

# Trading Conduct Report

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## Market Monitoring Weekly Report

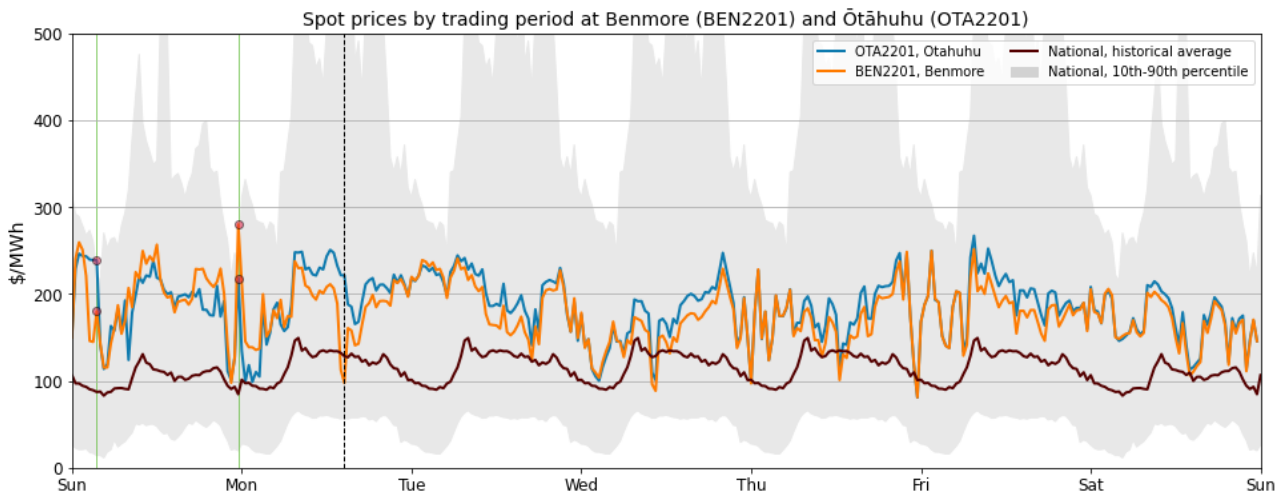
### 1. Overview for the week of 5-11 March 2023

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

### 2. Spot Prices

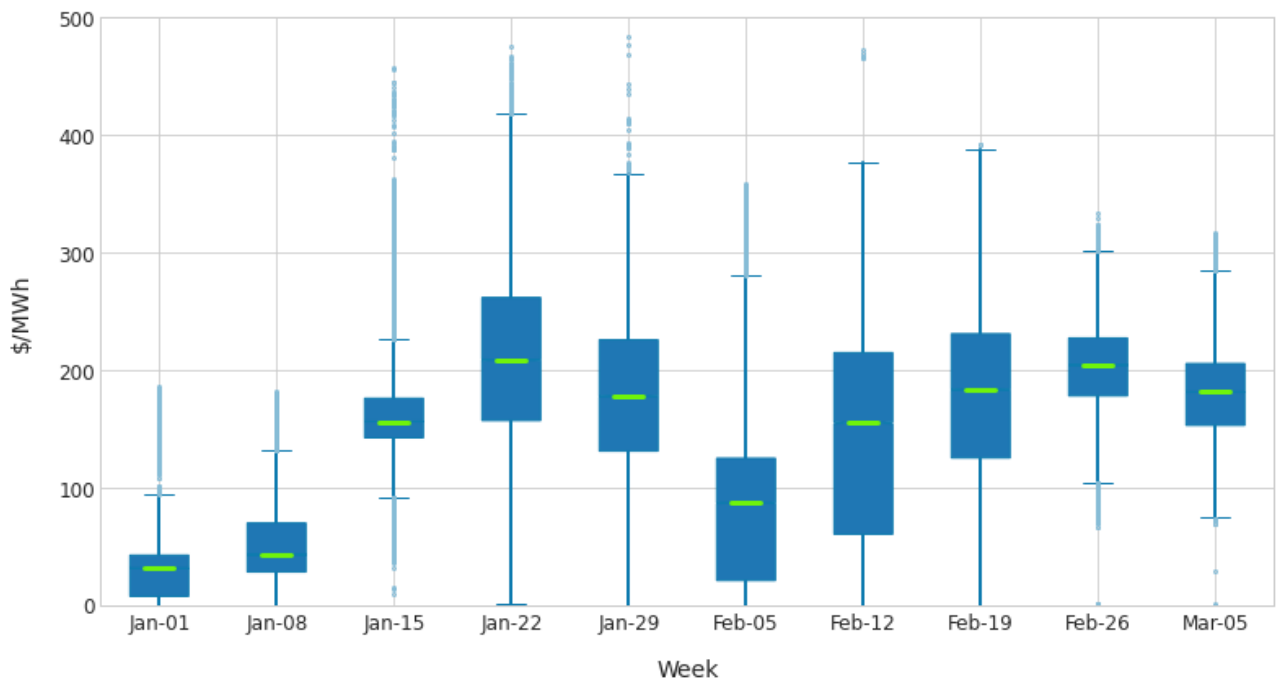
- 2.1. This report monitors underlying wholesale price drivers to assess whether there are trading periods that require further analysis for the purpose of considering potential non-compliance with the trading conduct rule. In addition to general monitoring, we also single out unusually high-priced individual 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 90<sup>th</sup> percentile are highlighted with a translucent green line. Other notable prices, but which did not breach the 90<sup>th</sup> percentile, are marked in black dashed lines.
- 2.2. Between 5-11 March 2023:
- (a) The average wholesale spot price across all nodes was \$183/MWh.
  - (b) 95 percent of prices fell between \$103/MWh and \$251/MWh.
- 2.3. Figure 1 shows spot prices at Benmore and Ōtāhuhu alongside their historic median and historic 10<sup>th</sup>- 90<sup>th</sup> percentiles adjusted for inflation.
- 2.4. The prices were mostly above the historic average and hovered around \$200/MWh. The relatively high prices were likely due to high thermal generation. There were two instances of prices above the 90<sup>th</sup> historic percentile, especially overnight. On Sunday and Monday, a few price separations occurred most likely due to the single pole HVDC outage, which ended on Monday.
- 2.5. The highest prices of the week occurred on Sunday at 11:30 pm at Benmore, when the spot price reached \$280/MWh, while the price at Ōtāhuhu was \$218/MWh. Another, price separation of notice occurred on Monday at 2:30 pm when the price at Ōtāhuhu was \$221/MWh, and \$97/MWh at Benmore.

Figure 1: Wholesale Spot Prices between 5 March (Sunday) – 11 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)<sup>1</sup> 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 slightly lowered compared to the week before. Most of the spot prices were above \$100/MWh as hydro generation drops, especially at stations with declining reservoirs, resulting in higher thermal generation. Hydro generation contributed 59 percent of total energy this week. During the HVDC outage prices were separated between the islands.

