

Trading Conduct Report

Market Monitoring Weekly Report

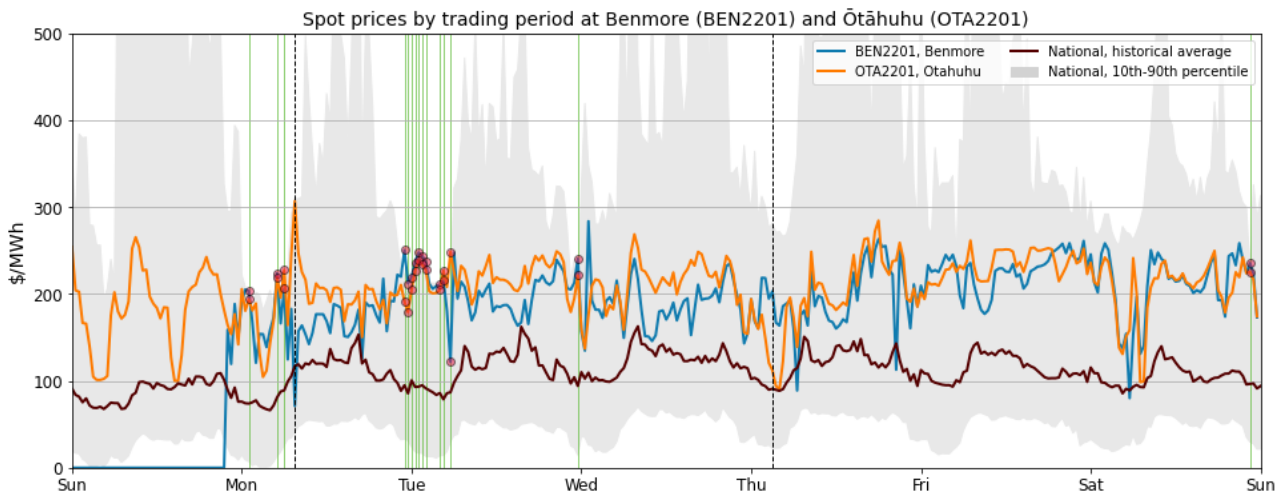
1. Overview for the week of 26 February to 4 March 2023

- 1.1. Spot prices between 26 February – 4 March 2023 appear to be consistent with market conditions.

2. Spot Prices

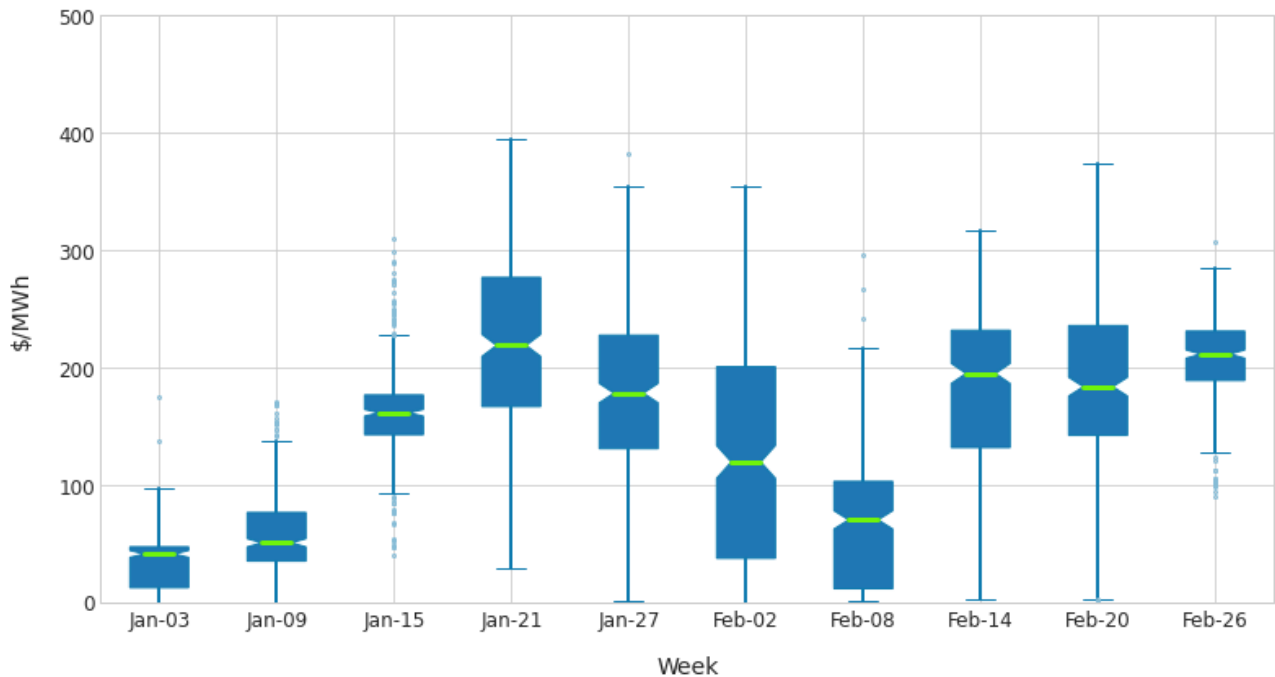
- 2.1. This report monitors underlying wholesale price drivers to assess whether there are trading periods that require further analysis for the purpose of considering potential non-compliance with the trading conduct rule. In addition to general monitoring, we also single out unusually high-priced individual 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 notable prices, but which did not breach the 90th percentile, are marked in black dashed lines.
- 2.2. Between 26 February – 4 March 2023:
 - (a) The average wholesale spot price across all nodes was \$194/MWh.
 - (b) 95 percent of prices fell between \$0.03/MWh and \$266/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. On Sunday the price separation occurred most likely due to the bi-pole HVDC outage, at that time spot prices were low at Benmore while relatively high at Ōtāhuhu. One HVDC pole was still on outage until 6 March. From Monday the price hovered around \$200/MWh. The relatively high prices were likely due to high thermal generation. There were instances of prices above the 90th historic percentile, especially overnight.
- 2.5. The highest prices of the week occurred on Monday at 7:30 am at Ōtāhuhu, when the spot price reached \$307/MWh, while the price at Benmore was \$71/MWh. Another, price separation of notice occurred on Thursday at 4:00 am when the price at Ōtāhuhu was \$90/MWh, and \$163/MWh at Benmore.

