

Trading Conduct Report

Market Monitoring Weekly Report

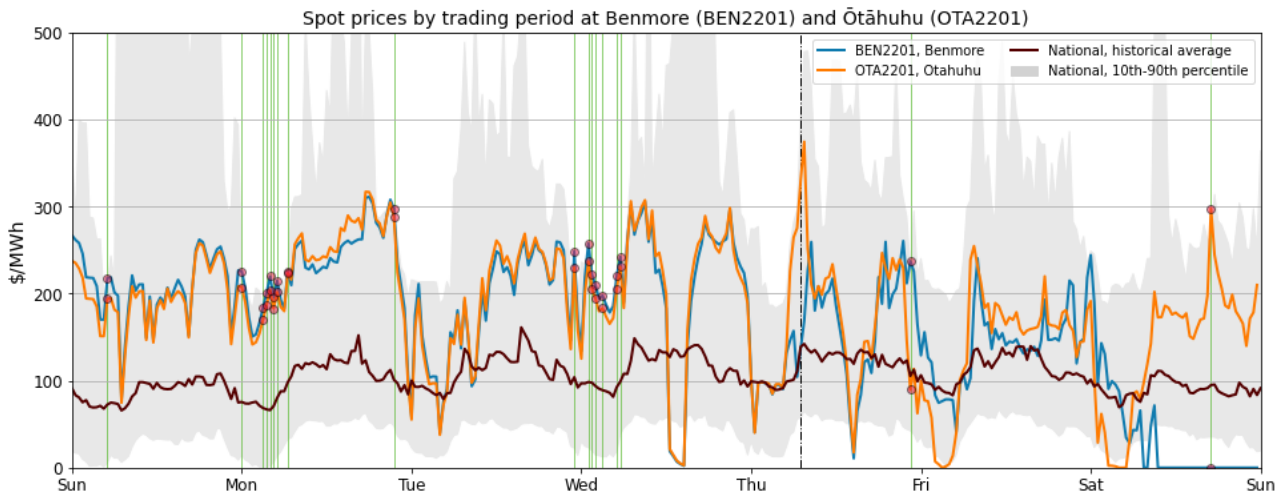
1. Overview for the week of 19-25 February 2023

- 1.1. Spot prices between 19-25 February 2023 appear to be consistent with market conditions.

2. Spot Prices

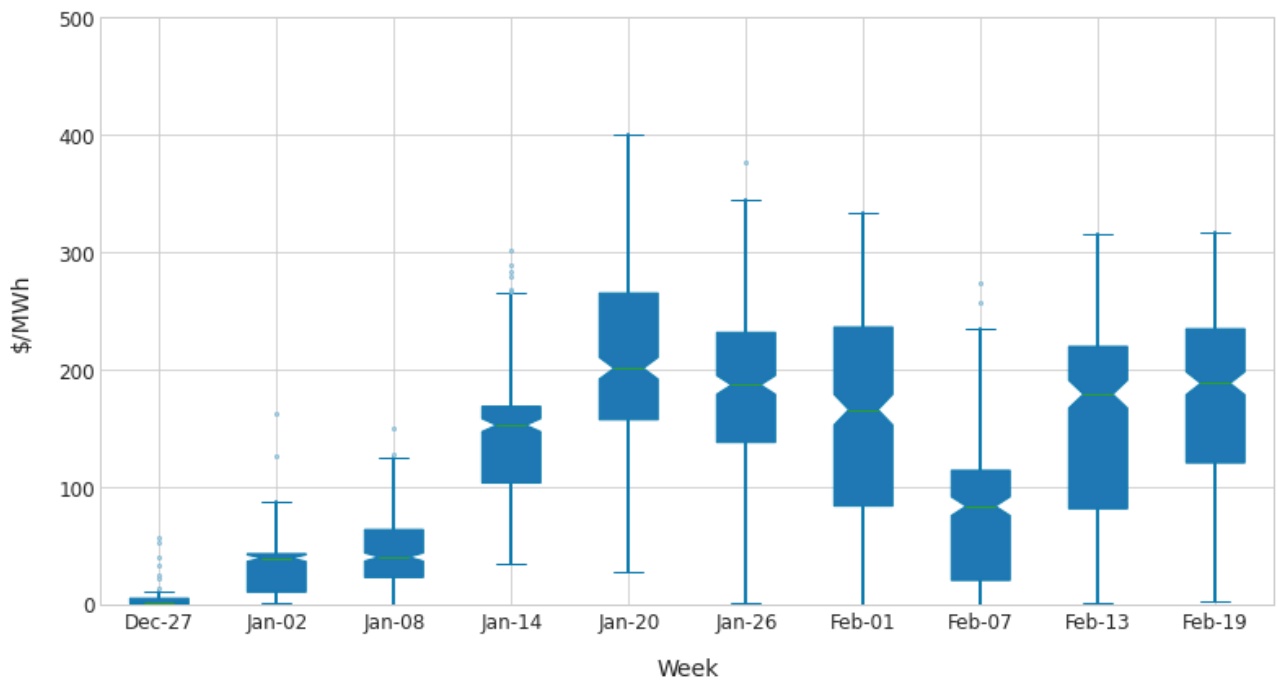
- 2.1. This report monitors underlying wholesale price drivers to assess whether there are trading periods that require further analysis for the purpose of considering potential non-compliance with the trading conduct rule. In addition to general monitoring, we also single out unusually high-priced individual 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 did not breach the 90th percentile, are marked in black dashed lines.
- 2.2. Between 19-25 February 2023:
- (a) The average wholesale spot price across all nodes was \$176/MWh.
 - (b) 95 per cent of prices fell between \$0.03/MWh and \$301/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. Early in the week, when thermal generation was high, prices mostly hovered between \$150-250/MWh. There were some instances of prices breaching the 90th historic percentile of February prices. This mostly occurred overnight on Monday and Wednesday. From Thursday onwards as wind generation increased, prices, especially overnight, fell. Some price separation occurred on Thursday and Friday, as the first HVDC pole went on outage. Prices separated on Saturday during the HVDC bipole outage.
- 2.5. The highest prices of the week occurred on Thursday at 7:30 am at Ōtāhuhu, with a price of \$374/MWh. While Benmore had its highest price on Monday at 6:00 pm, with a price of \$311/MWh.

Figure 1: Wholesale Spot Prices between 19 (Sunday) – 25 (Saturday) February 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 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. This week, prices were similar to the week before.
- 2.7. Despite high wind generation this week, spot prices remained mostly over \$150/MWh as hydro generation continues to be ramped back, especially at stations with declining reservoirs like Manapouri and along the Clyde scheme. There are also high amounts of South Island hydro generation on outage. Hydro generation contributed 59 per cent of total energy this week. During the HVDC outage prices separated between the islands, with very low prices in the South Island, and higher prices in the North Island.

