

29 January 2024



# Trading conduct report

Market monitoring weekly report

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## 1. Overview for week of 21 January – 27 January

1.1. Spot prices started high at the beginning of the week due to low wind generation and demand forecasting errors. The increase to hydro storage began to have an impact on prices mid-week with some price separation also occurring as spilling occurred at some South Island lakes. Demand decreased as temperatures dropped from Tuesday onwards. This drop in demand also saw a reduction in thermal generation. Lower demand and high wind generation on Saturday, along with sufficient South Island hydro storage, saw spot prices drop below \$0.10/MWh for a time. As of 27 January, hydro storage was 100.5% of historic mean.

## 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 range<sup>1</sup> of historic prices are highlighted with a vertical black line. Other notable prices are marked with black dashed lines.

2.3. Between 21-27 January:

(a) The average wholesale spot price across all nodes was \$155/MWh.

(b) 95 percent of prices fell between \$0.03/MWh and \$302/MWh

2.4. Overall, spot prices reduced this week after high inflows seen on the West Coast of the South Island. There were a number of highlighted prices over Sunday and Monday, which were possibly due to high demand that was often under forecast by up to 110MW. There was also very low wind generation across these days.

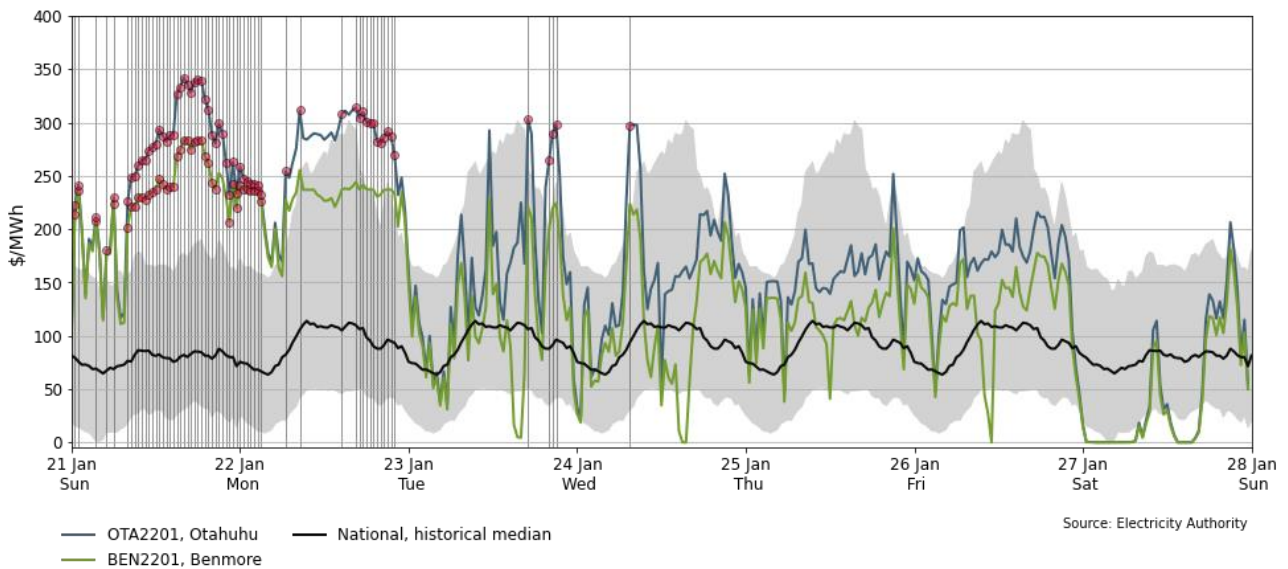
2.5. There were also instances of price separation between Benmore and Ōtāhuhu between Tuesday and Friday after high inflows into many Southern hydro lakes and rivers.

2.6. On Saturday prices in both islands neared \$0/MWh as high wind generation coincided with low demand.

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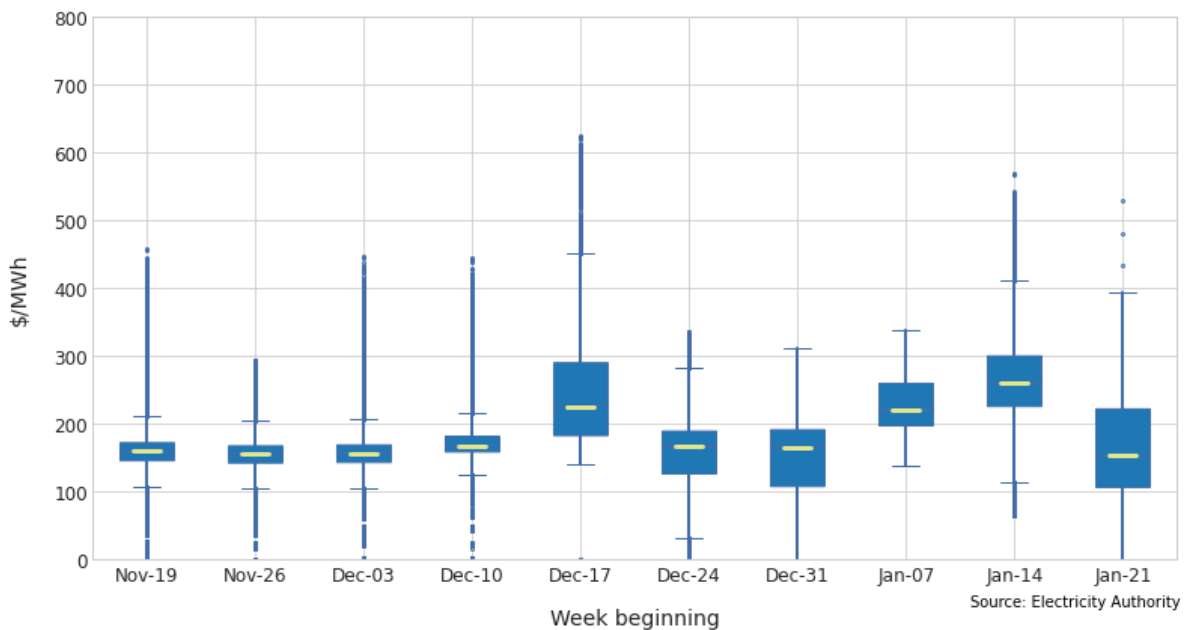
<sup>1</sup> We are identifying any significantly high prices by using the historic distribution of prices depending on whether it is a weekday or weekend day, and looking for prices that lie 1.5 times the interquartile range above the 75<sup>th</sup> percentile of the distribution. This is using the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

**Figure 1: Wholesale spot price at Benmore and Ōtāhuhu between 21-27 January**



- 2.7. Figure 2 shows a box plot with the distribution of spot prices during this week and the previous nine weeks. The yellow 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.
- 2.8. Compared to the previous week, the weekly median price fell significantly, with the majority of prices below \$300/MWh throughout the week. This week also saw trading periods with near \$0/MWh prices, which is a first for January 2024.

