

Trading Conduct Report

Market Monitoring Weekly Report

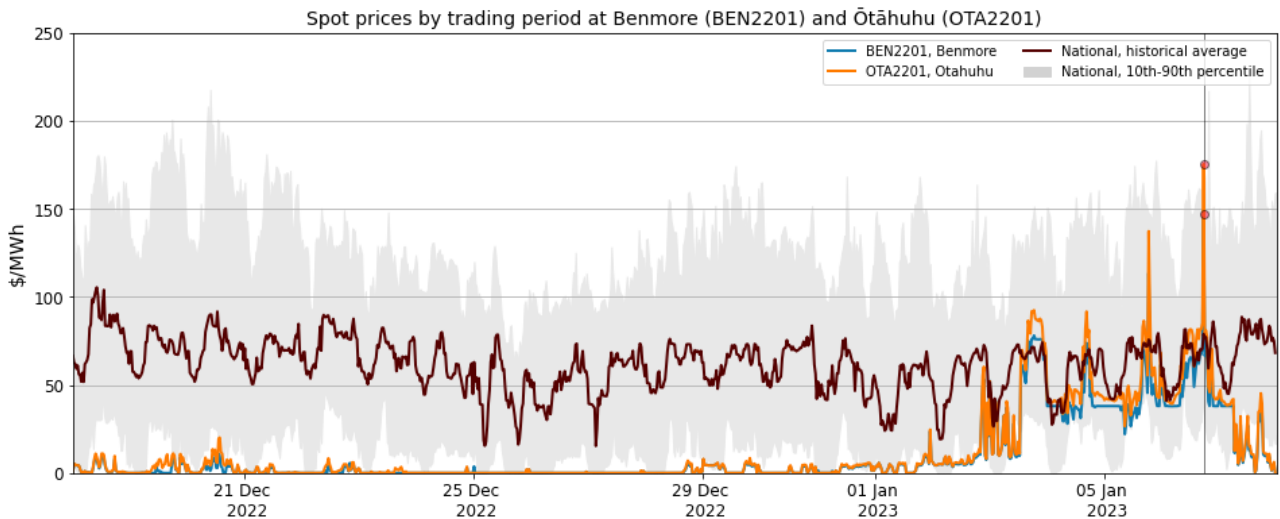
1. Overview for the week of 18 December 2022 – 7 January 2023

- 1.1. Wholesale spot prices between 18 December 2022 and 7 January 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.
- 2.2. Between 18 December 2022 and 7 January 2023:
- (a) The average wholesale spot price across all nodes was \$11.70/MWh.
 - (b) 95 per cent of prices fell between \$0.01/MWh and \$73.40/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. Spot prices were low during the final two weeks of December. Prices have increased in January, with higher average weekday prices and more price volatility. This is likely due to increased demand as people returned from vacation.
- 2.5. There was one price spike above the 90th percentile which occurred on Friday 6 January at 5:30pm. Here, the spot price at Ōtāhuhu was \$175/MWh and at Benmore it was \$146/MWh. This occurred when temperatures across Wellington, Auckland and Christchurch were high - with the extra air-conditioning likely increasing demand. Wind generation was also low, and higher tranches of hydro were dispatched.

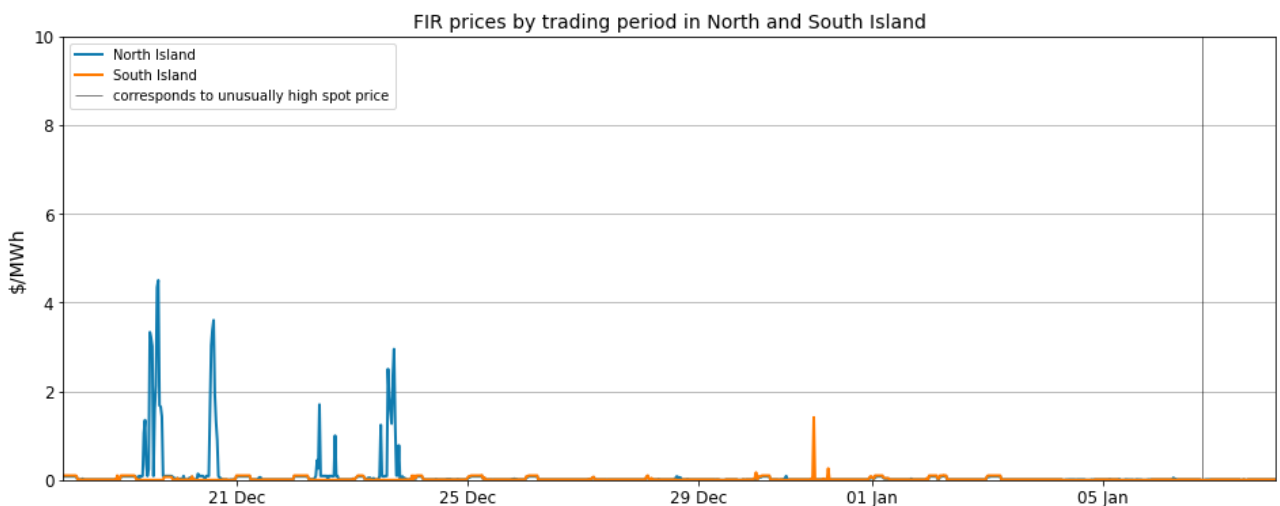
Figure 1: Wholesale Spot Prices between 18 December 2022 and 7 January 2023