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

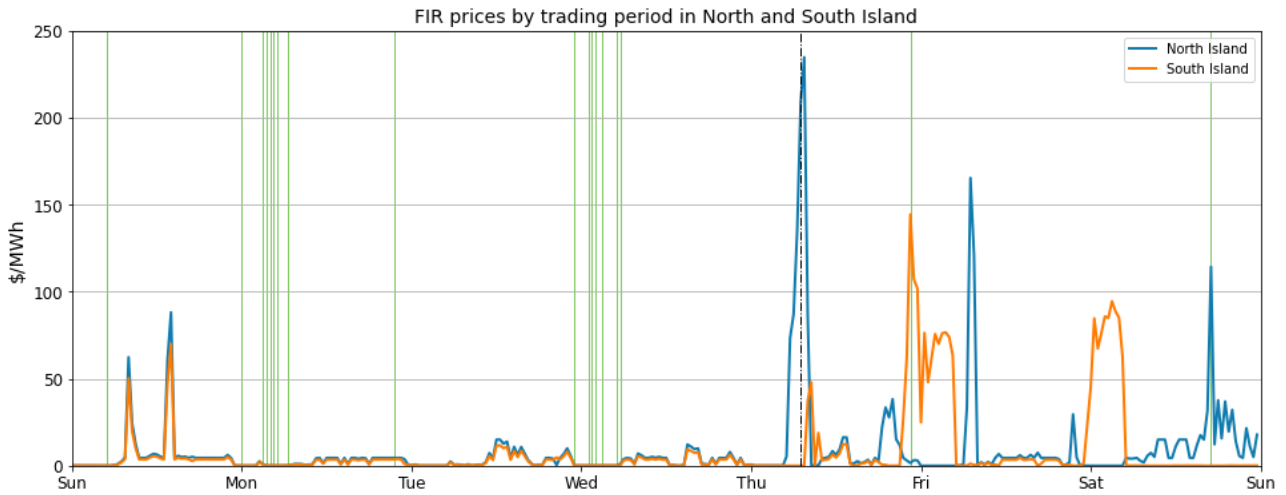


3. Reserve Prices

¹ Quartile - Wikipedia

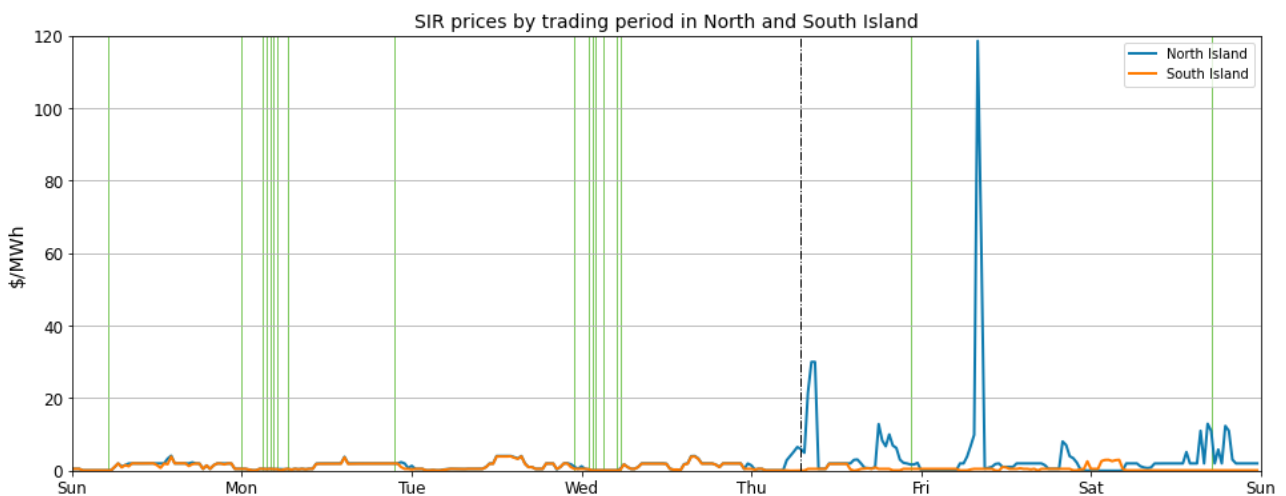
3.1. Fast instantaneous reserve (FIR) prices for the North and South Island are shown below in Figure 3. This week there were instances where both North and South Island FIR prices were above \$20/MWh, with the highest of these occurring on Thursday in the North Island. FIR prices separated at times from Thursday onwards, as the first HVDC pole went on outage. Some of the high FIR prices co-occurred during times of high spot prices.

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. From Thursday onwards, as the first HVDC pole went on outage, there were some high SIR prices in the North Island.

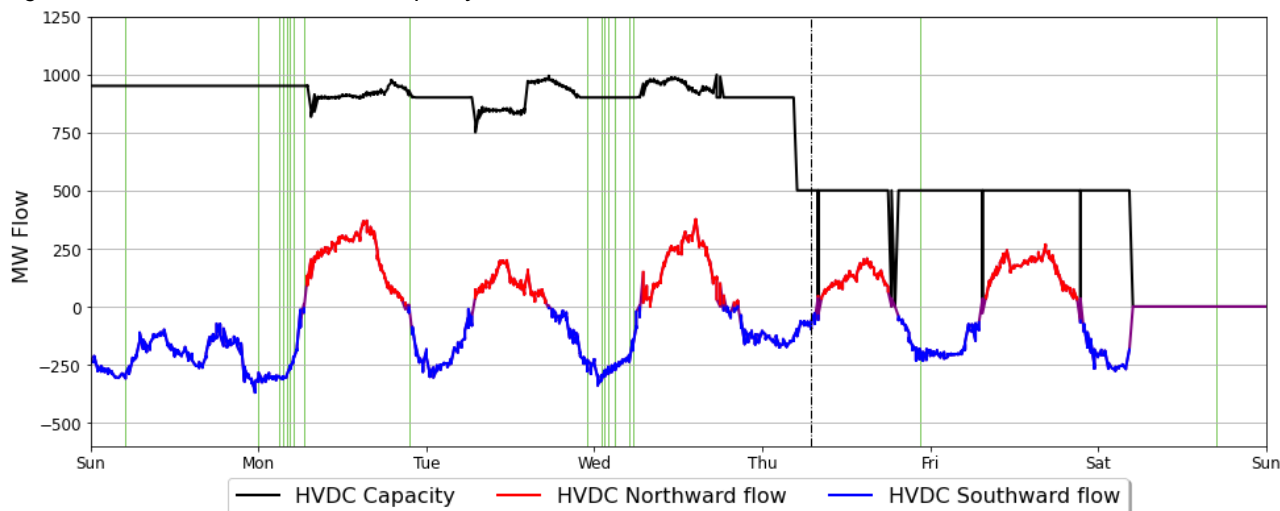
Figure 4: SIR prices by trading period and Island



4. HVDC

- 4.1. Figure 5 shows northward HVDC flow between 19-25 February. HVDC flows were mostly northward during the day from Monday onwards, but transfer remained below 300 MW. Overnight, and during Sunday, HVDC flows were southward. Note that a HVDC pole went on outage on Thursday, with a bipole outage beginning on Saturday. The HVDC transfer limit dropped to zero on Thursday and Friday, after the first pole outage started, when the flow across the poles was about to switch direction².

Figure 5: HVDC northward flow and capacity



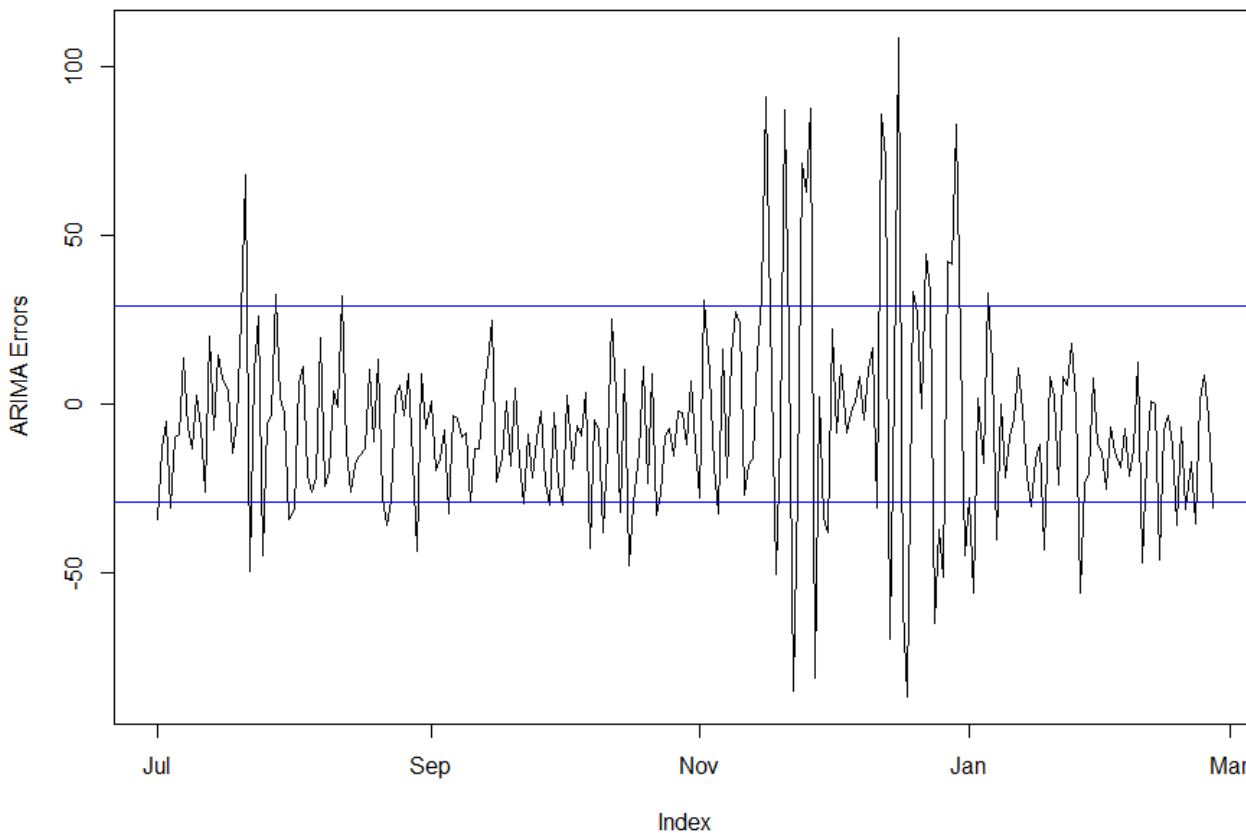
5. Regression Residuals

- 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 A³ 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 prices on those dates appear to be largely aligned with market conditions. There was a residual larger than one standard deviation of the data, which occurred on Tuesday. Here the residual was negative, indicating that the modelled price was too large.

² Each pole has a minimum transfer limit, so transfer must either be 0MW or above the limit. When the bipole is in operation, round power, when each pole is flowing in opposite directions, allows for net transfer below this limit.