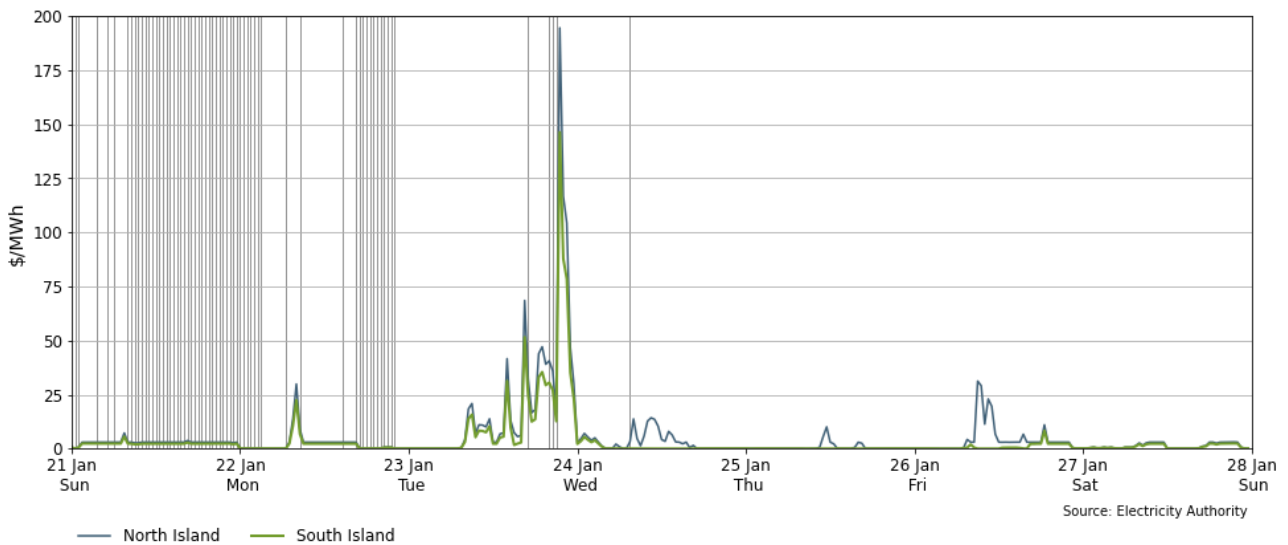
**Figure 2: Boxplots showing the distribution of spot prices this week and the previous nine weeks**



### 3. Reserve prices

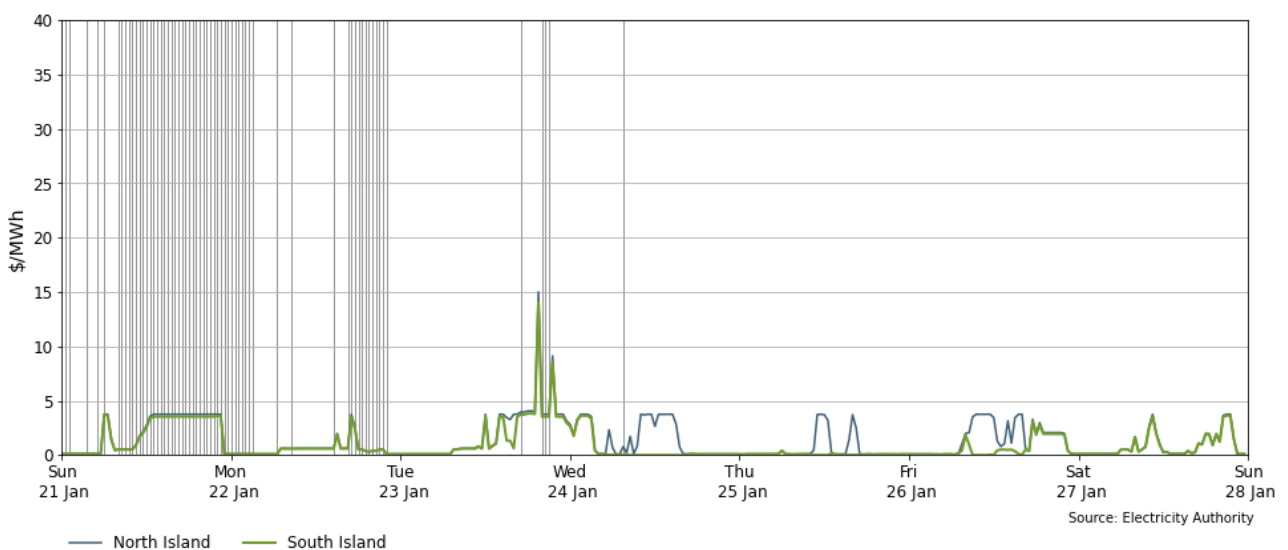
3.1. Fast Instantaneous Reserve (FIR) prices for the North and South Islands are shown below in Figure 3. This week FIR prices were mainly under \$5/MWh except on Tuesday which saw varied FIR prices across the day. Tuesday also saw a large spike at 9.30pm where the South Island FIR reached \$146/MWh and the North Island FIR reached \$196/MWh. This was likely due to baseload generation from both TCC and Huntly 5 being turned off a couple of hours earlier and the ramping down of Huntly 4 after 9.00pm, meaning there was less spare capacity available for reserve.

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. There were a couple of small spikes on Tuesday, but SIR prices remained below \$15/MWh.

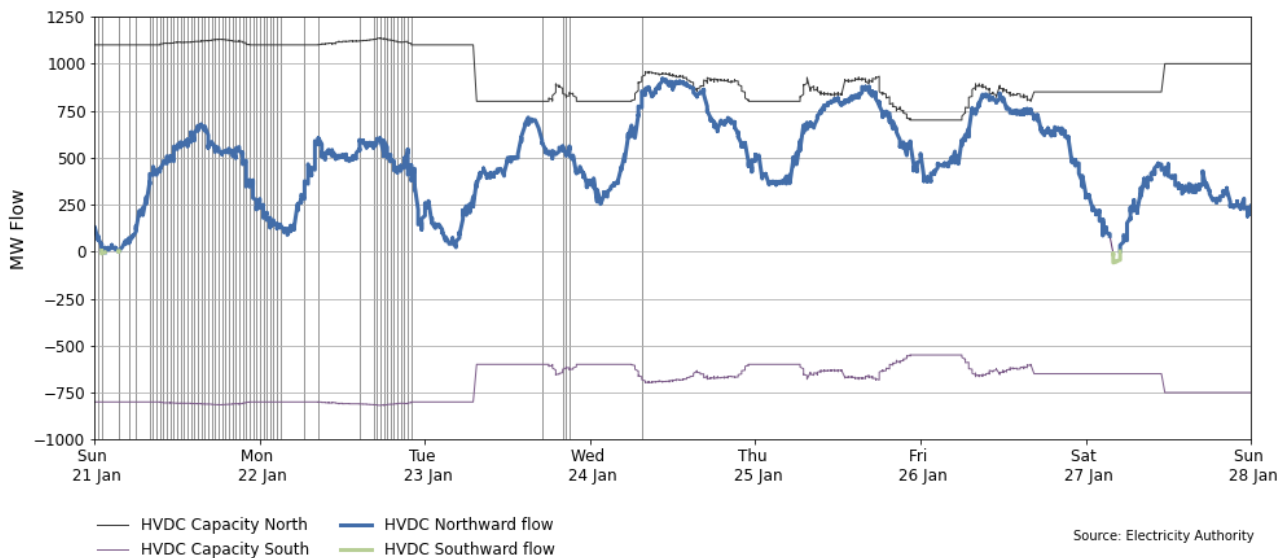
Figure 4: Sustained Instantaneous Reserve (SIR) prices by trading period and island