3. Reserve Prices

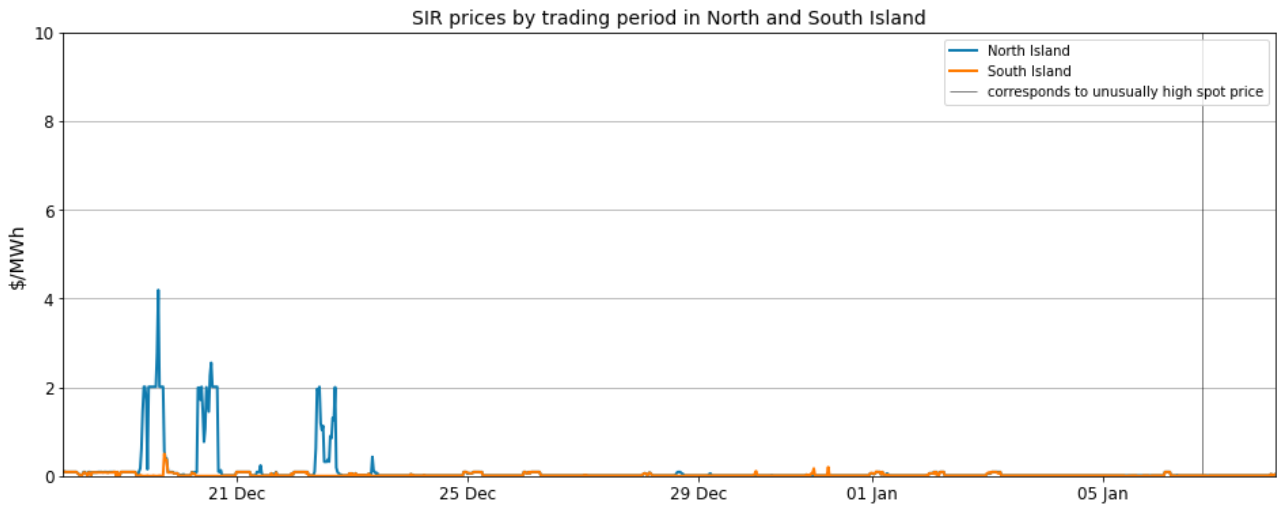
3.1. Fast instantaneous reserve (FIR) prices for the North and South Island are shown below in Figure 2. All trading periods between 18 December 2022 and 7 January 2023 had FIR prices below \$5/MWh.

Figure 2: FIR prices by trading period and Island



3.2. Sustained instantaneous reserve (SIR) prices for the North and South Island are shown below in Figure 3. All SIR prices between 18 December 2022 and 7 January 2023 were below \$5/MWh.

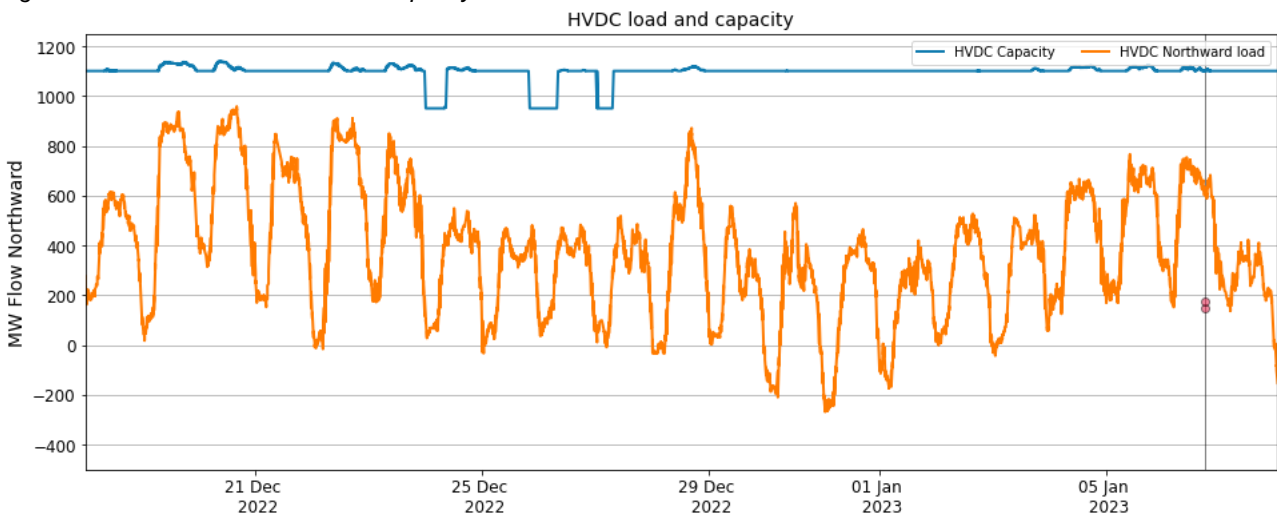
Figure 3: SIR prices by trading period and Island



4. HVDC

4.1. Figure 4 shows northward HVDC flow between 18 December 2022 and 7 January 2023. Northward HVDC flow reduced over the Christmas period, with a spike on December 28. There were some Southward flows overnight, especially close to New Years. HVDC flows increased day on day between 1 – 6 January as load increased.