Figure 1: Wholesale Spot Prices between 26 February (Sunday) – 4 March (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)¹ of the lower and upper quartile, and then observations that fall outside this range are displayed independently.
- 2.7. This week, the median prices were similar to the week before. Almost all spot prices were above \$100/MWh as hydro generation relatively continues to be dropped, especially at stations with declining reservoirs like Manapouri and along the Clyde scheme. Hydro generation contributed 62 percent of total energy this week. During the HVDC outage prices were 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

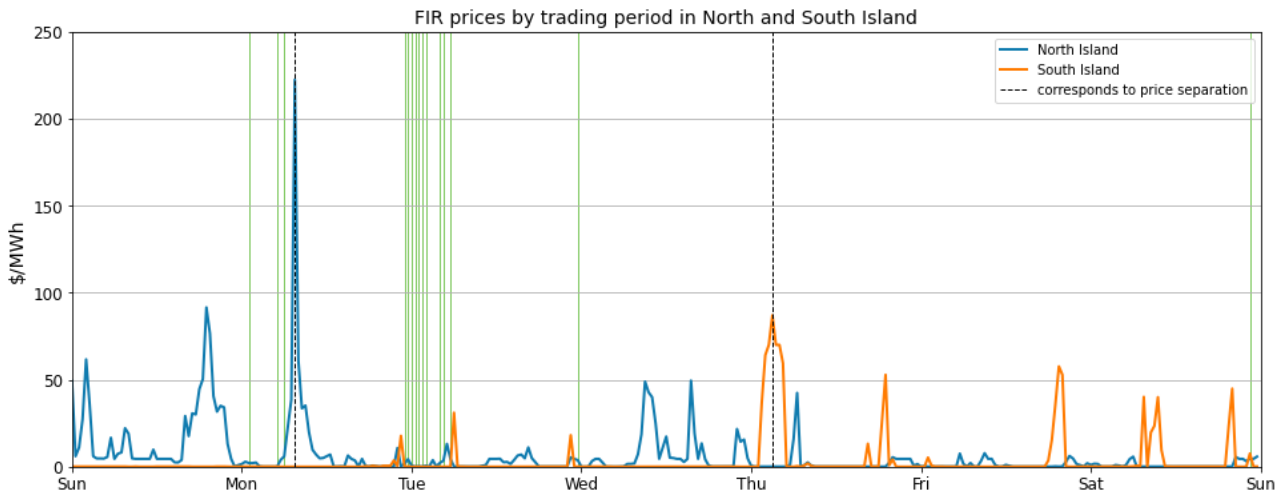


¹ Quartile - Wikipedia

3. Reserve Prices

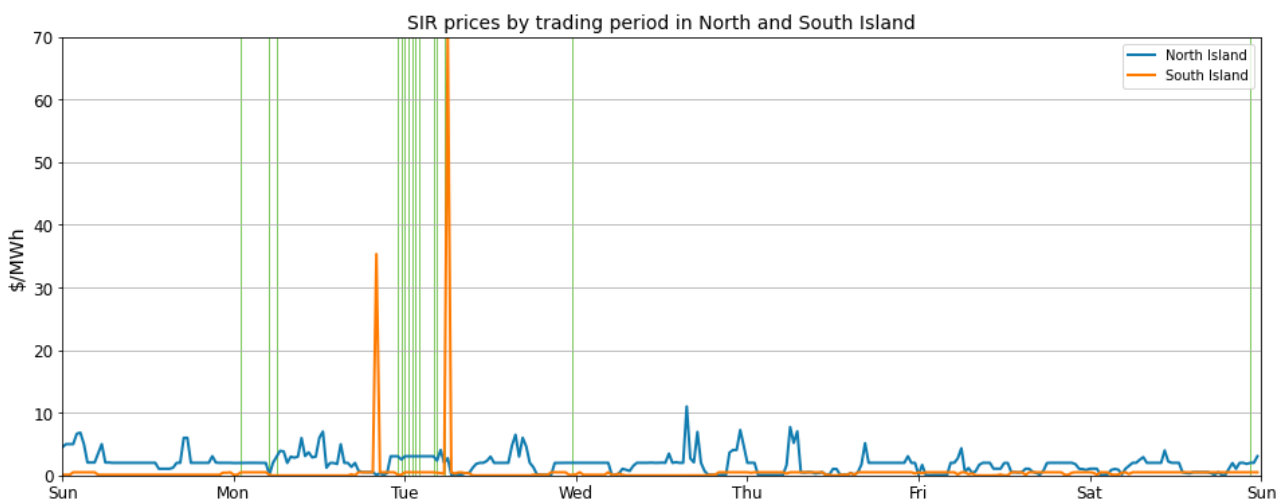
3.1. Fast instantaneous reserve (FIR) prices for the North and South Island are shown below in Figure 3. This week there were instances where both North and South Island FIR prices were above \$20/MWh. Higher FIR prices were likely due to the HVDC outage, which reduces reserve sharing between the islands, especially when the remaining HVDC pole is the risk setter. The highest FIR price of \$222/MWh occurred on Monday at 7:30 am in the North Island, co-occurring at the same trading period as price separation between the islands. The high FIR price and the price separation will be related due to co-optimisation of the energy and reserve market.

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. Despite the second HVDC pole outage from last Saturday, the SIR prices in the North Island were mostly below \$10/MWh. Two price spikes took place in the South Island on 27 February 2023 at 8:00 pm (\$35/MWh), and on 28 February at 6:00 am (\$70/MWh).

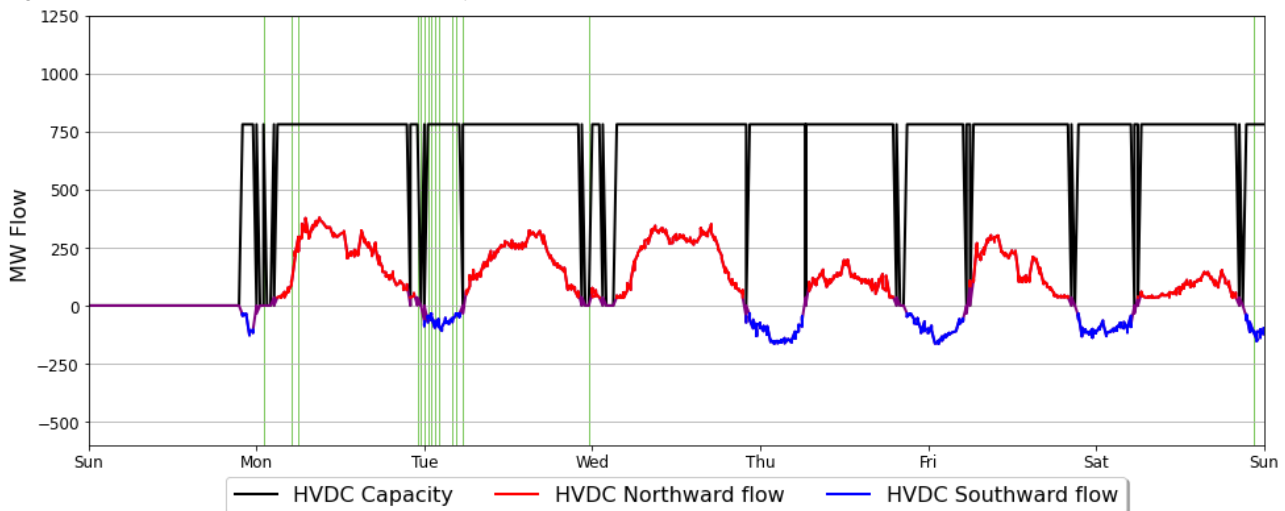
Figure 4: SIR prices by trading period and Island