³ <https://www.ea.govt.nz/assets/dms-assets/29/Appendix-A-Regression-Analysis.pdf>

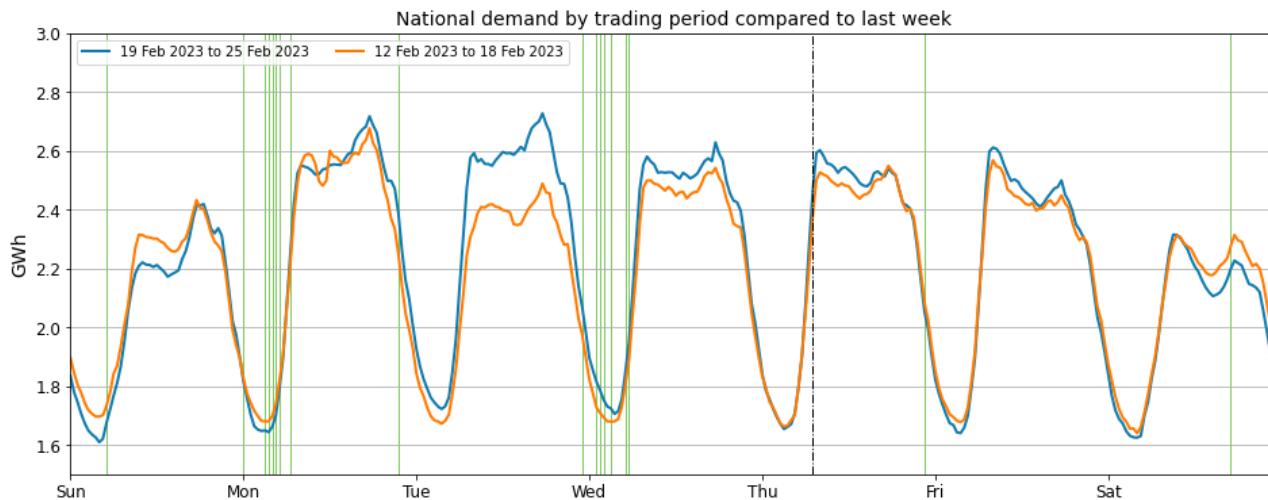
Figure 6: Residual plot of estimated daily average spot prices from 1 July 2022 – 25 February 2023. The blue lines show two standard deviations of the ARMA errors.



6. Demand

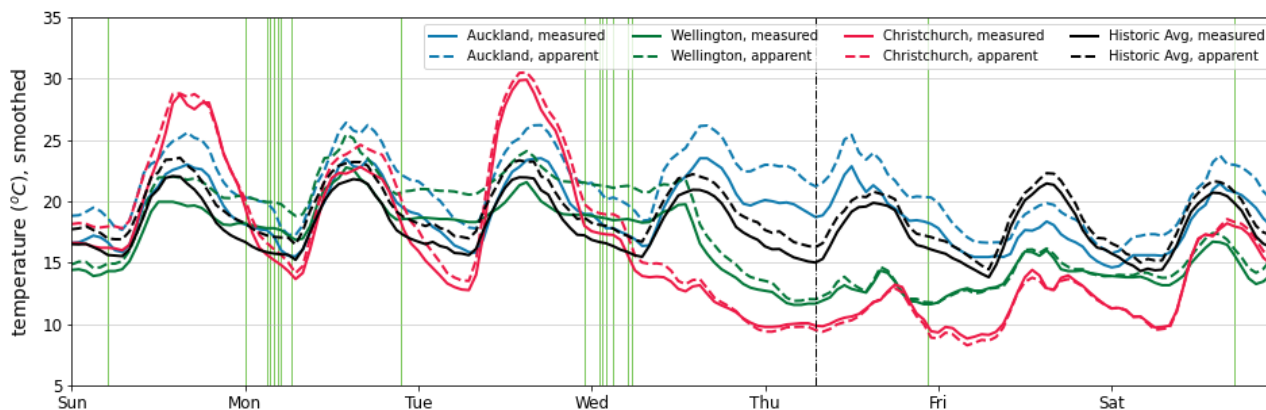
6.1. Figure 7 shows national grid demand between 19-25 February, compared to the previous week. Daily demand was mostly higher than the previous week. This was mostly due to low demand last week, as cyclone Gabrielle caused outages in the north and east of the North Island. Demand later in the week was more similar to the previous week.

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 Monday, temperatures across all main centres were mostly above historic average between Sunday and Tuesday. However, from Wednesday onwards, southerly winds decreased temperatures across Wellington and Auckland.

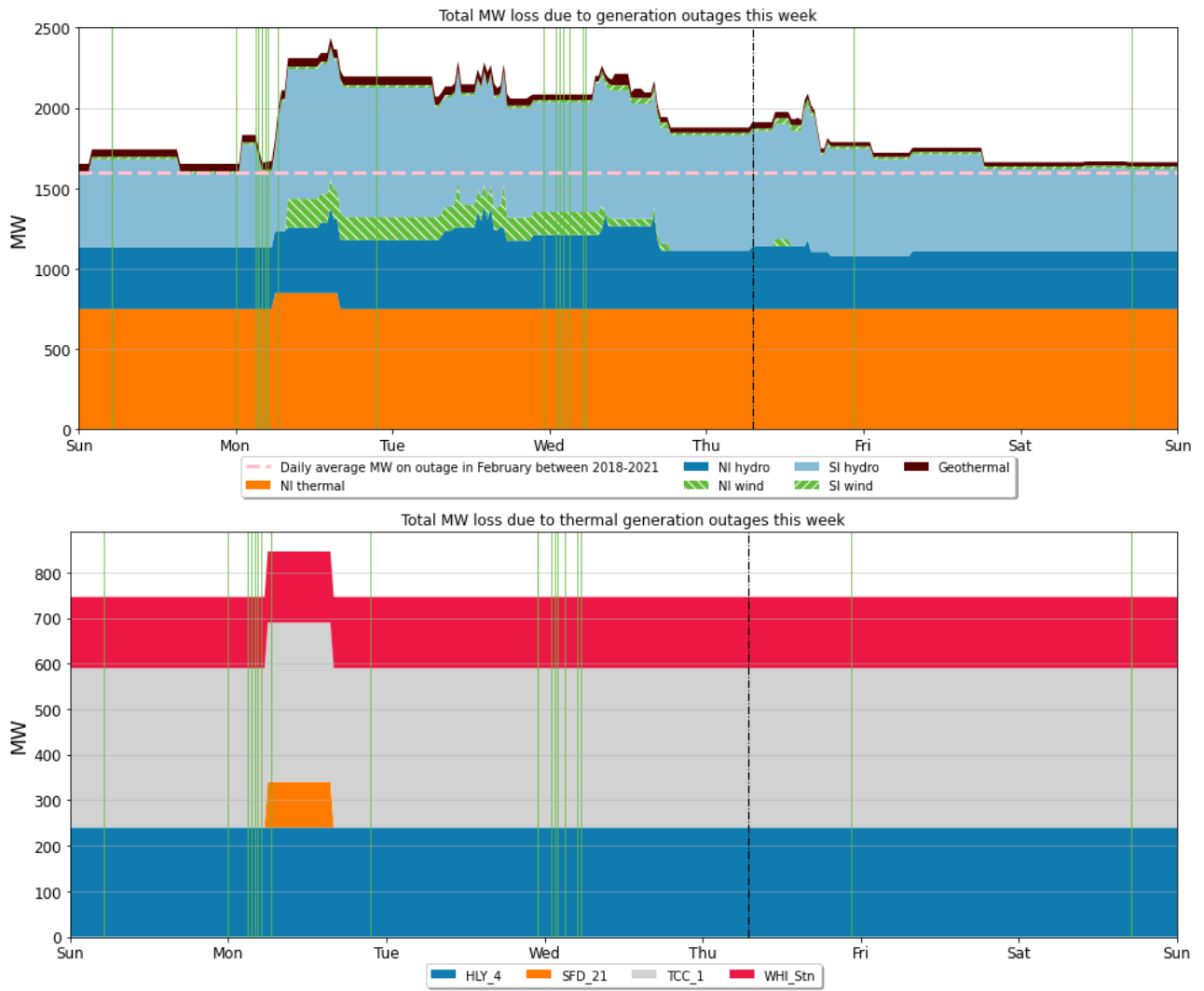
Figure 8: Temperatures across main centres



7. Outages

- 7.1. Figure 9 shows generation capacity on outage. Total capacity on outage between 19-25 February ranged between ~1,600 – 2,400 MW. Outages increased from Monday onwards, as North Island wind and more South Island hydro went on outage.
- 7.2. Notable outages include:
- Huntly 4 remains on outage.
 - TCC remains on outage.
 - Whirinaki remains on outage.
 - West Wind wind farm had an outage between Monday and Wednesday.
 - Multiple Manapouri units went on outage this week.
 - Multiple Benmore units went on outage this week.

