

# Trading Conduct Report

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## Market Monitoring Weekly Report

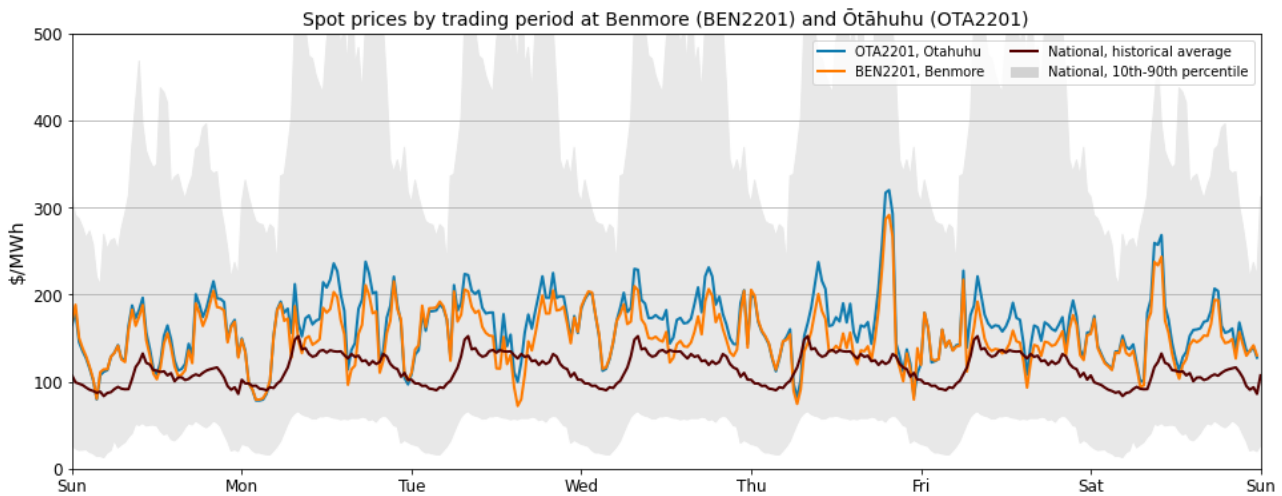
### 1. Overview for the week of 12-18 March 2023

- 1.1. Spot prices between 12-18 March 2023 appear to be consistent with market conditions.

### 2. Spot Prices

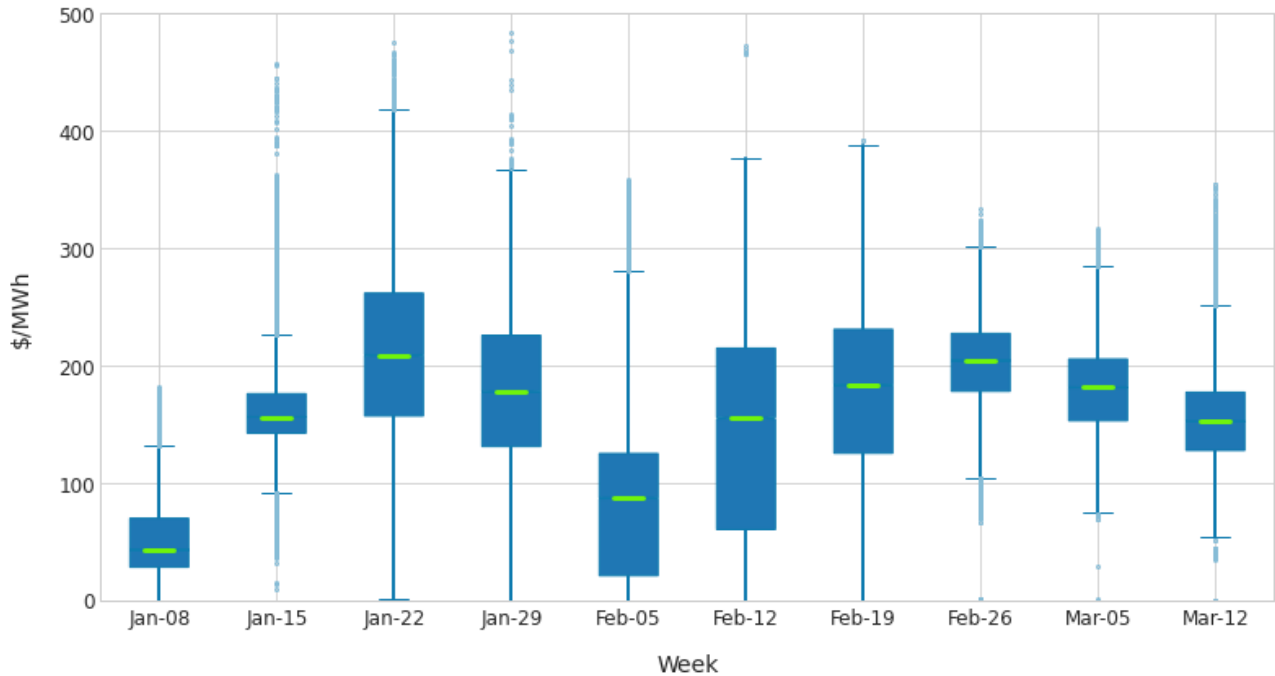
- 2.1. This report monitors underlying wholesale price drivers to assess whether there are trading periods that require further analysis for the purpose of identifying potential non-compliance with the trading conduct rule. In addition to general monitoring, we also single out unusually high-priced individual trading periods for further analysis by identifying when wholesale electricity spot prices at any node exceeds its historical 90<sup>th</sup> percentiles.
- 2.2. Between 12-18 March 2023:
- (a) The average wholesale spot price across all nodes was \$158/MWh.
  - (b) 95 percent of prices fell between \$90/MWh and \$233/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 \$150/MWh. The relatively high prices, especially overnight, were likely due to high thermal generation and low wind generation.
- 2.5. No prices above the 90<sup>th</sup> percentile occurred and there was only one occasion where the price at Otahuhu went above \$300/MWh at 7:30 pm on Thursday 16 March. The price at Otahuhu was \$320/MWh and at the same time, the Benmore price was \$291/MWh.