## 4. HVDC

- 4.1. Figure 5 shows HVDC flow between 21-27 January. HVDC flow was northwards nearly all week. With hydro storage now at a higher level than recent weeks, South Island hydro generation has increased. Wednesday and Thursday saw HVDC flow reaching close to the northward capacity. As a result, there was occasionally price separation.

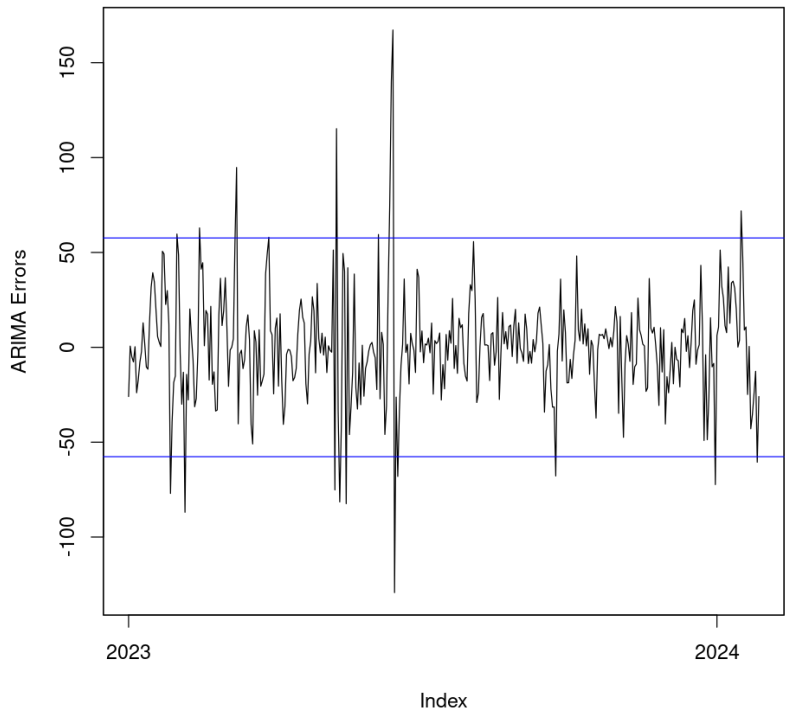
Figure 5: HVDC flow and capacity



## 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 there was one residual below two standard deviations of the data. This occurred on Saturday where increased hydro and high wind generation caused prices to be lower than the model expected.

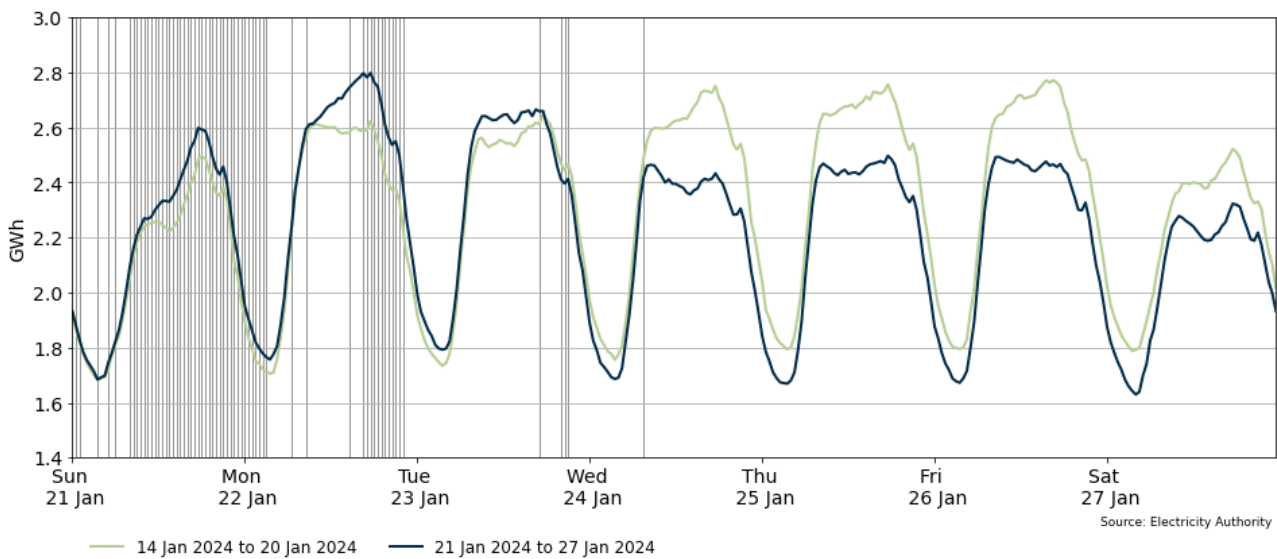
**Figure 6: Residual plot of estimated daily average spot prices from 1 January 2023 - 27 January 2024**



## 6. Demand

6.1. Figure 7 shows national demand between 21-27 January, compared to the previous week. Sunday and Monday had higher evening peak demand than the previous week with the country experiencing hot weather. Cooler conditions from Wednesday saw demand drop both compared to Monday and Tuesday and the previous week.