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

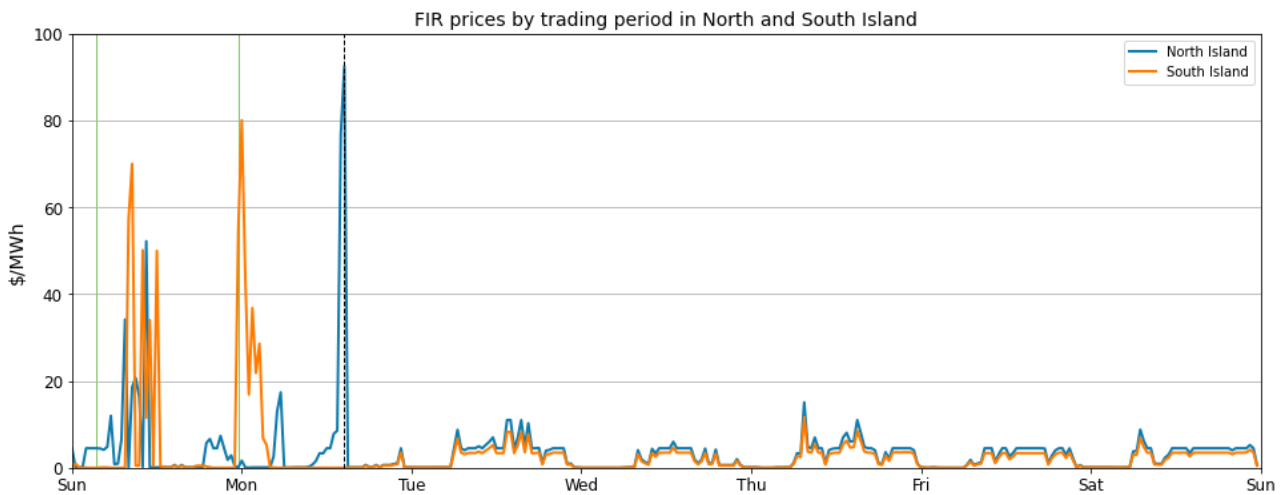


<sup>1</sup> Quartile - Wikipedia

### 3. Reserve Prices

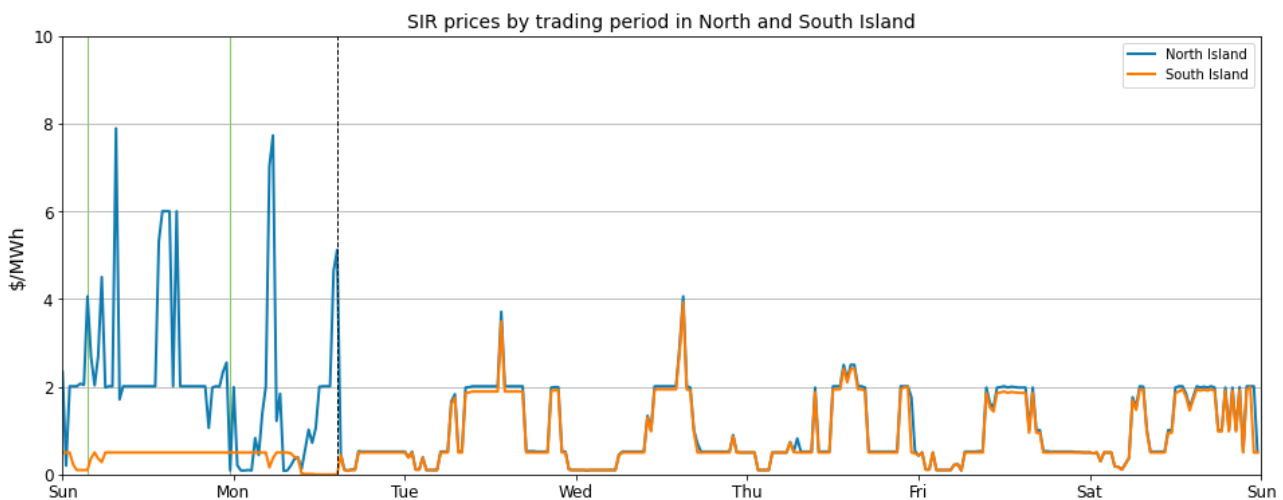
3.1. Fast instantaneous reserve (FIR) prices for the North and South Island are shown below in Figure 3. This week there were instances where both North and South Island FIR prices were above \$20/MWh. Higher FIR prices were likely due to the HVDC outage, which reduces reserve sharing between the islands, especially when the remaining HVDC pole is the risk setter. The highest FIR price of \$92/MWh occurred on Monday at 2:30 am in the North Island, co-occurring at the same trading period as price separation between the islands. Another high FIR price of \$80/MWh also happened on Monday at midnight in the South Island. 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. Relatively high SIR prices in the North Island observed on Sunday and Monday might be due to the HVDC outage. Despite the HVDC pole outage, the SIR prices in the North Island were mostly below \$8/MWh, and below \$4/MWh in the South Island.

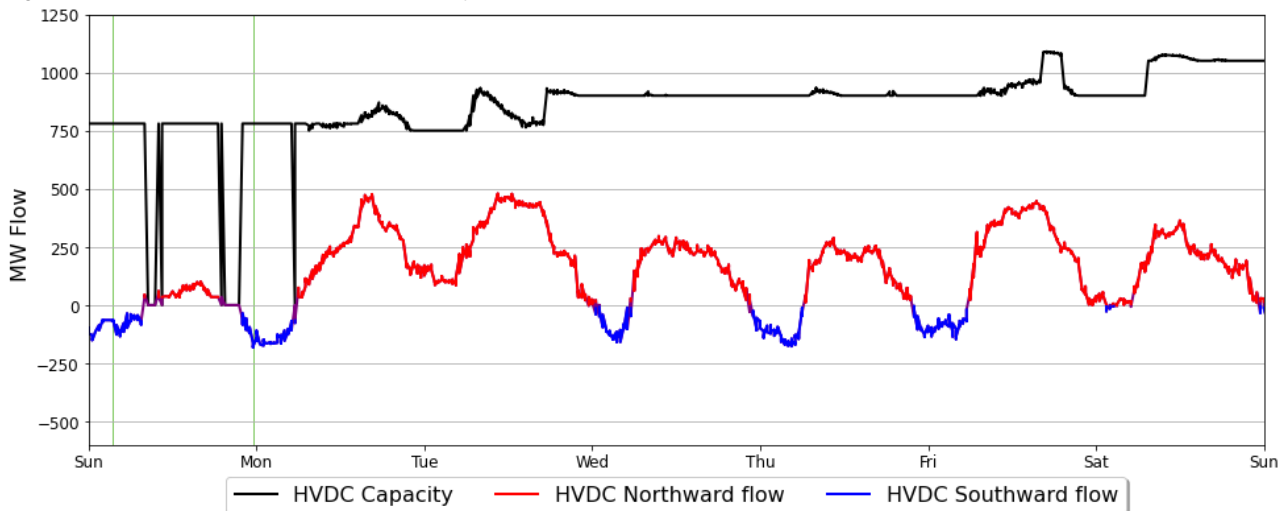
Figure 4: SIR prices by trading period and Island



## 4. HVDC

- 4.1. Figure 5 shows HVDC flow between 5-11 March. HVDC flows were mostly northward during the day from Monday onwards, but transfer remained below 500 MW. Overnight, HVDC flows were southward except on Tuesday. Note that one HVDC pole was on outage on Sunday and Monday (25 February to 6 March 2023).

