

23 January 2024



Trading conduct report

Market monitoring weekly report

Trading conduct report

1. Overview for weeks of 17 December – 30 December

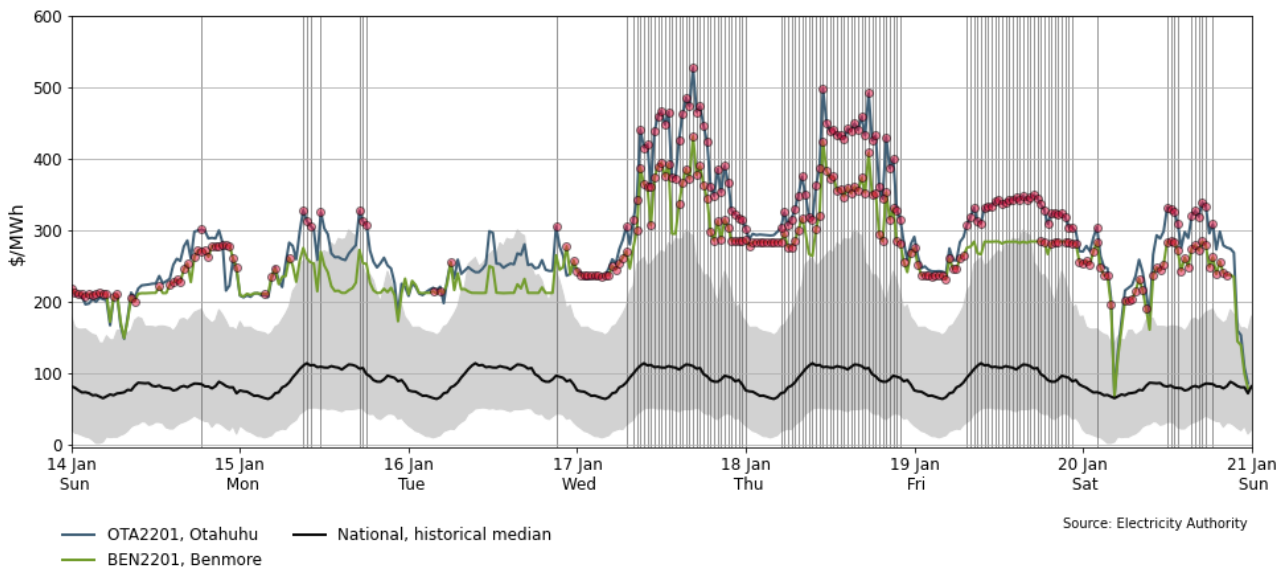
- 1.1. This week saw some high prices. The week started with prices in the region of \$200-\$300/MWh. Spot prices also rose to over \$300/MWh for a large part of the day on Wednesday and Thursday. TCC has continued to run as baseload with at least one Rankine in support. Huntly 5 returned from outage on Saturday and began generating as Huntly 4 ramped down. Hydro storage saw an increase at the end of the week as heavy rain hit the West Coast of the South Island, with controlled storage ~92% of mean as of 20 January.

2. Spot prices

- 2.1. This report monitors underlying wholesale price drivers to assess whether trading periods require further analysis to identify 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 are outliers compared to historic prices for the same time of year.
- 2.2. Figure 1 shows the wholesale spot prices at Benmore and Ōtāhuhu alongside the national historic median and historic 10th-90th percentiles adjusted for inflation. Prices greater than quartile 3 (75th percentile) plus 1.5 times the inter-quartile range¹ of historic prices, are highlighted with a red maker with those prices greater than \$300/MWh highlighted with a black vertical line.
- 2.3. Between 14-20 January:
 - (a) The average wholesale spot price across all nodes was \$272/MWh.
 - (b) 95 percent of prices fell between \$164/MWh and \$434/MWh.
- 2.4. Overall, the majority of spot prices were above \$200/MWh this week with the red makers highlighting how many prices were outliers compared to historical prices. Wednesday and Thursday saw multiple trading periods with prices above \$300/MWh. Wind generation was low both of these days. Two Rankines were running alongside TCC as baseload and hydro was also ramped up to meet demand. We will be doing further analysis of these high prices.

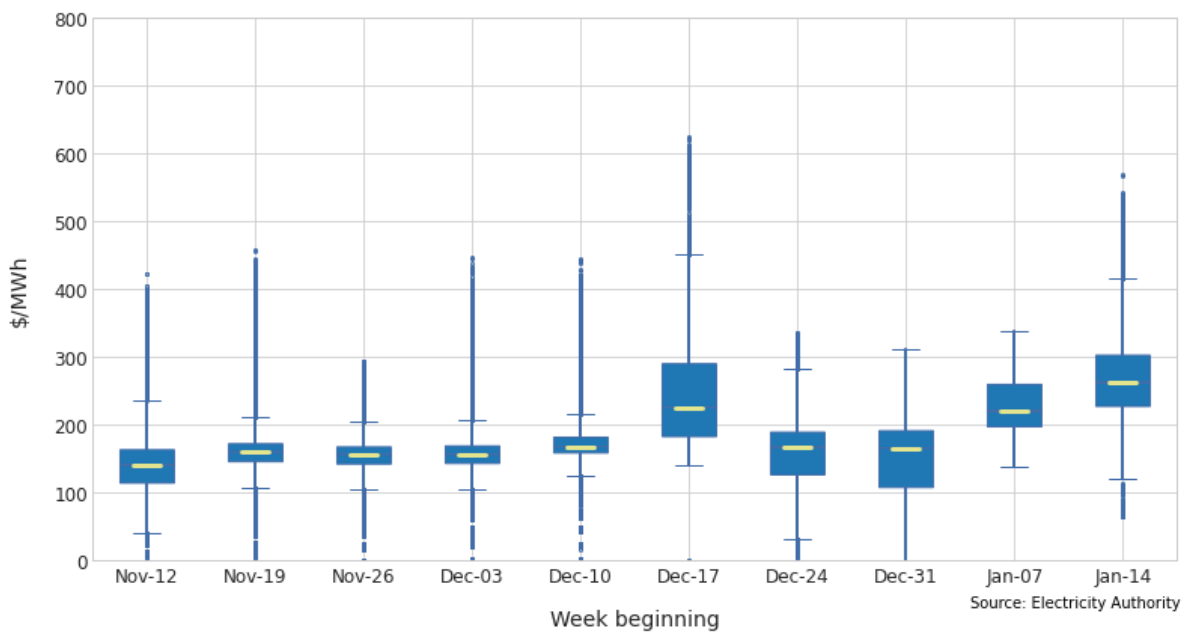
¹ We are identifying any significantly high prices by using the historic distribution of prices depending on whether it is a weekday or weekend day, and looking for prices that lie 1.5 times the interquartile range above the 75th percentile of the distribution. This is using the outlier calculation $Q_3 + 1.5 \times IQR$, where Q_3 is the 75th percentile (or third quartile value) and IQR is your inter-quartile range.

Figure 1: Wholesale spot price at Benmore and Ōtāhuhu between 14-20 January



- 2.5. 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) of the lower and upper quartile, and then observations that fall outside this range are displayed independently.
- 2.6. There was a larger spread of prices compared to the previous week with over 75% of prices also sitting above the median price from the week before. The middle 50% of prices were within \$227/MWh and \$302/MWh, with a median this week of 262/MWh. There were also a number of prices sitting above \$400/MWh.