**Figure 7: National demand between 21-27 January compared to the previous week**

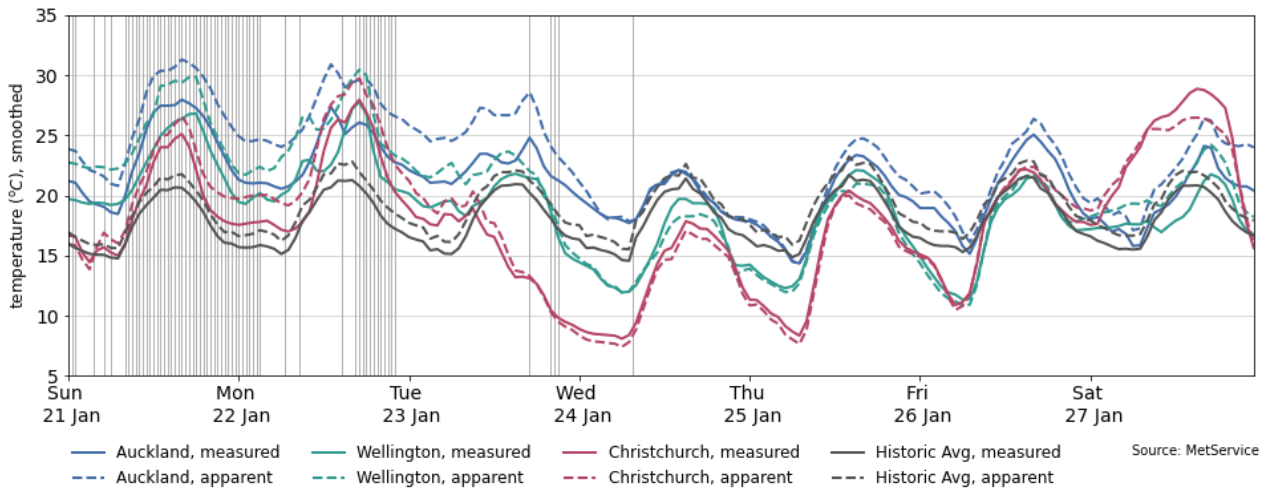


6.2. Figure 8 shows the hourly temperature at main population centres from 21-27 January. The measured temperature is the recorded temperature, while the apparent temperature adjusts for factors like wind speed and humidity to estimate how cold it feels. Also included for

reference is the mean historical temperature of similar weeks, from previous years, averaged across the three main population centres.

- 6.3. Temperatures across the country were high on Sunday and Monday, with apparent temperatures in Auckland and Wellington reaching ~30°C on both days. High temperatures contributed to the higher demand seen on those days. From Tuesday onwards, however, temperatures dropped sharply, but increased again towards Saturday.

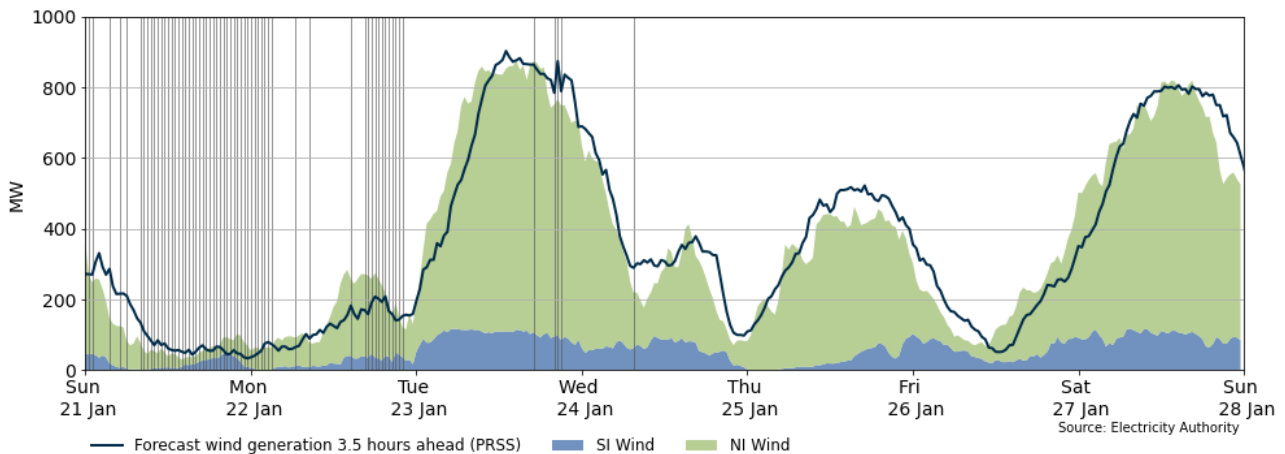
**Figure 8: Temperatures across main centres**



## 7. Generation

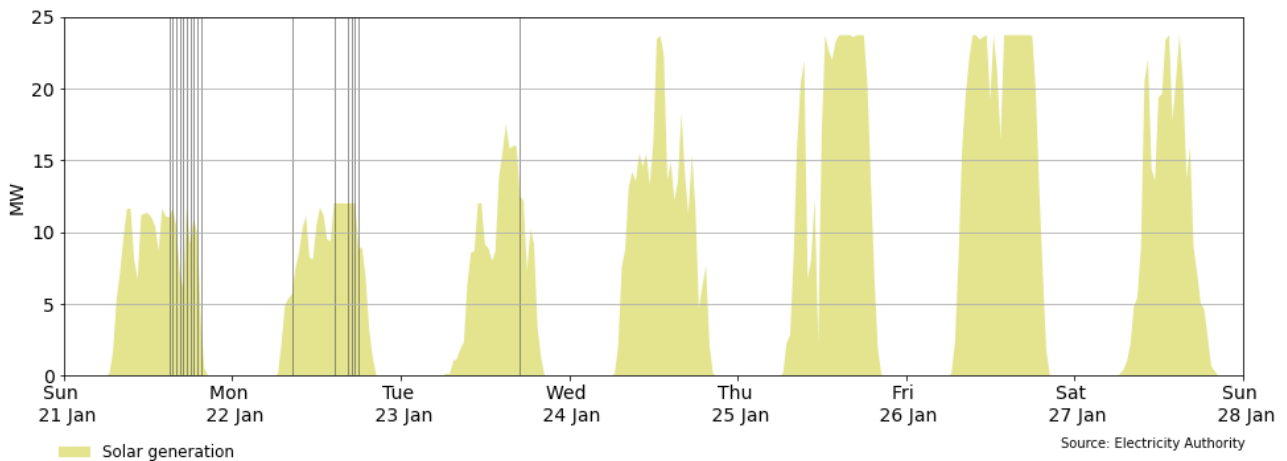
- 7.1. Figure 9 shows wind generation, from 21-27 January. This week wind generation varied between 30MW and 874MW. Wind generation was mostly below 200MW between Sunday and Monday, before rising to over 800MW on Tuesday. Wind generation then dropped between Wednesday and Friday, remaining mostly below 400MW, before rising sharply again. High wind generation from Tuesday onwards contributed to lower spot prices.