Figure 4: HVDC northward flow and capacity

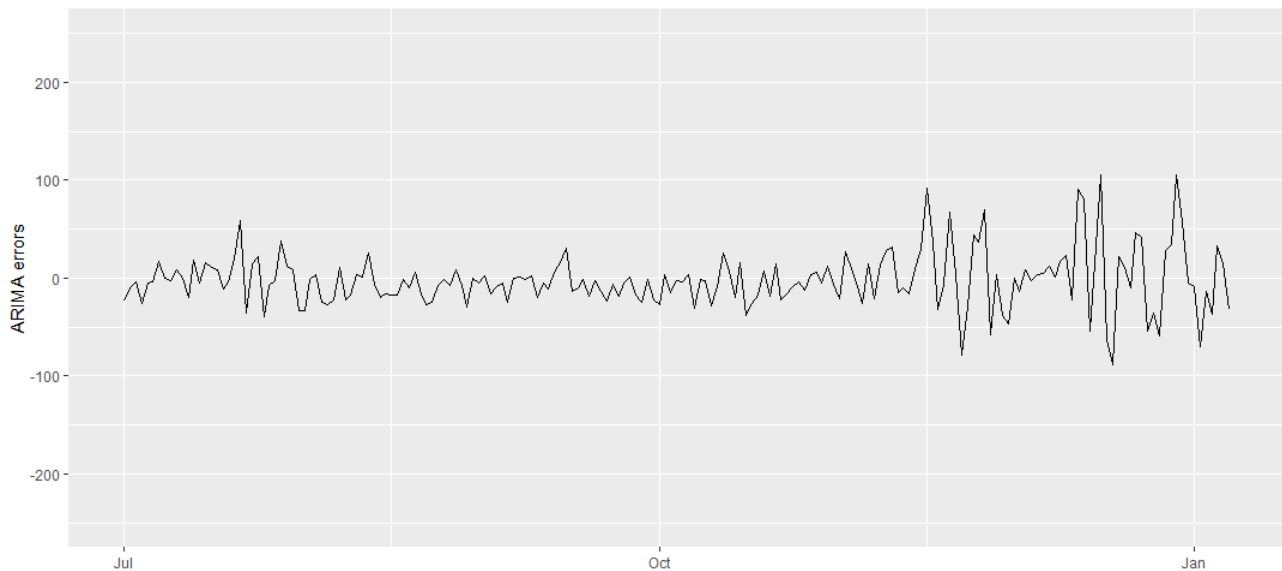


5. Regression Residuals

- 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 A¹ on the trading conduct webpage.
- 5.2. Figure 5 shows the residuals of autoregressive moving average (ARMA) errors from the daily model. Residuals for 18 December – 7 January were large on some days. However, the mean of all the errors over this period is close to zero. The magnitude of residuals has increased since November 2022, and the monitoring team is undertaking further analysis regarding this.

¹ <https://www.ea.govt.nz/assets/dms-assets/29/Appendix-A-Regression-Analysis.pdf>

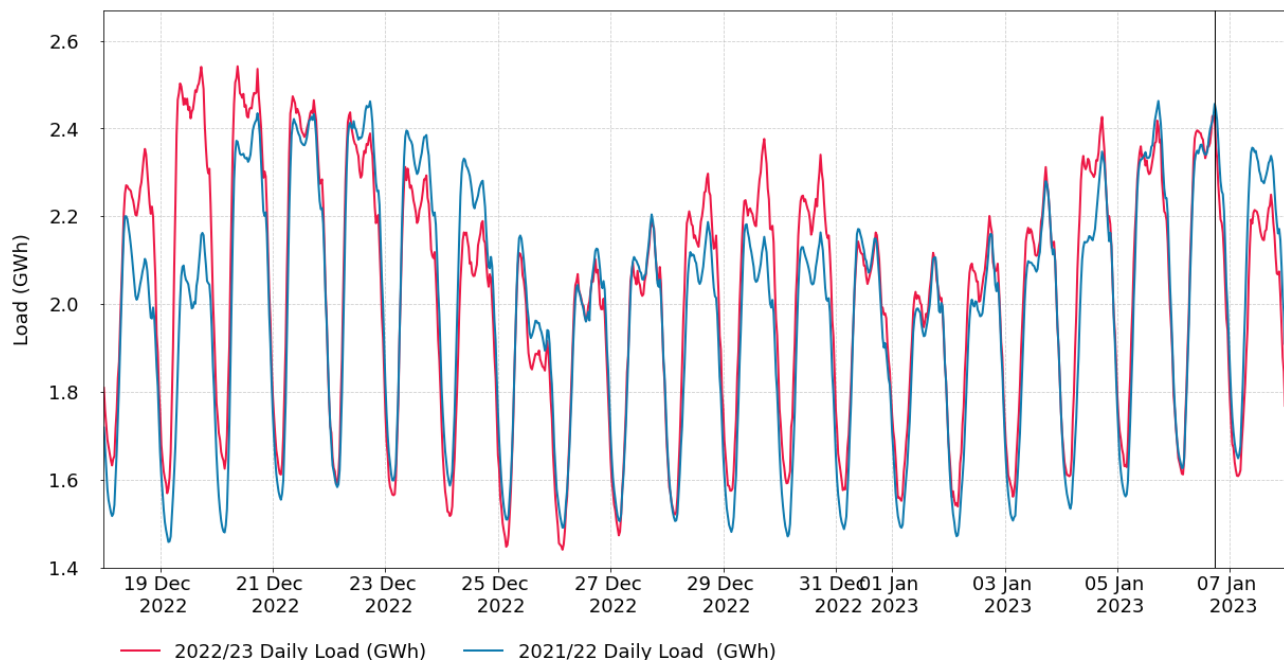
Figure 5: Residual plot of estimated daily average spot prices from 1 July 2022 – 7 January 2023



6. Demand

- 6.1. Figure 6 shows national grid demand between 18 December and 7 January for the 2022/23 period and the 2021/22 period for comparison. Daily demand decreased as Christmas approached, with low demand on Christmas day. Demand remained low over the following week but did increase during the first few days of January.
- 6.2. Daily demand was mostly lower in 2022 during the December Christmas period, when compared to the same dates in 2021. However, January demand in 2023 has been mostly higher when compared to the same period in 2022.