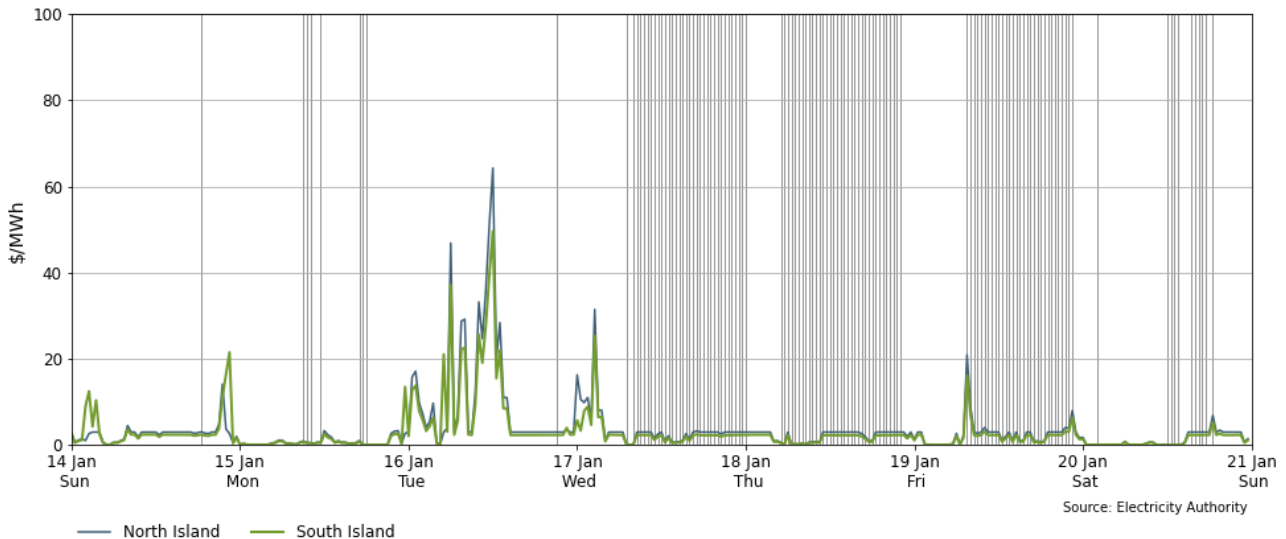
Figure 2: Boxplots showing the distribution of spot prices this week and the previous nine weeks



3. Reserve prices

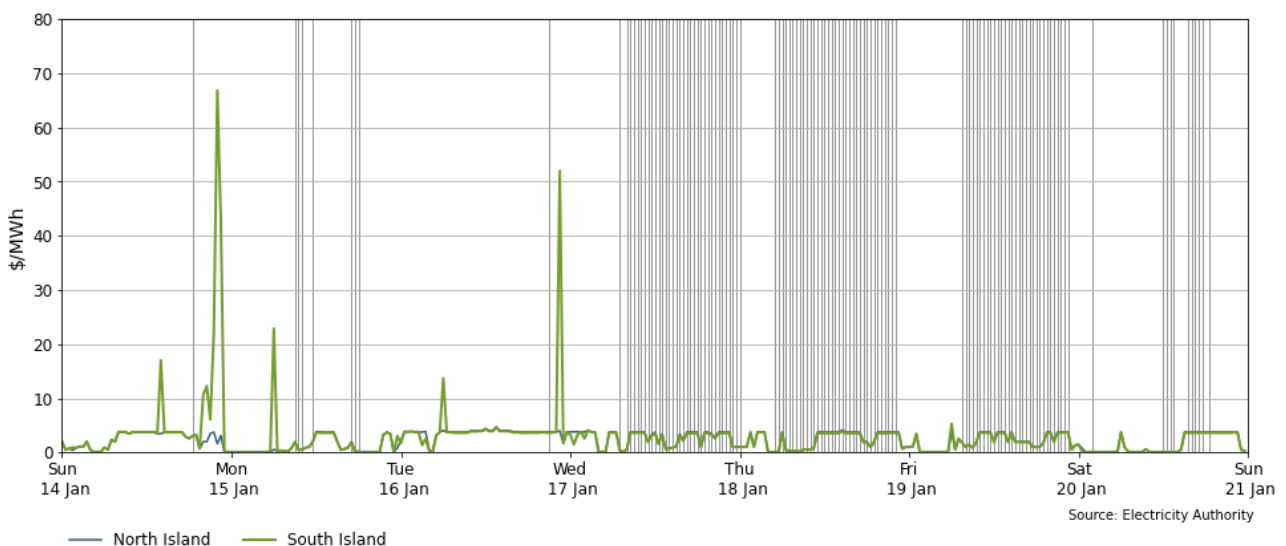
3.1. Fast Instantaneous Reserve (FIR) prices for the North and South Islands are shown below in Figure 3. This week FIR prices were mainly below \$10/MWh. There were number of spikes early in the week, particularly on Tuesday between 7.30am to 1.00pm when the North and South Island FIR price was often above \$20/MWh. The highest spike was at 12.00pm, where the North Island FIR was \$64/MWh and the South Island FIR was \$50/MWh.

Figure 3: Fast Instantaneous Reserve (FIR) price by trading period and island



3.2. Sustained Instantaneous Reserve (SIR) prices for the North and South Islands are shown in Figure 4. SIR prices were mostly under \$5/MWh. However, there has again been some separation with the South Island SIR spiking on a few occasions. Twice it went above \$50/MWh, initially on Sunday at 10.00pm where the South Island SIR was \$67/MWh and again on Tuesday at 10.30pm where it was \$52/MWh.

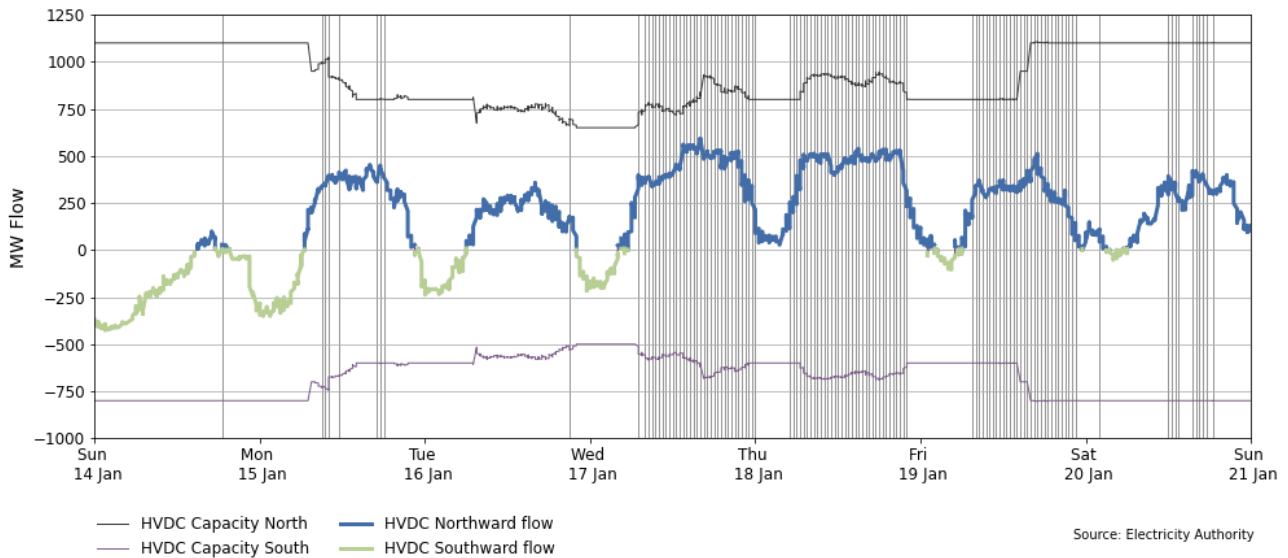
Figure 4: Sustained Instantaneous Reserve (SIR) prices by trading period and island



4. HVDC

- 4.1. Figure 5 shows HVDC flow between 14-20 January. HVDC flow was mostly northwards this week. Sunday saw more southward flow with some overnight southward flow also during the week. Maximum southward flow was ~426MW and maximum northward flow was ~677MW.

