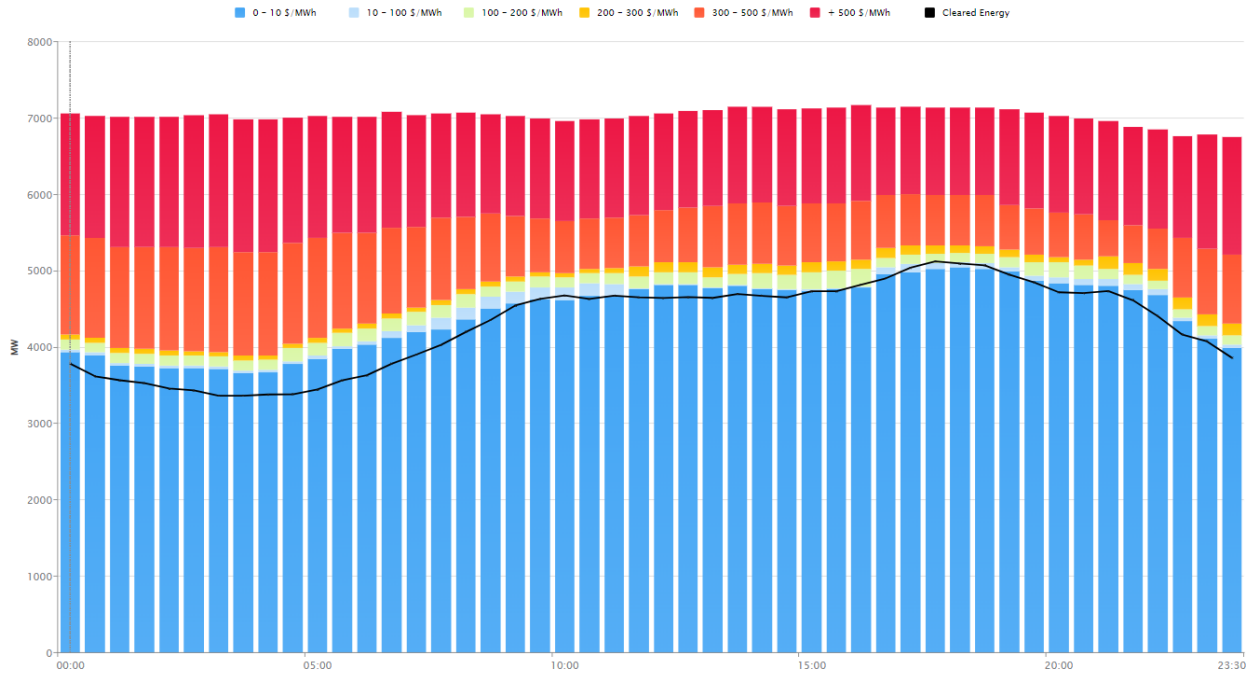
⁶ Cleared Energy Stack | WITS (electricityinfo.co.nz)