Figure 5: HVDC northward flow and capacity

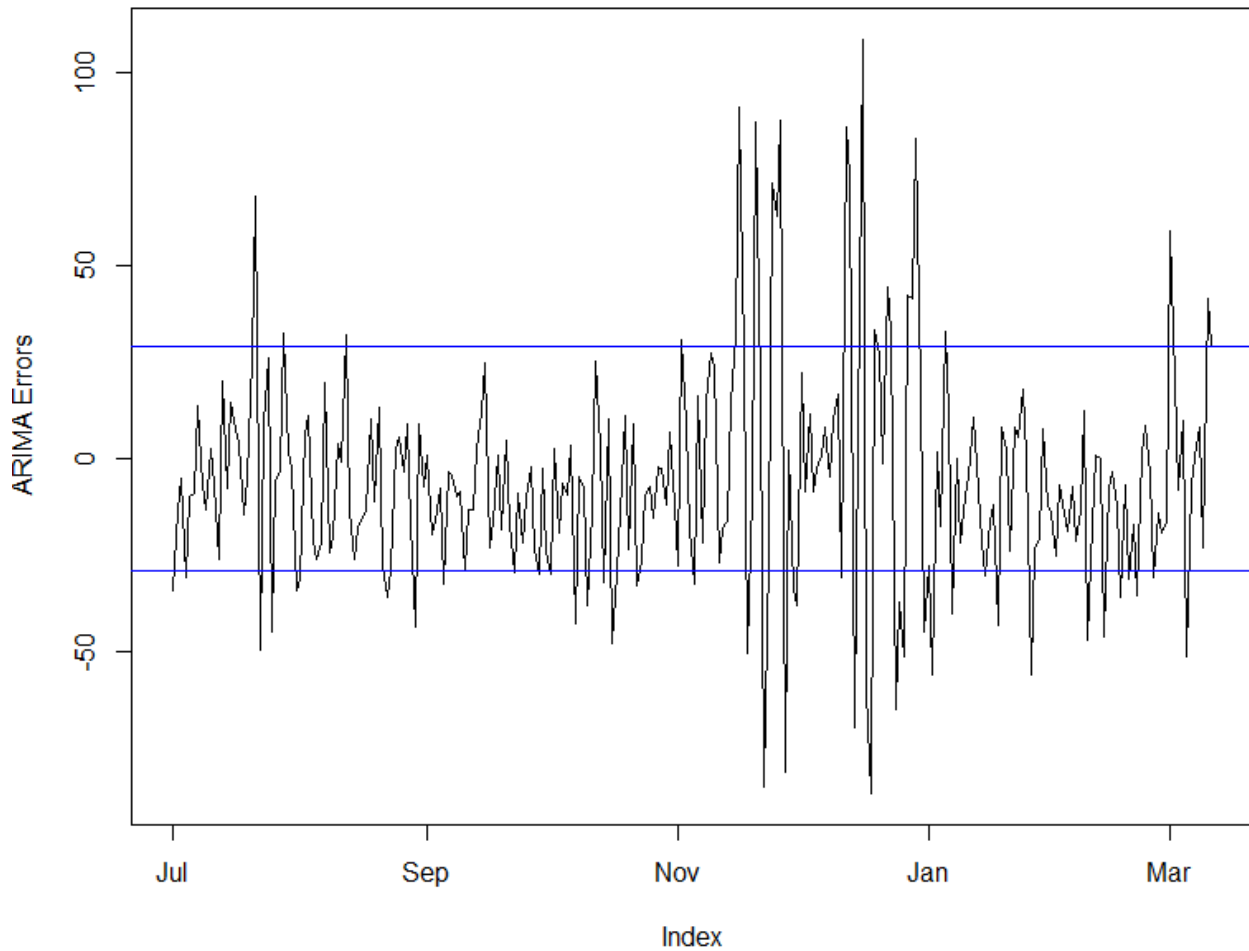


## 5. Regression Residuals

- 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 A<sup>2</sup> 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 Friday. Here the residual was positive, indicating that the modelled price was too low. However, underestimated for Monday and Tuesday, implying that the modelled price was relatively high.

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

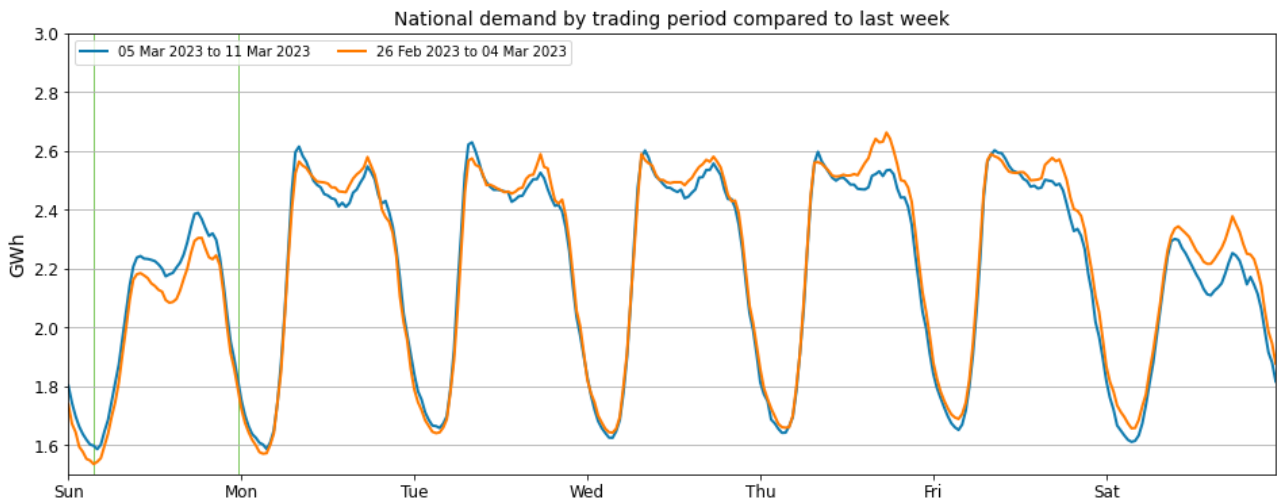
Figure 6: Residual plot of estimated daily average spot prices from 1 July 2022 – 11 March 2023. The blue lines show two standard deviations of the ARMA errors