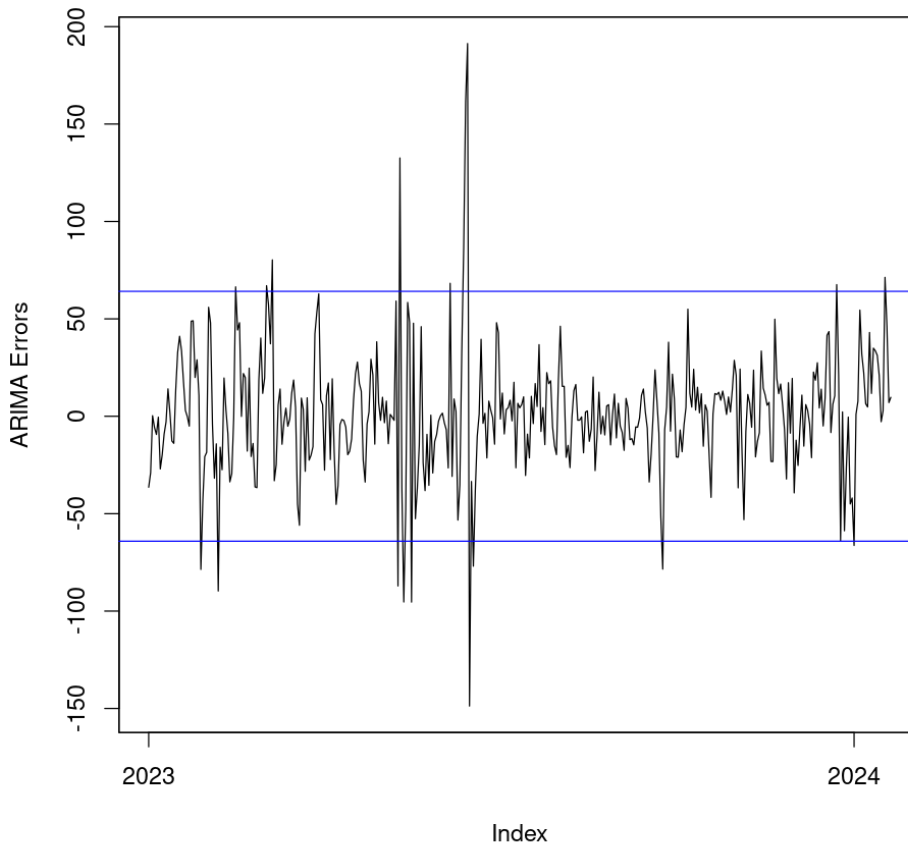
Figure 5: HVDC flow and capacity



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](#) on the trading conduct webpage.
- 5.2. Figure 6 shows the residuals of autoregressive moving average (ARMA) errors from the daily model. Positive residuals indicate that the modelled daily price is lower than actual average daily price and vice versa. When residuals are small this indicates that average daily prices are likely largely aligned with market conditions. These small deviations reflect market variations that may not be controlled for in the regression analysis.
- 5.3. This week the residual was larger than two standard deviations on Wednesday. Large positive residuals indicate that prices may have been higher than justified given market conditions. We will be further analysing the high prices on Wednesday and Thursday.

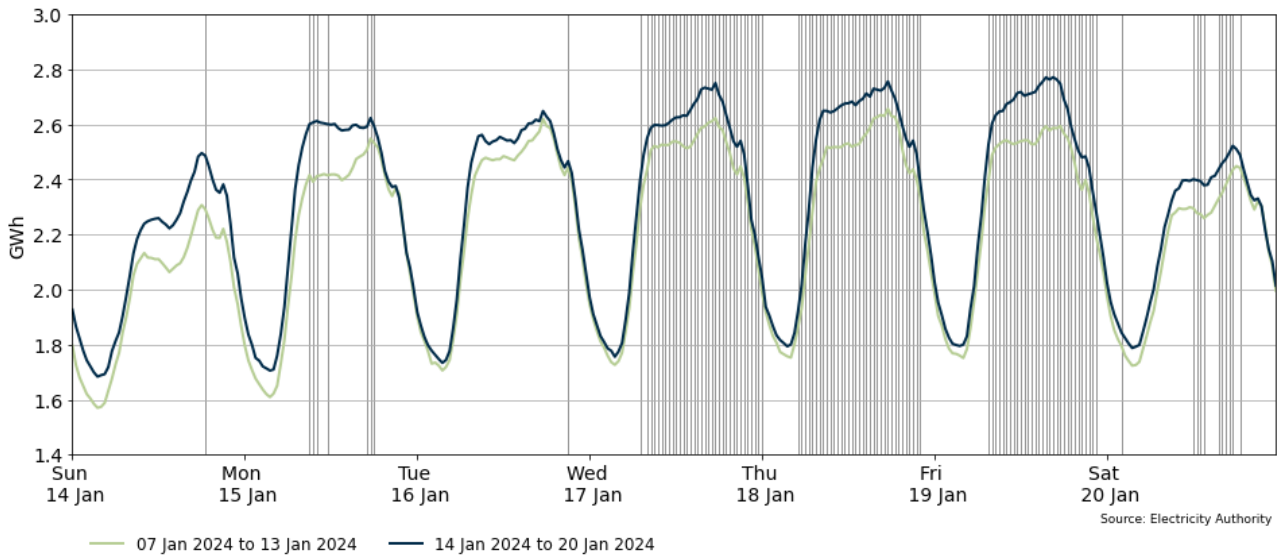
Figure 6: Residual plot of estimated daily average spot prices from 1 January 2023 - 6 January 2024