Figure 1: Wholesale Spot Prices between 12 March (Sunday) – 18 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 lower compared to the week before. Most of the spot prices were above \$90/MWh as hydro generation relatively continues to be lower, especially at stations with declining reservoirs, and thermal generation relatively increased. Hydro generation contributed 59 percent of total energy this week similar to last week.

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

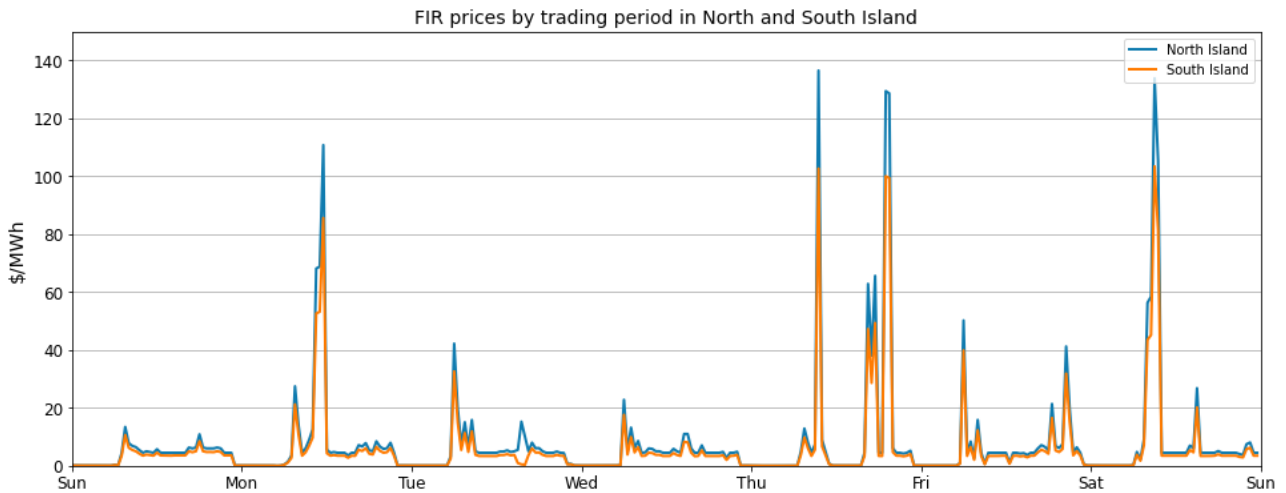


<sup>1</sup> Quartile - Wikipedia

### 3. Reserve Prices

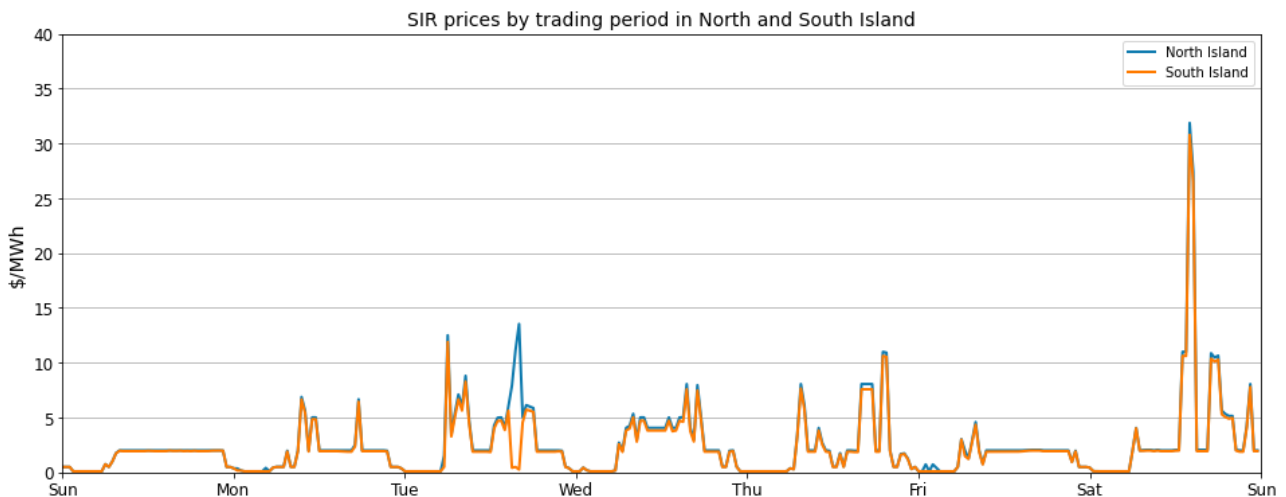
3.1. Fast instantaneous reserve (FIR) prices for the North and South Island are shown below in Figure 3. This week there were instances where both North and South Island FIR prices were above \$20/MWh. The highest FIR price of \$136/MWh occurred on Thursday at 9:30 am in the North Island, and \$103/MWh in the South Island. The high FIR prices appear to be caused by tight supply of FIR, which was at least partly due to lower wind generation than expected, requiring capacity to be dispatched as energy instead of held in reserve.

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. The SIR prices in the North and South Islands were mostly below \$5/MWh. Relatively high SIR prices in the North Island observed on Saturday at 2:00 pm might be due to the tight supply of FIR.