## 6. Demand

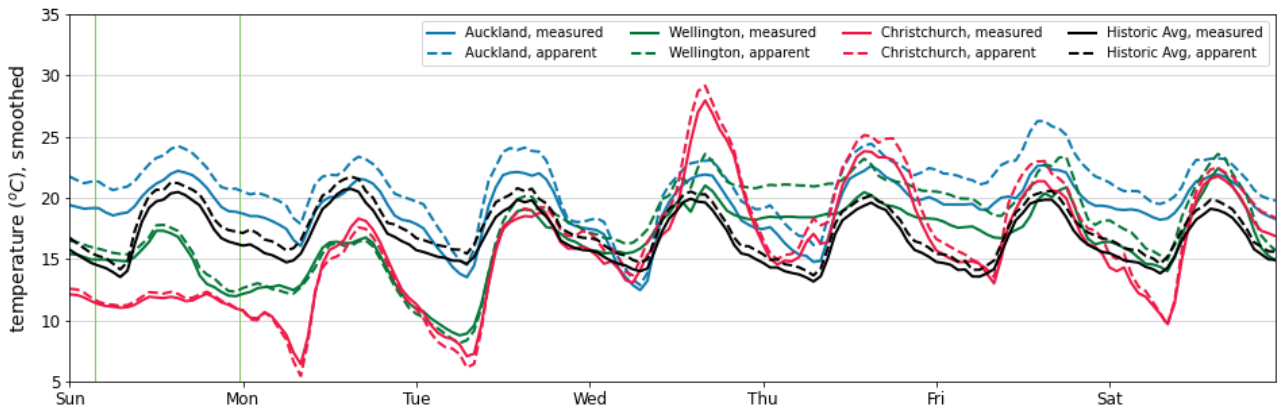
- 6.1. Figure 7 shows national grid demand between 5-11 March, compared to the previous week. Daily demand was higher on Sunday, while Monday and Tuesday saw a slight increase to the morning peaks which could be due to the drop in temperature these mornings in Wellington and Christchurch. There were lower afternoon peaks seen from Thursday onwards with lower demand overall on Saturday compared 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 historic temperature of similar weeks from previous years, averaged across the three main population centres.
- 6.3. Between Sunday and Wednesday, temperatures in Wellington and Christchurch were mostly below historic average, with Christchurch dipping to around 5 degrees on Monday morning. Christchurch had varied temperatures for most of the week with a peak apparent temperature around 30 degrees on Wednesday, but then temperatures dropping again at the end of the week. Apparent temperatures in Auckland were generally between 15 and 25 degrees, which is mostly above historic average the whole week.

Figure 8: Temperatures across main centres

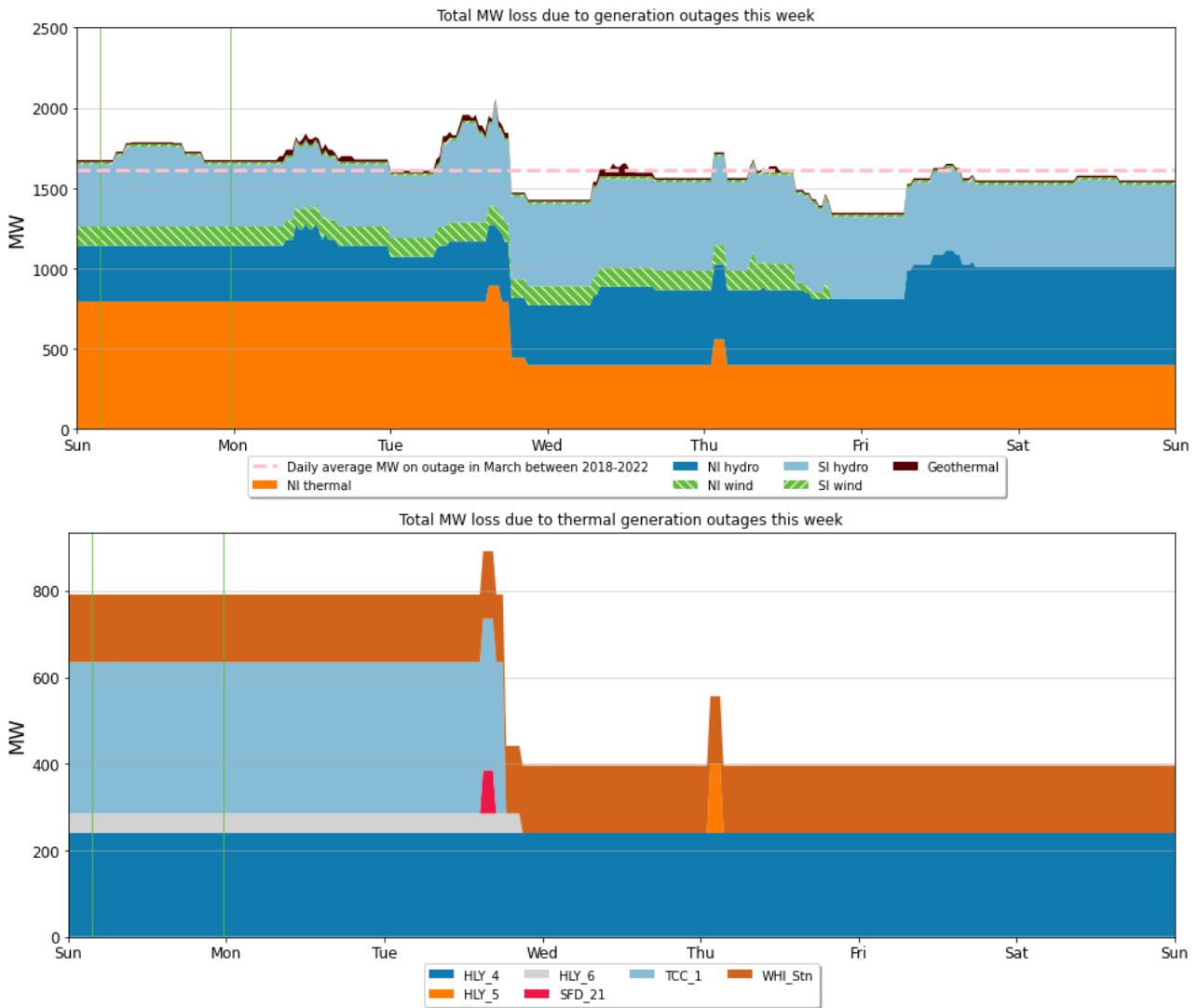


## 7. Outages

- 7.1. Figure 9 shows generation capacity on outage. Total capacity on outage between 5-11 March ranged between ~1,400 – 1,900 MW. Outages were relatively steady during the week.
- 7.2. Notable outages include:
  - (a) Huntly 4 remains on outage.
  - (b) TCC back from outage on Tuesday.