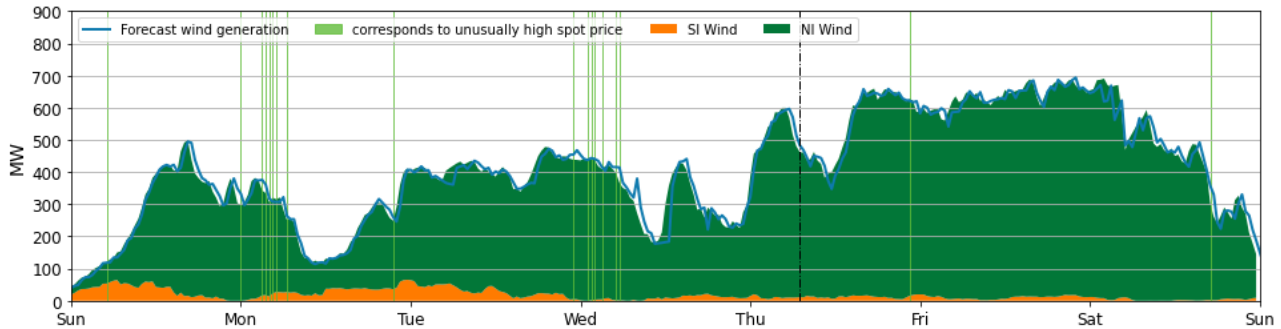
Figure 9: Total MW loss due to generation outages



8. Generation

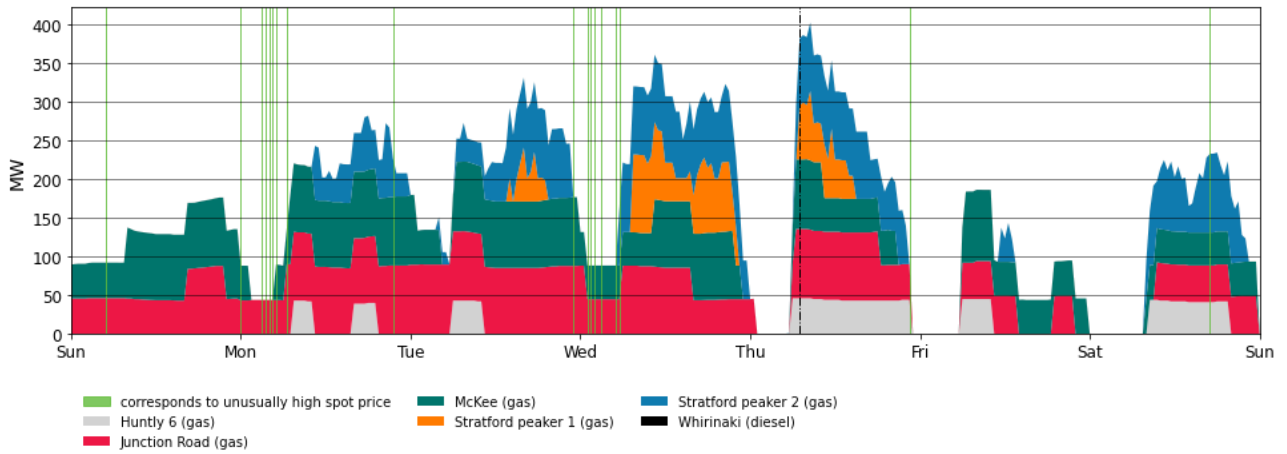
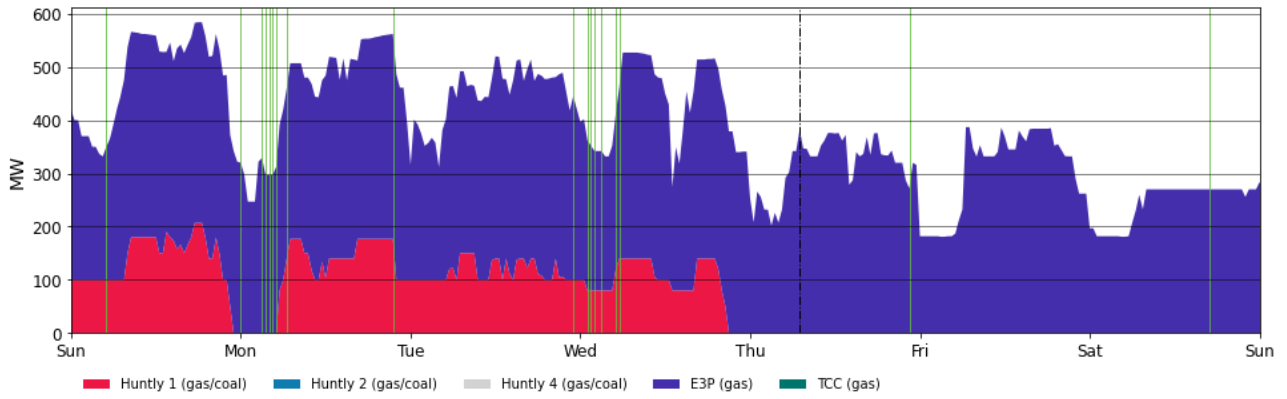
- 8.1. Wind generation, between 19-25 February, varied between ~50 -700 MW. Between Sunday and Thursday wind generation hovered between 100-500 MW, with prices above the 90th percentile occurring at times when wind was low, such as Sunday morning. Some prices breached the 90th percentile on Monday and Wednesday even though wind generation was between 300 - 400 MW. From Thursday onwards wind generation increased and was mostly between 500-700 MW, before dropping off on Saturday afternoon.

Figure 10: Wind Generation and forecast.



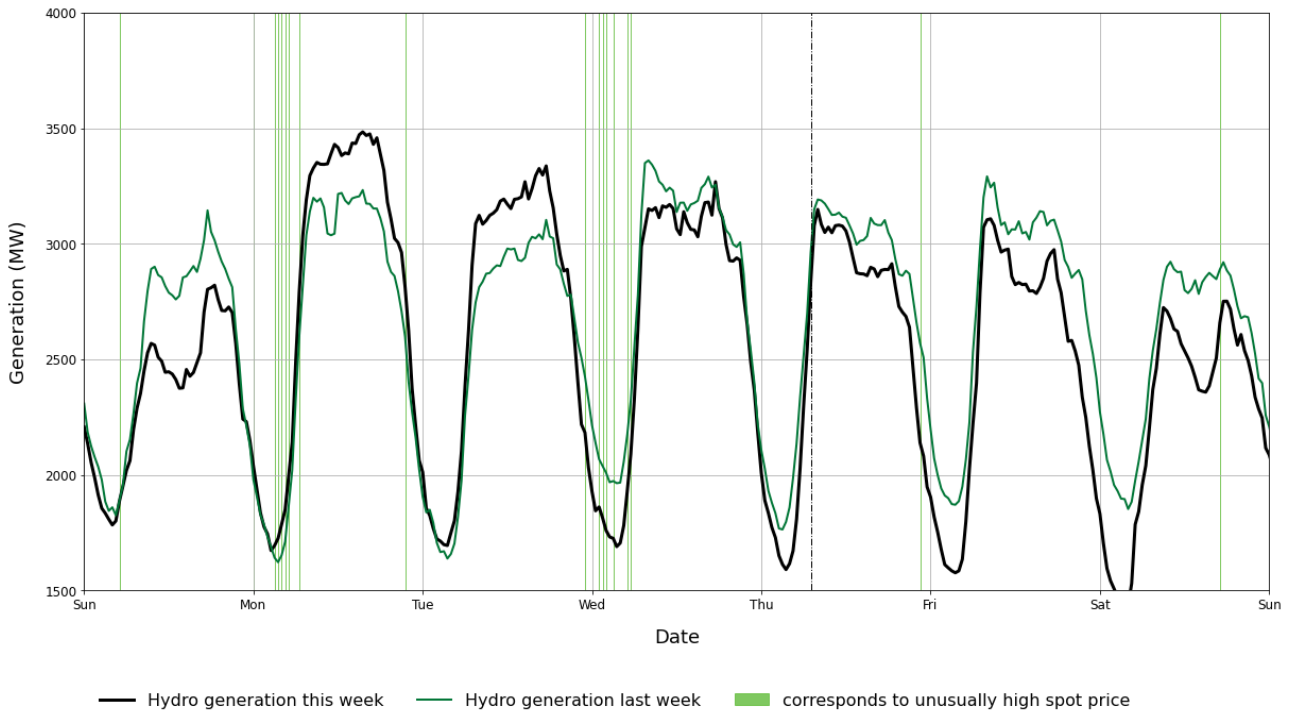
- 8.2. Figure 11 shows generation of thermal baseload and thermal peaker plants between 19-25 February. E3P (Huntly 5) ran all week. Huntly 2 also ran between Sunday and Thursday.
- 8.3. Practically all peakers ran this week, bar Whirkinaki. Junction road and McKee ran nearly constantly between Sunday and Thursday. Huntly 6 ran during peak times on Monday and Tuesday, and during the day on Thursday. Both Stratford peakers ran between Tuesday and Thursday, with varied outputs. Less peakers were needed on Friday and Saturday, when wind generation was highest.

Figure 11: Thermal Generation



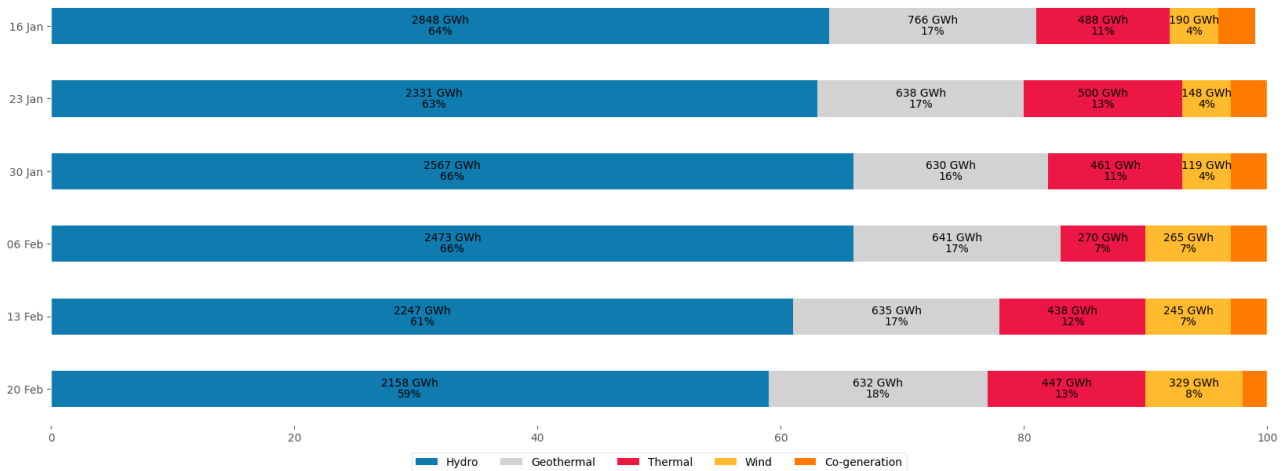
8.4. Figure 12 shows total hydro generation in MW produced each trading period, compared to the same time in the previous week. Hydro generation was higher than the previous week on Monday and Tuesday, but decreased later in the week, especially from Thursday when the HVDC outage started. Overall hydro generation was lower this week compared to the previous five weeks.