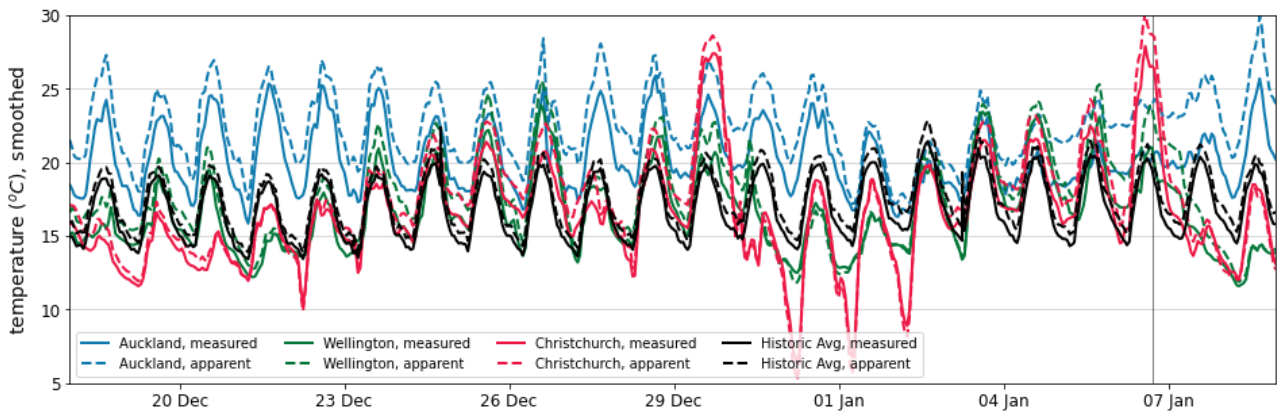
Figure 6: National demand by trading period compared to the previous week



- 6.3. Figure 7 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.

6.4. Between 18 December and 7 January, temperatures were between 15-25 degrees in Auckland. Temperatures in Wellington ranged between 13-25 degrees, and Christchurch swung between 5-27 degrees. High temperatures in all main centres between 3-6 January onwards likely drove up demand, which in turn pushed spot prices up.

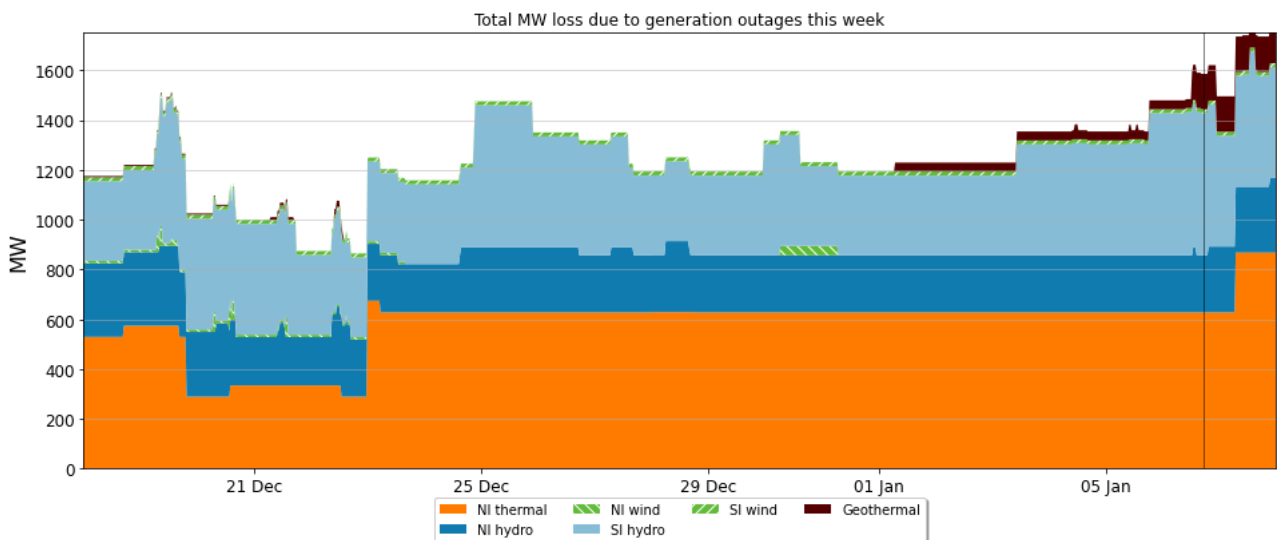
Figure 7: Temperatures across main centres



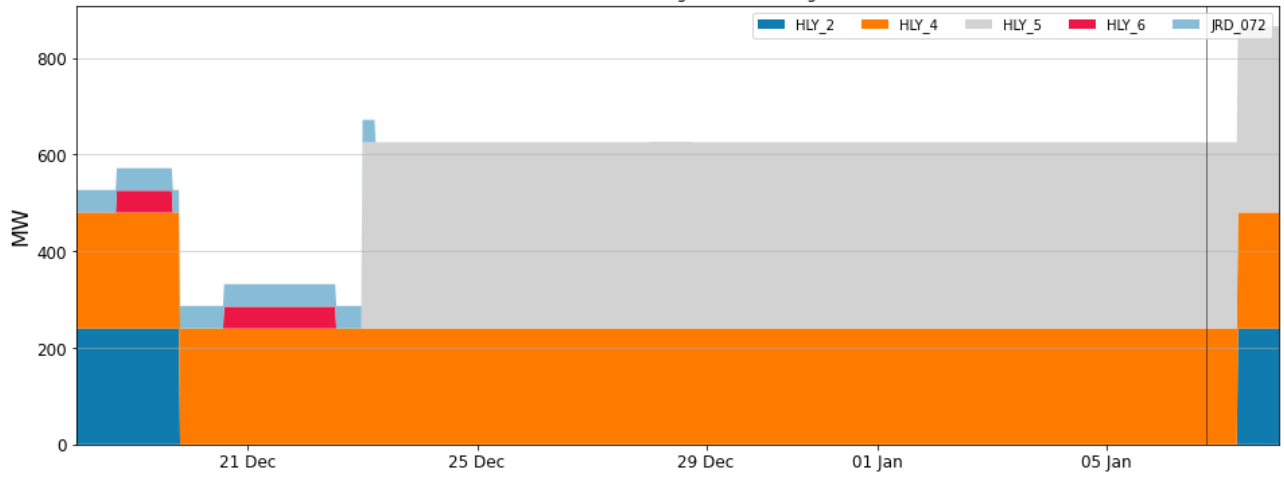
7. Outages

7.1. Figure 8 shows generation capacity on outage. Total capacity on outage between 18 December 2022 and 7 January 2023 ranged between ~800 – 1,700MW. Outages remained mostly below 1,400 MW between Christmas and New Year's. The start of 2023 saw increases in South Island hydro and some geothermal and thermal outages occur.