4. HVDC

- 4.1. Figure 5 shows HVDC flow between 26 February - 4 March. HVDC flows were mostly northward during the day from Monday onwards, but transfer remained below 400 MW. Overnight, HVDC flows were southward except on Wednesday. Note that a HVDC pole went on outage on Thursday, with a bipole outage on Saturday and Sunday (25-26 February 2023). The HVDC transfer limit dropped to zero on Sunday, when both poles were on outage.

Figure 5: HVDC northward flow and capacity

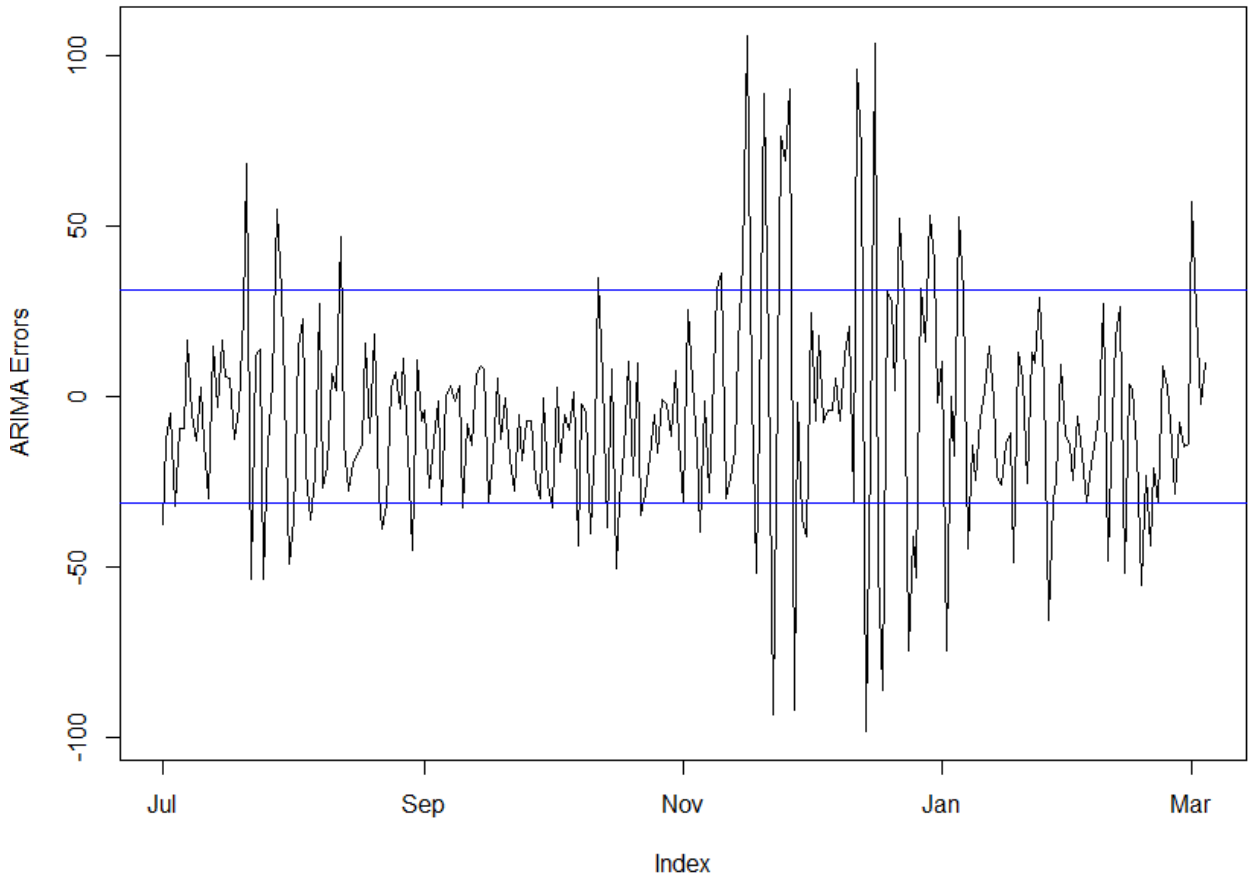


5. Regression Residuals

- 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 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 Wednesday. Here the residual was positive, indicating that the modelled price was too low. This discrepancy may be due to low wind conditions on Wednesday, which are not fully captured by the daily model.

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

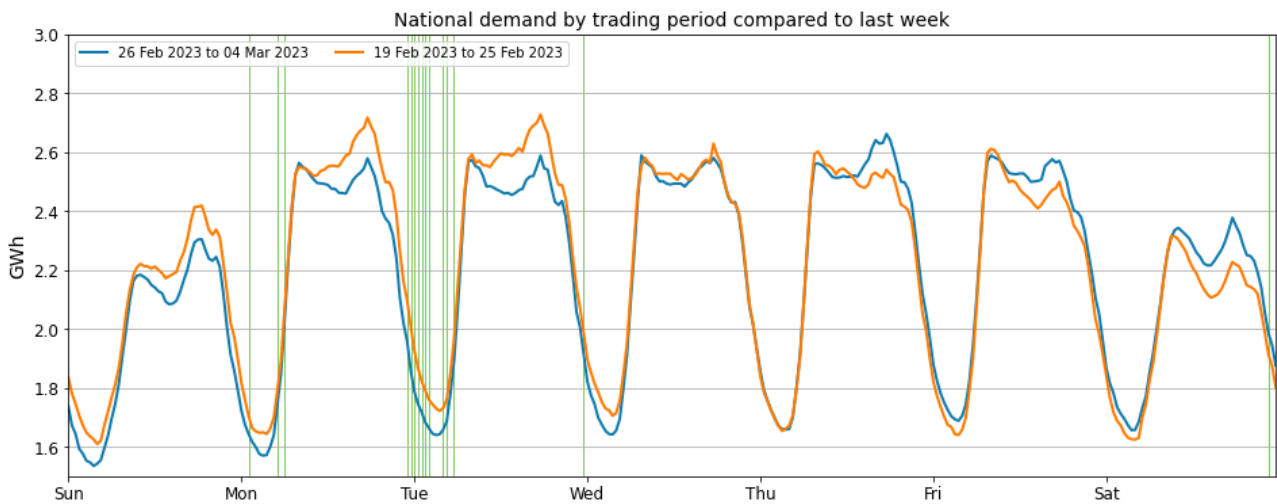
Figure 6: Residual plot of estimated daily average spot prices from 1 July 2022 – 4 March 2023. The blue lines show two standard deviations of the ARMA errors.