**Figure 9: Wind generation and forecast between 21-27 January**



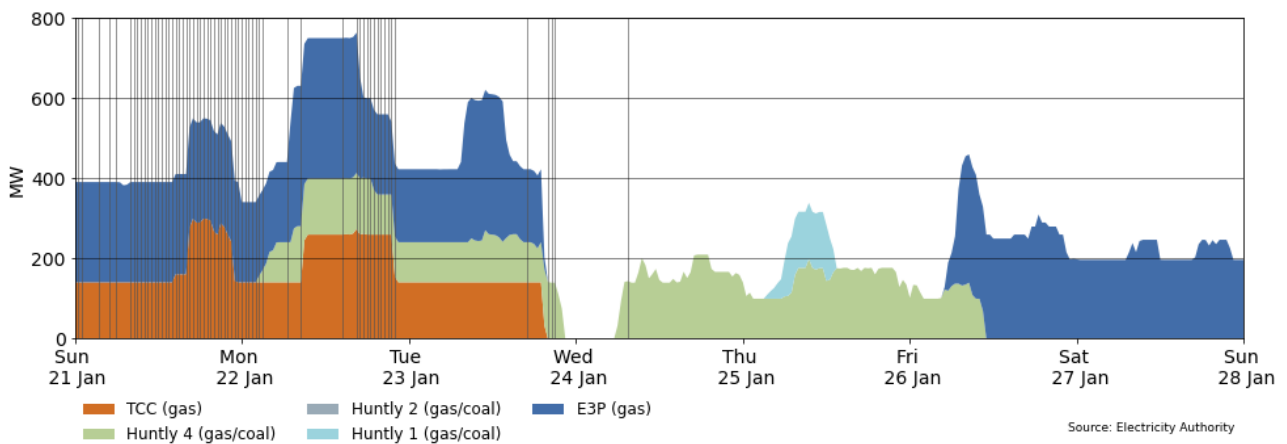
- 7.2. Figure 10 shows solar generation from 21-27 January. Kaitaia Solar Farm has now been fully commissioned with generation reaching the full capacity output of 24MW at times. Solar generation was highest on Friday when the output was near maximum all day.

**Figure 10: Solar generation between 21-27 January**



7.3. Figure 11 shows the generation of thermal baseload between 21-27 January. The early part of the week saw TCC, Huntly 4 and Huntly 5 running as baseload. This would have been needed to cover both the lack of wind and the errors in demand forecast for some trading periods. The latter half of the week saw less baseload thermal running, with Huntly 4 starting up again on Wednesday morning and running until mid-morning on Friday. Huntly 5 also came back on during Friday morning and ran throughout Saturday. Huntly 1 ran from morning until early afternoon on Thursday.

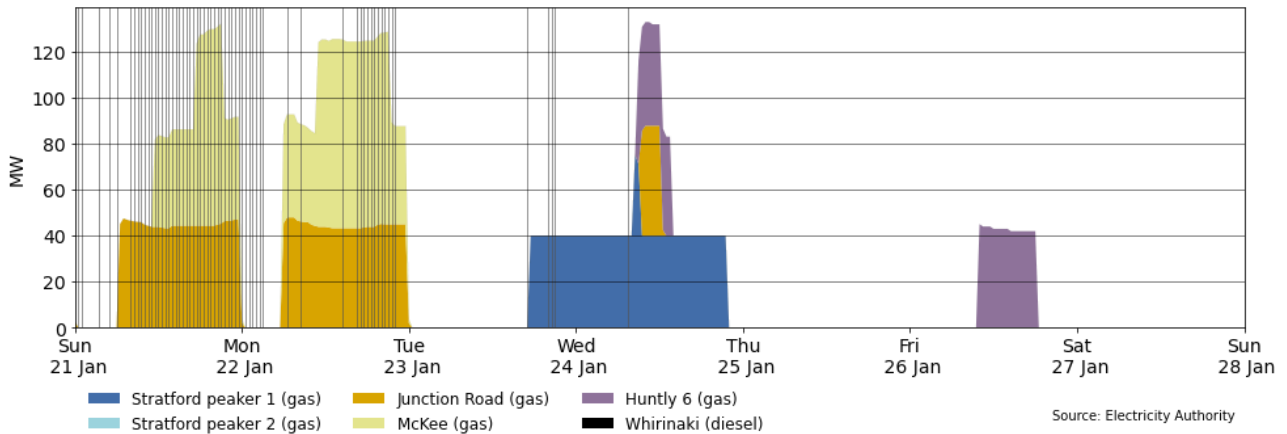
**Figure 11: Thermal baseload generation between 21-27 January**



7.4. Figure 12 shows the generation of thermal peaker plants between 21-27 January. This week the peakers ran less, with less continuous generation from units, as seen in recent months. McKee and Junction Road ran to cover the high demand periods seen over Sunday and Monday. Stratford 1 ran from Tuesday evening until late Wednesday evening. Junction Road and Huntly 6 ran over Wednesday's late morning to early afternoon period. Huntly 6 also ran during the day on Friday.