Figure 8: Total MW loss due to generation outages



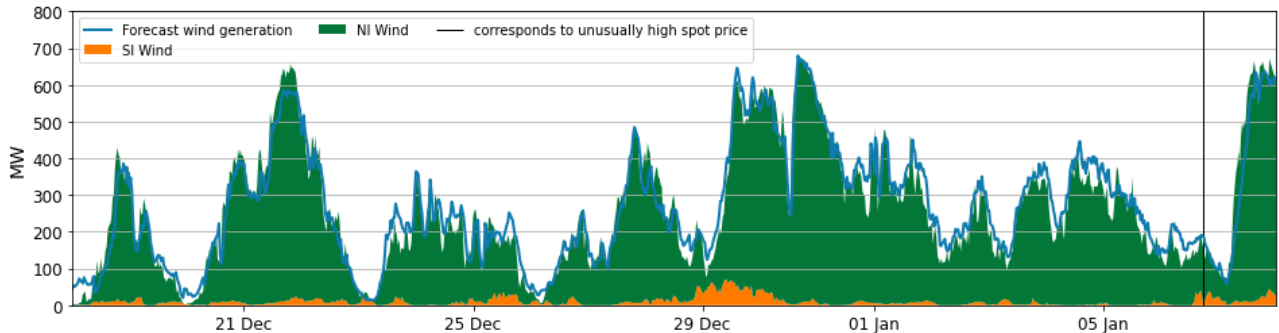
Total MW loss due to thermal generation outages this week



8. Generation

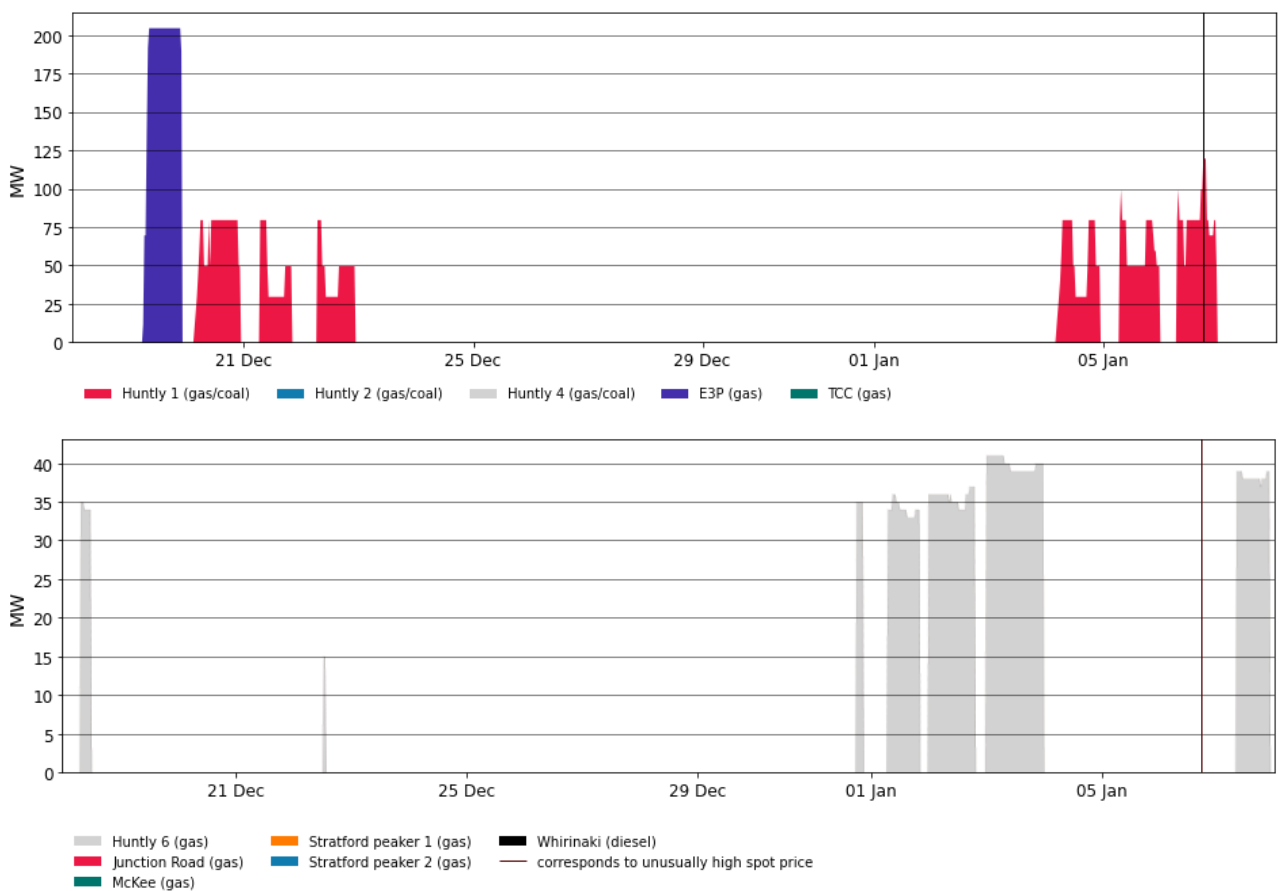
8.1. Wind generation, between 18 December 2022 and 7 January 2023, varied between ~20 and 700 MW. Wind generation was over 300 MW between December 20-22 and again between December 29 and January 1. Lower wind as 2023 began, with some non-trivial deviations between forecast and actual, likely contributed to higher spot prices.