6. Demand

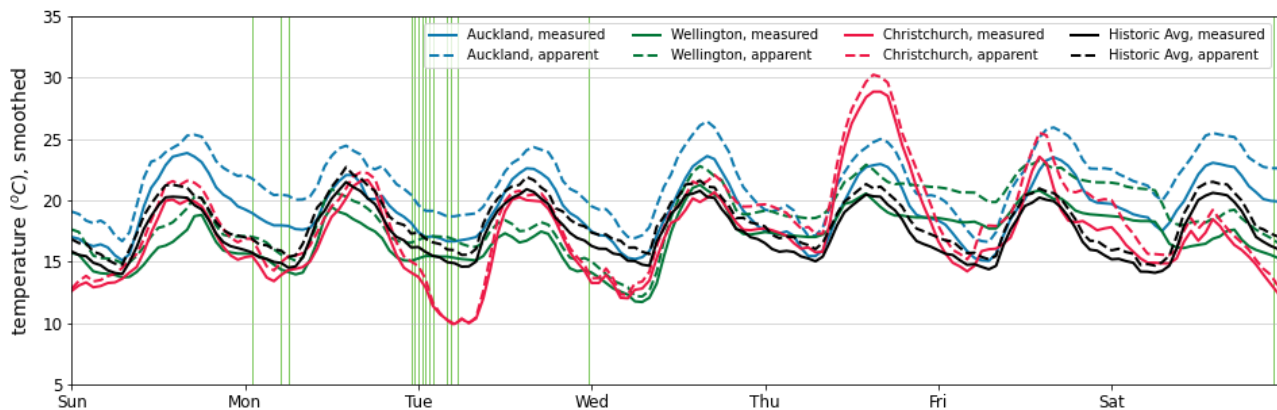
6.1. Figure 7 shows national grid demand between 26 February - 4 March, compared to the previous week. Daily demand was lower at the start of the week from Sunday to Tuesday. From Thursday to Saturday similar morning peaks were observed to the week before but higher evening peaks compared to last week.

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 Wednesday, temperatures across in Wellington and Christchurch were mostly around or below historic average, with Christchurch dipping to around 10 degrees on Tuesday morning. Christchurch had varied temperatures for most of the week with a peak apparent temperature around 30 degrees on Thursday, but then temperatures dropping again at the end of the week. Apparent temperatures in Auckland were generally above historic average the whole week.

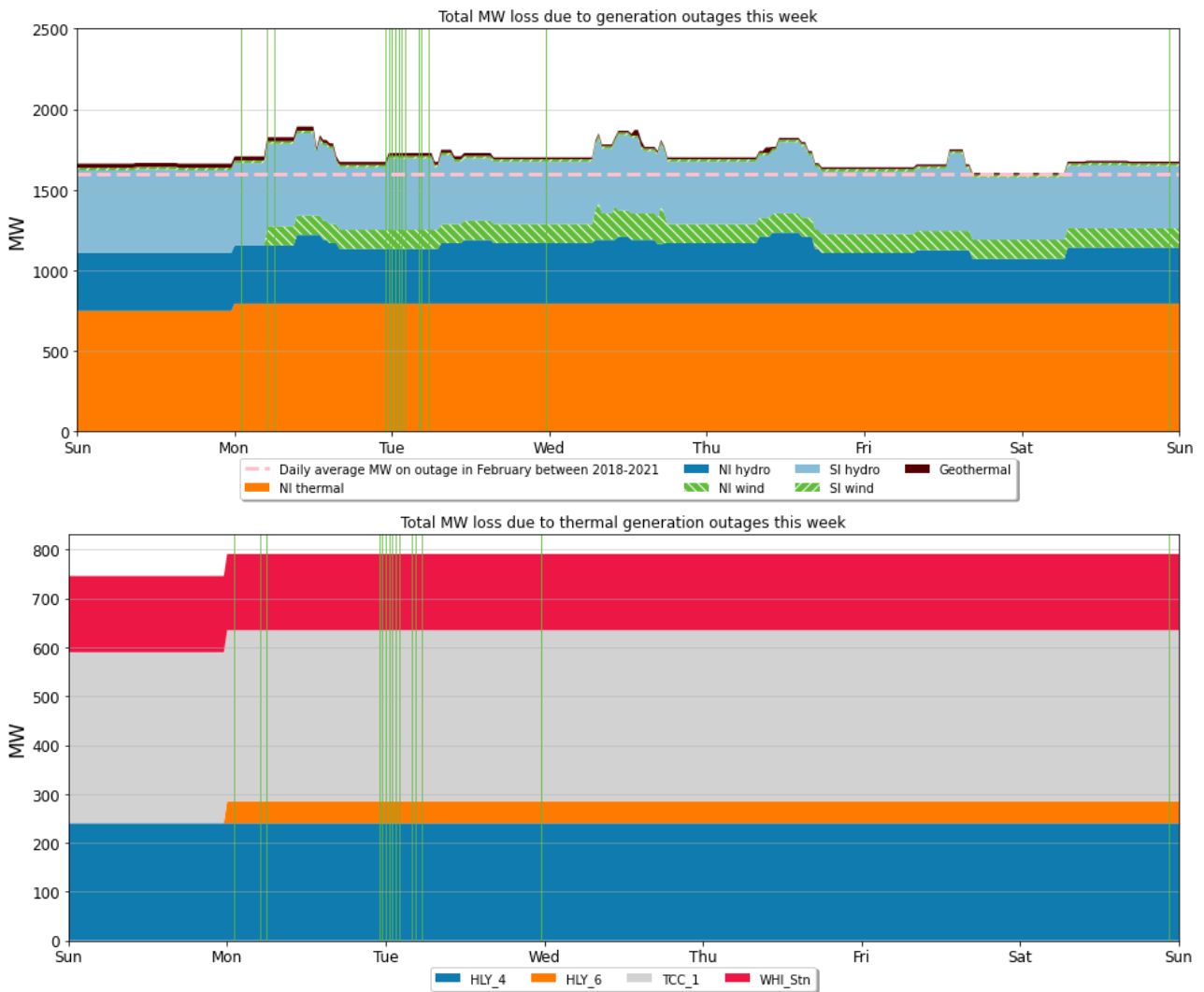
Figure 8: Temperatures across main centres



7. Outages

- 7.1. Figure 9 shows generation capacity on outage. Total capacity on outage between 26 February – 4 March ranged between ~1,600 – 1,800 MW. Outages were relatively steady during the week.
- 7.2. Notable outages include:
- Huntly 4 remains on outage.
 - TCC remains on outage.
 - Whirinaki remains on outage.
 - Huntly 6 was on outage
 - Linton wind farm went on outage on Monday 27 February until 9 March.
 - A few hydro units are continuing outage this week.