- (c) Whirinaki remains on outage.
- (d) Huntly 6 was on outage.
- (e) Linton wind farm came back from outage on 9<sup>th</sup> March.
- (f) A few hydro units are continuing outage this week.

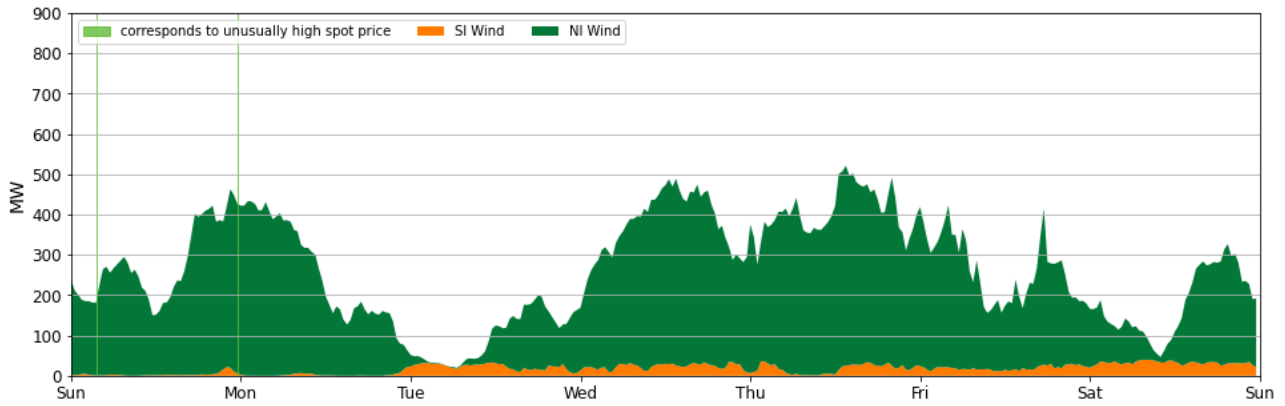
Figure 9: Total MW loss due to generation outages



## 8. Generation

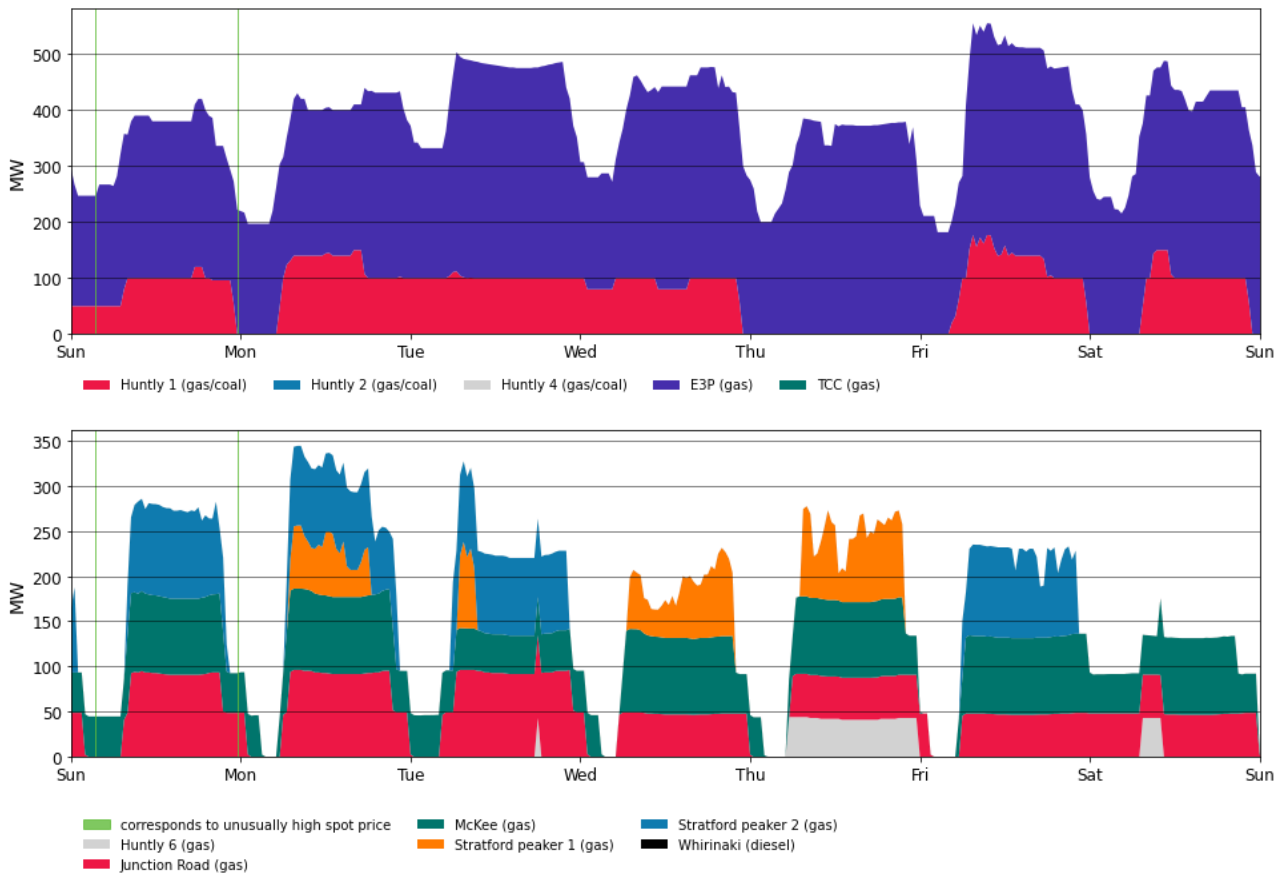
- 8.1. Wind generation, between 5-11 March, varied between ~20 -500 MW (Figure 10). Wind generation was around 200 MW at the start of the week and increased to 400 MW on Monday. The wind dropped to 20 MW on Tuesday. From Wednesday wind generation increased gradually and reached up to 500 MW. On Thursday wind generation peaked to 500 MW. Wind again dropped to 50 MW on Saturday midday. A significant difference between the forecasted wind generation has also been observed.

Figure 10: Wind Generation



- 8.2. Figure 11 shows generation of thermal baseload and thermal peaker plants between 5-11 March. E3P (Huntly 5) ran all week as baseload. Huntly 1 also ran as baseload from Monday to Wednesday, and during the daytime on Friday and Saturday.
- 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 from Sunday to Tuesday, and on Friday. Stratford 1 ran from Monday to Friday. Huntly 6 ran on Thursday after coming back from outage on 8 March.