Figure 9: Wind Generation and forecast



8.2. Figure 10 shows generation of thermal baseload and thermal peaker plants between 18 December 2022 and 7 January 2023. E3P ran on December 19, after which Huntly 1 ran during the day to cover baseload, with it ramping up during peak periods, before turning off on the 24th. Huntly 1 turn on again between 4-6 January. The January 6 price spike aligned with a ~50 MW increase in Huntly 1 output.

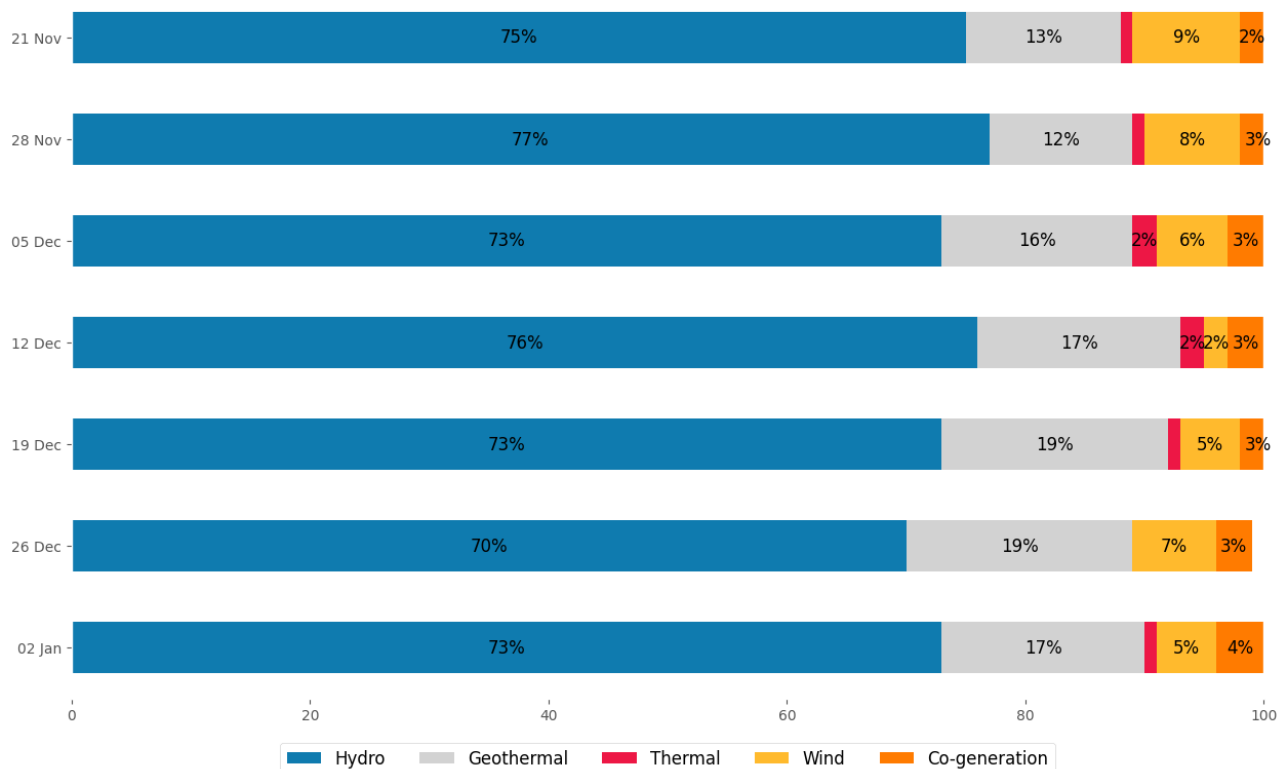
Figure 10: Thermal Generation



8.3. Huntly 6 ran briefly on December 18, 23 and 31. Huntly 6 ran during the day between January 1-3 and on January 7 to cover baseload when Huntly 1 was not running.

8.4. As a percentage of total generation, between 18 December and 8 January, weekly hydro varied between 70-73 percent, geothermal between 17-19 percent, thermal between 0-1 percent, wind 5-7 percent and co-generation 3-4 percent.

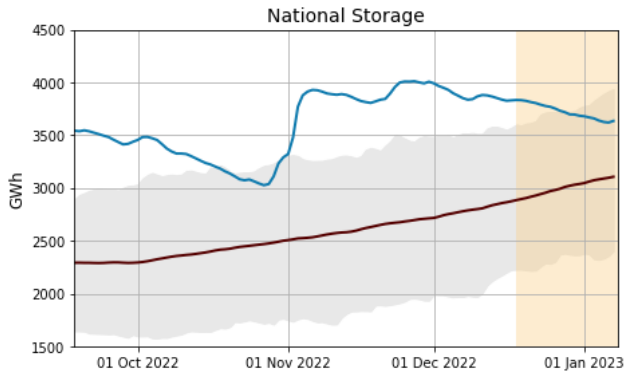
Figure 11: Total generation as a percentage each week between 21 November 2022 and 8 January 2023