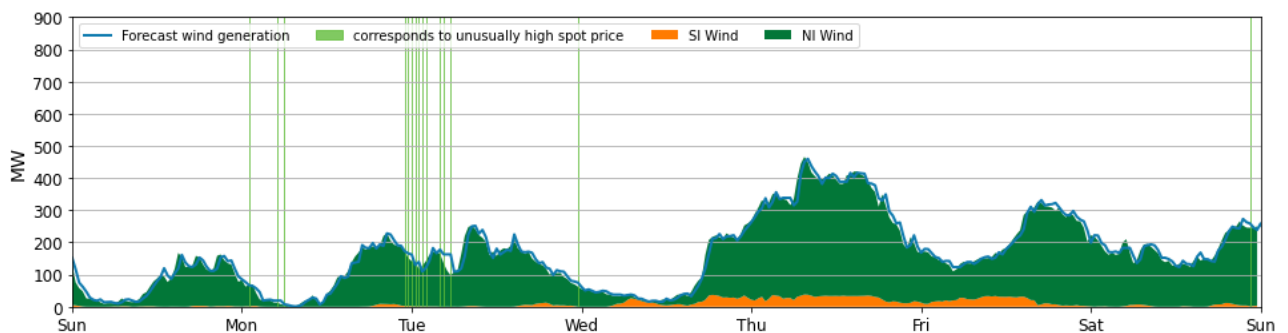
Figure 9: Total MW loss due to generation outages



8. Generation

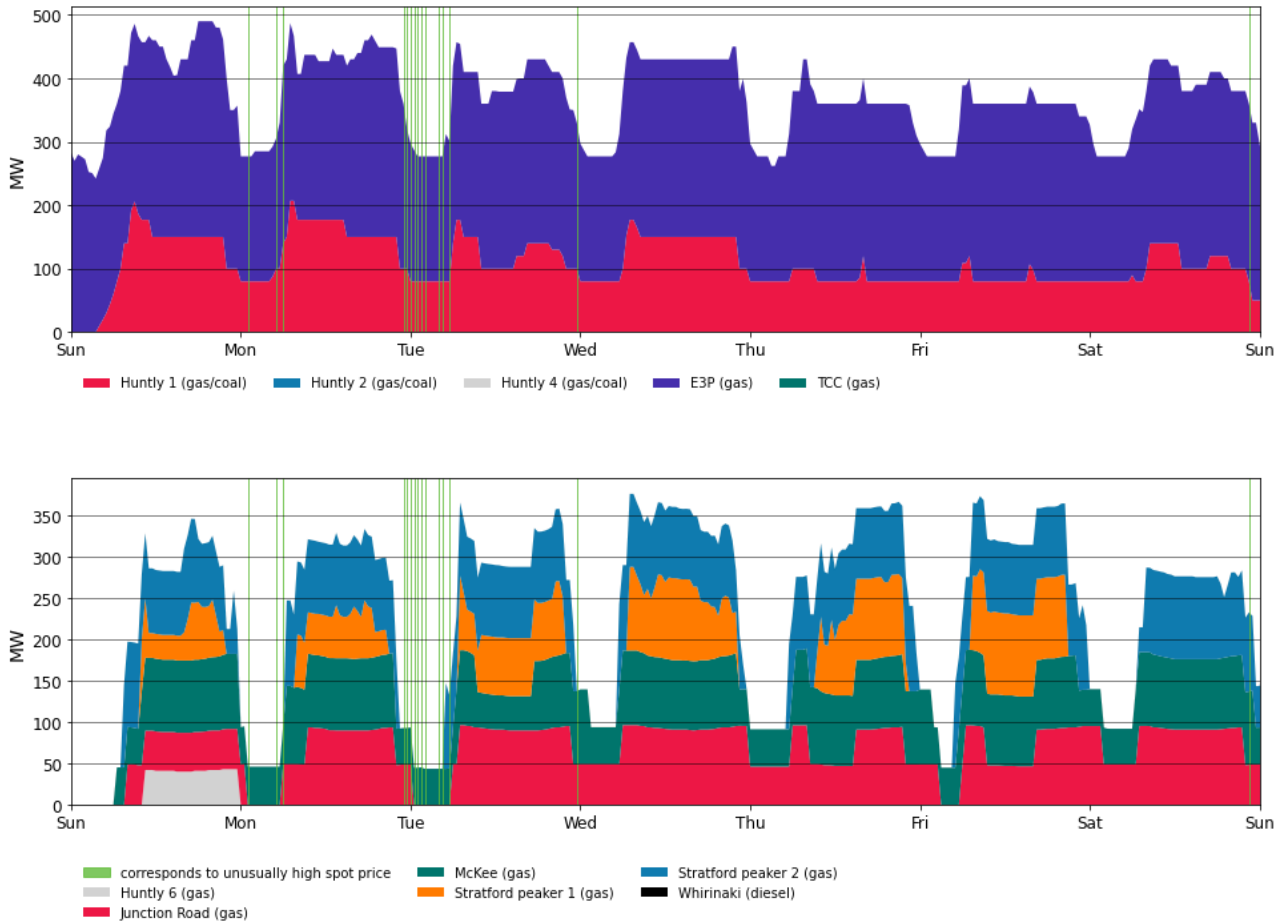
- 8.1. Wind generation, between 26 February - 4 March, varied between ~20 -450 MW. Wind generation was low at the start of the weekly barely reaching 200 MW by late Wednesday. There was an increase in wind during Thursday where towards the middle of the day it reached around 400 MW. Wind then decreased again during Friday with the highest winds on Friday evening producing around 300MW and on Saturday it was mostly below 200MW.