Figure 11: Thermal Generation

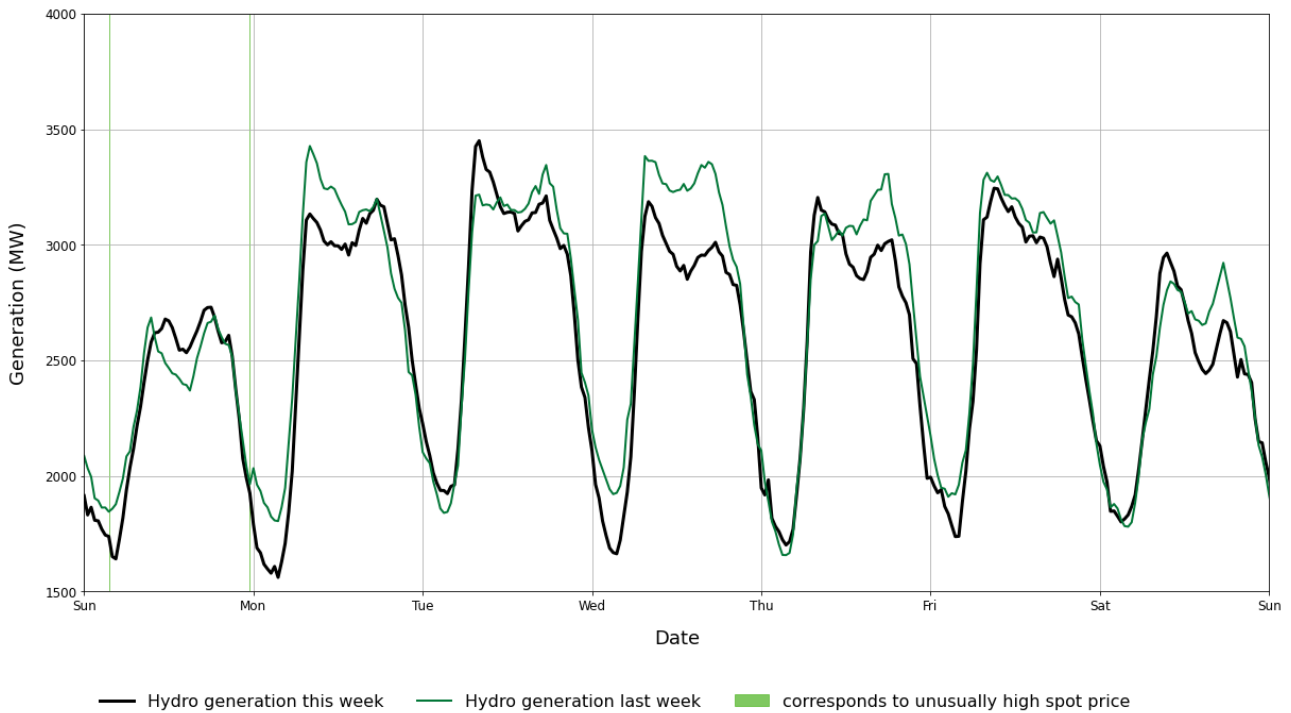


- 8.4. Figure 12 shows total hydro generation in MW produced each trading period, compared to the same time in the previous week. There was lower hydro generation compared to last week except during the morning peak times. Overall hydro generation was 2 percent lower



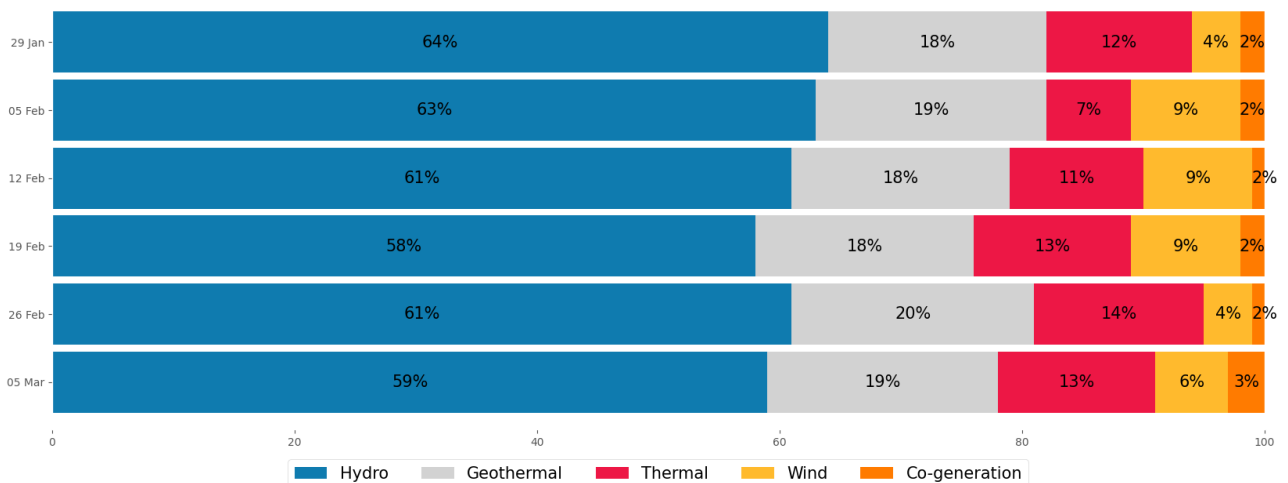
than the previous week. On Wednesday hydro generation was significantly lower compared to previous week.

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



8.5. As a percentage of total generation, between 5-11 March, total weekly hydro generation totalled 59 percent, geothermal 19 percent, thermal 13 percent, wind 6 percent, and co-generation 3 percent.