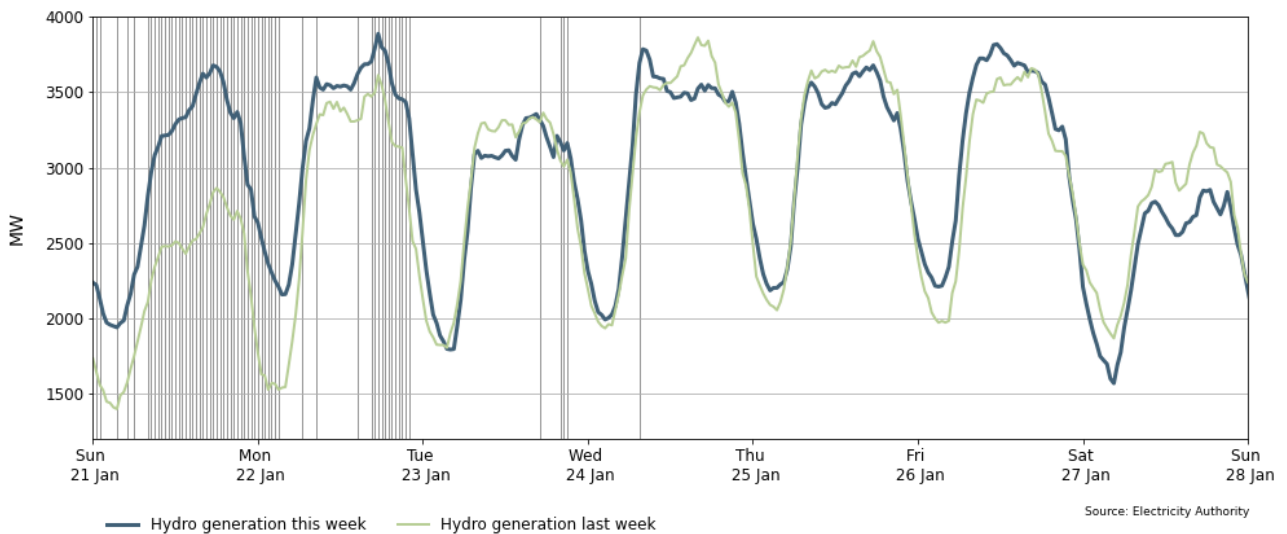


**Figure 12: Thermal peaker generation between 21-27 January**



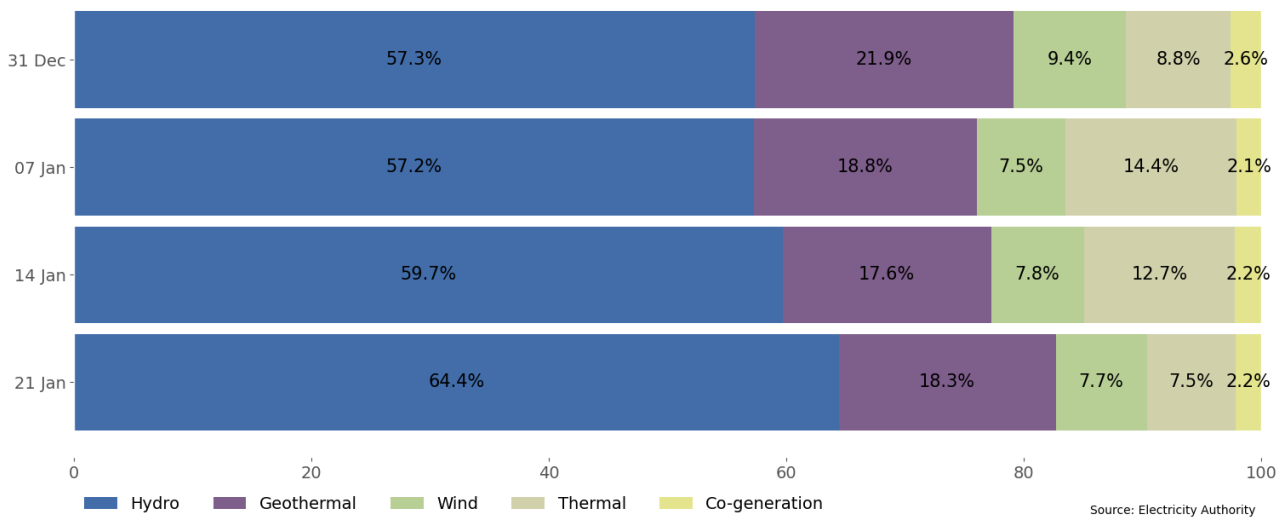
7.5. Figure 13 shows hydro generation between 21-27 January. Hydro generation was high on Sunday and Monday, with the Sunday hydro generation being especially higher than the previous week. Hydro generation dropped on Tuesday as high winds offset the need for continued high hydro running. Generation from Wednesday onwards was similar to the previous week. However, spot prices were lower as many lakes saw healthy inflows over the weekend and some lakes were spilling.

**Figure 13: Hydro generation between 21-27 January**



7.6. As a percentage of total generation, between 21-27 January, total weekly hydro generation was 64.4%, geothermal 18.3%, wind 7.7%, thermal 7.5%, and co-generation 2.2%. Higher hydro generation and lower demand this week reduced the need for thermal generation.

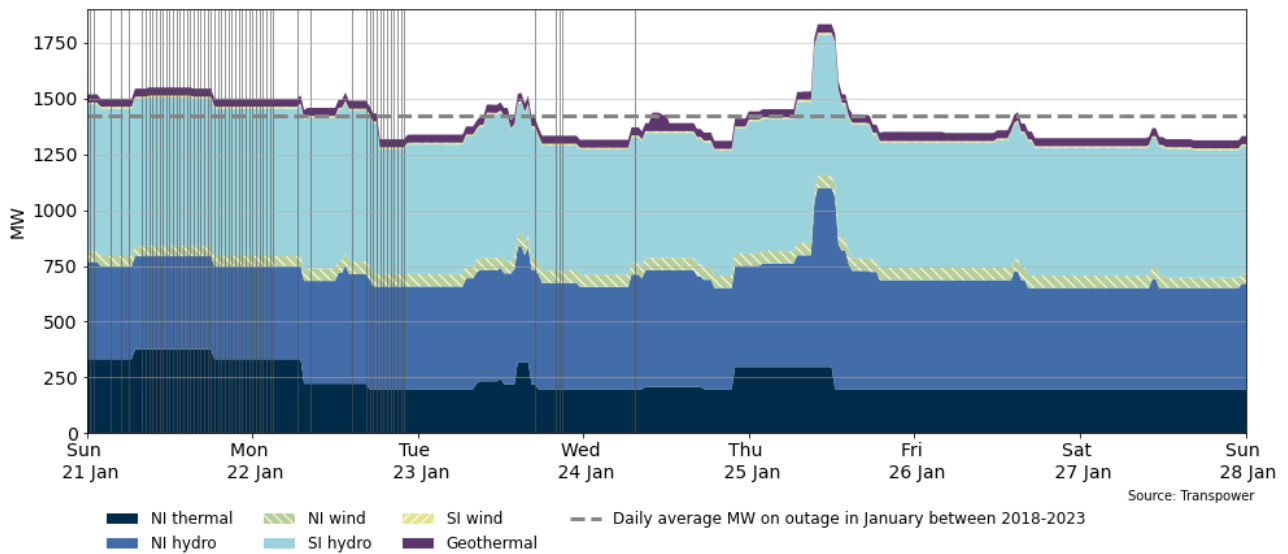
**Figure 14: Total generation by type as a percentage each week between 21-27 January**



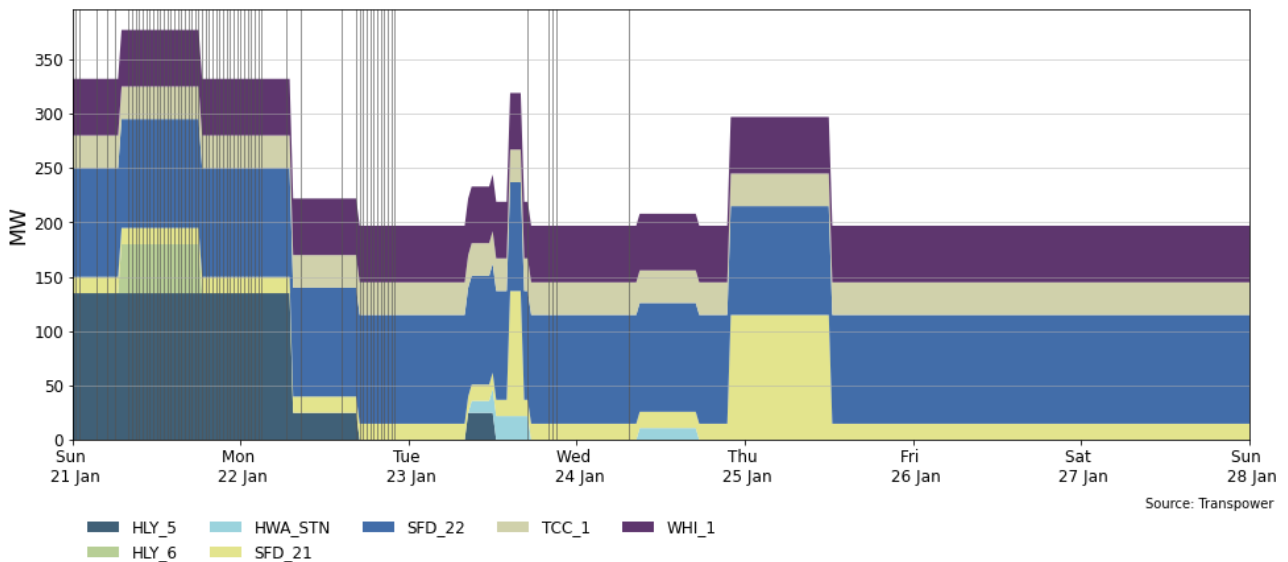
## 8. Outages

- 8.1. Figure 15 shows generation capacity on outage. Total capacity on outage between 21-27 January ranged from 1300MW to ~1800MW. There was a significant drop in the number of thermal units on outage this week as can be seen from Figure 16.
- 8.2. Notable outages include:
- Huntly 5 ended its sequence of partial outages from Tuesday onwards.
  - Stratford 2 remains on outage however, Contact Energy have confirmed a reduced outage time, with this unit now scheduled to return on 1 May 2024.
  - Stratford 1 also had a sequence of full and partial outages this week.
  - A number of large hydro outages continued this week, in particular at Manapōuri where three 125MW units are on outage.