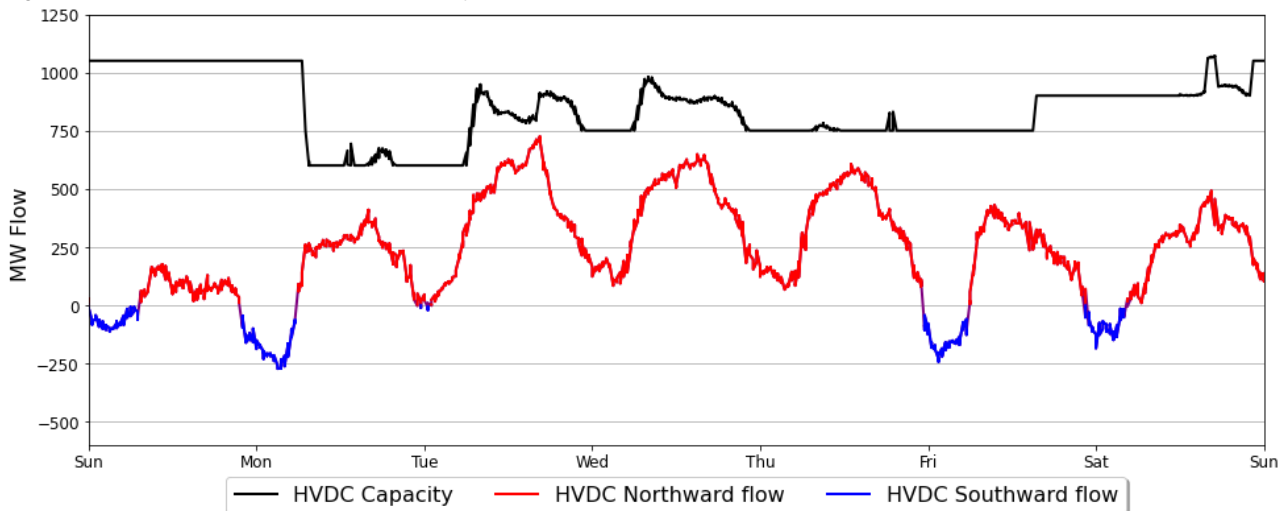
Figure 4: SIR prices by trading period and Island



## 4. HVDC

- 4.1. Figure 5 shows HVDC flow between 12-18 March. HVDC flows were mostly northward during the day from Monday onwards, highest on Tuesday at around 750 MW. Due to very low wind generation between Tuesday and Thursday, no overnight southward HVDC flow took place.

Figure 5: HVDC northward flow and capacity

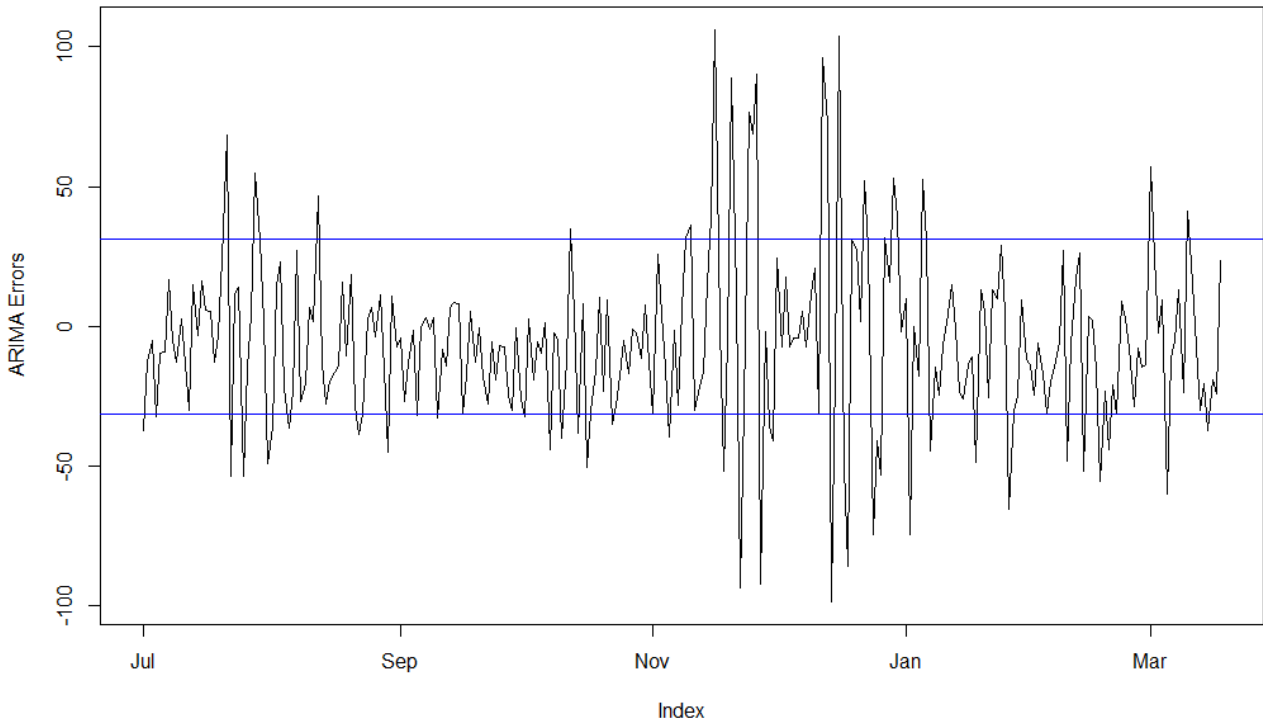


## 5. Regression Residuals

- 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 smaller than one standard deviation of the data, which occurred on Sunday. Here the residual was negative, indicating that the modelled price was slightly high. This discrepancy may be due to relatively high wind conditions on that day.