9. Storage/Fuel Supply

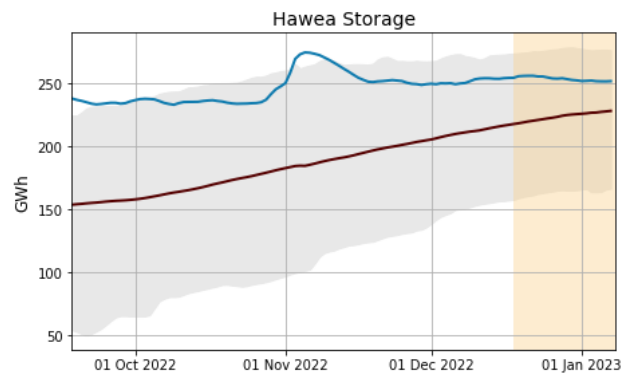
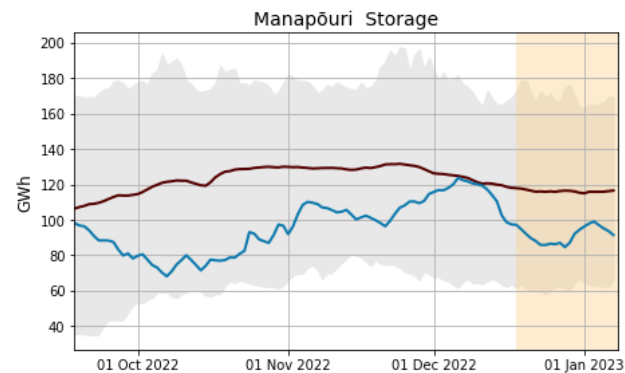
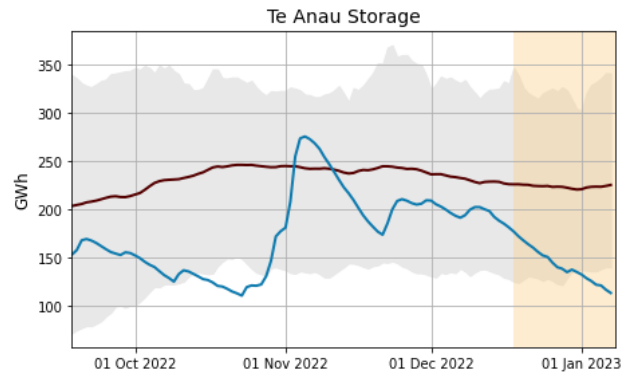
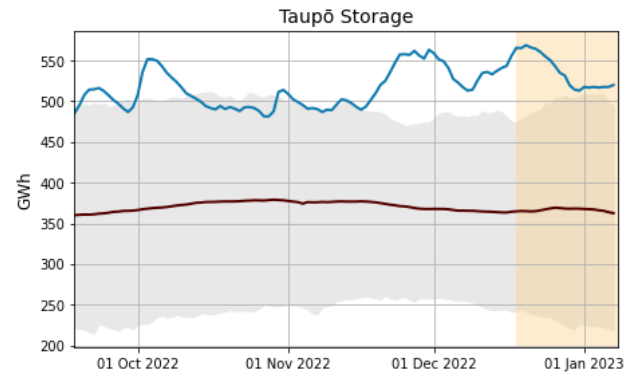
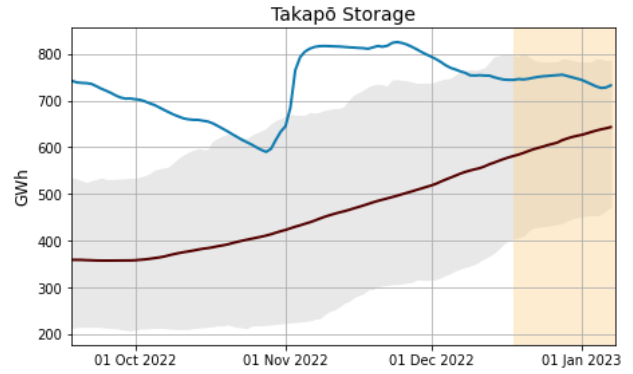
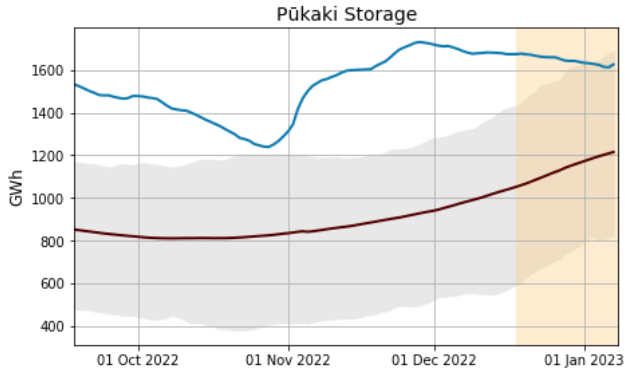
- 9.1. Figure 12 shows total controlled national hydro storage as well as the storage of major catchment lakes including their historical mean and 10th to 90th percentiles.
- 9.2. National hydro storage levels have decreased over the holiday period, but is still around 89.2 per cent of nominal full.
- 9.3. All lakes, bar Taupō, have dipped below their 90th percentile. Storage at Lake Te Anau has decreased below its 10th percentile, while Manapōuri remains above its 10th percentile but below its mean.

Figure 12: Hydro Storage



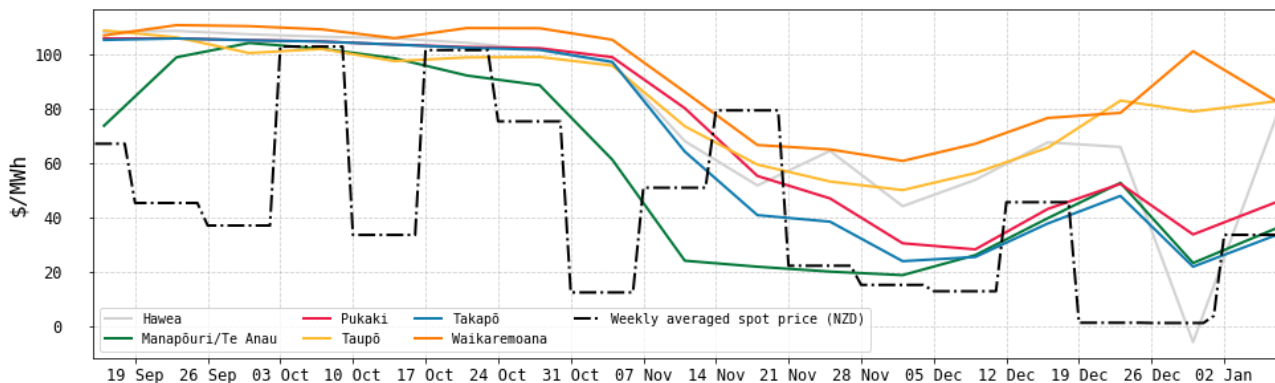
Storage of major lakes

- Mean Storage
- Storage
- 10th to 90th percentile
- Most recent week



10. JADE Water Values

Figure 13: JADE water values across various reservoirs between 15 September 2022 and 7 January 2023