**Figure 15: Total MW loss due to generation outages**



**Figure 16: MW loss from thermal outages**

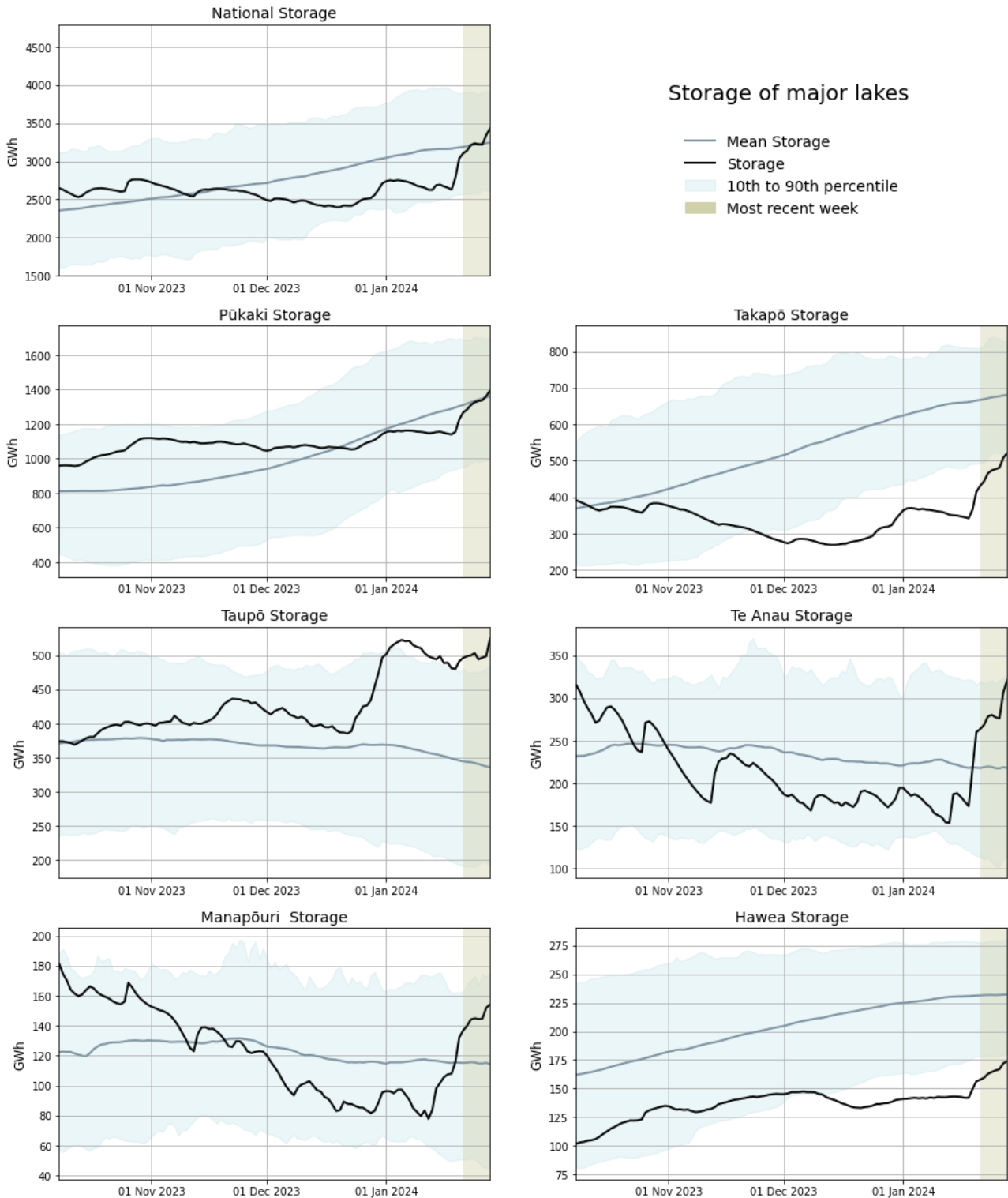


## 9. Storage/fuel supply

- 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 rose last week, as all major catchments received inflows, and national storage levels reached the national mean. Storage was at 100.5% of mean and ~81% nominally full as of 27 January.
- 9.3. Taupō storage remains above its 90<sup>th</sup> percentile. Pūkaki storage increased and now sits at its historic mean. Takapō storage also increased, however remains just below its historic 10<sup>th</sup> percentile. Hawea storage is also below its 10<sup>th</sup> percentile, although also saw some increase to storage.

9.4. Manapōuri and Te Anau saw more inflows on top of the inflows from the previous week with both lake's storage above historic average. Meridian advised that Manapouri is spilling due to high lake levels and high river flows, as required by resource consents.