Figure 12: Hydro generation between 19-25 February compared to the previous week



8.5. As a percentage of total generation, between 20-26 February, total weekly hydro generation totalled 58.6 percent, geothermal 17.5 percent, thermal 12.4 percent, wind 8.7 percent, and co-generation 2.8 percent.

Figure 13: Total generation as a percentage each week between 16 January and 26 February 2023

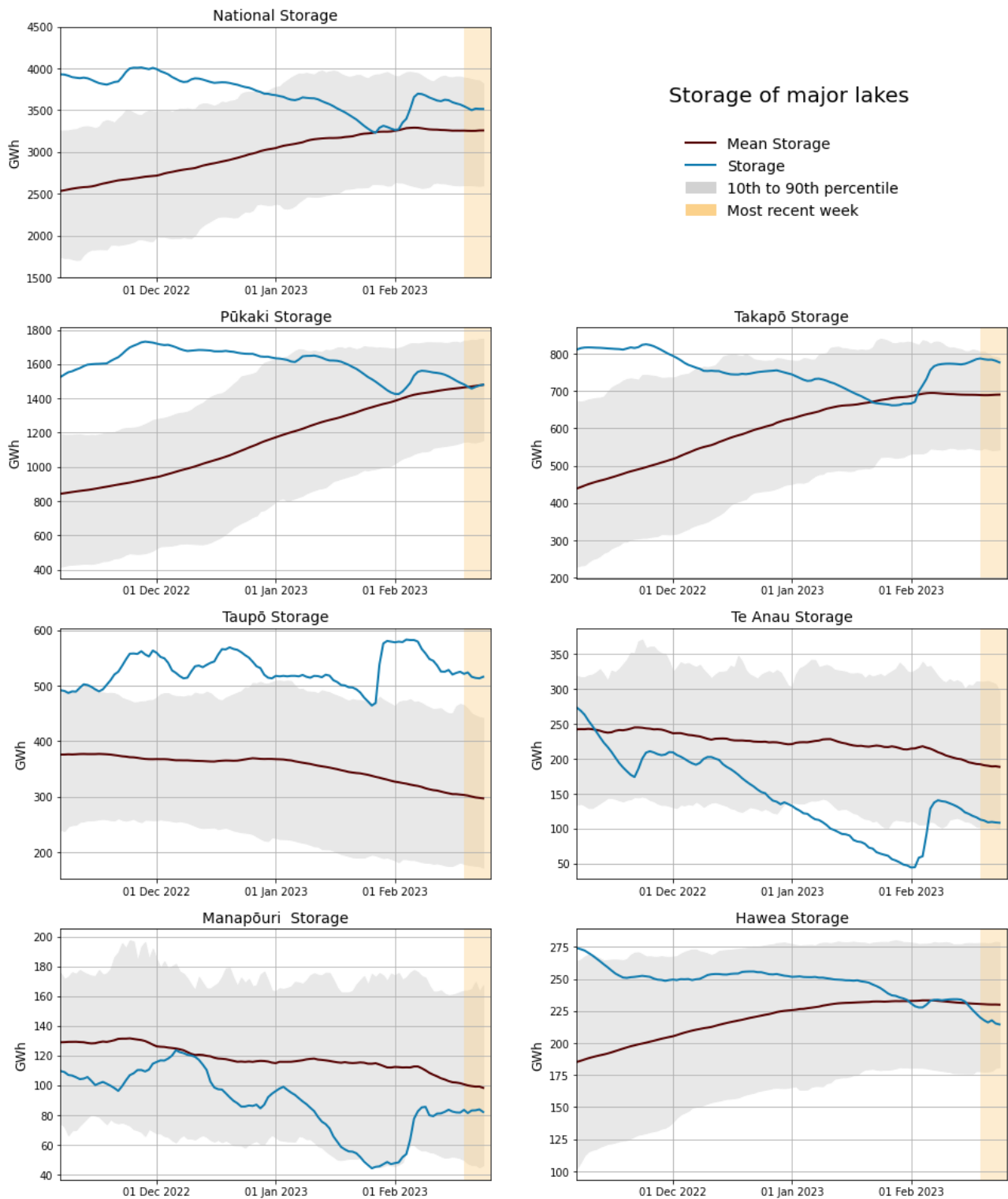


9. Storage/Fuel Supply

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 remained relatively flat overall this week. Taupō and Pūkaki showed a slight increase. Otherwise, storage in all other lakes decreased. Te Anau is approaching its 10th percentile, while storage at Manapouri remains relatively constant. Total national storage is around 86 percent of nominal full.

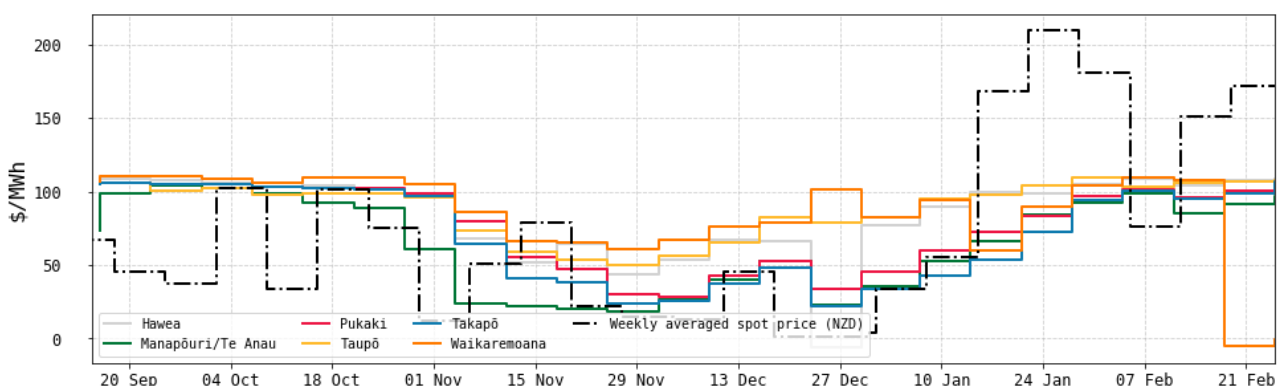
Figure 14: Hydro Storage



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 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 B⁵ on the trading conduct webpage.
- 10.2. At the beginning of 2023, water values were rising, as lake levels were declining. Water values across all lakes slightly increased last week, with most lakes receiving only small inflows. The weekly average spot price this week was higher than the highest water values. Note that the water value for Waikaremoana has dropped to below zero as it is full and only able to supply energy to parts of the Hawkes Bay.

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



11. Price versus estimated costs

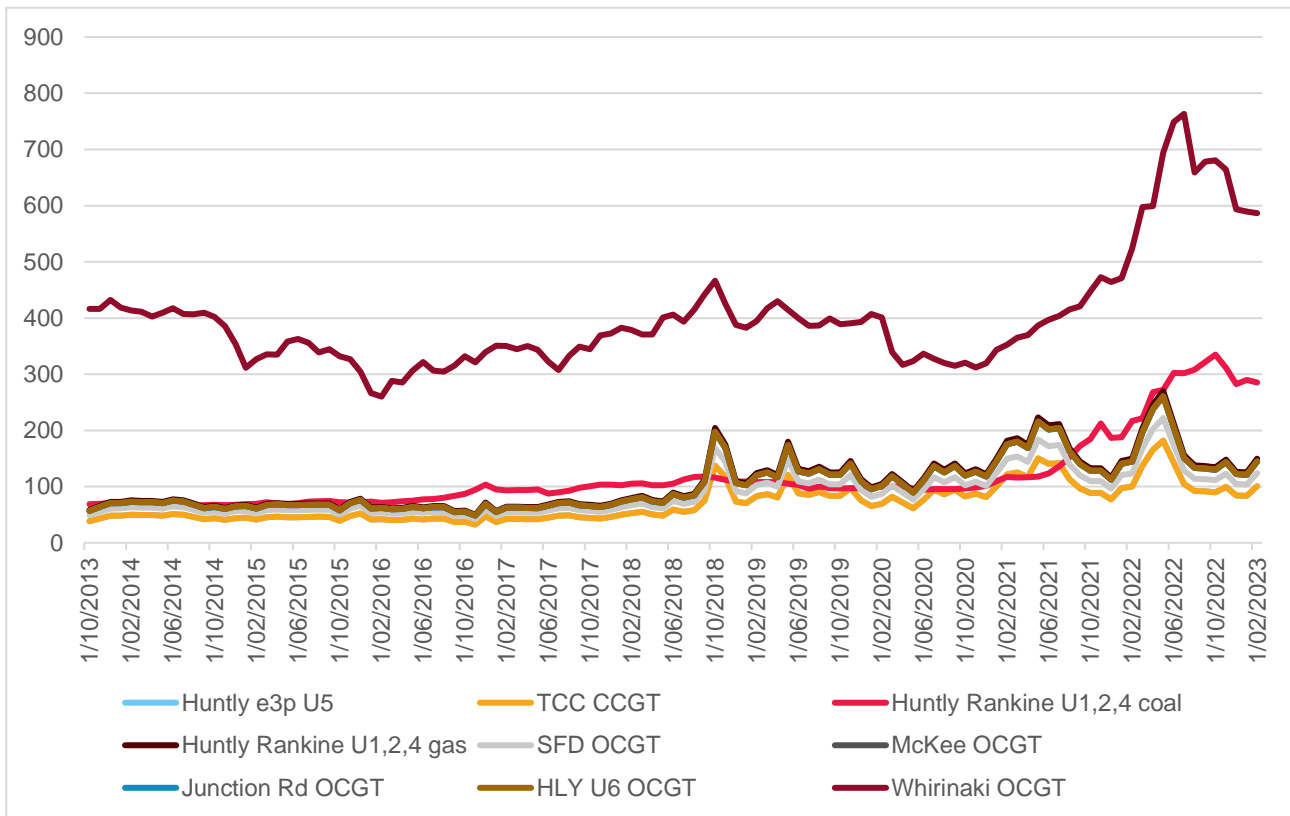
- 11.1. In a competitive market, prices should be close to (but not necessarily at) the short run marginal cost (SRMC) of the marginal generator (where SRMC includes opportunity cost).
- 11.2. The SRMC (excluding opportunity cost of storage) for thermal fuels is estimated using gas and coal prices, and 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.