6. Demand

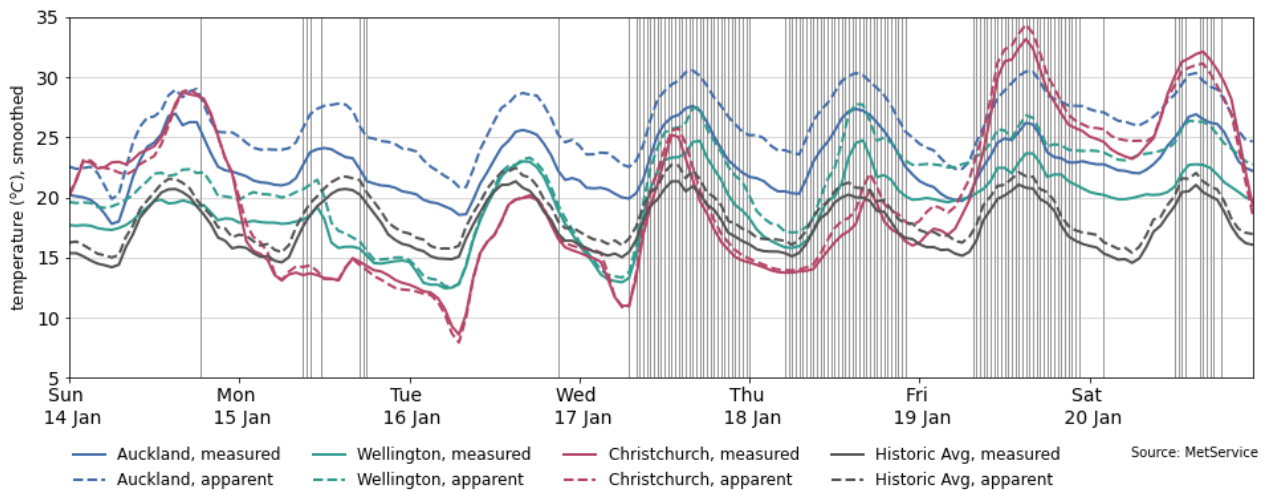
- 6.1. Figure 7 shows national demand between 14-20 January, compared to the previous week. Demand has been high this week with continued hot conditions across the country.
- 6.2. Wednesday to Friday demand was above 2.6GWh from late morning and getting close to 2.8GWh at the evening peak. Prices were high all week, but in particular over these three days went above \$300/MWh for periods. Demand forecasts during some of these trading periods was out by ~50-100MW which along with lower wind generation likely contributed to the high prices.

Figure 7: National demand between 14-20 January compared to the previous week



- 6.3. Figure 8 shows the hourly temperature at main population centres from 14-20 January. 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. Temperatures again have mostly been above 15°C this week with Auckland seeing apparent temperatures consistently within 20-30°C. Early in the week some Wellington temperatures dipped below 15°C but later in the week apparent temperatures reached around 28°C. Christchurch saw the biggest variation in temperatures with a low temperature of 8°C on Tuesday, but also the highest temperature of 34°C on Friday.

Figure 8: Temperatures across main centres

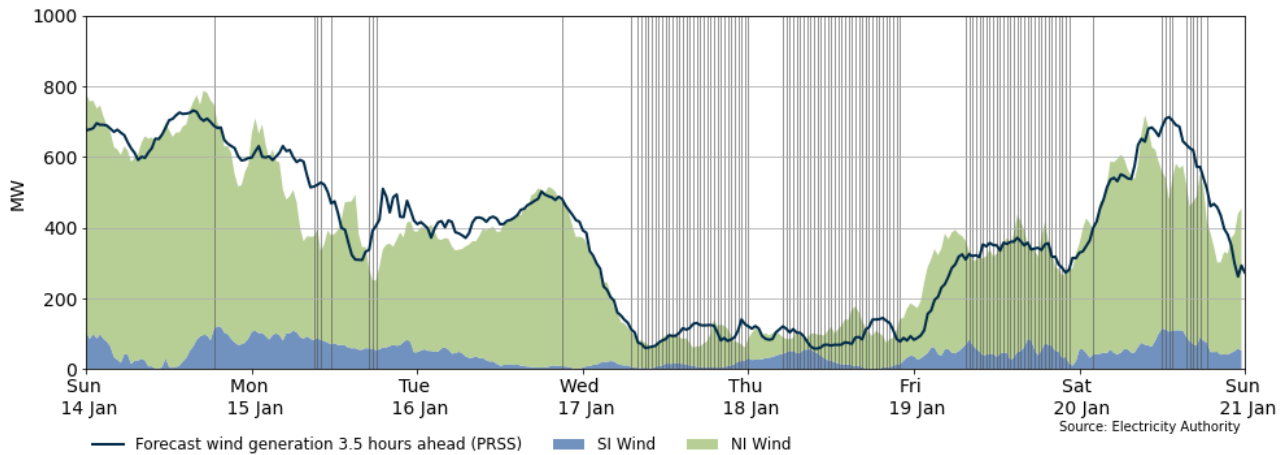


7. Generation

- 7.1. Figure 9 shows wind generation, from 14-20 January. There was significantly low wind generation on Wednesday and Thursday, coinciding with high temperatures and high demand. There were also multiple trading periods where actual wind was lower than

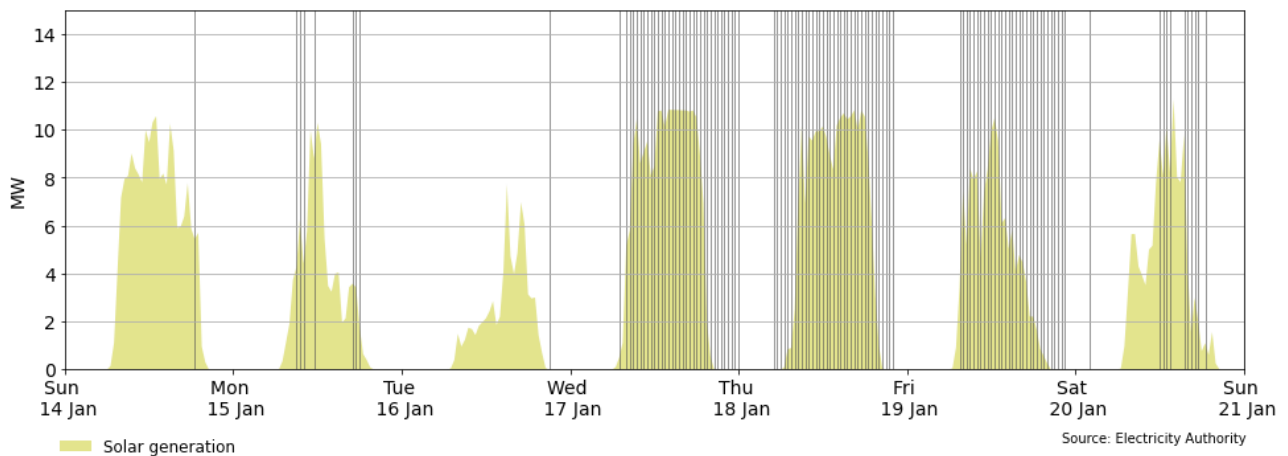
forecast by over 150MW. Forecasting errors and low wind generation can have an impact on prices especially with the recent high and sometimes under forecast demand.

Figure 9: Wind generation and forecast between 14-20 January



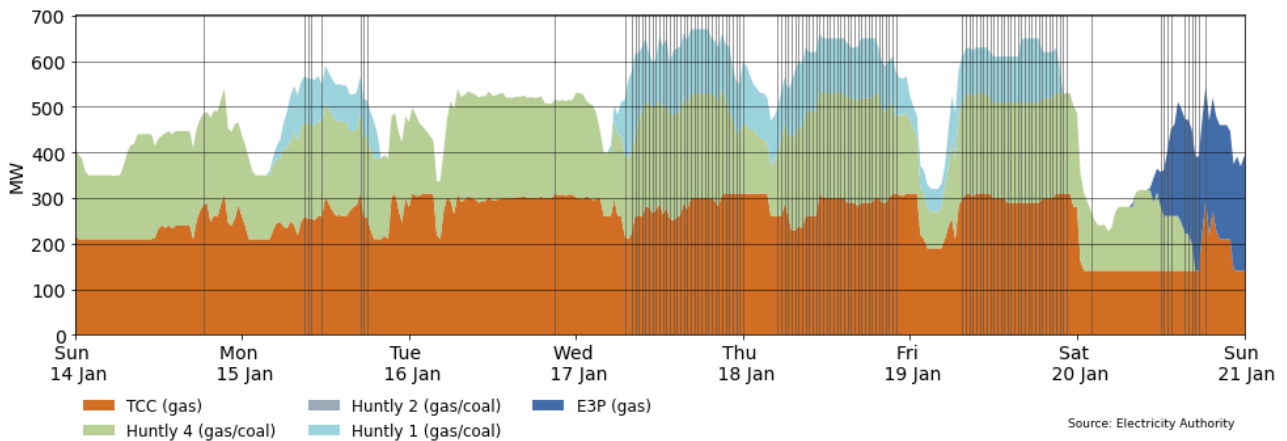
7.2. Figure 10 shows solar generation from 14-20 January. Maximum trading period output remains around 11MW with overall last week seeing more variation in solar generation as seen from the lower output on Monday and Tuesday especially. Cloud cover is the possible reason for this with some variable weather seen in the northern region of the country over the last week.