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

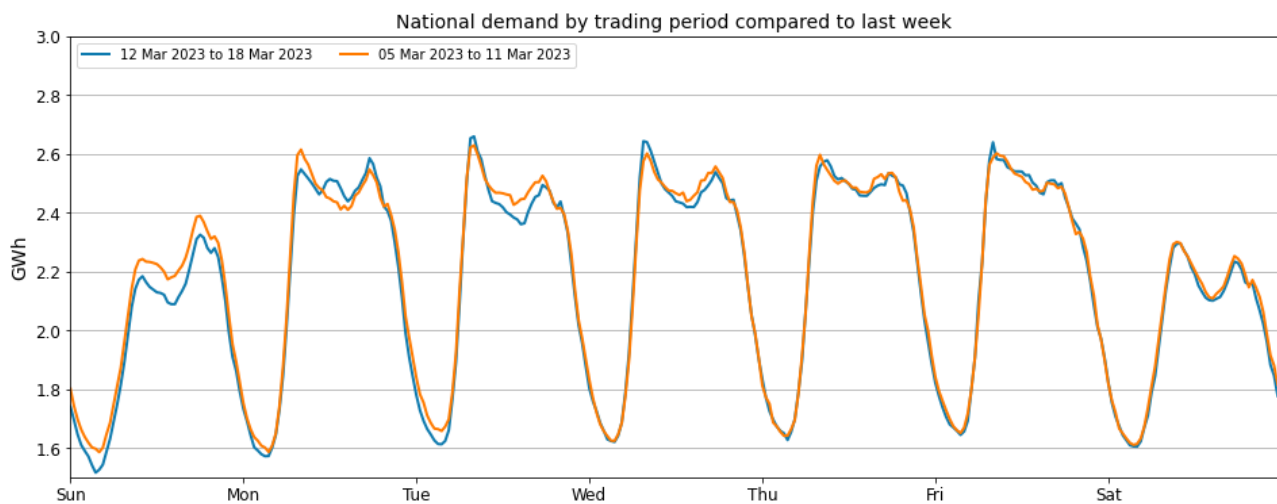
Figure 6: Residual plot of estimated daily average spot prices from 1 July 2022 – 18 March 2023. The blue lines show two standard deviations of the ARMA errors.



## 6. Demand

6.1. Figure 7 shows national grid demand between 12-18 March, compared to the previous week. Daily demand was a bit lower on Sunday but overall similar to the last week for the remainder of the week, with higher morning peaks than afternoon peaks.

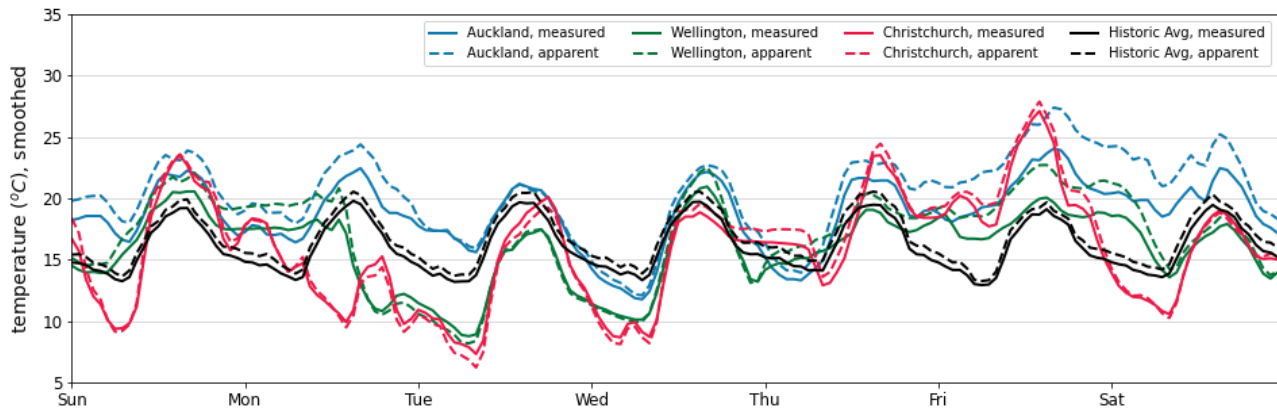
Figure 7: National demand by trading period compared to the previous week



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 Monday and Wednesday, temperatures across Wellington and Christchurch were mostly below the historic average, with Christchurch dipping to around 5 degrees on Tuesday morning. Temperatures were above or around average from Thursday. Apparent temperatures in Auckland were generally between 15 and 25 degrees, which is mostly around the historic average for the whole week.

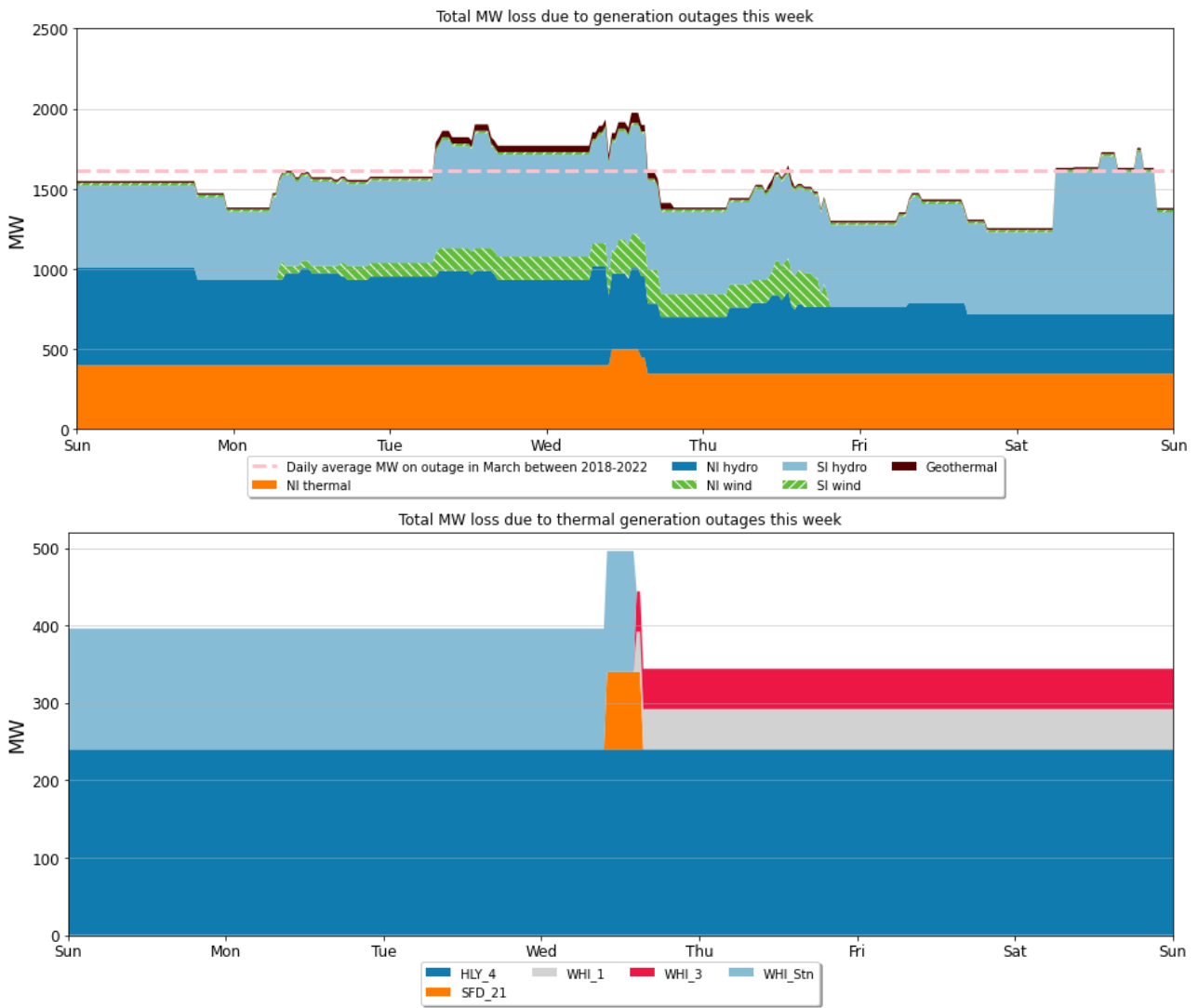
Figure 8: Temperatures across main centres