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.

⁵ <https://www.ea.govt.nz/assets/dms-assets/29/Appendix-B-JADE-water-value-model.pdf>

11.6. More information on how the SRMC of thermal plants is calculated can be found in Appendix C⁶ on the trading conduct webpage.

Figure 16: Estimated monthly SRMC for thermal fuels.



12. Offer Behaviour

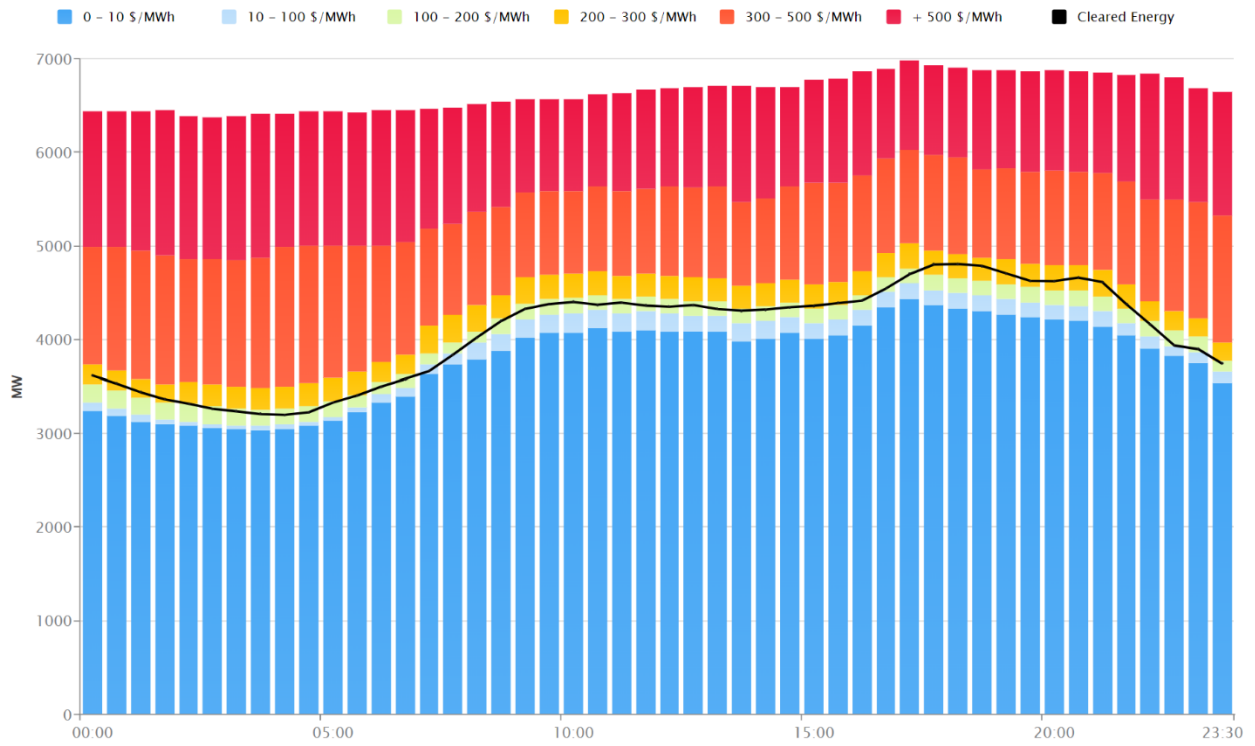
12.1. Figure 17 shows this week's national daily offer stacks from WITS⁷. The black line shows cleared energy, indicating the range of the average final price. Between Sunday and Tuesday, most of the energy was cleared in the \$100-200/MWh or \$200-300/MWh band. From Thursday onwards most energy cleared 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. Saturday offer stacks are shown separately for the North and South Island.

⁶ <https://www.ea.govt.nz/assets/dms-assets/30/Appendix-C-Calculating-thermal-SRMCs.pdf>

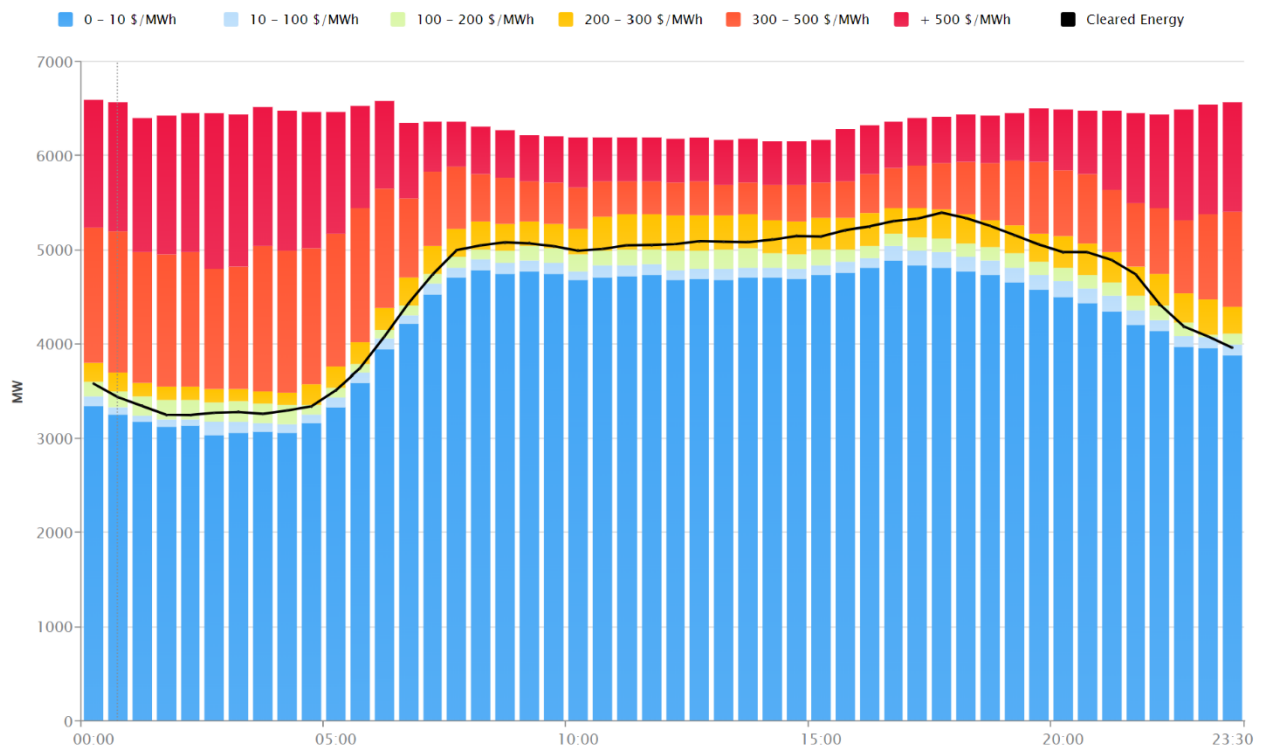
⁷ [Cleared Energy Stack | WITS \(electricityinfo.co.nz\)](https://www.electricityinfo.co.nz/cleared-energy-stack)