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

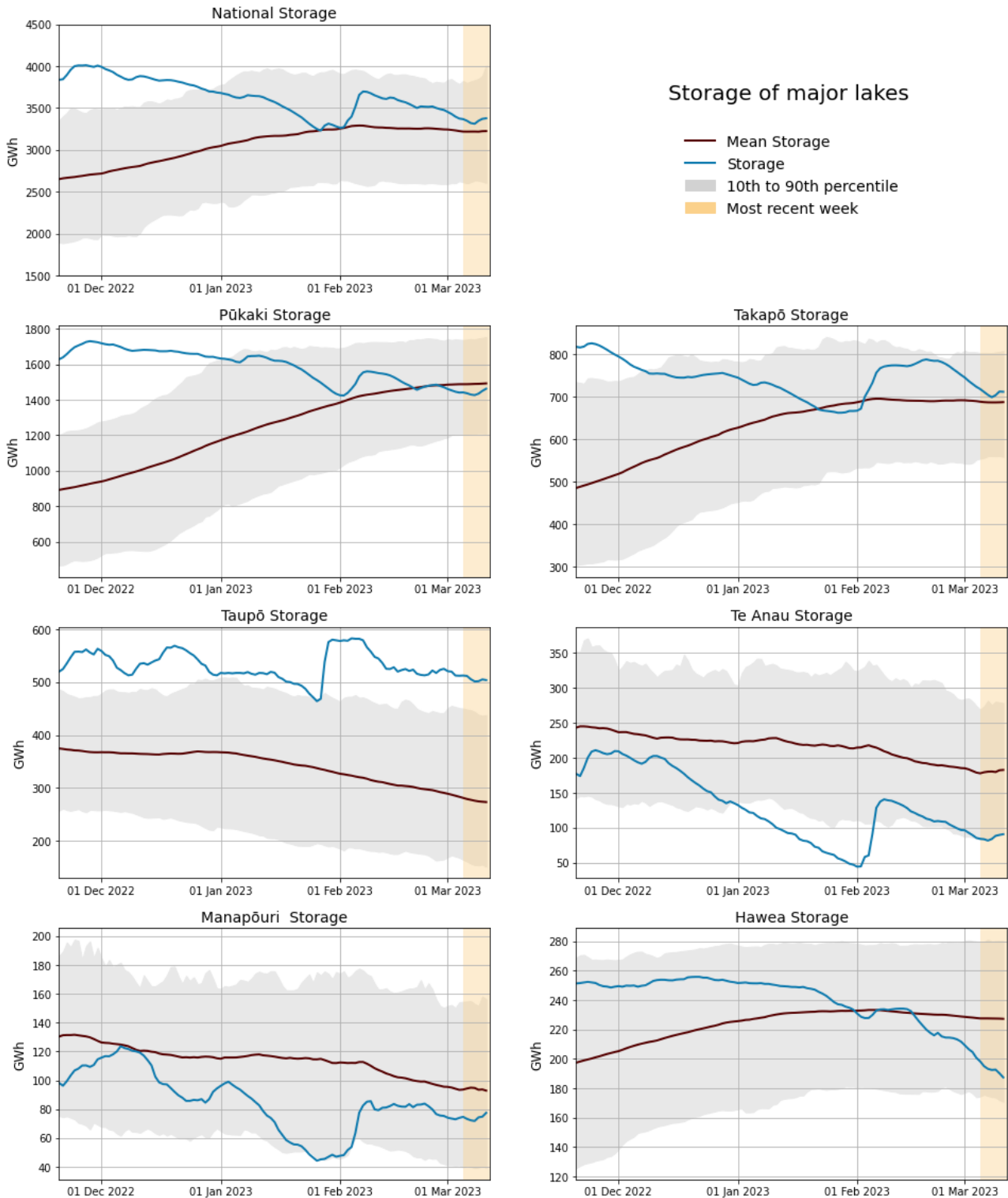


## 9. Storage/Fuel Supply

9.1. Figure 14 shows total controlled national hydro storage as well as the storage of major catchment lakes including their historical mean and 10<sup>th</sup> to 90<sup>th</sup> percentiles.

- 9.2. Overall, national hydro storage levels remained steady (decreased and increased again). Total national storage is around 82.5 percent of nominal full as of 11 March.
- 9.3. Storage at most South Island lakes are showing increases with Pūkaki approaching it's historical average again. Manapōuri, although below its historical average is still above previous year's storage levels and Te Anau remains around its historic 10<sup>th</sup> percentile. Lake Hāwea levels continue to drop and are now approaching it's historic 10<sup>th</sup> percentile. In the North Island Taupō remains above it's historic 90<sup>th</sup> percentile.

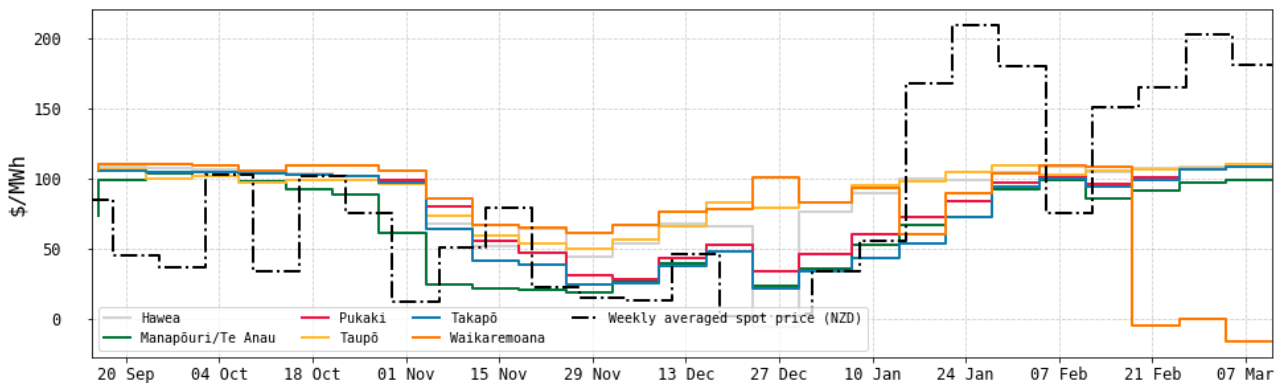
Figure 14: Hydro Storage



## 10. JADE Water Values

- 10.1. The JADE<sup>3</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 11 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 B<sup>4</sup> 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 11 March 2023