## 7. Outages

- 7.1. Figure 9 shows generation capacity on outage. Total capacity on outage between 12-18 March ranged between ~1,400 – 2,000 MW. Outages were high on Tuesday and Wednesday.
- 7.2. Notable outages include:
- Huntly 4 remains on outage.
  - Whirinaki Station came back from outage on Wednesday but still two units are on outage.
  - West wind farm was on outage between Monday and Thursday.
  - A few North and South Island hydro units are continuing outage this week.

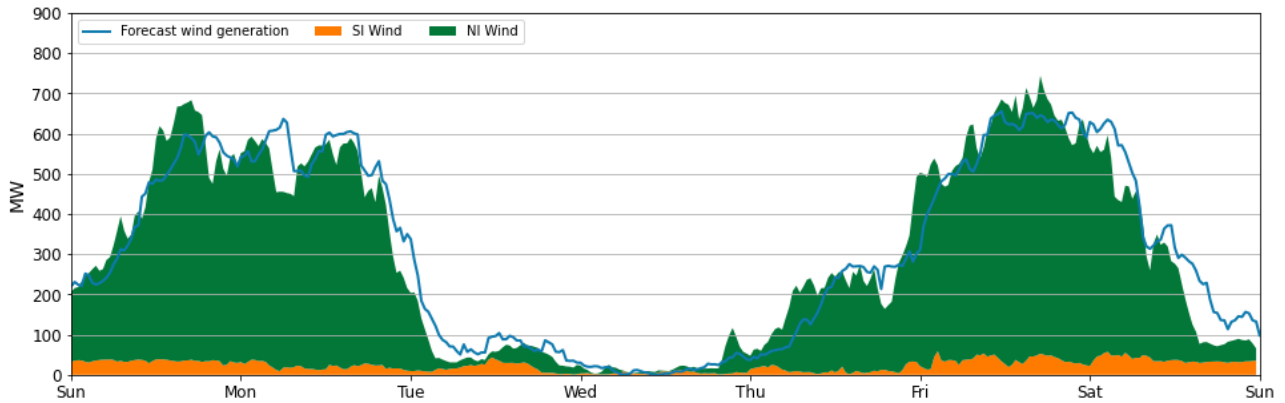
Figure 9: Total MW loss due to generation outages



## 8. Generation

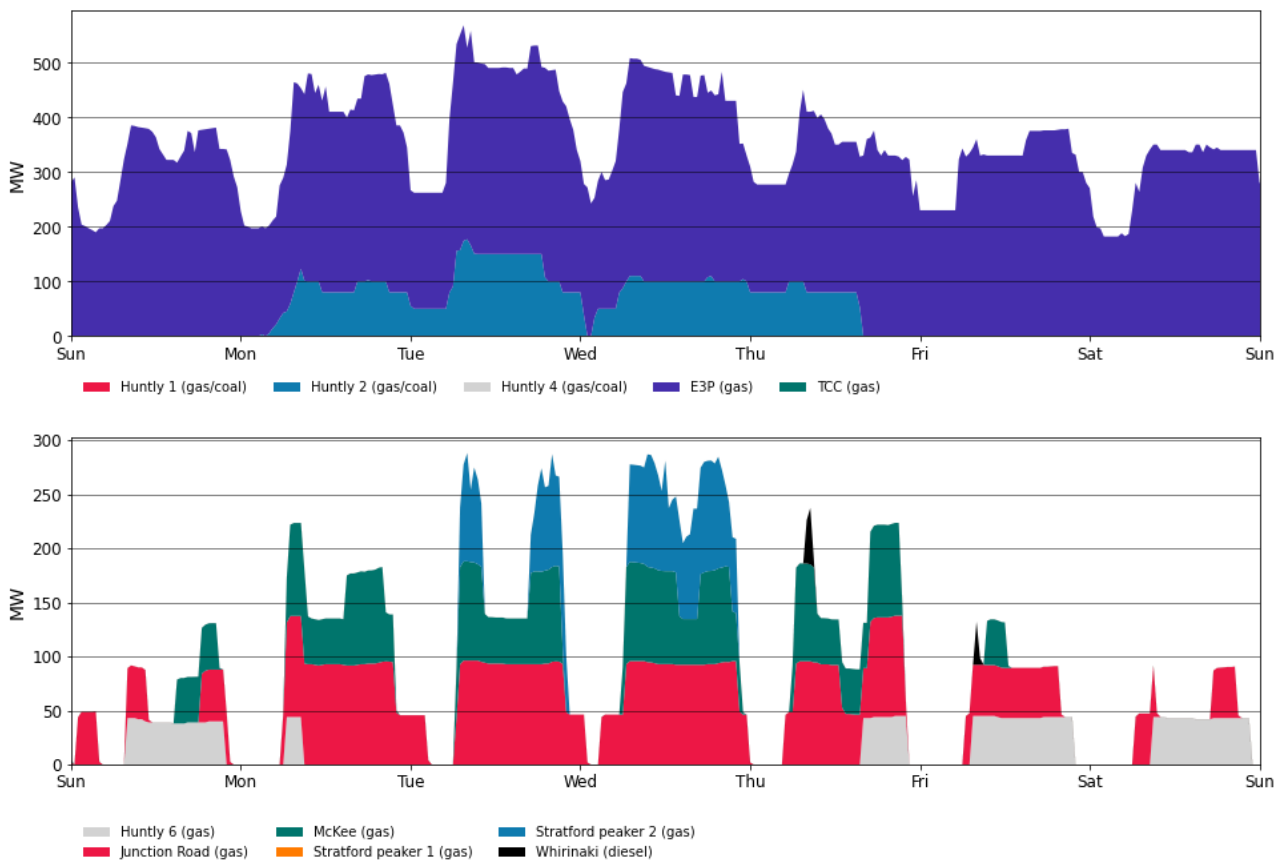
- 8.1. Wind generation, between 12-18 March, varied between 3-700 MW. Wind generation was around 600 MW at the start of the week and decreased to 10 MW on Tuesday. The wind was mostly below 10 MW on Tuesday and Wednesday. From Thursday wind generation increased gradually and reached up to 700 MW on Friday. After reaching a peak of 700 MW on Friday wind again dropped to 20 MW on Sunday. A difference between the forecasted wind generation has also been observed.