Figure 10: Wind Generation and forecast



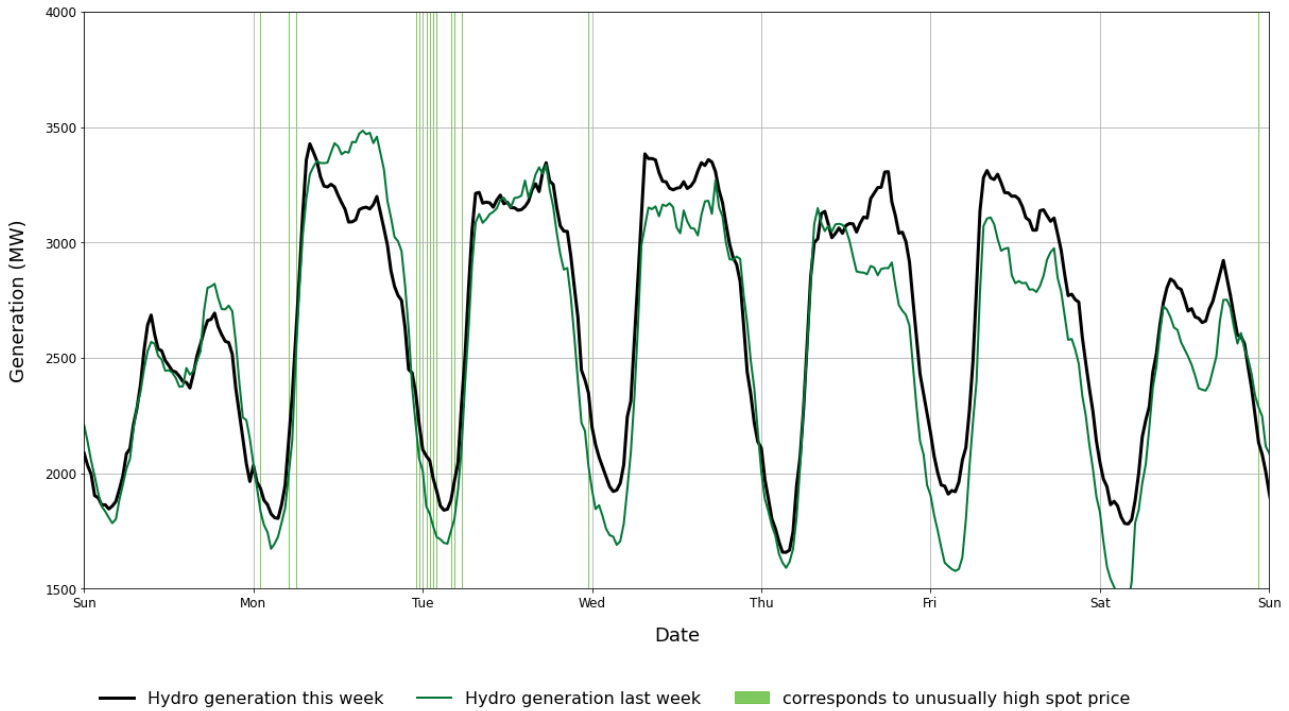
- 8.2. Figure 11 shows generation of thermal baseload and thermal peaker plants between 26 February – 4 March. E3P (Huntly 5) and Huntly 1 ran all week as baseload.
- 8.3. All peakers ran this week to cover demand (except Whirinaki), likely due to the low wind generation. Junction road and McKee ran nearly constantly all week. Stratford peaker 2 ran all week, and Stratford 1 ran from Sunday to Friday. Huntly 6 ran on Sunday only as it is on outage from Monday 27 February until 8 March.

Figure 11: Thermal Generation



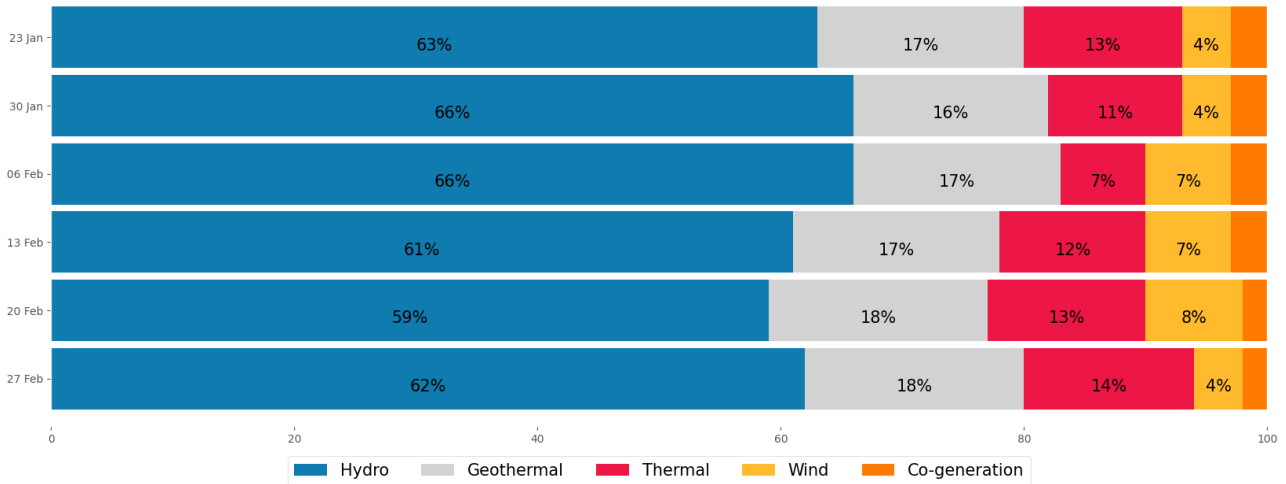
- 8.4. Figure 12 shows total hydro generation in MW produced each trading period, compared to the same time in the previous week. There was lower hydro generation on Monday compared to last week. However, overall hydro generation was higher than the previous week, particularly from Wednesday onwards. An increase in hydro generation can be seen in line with the higher afternoon demand times over Thursday, Friday and Saturday.

Figure 12: Hydro generation between 26 February – 4 March compared to the previous week



8.5. As a percentage of total generation, between 26 February – 4 March, total weekly hydro generation totalled 62 percent, geothermal 18 percent, thermal 14 percent, wind 4 percent, and co-generation 2 percent.

Figure 13: Total generation as a percentage each week between 23 January and 4 March 2023