- 10.1. The JADE² 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 13 shows the national water values between 15 September 2022 and 7 January 2023 using values obtained from JADE. These values are used to estimate marginal water value at the actual storage level. More details on how water values are calculated can be found in Appendix B³ 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. Over the last couple of weeks, the water values at most reservoirs have been mostly increasing, with a small dip for most lakes in late December.

11. Price versus estimated costs

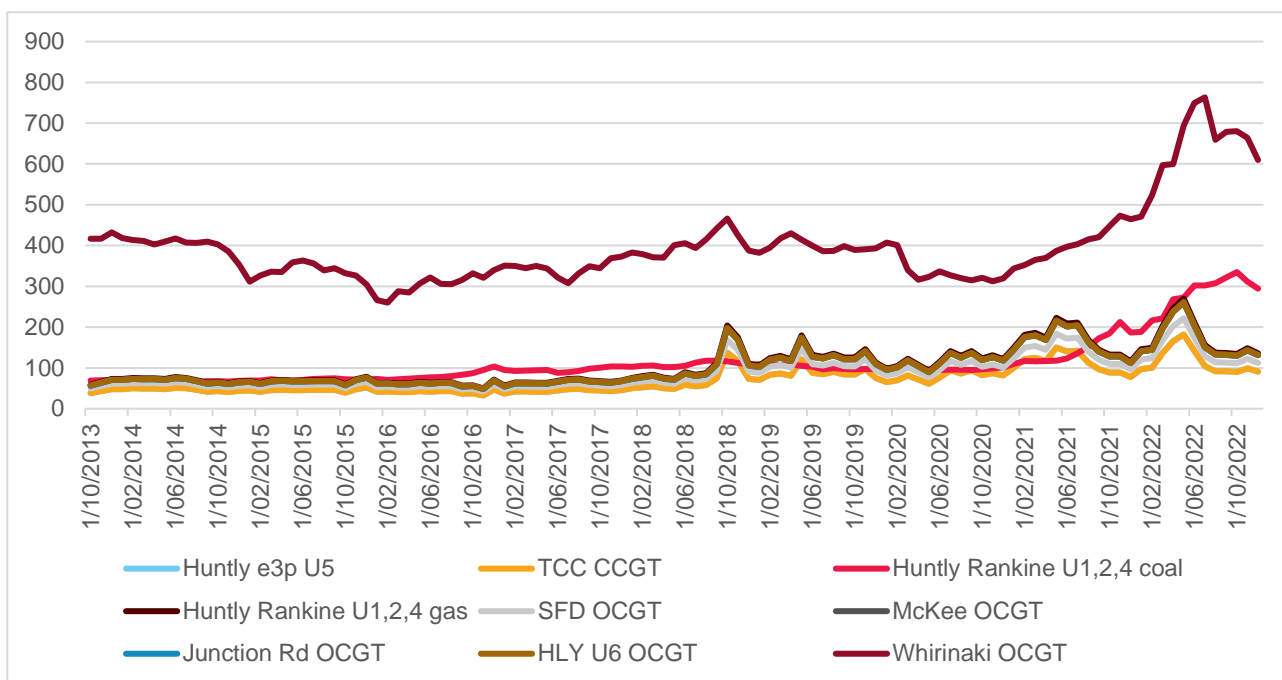
- 11.1. In a competitive market, prices should be close to (but not necessarily at) the short run marginal cost (SRMC) of the marginal generator (where SRMC includes opportunity cost).
- 11.2. The SRMC (excluding opportunity cost of storage) for thermal fuels is estimated using gas and coal prices, and 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 14 shows an estimate of thermal SRMCs as a monthly average up to 1 December 2022. The SRMC of gas fuelled plants has remained relatively flat, the SRMC of diesel has continued to fall from its June peak, and the SRMC of coal has also fallen.
- 11.4. In early December Indonesian coal was around ~\$480/tonne putting the latest SRMC of coal fuelled Huntly generation at ~\$300/MWh. The SRMC of Whirinaki has fallen to ~\$600/MWh. Both are likely reactions to a slight easing of international demand and prices.
- 11.5. The SRMC of gas run thermal plants decreased to between \$90/MWh and \$135/MWh, likely due to the increase in gas fuel availability in December, as Kupe returned from outage in late November.
- 11.6. More information on how the SRMC of thermal plants is calculated can be found in Appendix C⁴ on the trading conduct webpage.

² 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.

³ <https://www.ea.govt.nz/assets/dms-assets/29/Appendix-B-JADE-water-value-model.pdf>

⁴ <https://www.ea.govt.nz/assets/dms-assets/30/Appendix-C-Calculating-thermal-SRMCs.pdf>

Figure 14: Estimated monthly SRMC for thermal fuels



12. Ongoing Work in Trading Conduct

- 12.1. This week, all prices appeared to be consistent with supply and demand conditions, however a few trading periods from 2022 are undergoing further analysis.
- 12.2. 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.
15/11/2022 – 24/11/2022	Several	Further analysis	The Authority will continue analysis into the high energy prices.
13/12/2022-16/12/2022	Several	Further analysis	The Authority will continue analysis into the high energy prices.