Figure 10: Wind Generation and forecast



- 8.2. Figure 11 shows generation of thermal baseload and thermal peaker plants between 12-18 March. E3P (Huntly 5) ran all week as baseload. Huntly 2 also ran from Monday to Thursday.
- 8.3. Generation from peakers this week was highest on the days with very low wind generation. Junction road and McKee ran most days this week. Huntly 6 ran on the days Huntly 2 was not running as well as Monday morning when Huntly 2 was ramping up. Stratford peaker 2 ran on Tuesday and Wednesday when wind generation was lowest. Whirinaki ran briefly on Thursday and Friday after one of the units returned from outage.

Figure 11: Thermal Generation

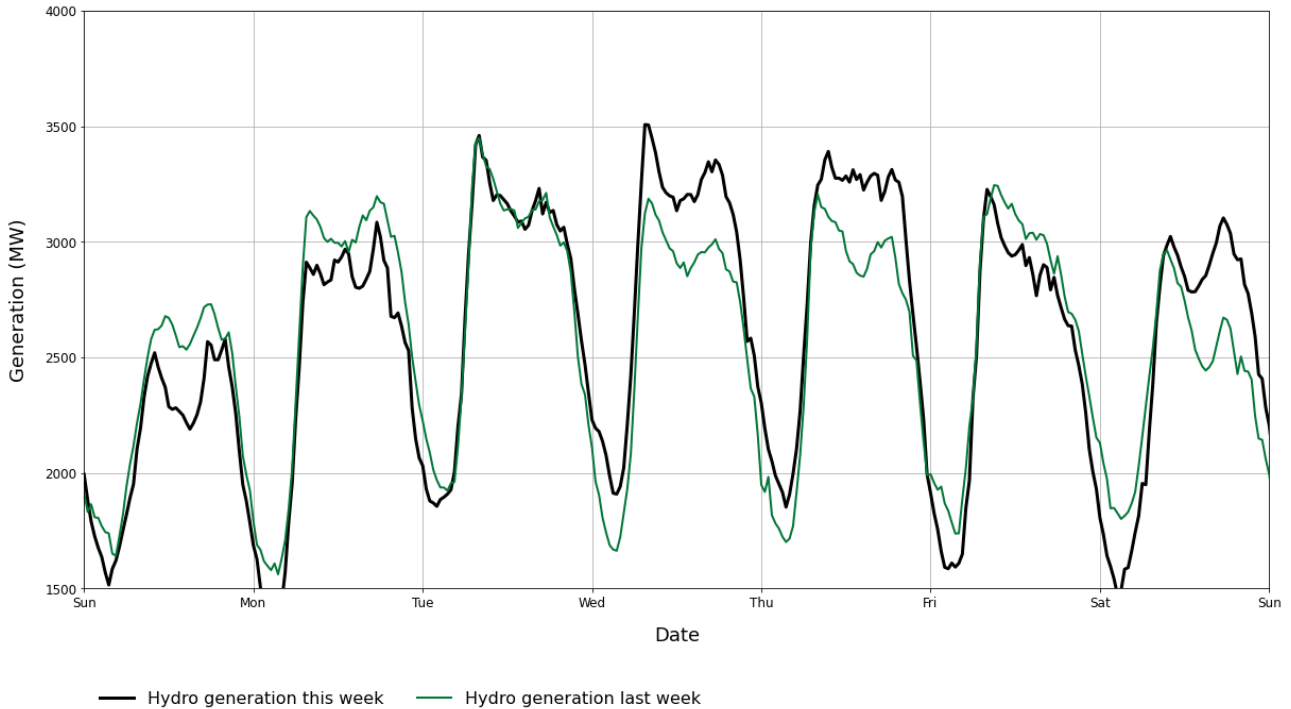


- 8.4. Figure 12 shows total hydro generation in MW produced each trading period, compared to the same time in the previous week. Overall hydro generation was similar compared to the previous week. There was lower hydro generation compared to last week on Sunday and