Figure 17: Daily offer stack from WITS

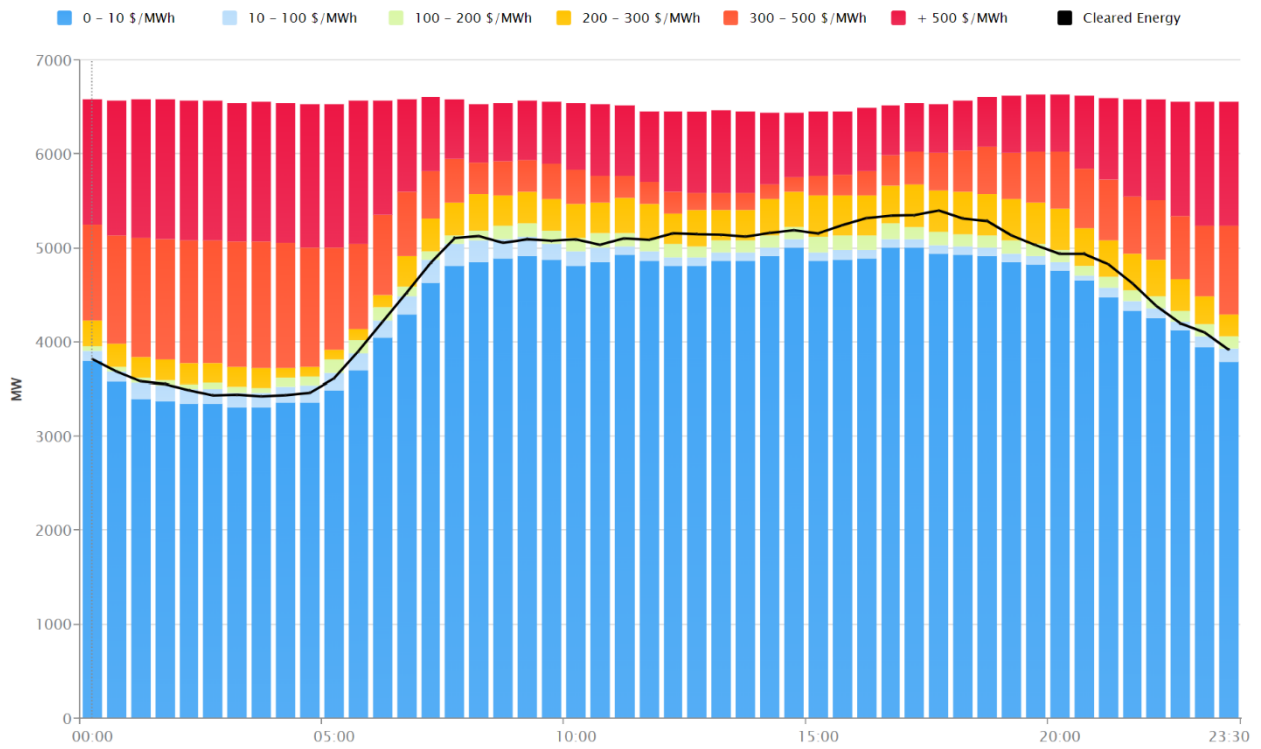
Sunday 19 February



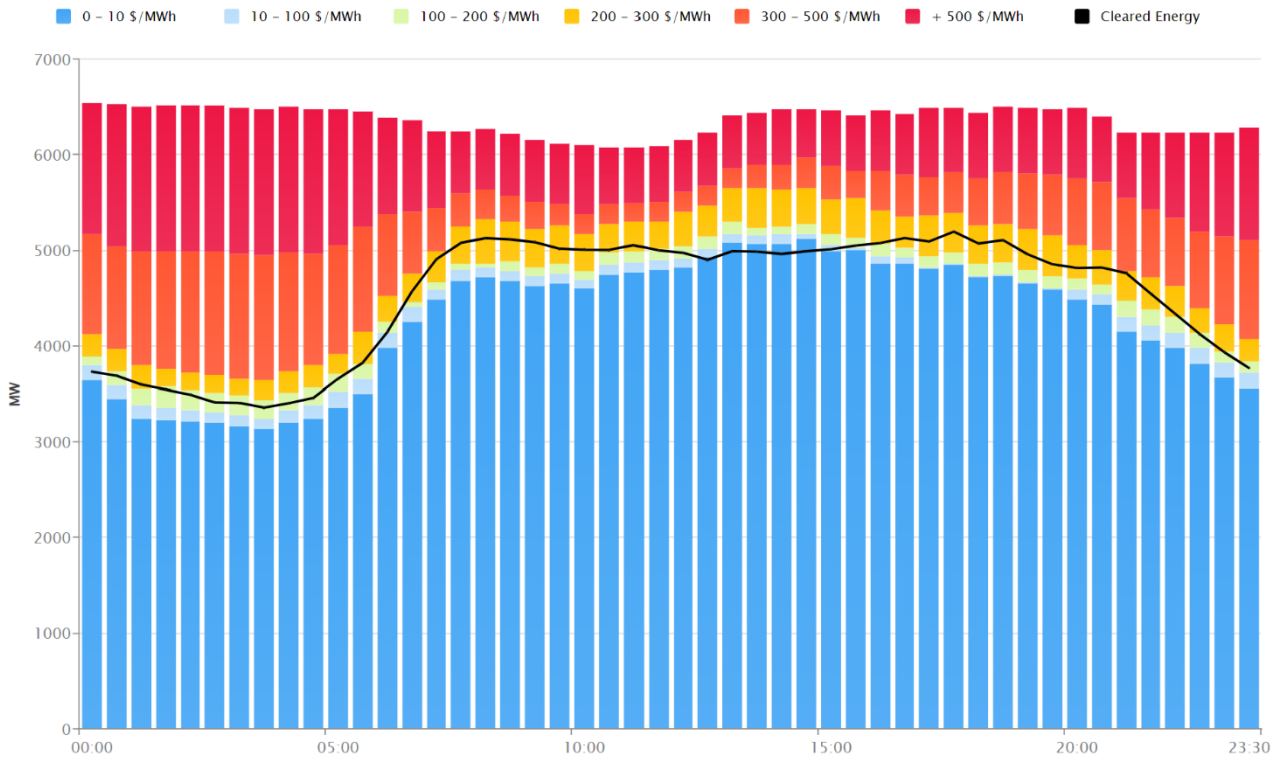
Monday 20 February



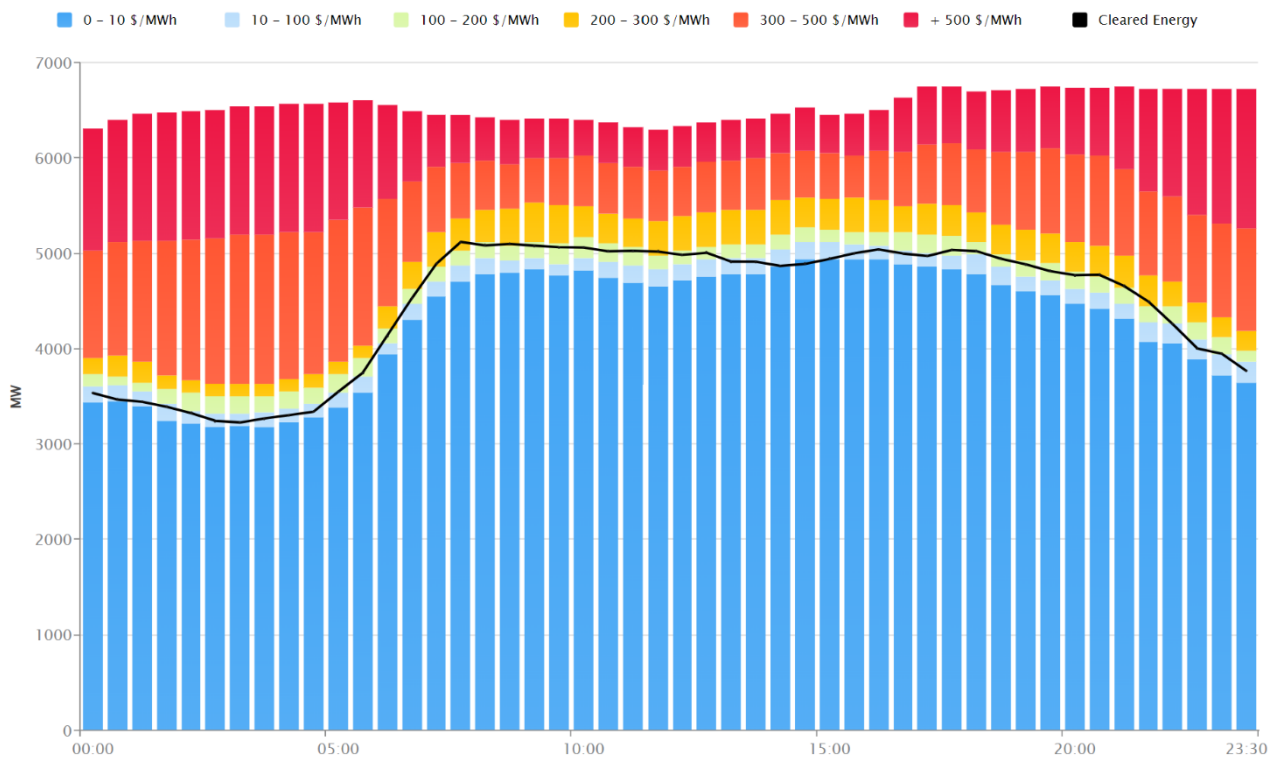
Tuesday 21 February



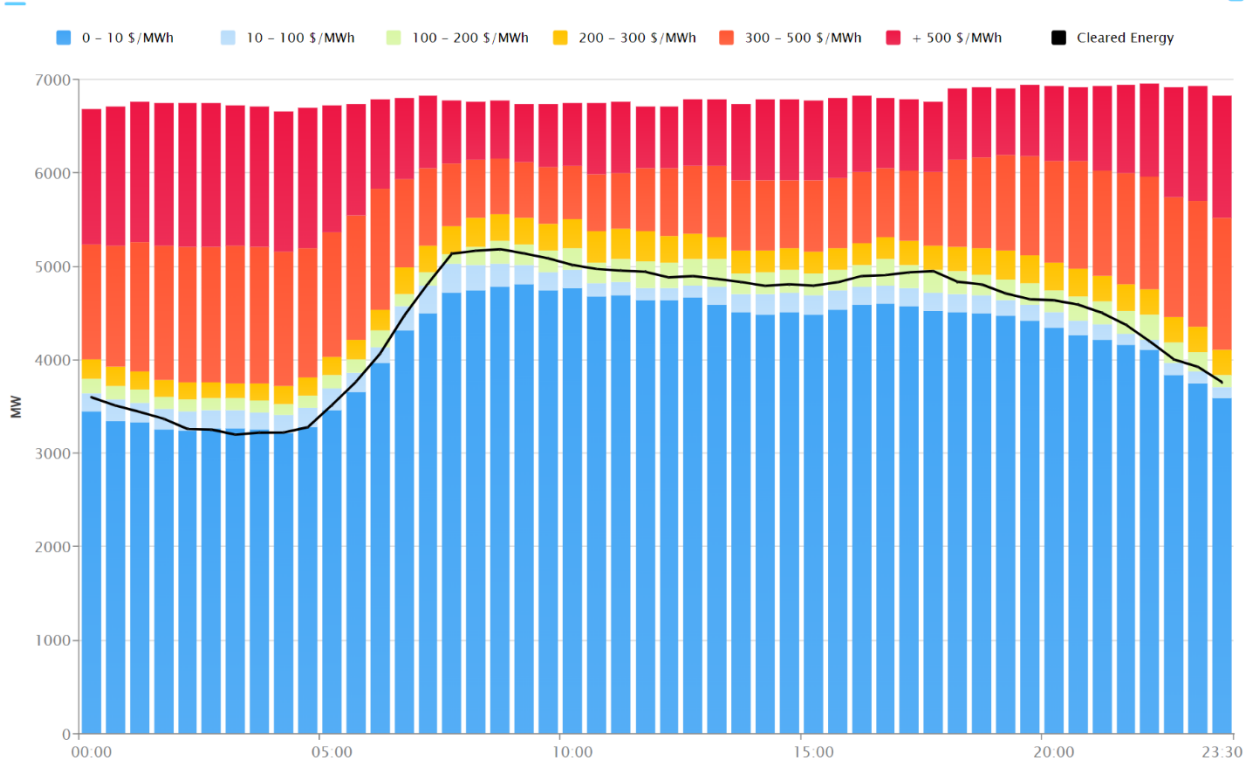
Wednesday 22 February



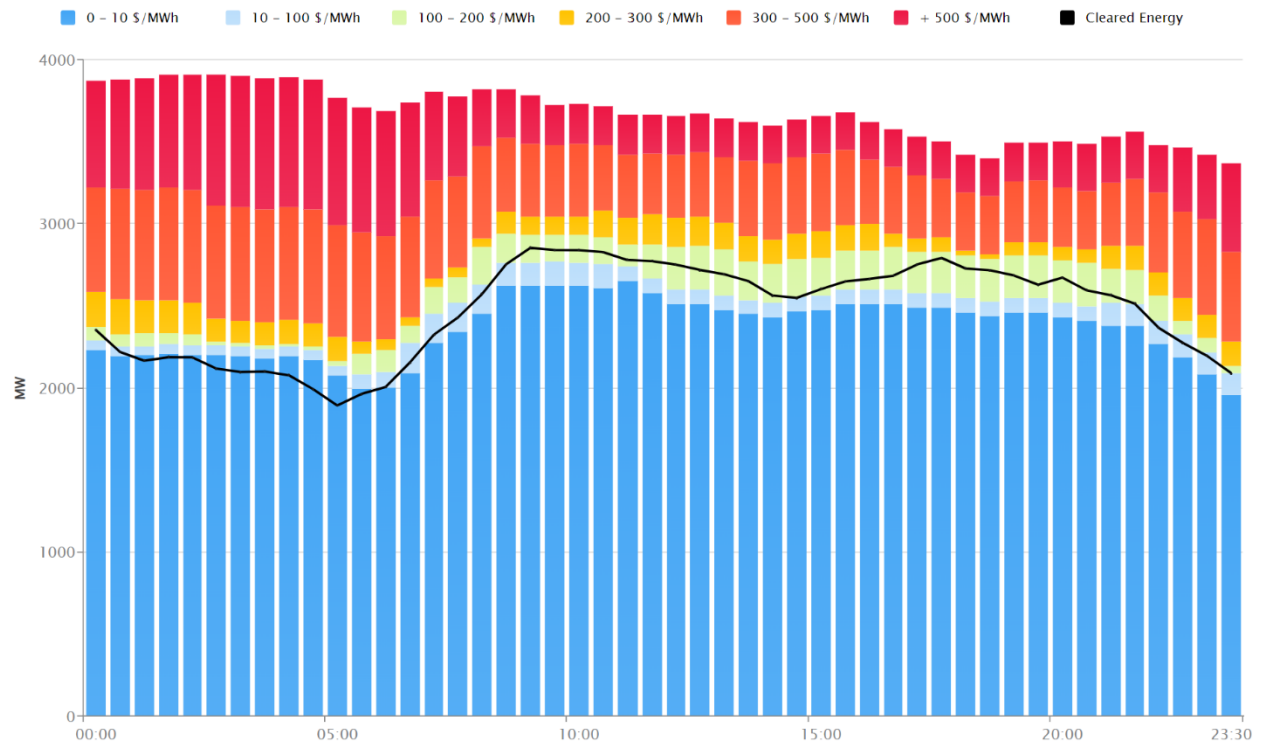
Thursday 23 February



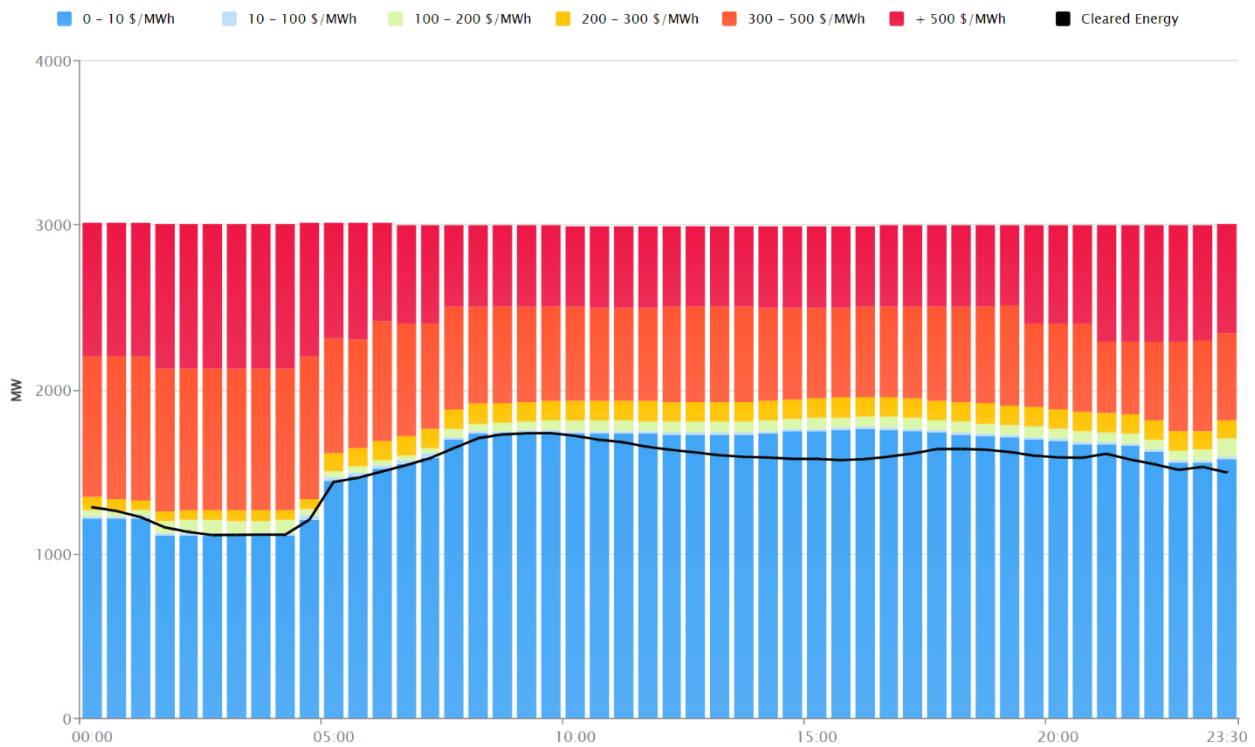
Friday 24 February



Saturday 25 February – North Island



Saturday 25 February – South Island



13. Ongoing Work in Trading Conduct

- 13.1. This week, all prices 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	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.
15/02/2023 and several others	Several	Further analysis	The Authority is making inquiries with Contact regarding their offers at Roxburgh.