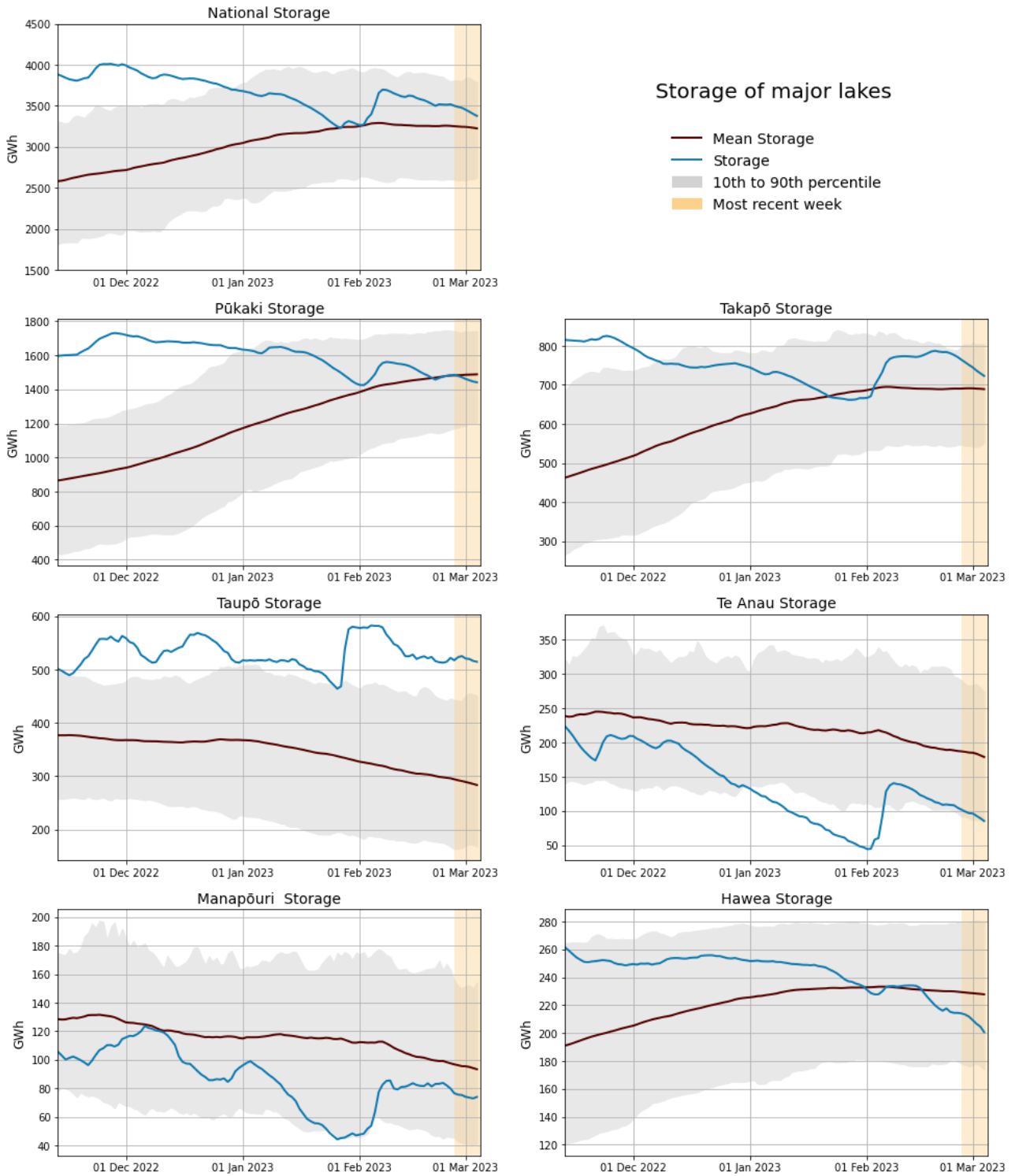
9. Storage/Fuel Supply

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.

9.1. National hydro storage levels decreased slightly this week with most lakes showing a decrease. Taupō remained above its 90th percentile. Storage at Lake Takapō is slightly above its historic mean. Lakes Hawea and Pūkaki are below their respective historic mean. Storage at Lake Te Anau continues to drop and is again around its 10th percentile, while

storage at Manapōuri dropped at the start of the week, before levelling out, remaining above its 10th percentile. Generation at Manapōuri remains relatively low.

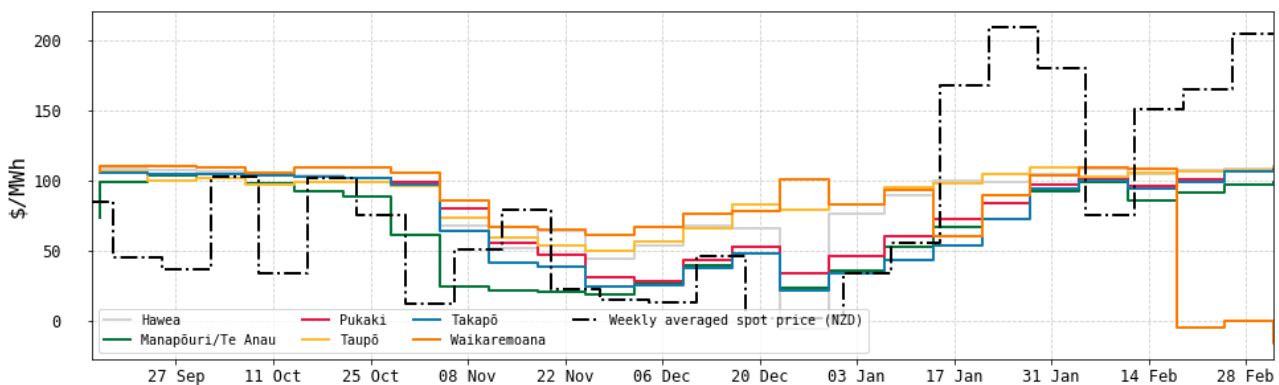
Figure 14: Hydro Storage



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 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 March 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. 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. 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 Hawkes Bay.

Figure 15: JADE water values across various reservoirs between 15 September 2022 and 4 March 2023