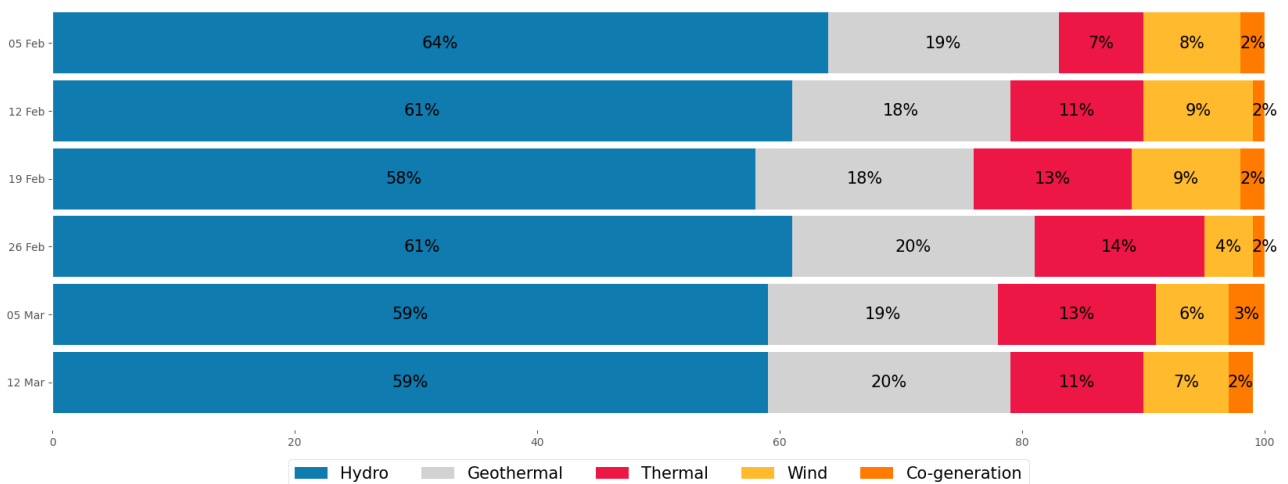
Monday, equal on Tuesday, and higher on Wednesday and Thursday. On Sunday hydro generation was significantly higher compared to the previous week for the evening week. The increase in hydro generation over the week coincided with increased hydro storage.

Figure 12: Hydro generation between 12 – 18 March compared to the previous week



8.5. As a percentage of total generation, between 12-18 March, total weekly hydro generation totalled 59 percent, geothermal 20 percent, thermal 11 percent, wind 7 percent, and co-generation 2 percent.

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



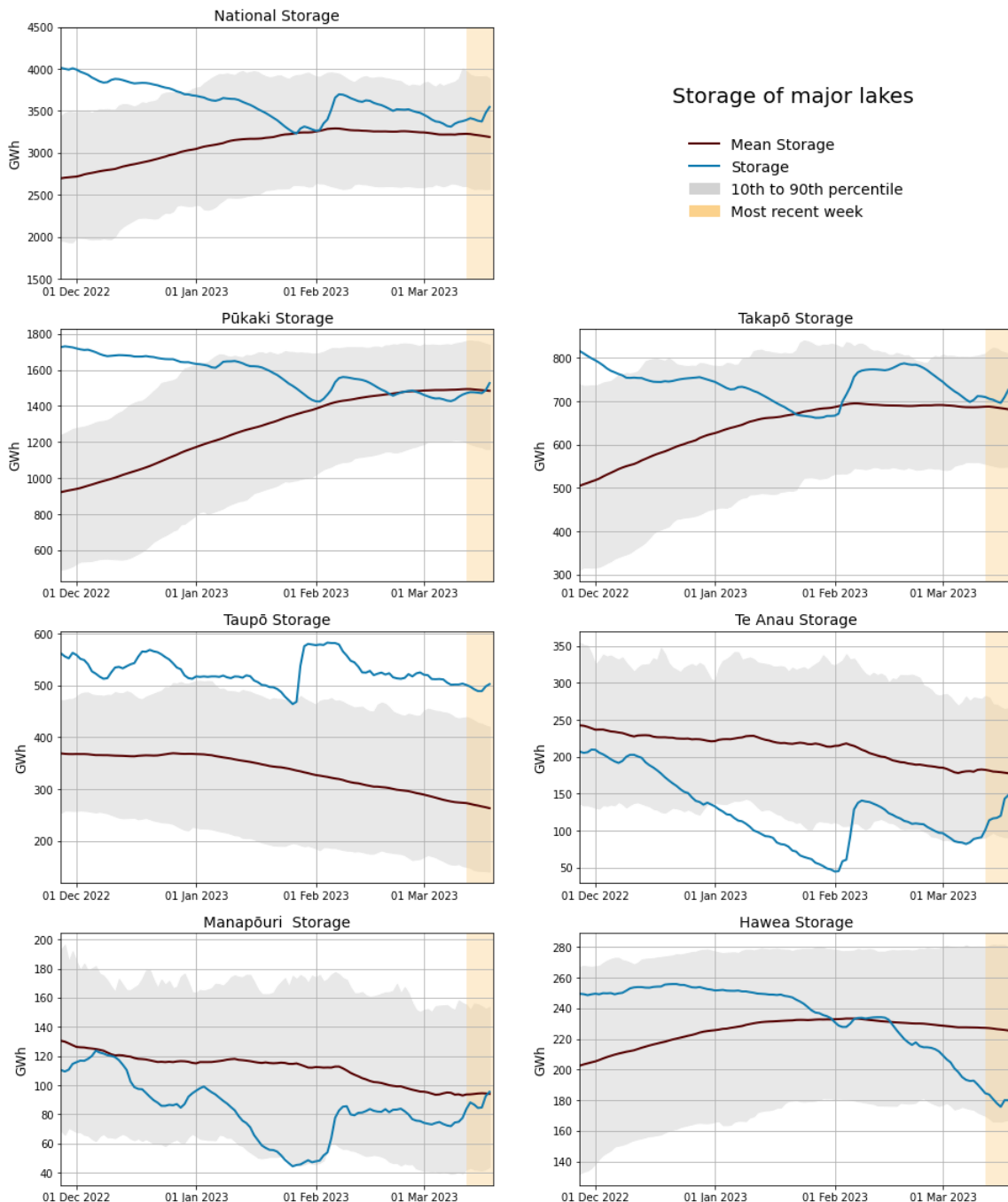
## 9. Storage/Fuel Supply

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

9.1. Overall, national hydro storage levels slightly increased. Total national storage is around 85 percent of nominal full as of 18 March.