Figure 10: Solar generation between 14-20 January



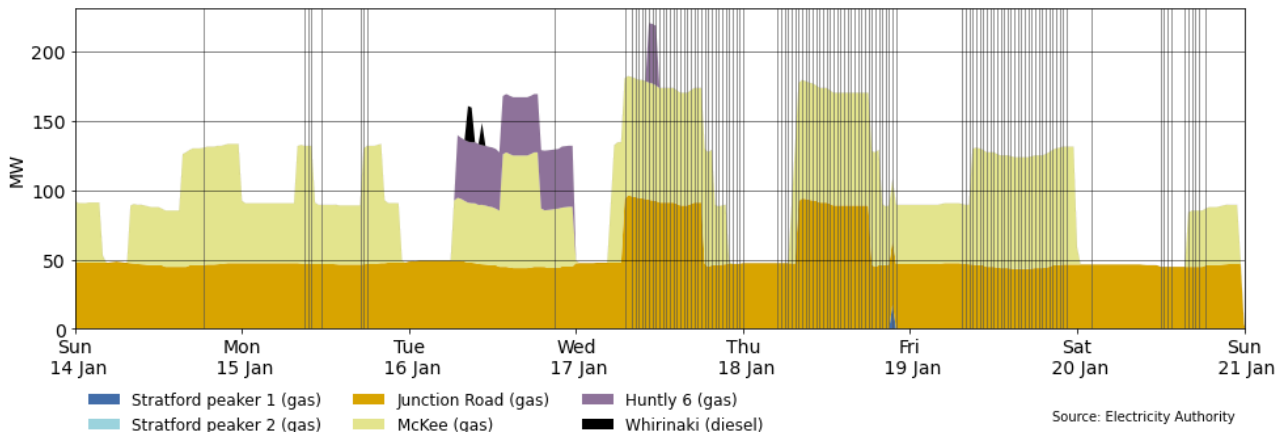
7.3. Figure 11 shows the generation of thermal baseload plants between 14-20 January. TCC and Huntly 4 ran as baseload this week with Huntly 1 supporting baseload a few days, particularly during the low wind generation days on Wednesday and Thursday. Some high priced thermal was dispatched these days. On Saturday Huntly 5 returned from outage and started generating again, after which Huntly 4 ramped down.

Figure 11: Thermal baseload generation between 14-20 January



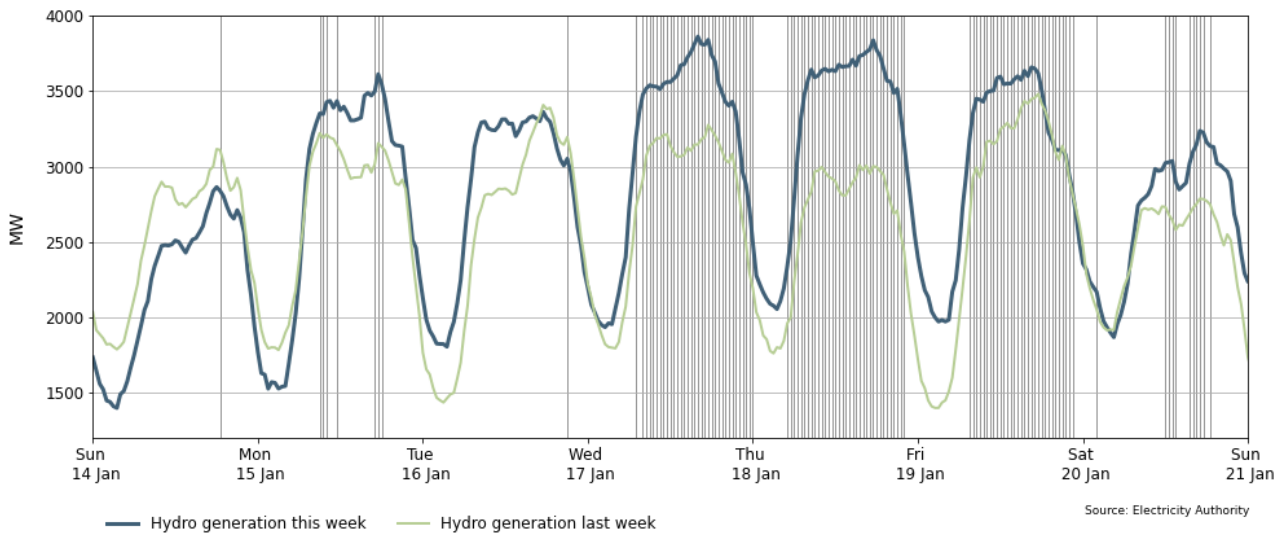
- 7.4. Figure 12 shows the generation of thermal peaker plants between 14-20 January. Junction Road ran continuously all week, mainly at around 50MW, although ramped up during the day on Wednesday and Thursday. McKee also ran regularly this week. Huntly 6 ran on Tuesday and a short time on Wednesday in the middle of the day.
- 7.5. Contact advised of testing a unit at Whirinaki which ran for a few trading periods during the day on Tuesday. Since this testing, the unit has been put on outage until 29 January.

Figure 12: Thermal peaker generation between 14-20 January



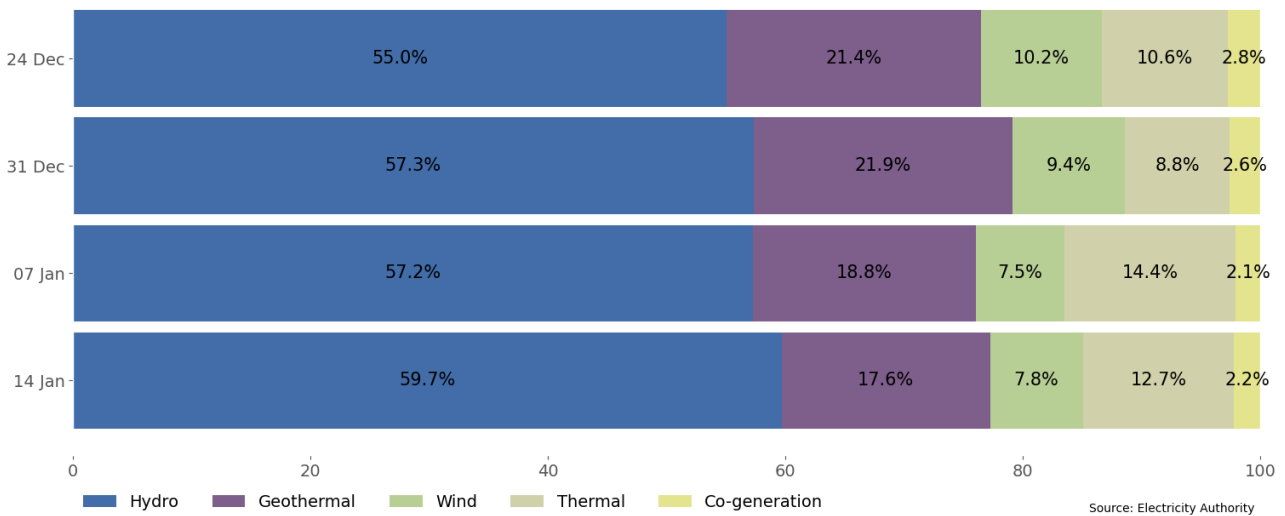
- 7.6. Figure 13 shows hydro generation between 14-20 January. There was more hydro generation than the previous week with generation ramping up in line with the really high demand days from mid-week.