11. Price versus estimated costs

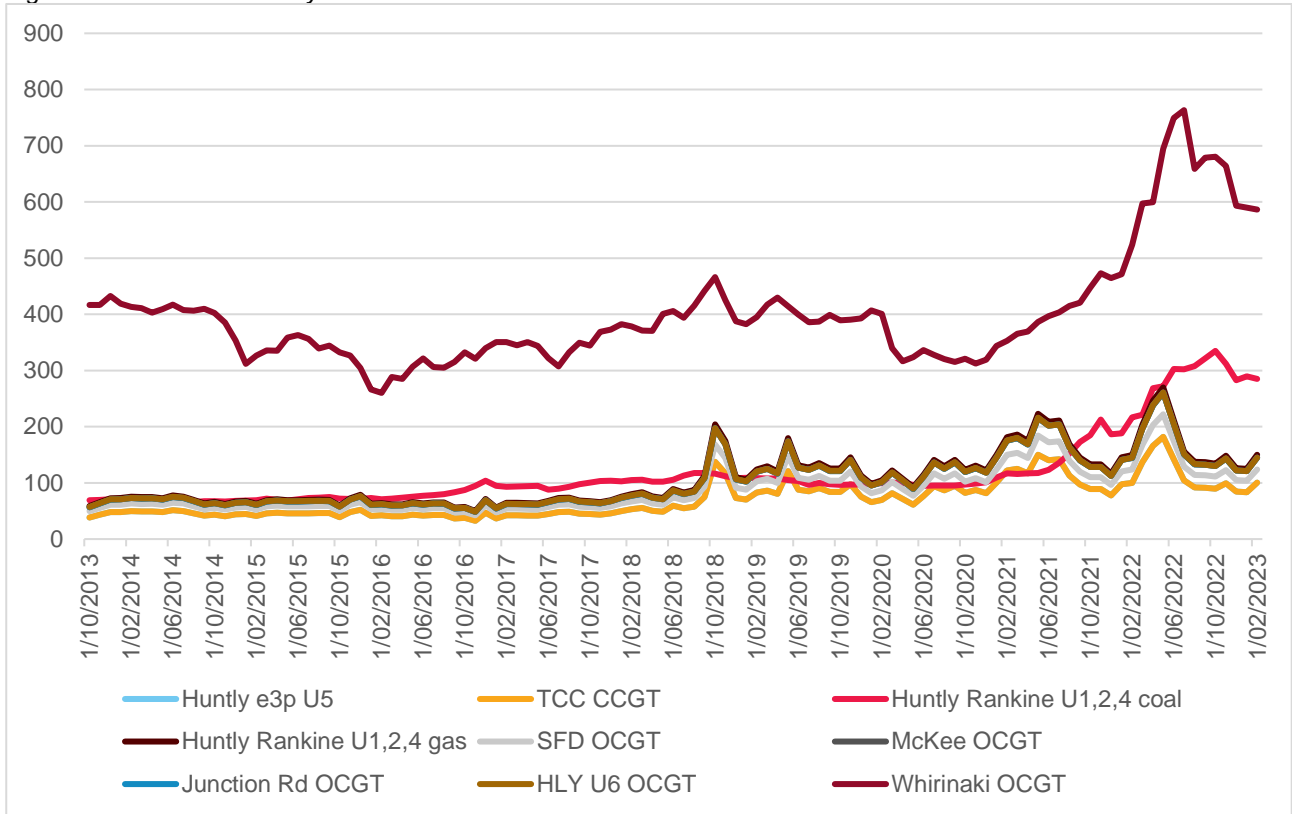
- 11.1. In a competitive market, prices should be close to (but not necessarily at) the short run marginal cost (SRMC) of the marginal generator (where SRMC includes opportunity cost).
- 11.2. The SRMC (excluding opportunity cost of storage) for thermal fuels is estimated using gas and coal prices, and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

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.

⁴ <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 C⁵ on the trading conduct webpage.

Figure 16: Estimated monthly SRMC for thermal fuels



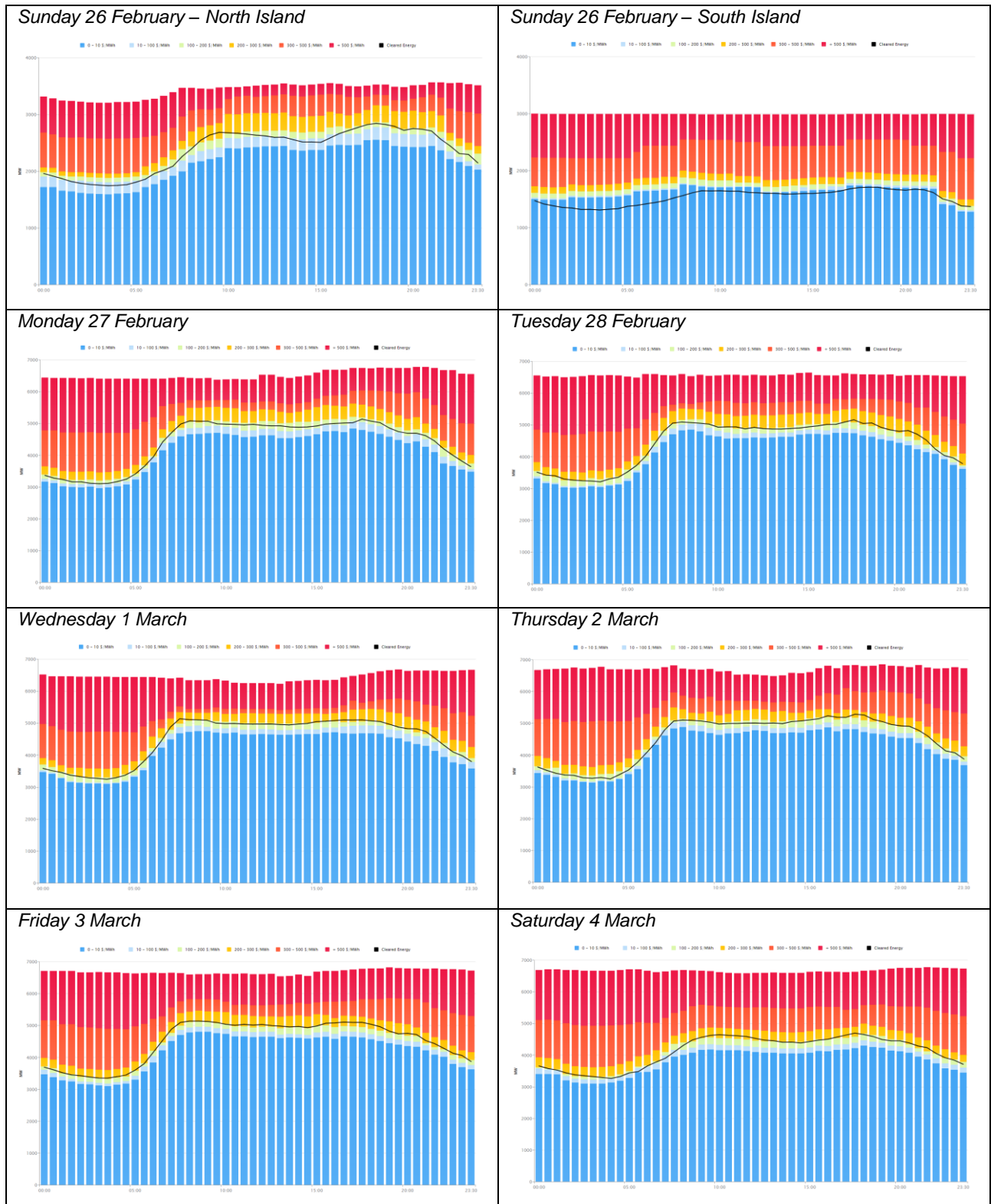
12. Offer Behaviour

12.1. Figure 17 shows this week's national daily offer stacks from WITS⁶. The black line shows cleared energy, indicating the range of the average final price. Sunday offer stacks are shown separately for the North and South Island to reflect the full bipole outage. Most of the energy was cleared in the \$100-200/MWh or \$200-300/MWh band. This shift to clearing in the lower priced bands reflects the relatively high hydro generation experienced this week.

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

⁶ [Cleared Energy Stack | WITS \(electricityinfo.co.nz\)](https://www.electricityinfo.co.nz/cleared-energy-stack)

Figure 17: Daily offer stack from WITS



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.