9.2. Storage at most South Island lakes are increasing with lakes Pūkaki, Takapō, and Manapōuri slightly above their historic average again. Storage at lake Te Anau increased but still remains below its historic average. Lake Hāwea levels continue to drop despite a small uptick at the end of the week and are now approaching its historic 10<sup>th</sup> percentile. In the North Island Taupō remains above its historic 90<sup>th</sup> percentile.

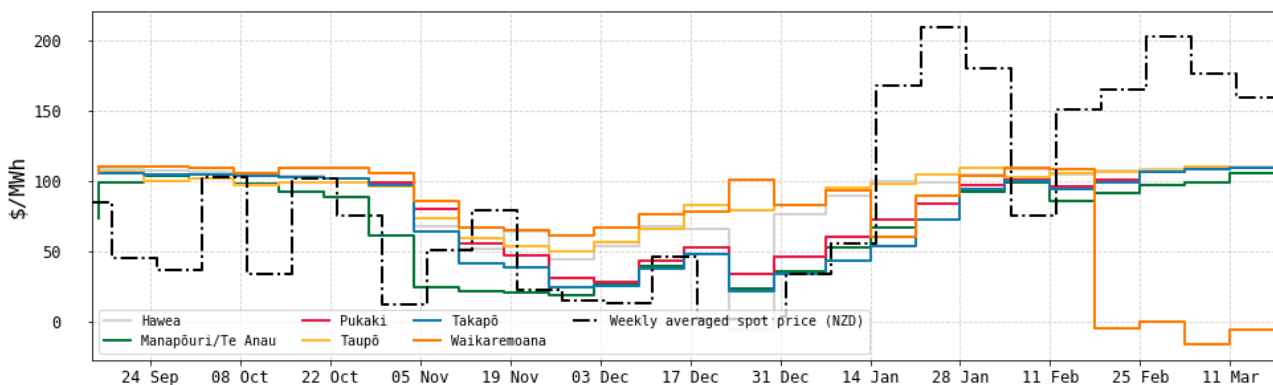
Figure 14: Hydro Storage



## 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 18 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 18 March 2023



## 11. Price versus estimated costs

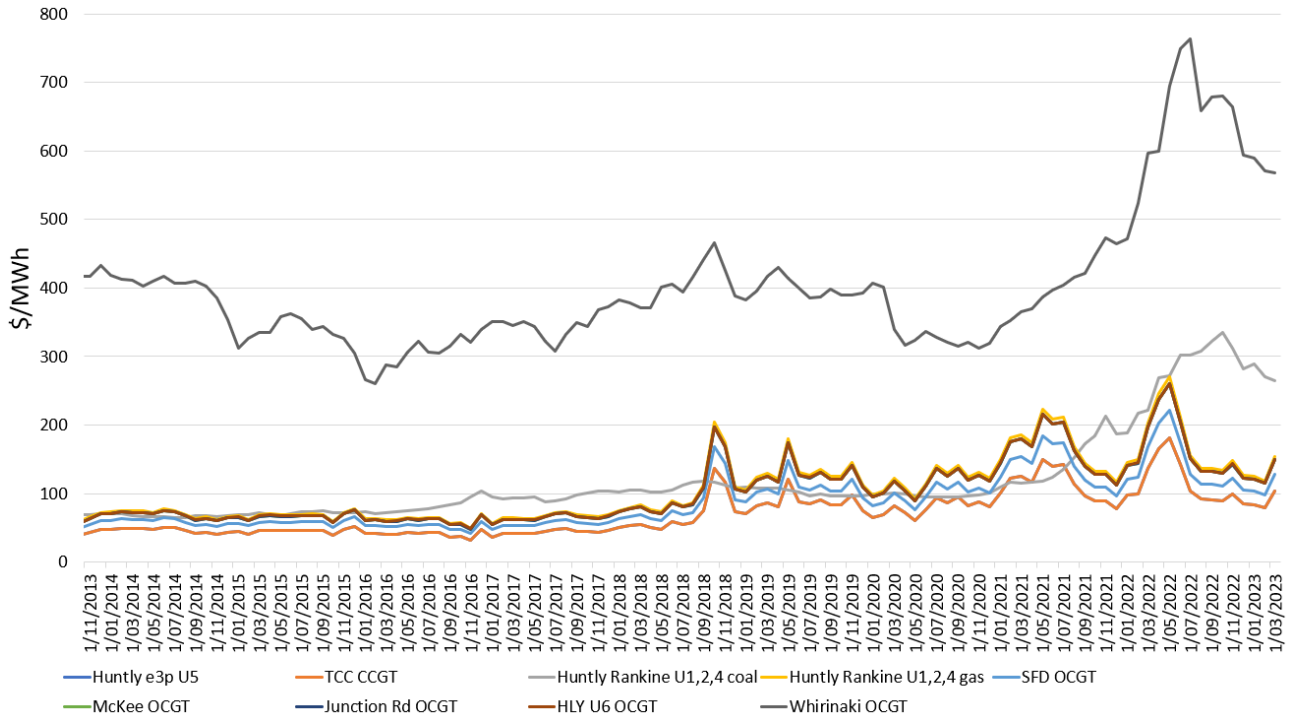
- 11.1. In a competitive market, prices should be close to (but not necessarily at) the short run marginal cost (SRMC) of the marginal generator (where SRMC includes opportunity cost).
- 11.2. The SRMC (excluding opportunity cost of storage) for thermal fuels is estimated using gas and coal prices, and 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.
- 12.2. Generation offers at the start of the week were similar to the previous week. Towards the end of the week there was an increase in the amount of generation offered between \$200 and 300/MWh. This appears to be due to a decrease in offer prices as hydro storage increases, with the top tranche at Manapōuri dropping by up to \$200/MWh on 15 March.

<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-wits)

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	Completed	The Authority reviewed and was satisfied with Genesis' reasons for the way in which Tekapo B generation was offered. These reasons included operational requirements following a unit returning to service, water management and resource consent issues.
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.