## 11. Price versus estimated costs

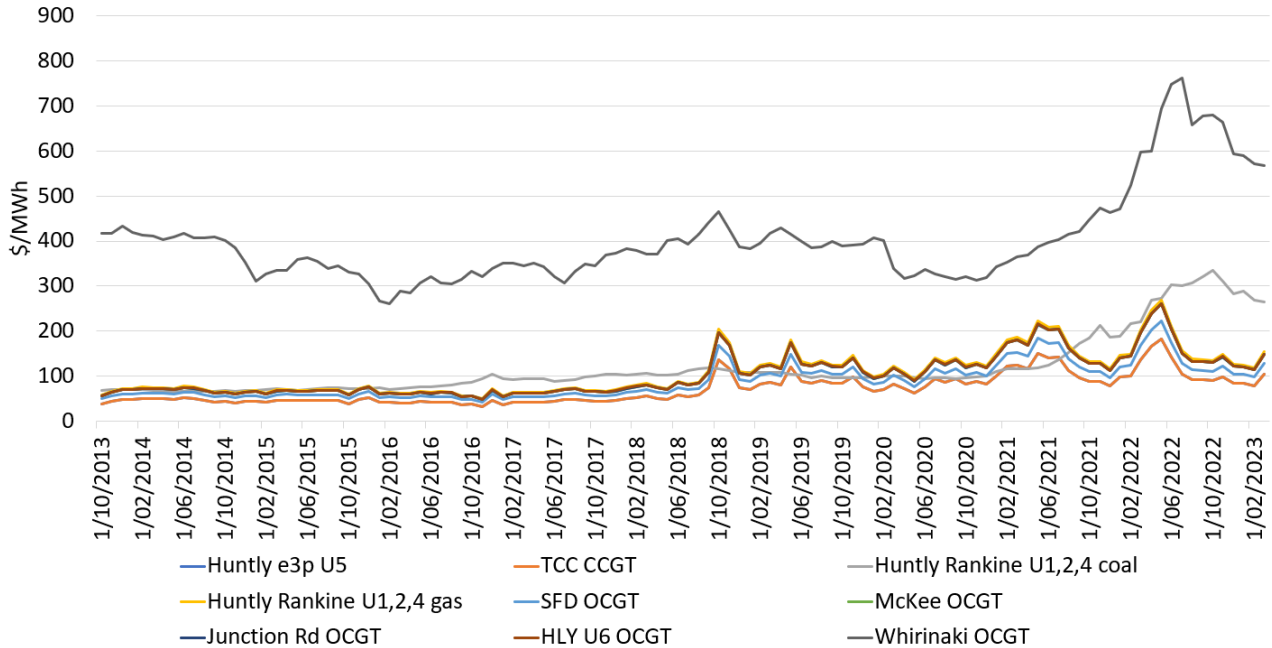
- 11.1. In a competitive market, prices should be close to (but not necessarily at) the short run marginal cost (SRMC) of the marginal generator (where SRMC includes opportunity cost).
- 11.2. The SRMC (excluding opportunity cost of storage) for thermal fuels is estimated using gas and coal prices, and 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 March 2023. The SRMC of gas fuelled plants has increased, while the SRMC of diesel and coal has relatively decreased.
- 11.4. In early March Indonesian coal fell to around ~\$450/tonne (NZD) putting the latest SRMC of coal fuelled Huntly generation at ~\$265/MWh. The SRMC of Whirinaki has decreased slightly to ~\$567/MWh.
- 11.5. The SRMC of gas run thermal plants increased to between \$105/MWh and \$150/MWh, likely due to the increase in gas demand.

<sup>3</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.

<sup>4</sup> <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 C<sup>5</sup> on the trading conduct webpage.

Figure 16: Estimated monthly SRMC for thermal fuels



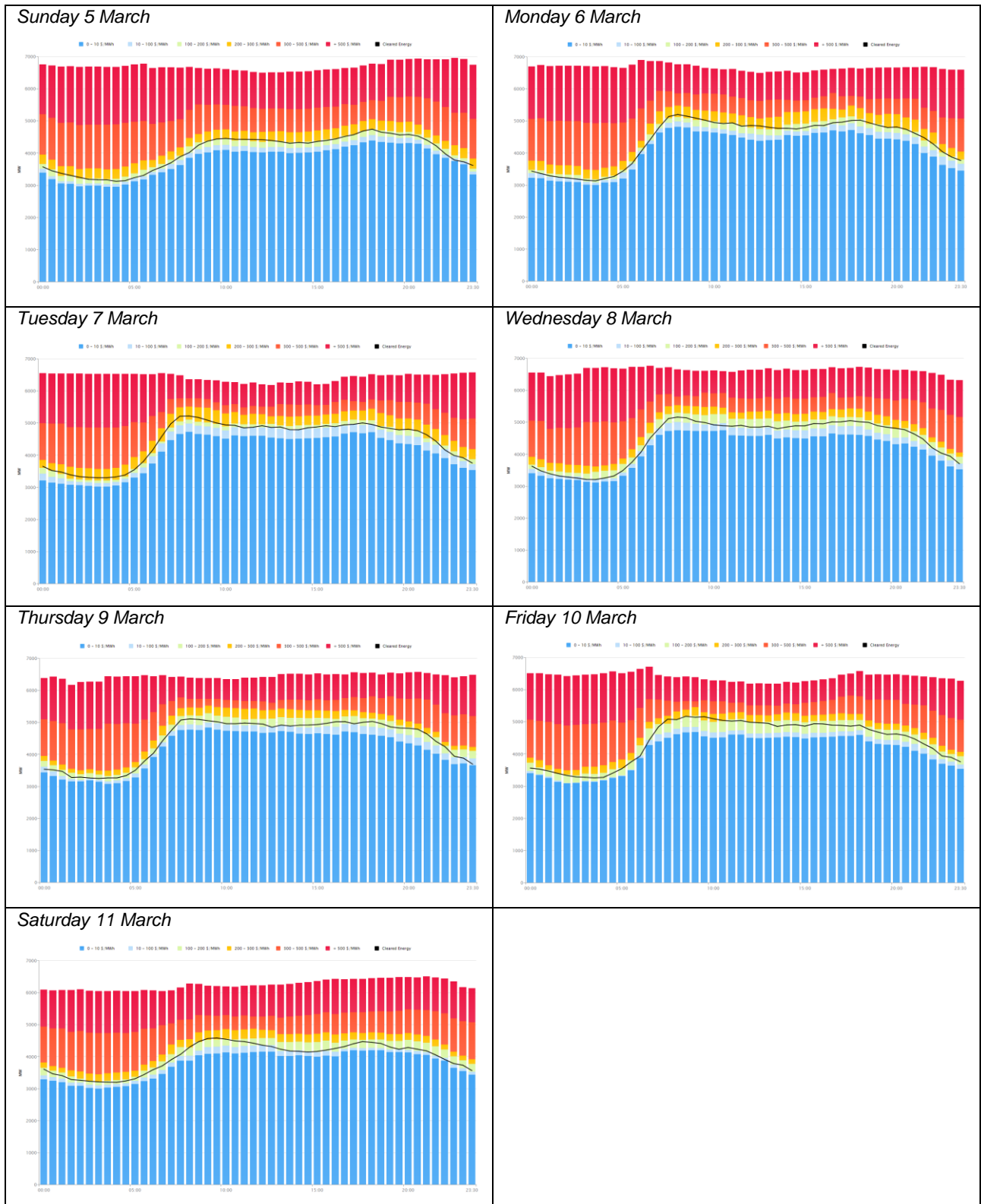
## 12. Offer Behaviour

12.1. Figure 17 shows this week's national daily offer stacks from WITS<sup>6</sup>. The black line shows cleared energy, indicating the range of the average final price. Most of the energy was cleared in the \$100-200/MWh or \$200-300/MWh band. The shift of clearing in these price bands reflects relatively low hydro and high thermal generation experienced this month.

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

<sup>6</sup> [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

<b>Date</b>	<b>TP</b>	<b>Status</b>	<b>Notes</b>
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.