Figure 17: Daily offer stack from WITS

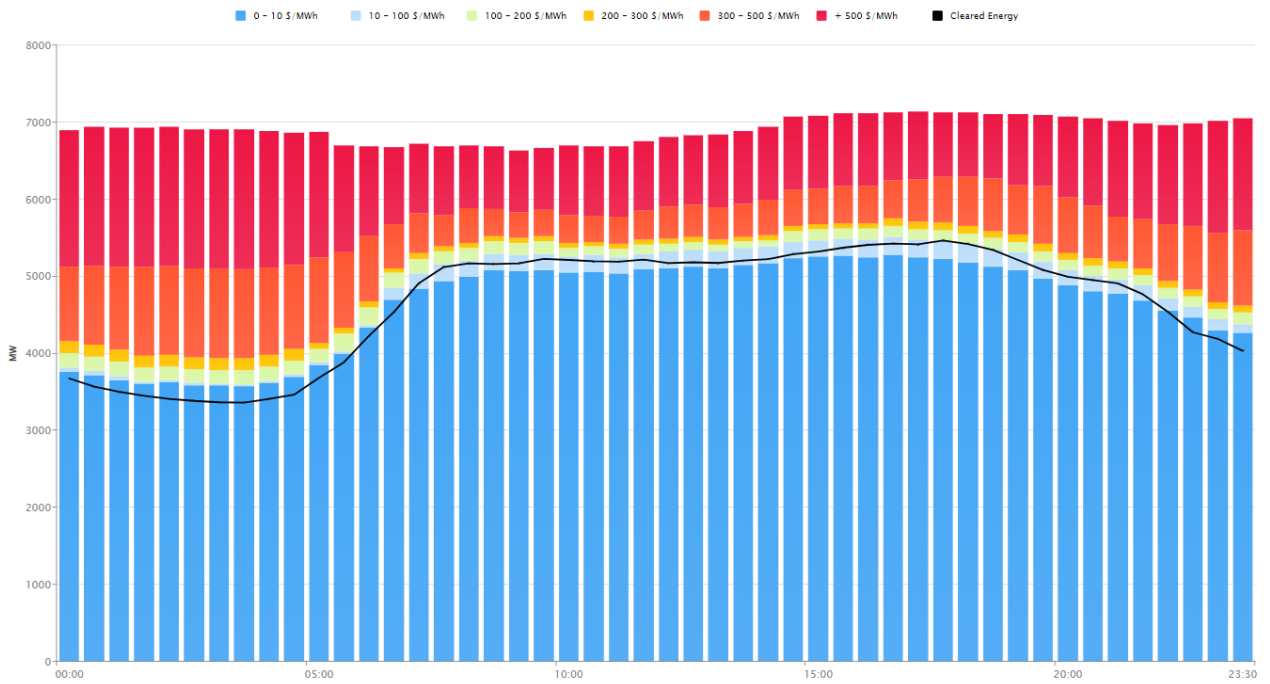
Sunday 5 February



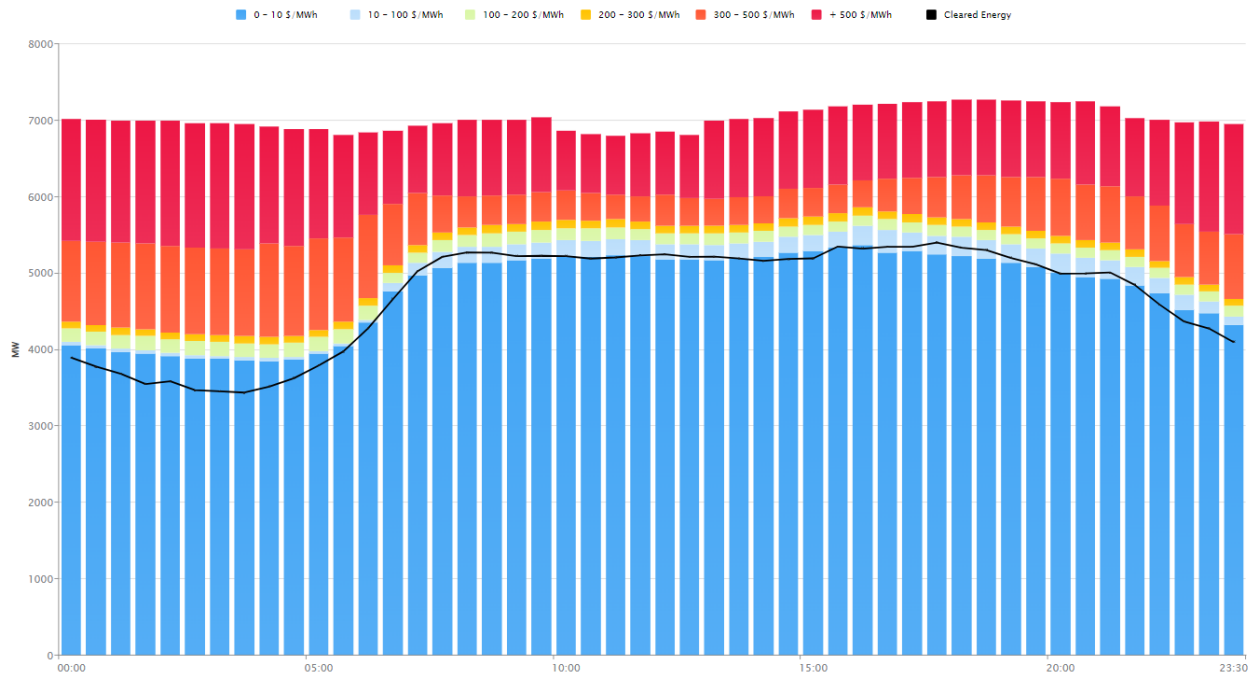
Monday 6 February



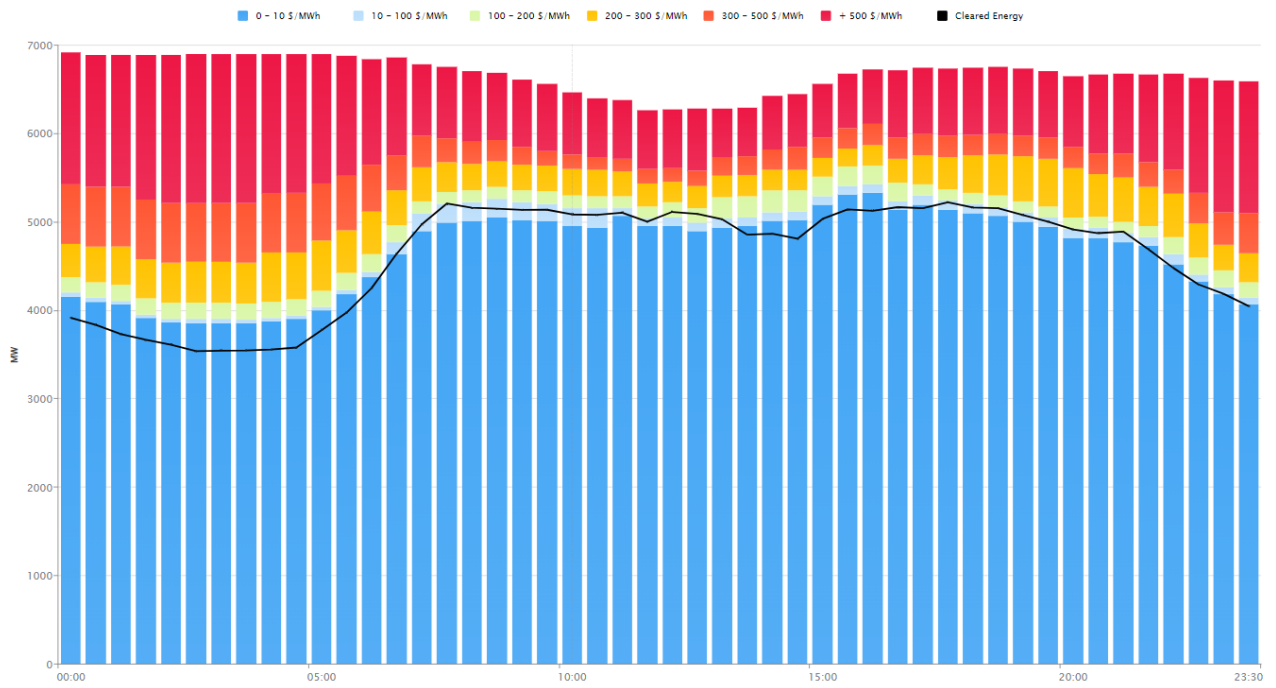
Tuesday 7 February



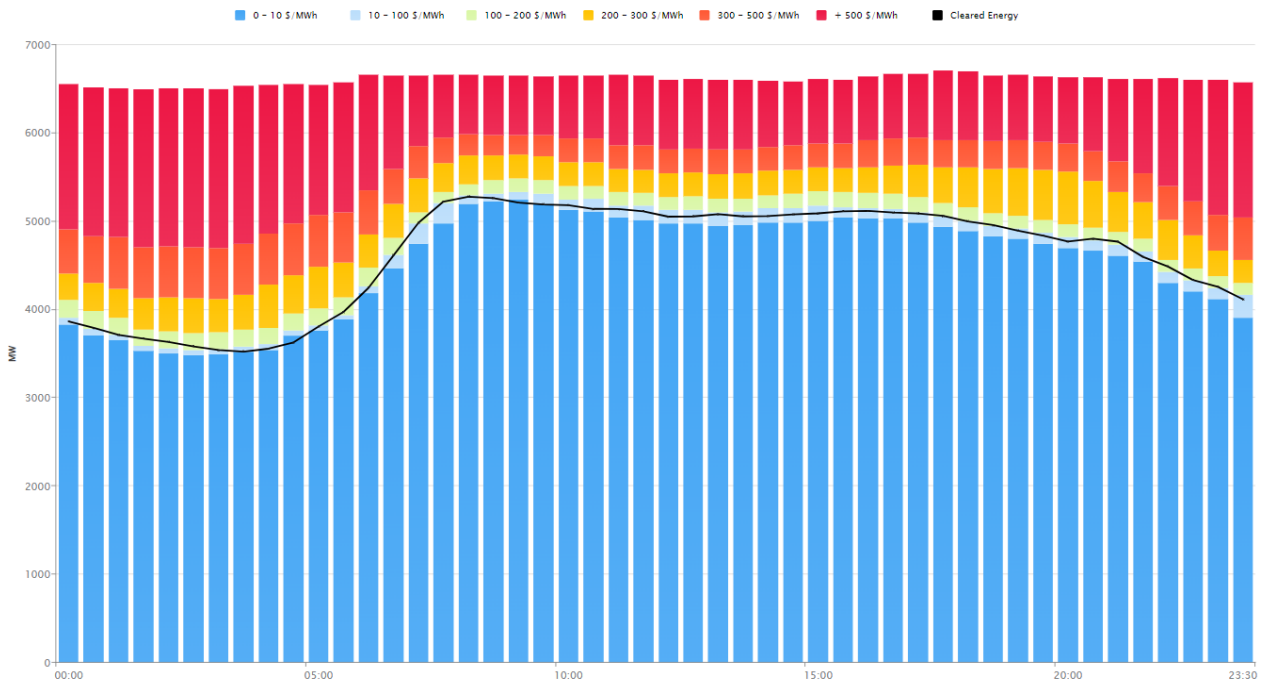
Wednesday 8 February



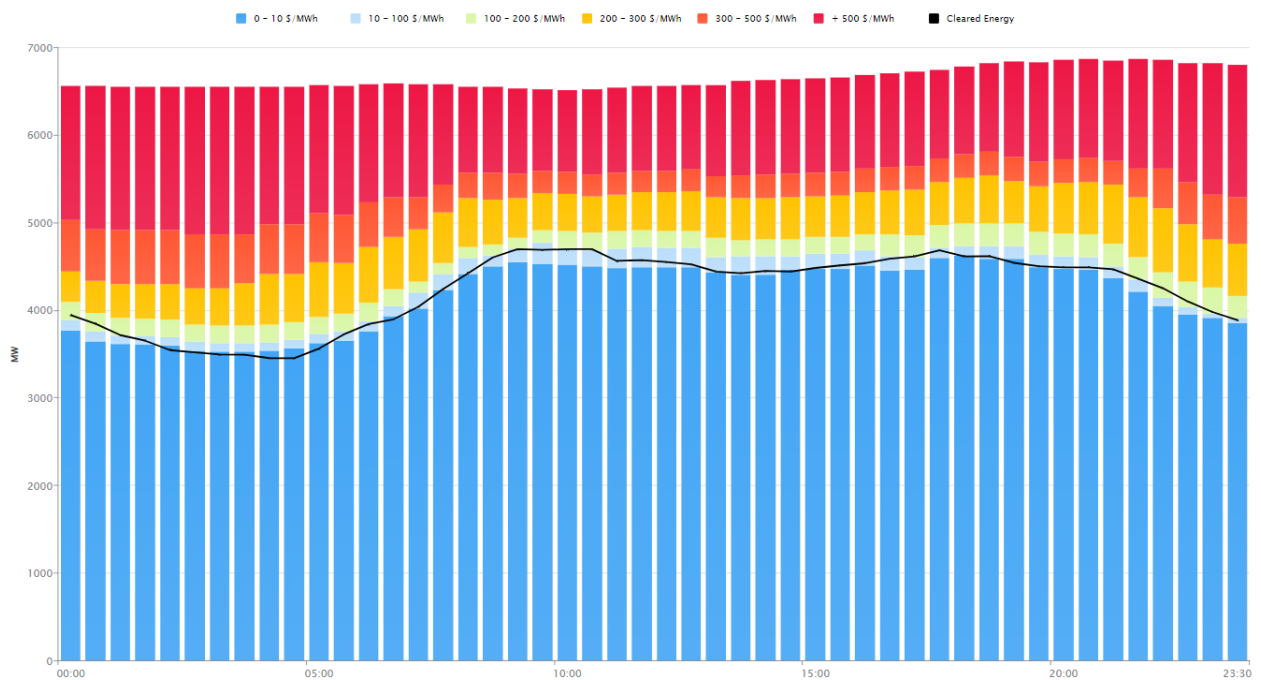
Thursday 9 February



Friday 10 February



Saturday 11 February



13. Ongoing Work in Trading Conduct

13.1. This week, all prices appeared to be consistent with supply and demand conditions, however, hydro offers this week are undergoing further analysis.

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	Notes
19/02/2022-24/02/2022	Several	Compliance enquiries in progress	After reviewing information received from Genesis regarding offers from Tekapo B while Lake Tekapo was spilling, this case has been passed to compliance to assess if the offers were compliant with trading conduct rules.
07/10/2022	15-16	Further analysis	The Monitoring team is making enquires with Genesis regarding offers changes to final tranche prices at Huntly 5 for trading period 15-16.
13/12/2022-16/12/2022	Several	Further analysis	The Authority will continue analysis into the high energy prices.
15/1/2023 4/2/2023	Several	Further analysis	The Authority will continue analysis into the high energy prices associated with high hydro offers.