Figure 13: Hydro generation between 14-20 January



7.7. As a percentage of total generation, between 14-20 January, total weekly hydro generation was 59.7%, geothermal 17.6%, wind 7.8%, thermal 12.7%, and co-generation 2.2%.

Figure 14: Total generation by type as a percentage each week between 14-20 January



8. Outages

8.1. Figure 15 shows generation capacity on outage. Total capacity on outage between 14-20 January ranged from ~1500MW to ~2400MW. There was a noticeable increase to outages from Wednesday to Friday this week which may have had some impact on the increased prices we saw over those days.

8.2. Notable outages include:

- (a) Huntly 5 returned from outage on 20 January, with a partial (135MW) outage logged from 20-22 January
- (b) Stratford 2 is on outage until 1 May 2024

- (c) Huntly 2 was on outage from 17-19 January
- (d) Stratford 1 was on outage from 18-19 January
- (e) Various North and South Island hydro remain on outage

Figure 15: Total MW loss due to generation outages

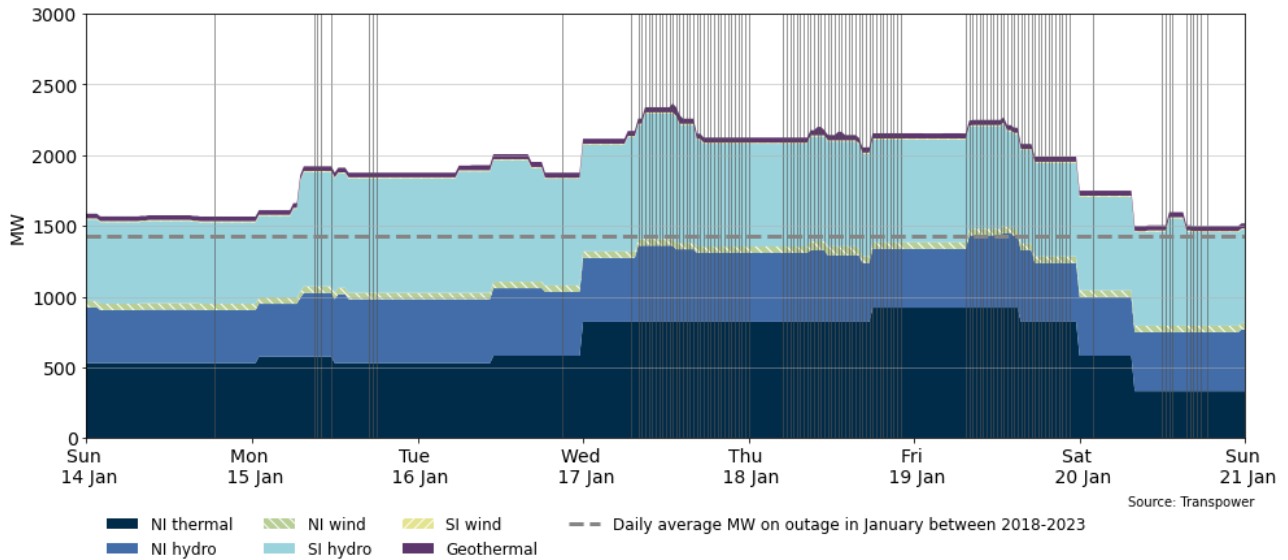
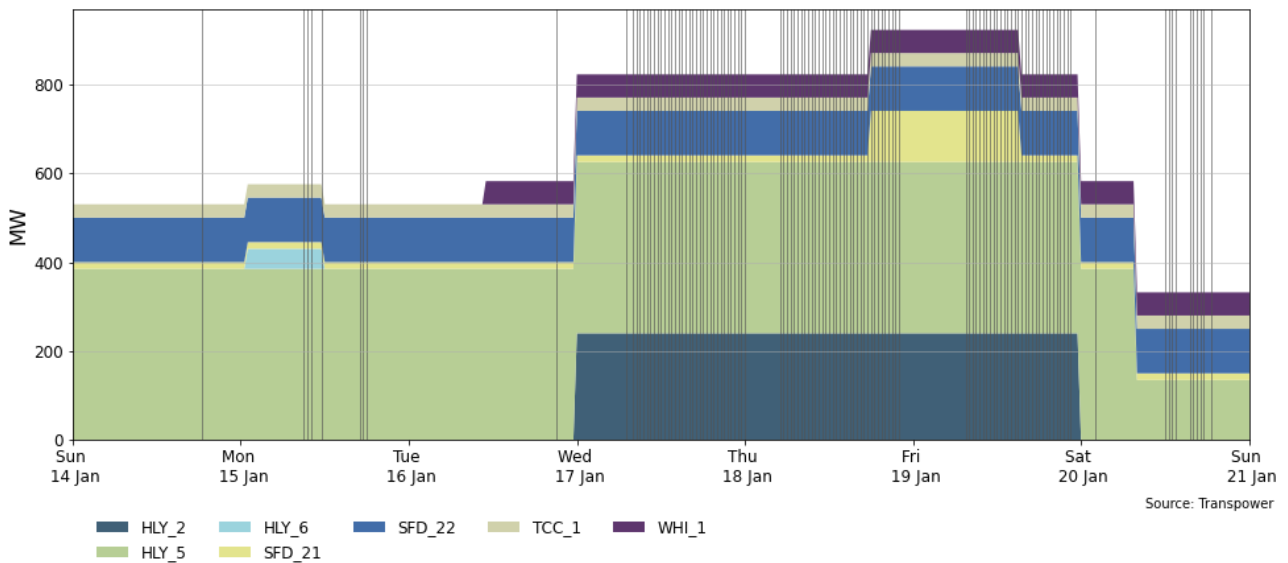


Figure 16: MW loss from thermal outages

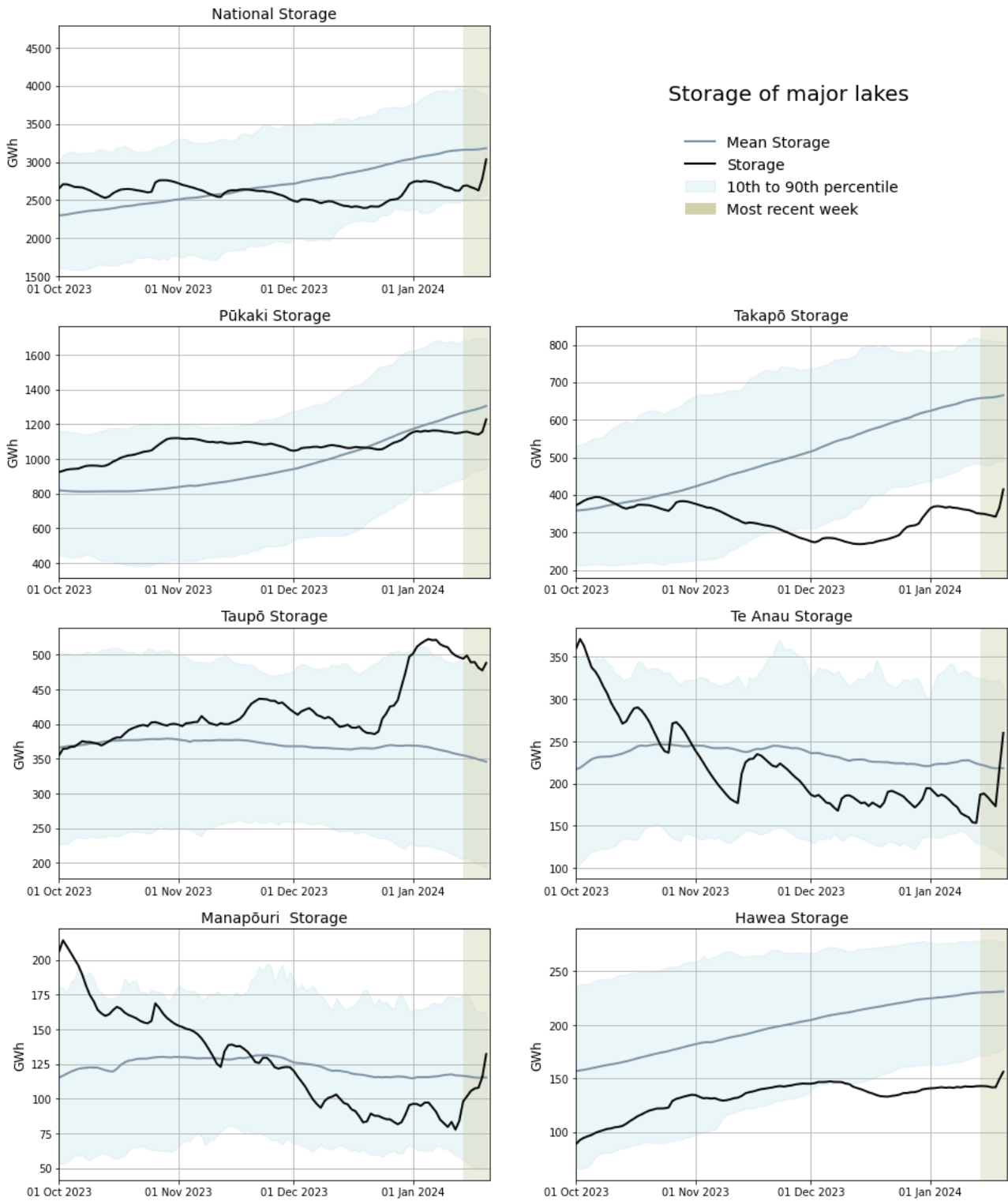


9. Storage/fuel supply

- 9.1. Figure 17 shows the 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 saw a small increase on 15 January before starting to decrease to 3009GWh on 19 January. Heavy rain in the South Island over the weekend, however, has seen controlled storage increase to 3207GWh as of 20 January. This is 72.6% nominally full and ~92% of mean.

- 9.3. All lakes have seen some increase to storage over the week. Taupō continued on a downward trend this week with a small uptick at the end of the week taking it back above its 90th percentile region. South Island lakes mainly saw a steady or slowly increasing trend until the end of the week where there was a steep uptick as heavy rain hit the West Coast of the South Island.
- 9.4. Pūkaki remains close to its mean storage, with Manapōuri and Te Anau both back above their mean for this time of year. Takapō and Hawea both remain below their historic 10th percentile for this time of year.

Figure 17: Hydro storage



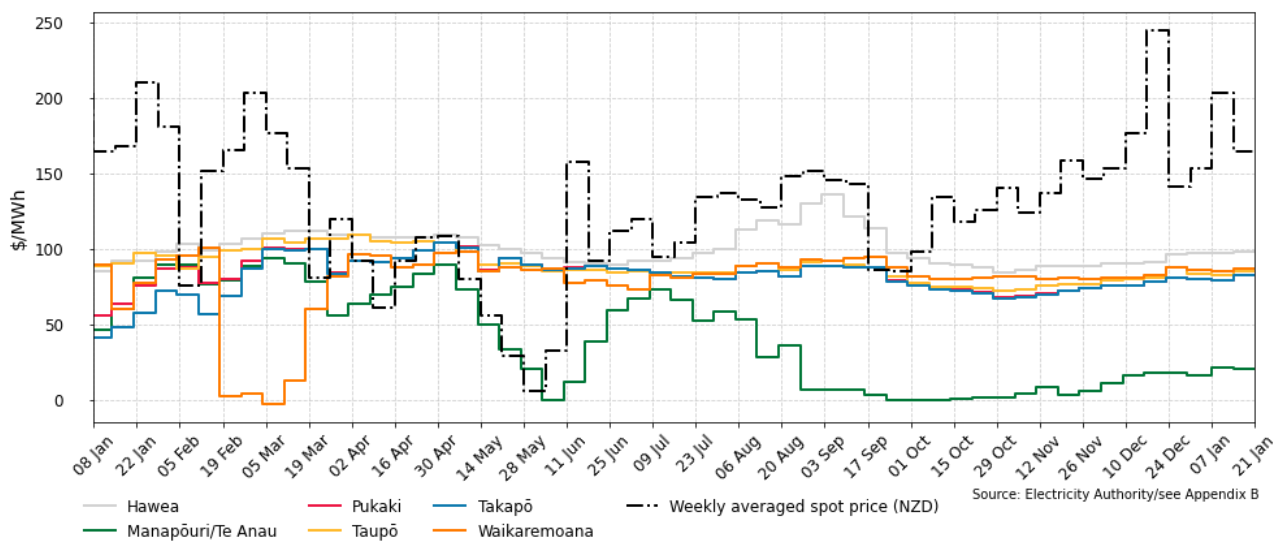
Source: Electricity Authority

10. JADE water values

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 18 shows the national water values between 8 January 2023 and 21 January 2024 obtained from JADE calculated as at the start of the week. 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](#).

10.2. Most lakes saw an increase in water values of \$2-\$3/MWh, with the Manapōuri/Te Anau value remaining around \$20/MWh.

Figure 18: JADE water values across various reservoirs between 8 January 2023 and 21 January 2024



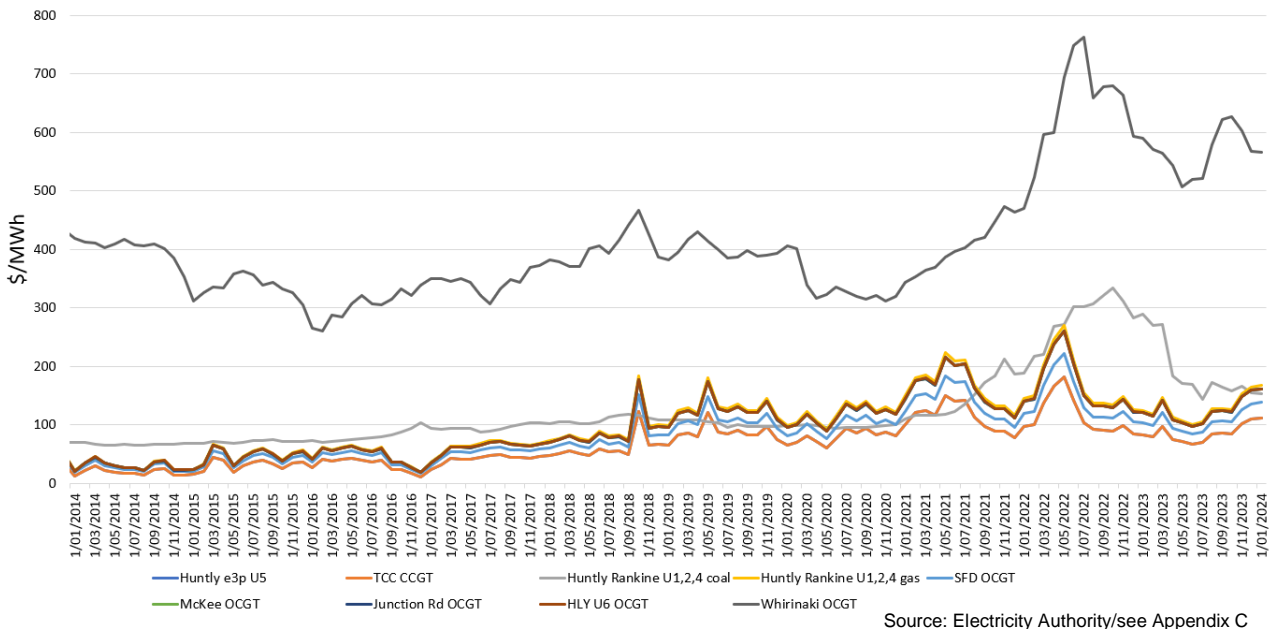
11. Prices versus estimated costs

- 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 19 shows an estimate of thermal SRMCs as a monthly average up to 1 January 2024. The SRMC for diesel decreased slightly compared to the previous month. The coal SRMC also continued its slightly decreasing trend, while the gas SRMC continued to slightly increase.
- 11.4. The latest SRMC of coal-fuelled Rankine generation is ~\$154/MWh. This is now lower than the cost of running the Rankines on gas at ~\$168/MWh.

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.

- 11.5. The SRMC of gas fuelled thermal plants is currently between \$112/MWh and \$168/MWh.
- 11.6. The SRMC of Whirinaki has decreased to ~\$566/MWh.
- 11.7. More information on how the SRMC of thermal plants is calculated can be found in [Appendix C](#) on the trading conduct webpage.

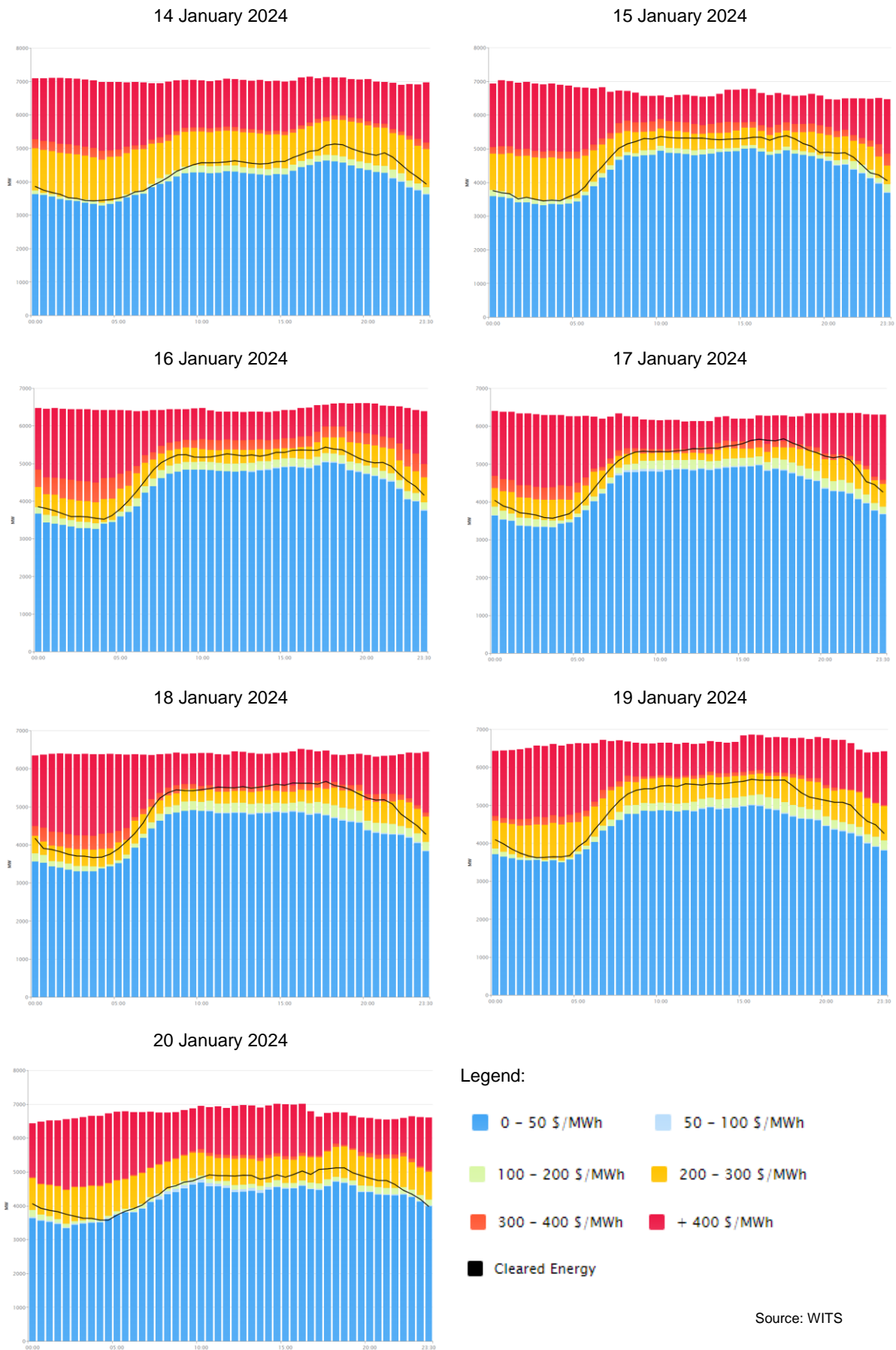
Figure 19: Estimated monthly SRMC for thermal fuels



12. Offer behaviour

- 12.1. Figure 20 shows this week's national daily offer stacks. The black line shows cleared energy, indicating the range of the average final price.
- 12.2. There continues to be minimal offers in the \$50-\$100/MWh band and this week also saw thinner \$100-\$200/MWh offer bands on multiple days.
- 12.3. There were more offers in the \$200-\$300/MWh across the week as well as thicker \$300-\$400/MWh offer bands appearing mid-week. This saw most offers clearing within \$200-\$400/MWh across the week in line with and increase in demand because of hot weather conditions across the country.

Figure 20: Daily offer stacks



13. Ongoing work in trading conduct

- 13.1. This week, prices were higher than seen in recent weeks, especially on Wednesday and Thursday. We will do further analysis of offers to check this is 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	Participant	Location	Enquiry topic
14/06/2023-15/06/2023	15-17/ 15-19	Passed to Compliance	Genesis	Multiple	High energy prices associated with high energy offers.
22/09/2023-30/09/2023	Several	Further analysis	Contact	Multiple	High hydro offers.
17/01/2024-19/01/2024	Several	Further analysis	Various	Multiple	High energy prices associated with high energy offers.