Figure 17: Hydro storage



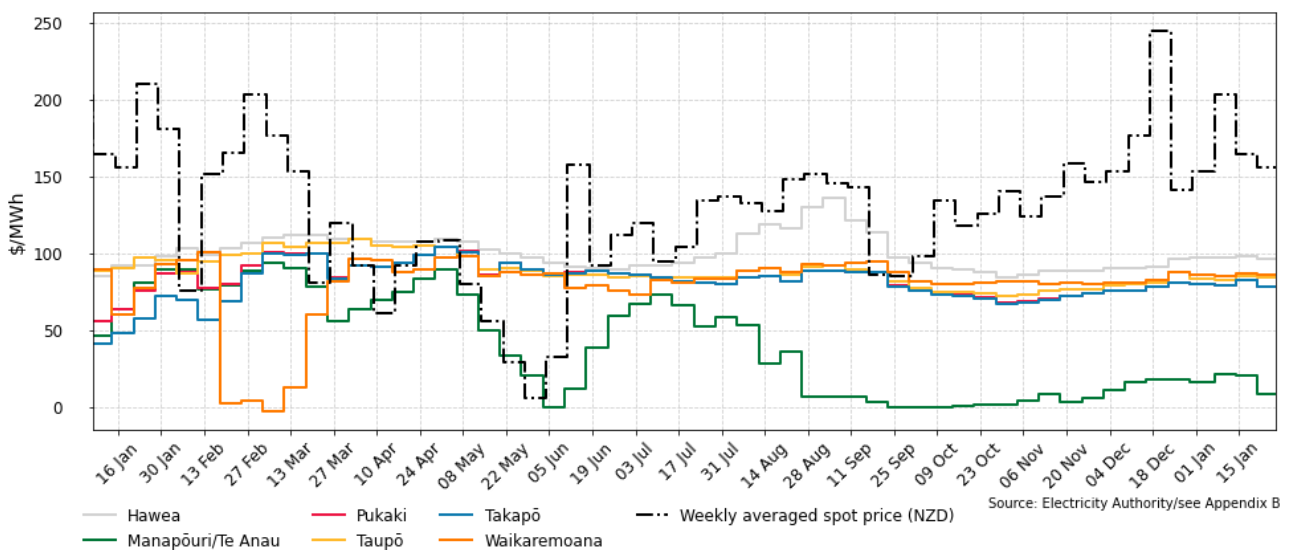
Source: Electricity Authority

## 10. JADE water values

10.1. The JADE<sup>2</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 18 shows the national water values between 8 January 2023 and 27 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 water values decrease by \$1-\$2/MWh. With the large inflows in the South Island recently, Manapōuri/Te Anau water value is now ~\$8/MWh.

**Figure 18: JADE water values across various reservoirs between 8 January 2023 and 27 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.

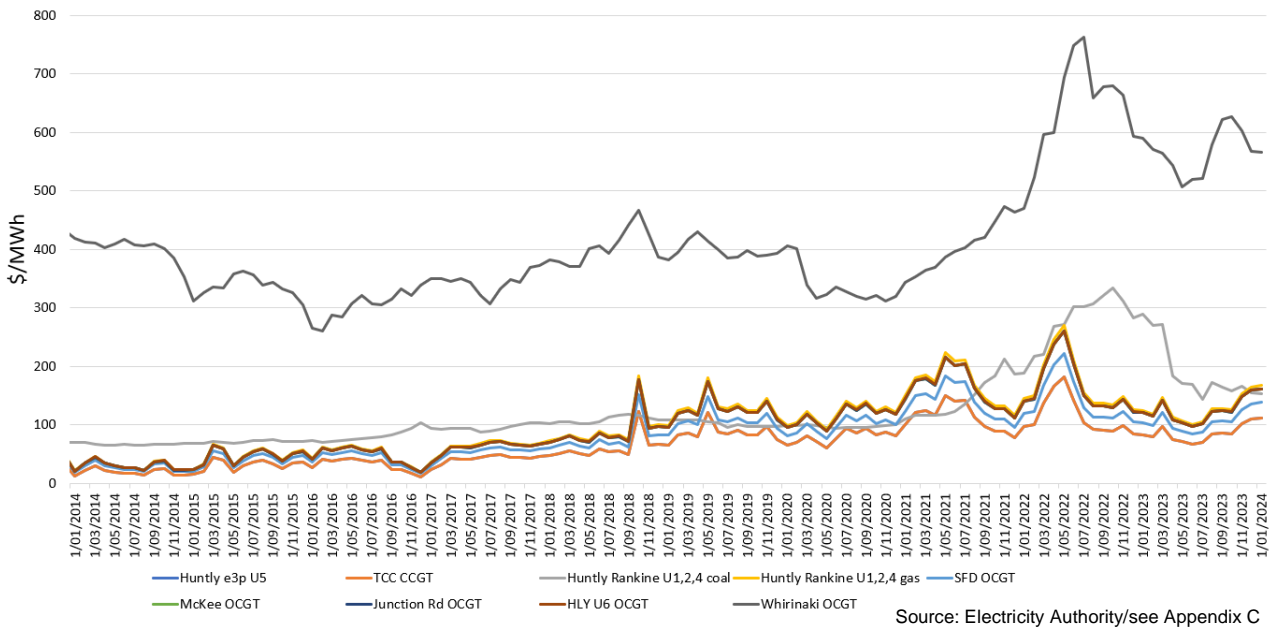
11.3. Figure 19 shows an estimate of thermal SRMCs as a monthly average up to 1 January 2024. The SRMC for diesel decreased slightly compared to the previous month. The coal SRMC also continued its slightly decreasing trend, while the gas SRMC continued to slightly increase.

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.

<sup>2</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.

- 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.

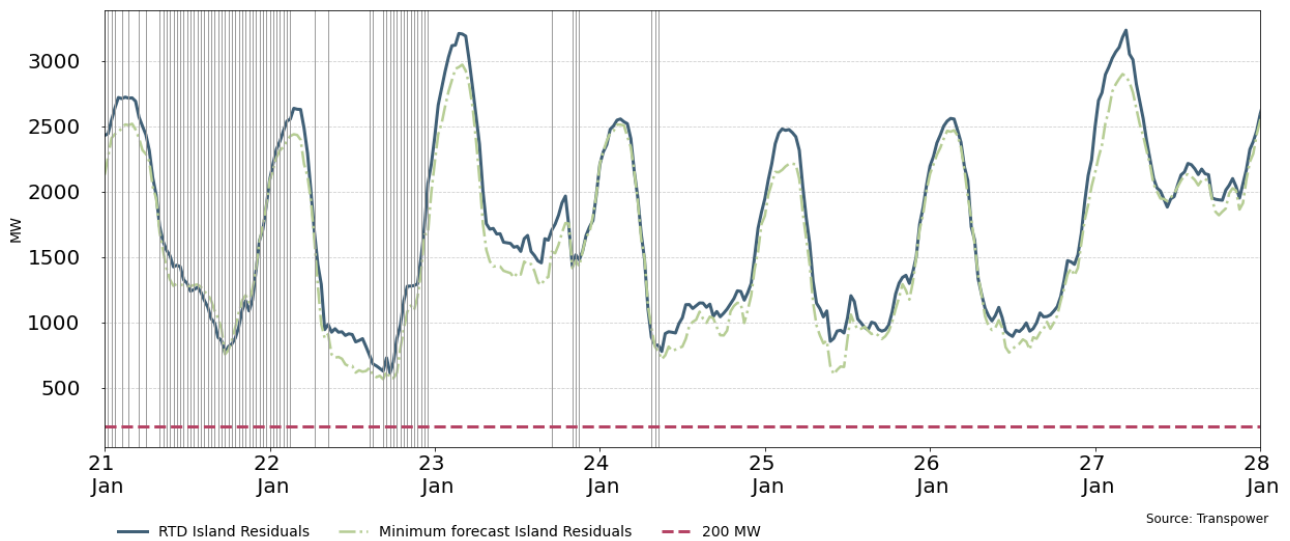
**Figure 19: Estimated monthly SRMC for thermal fuels**



## 12. Generation balance residuals

- 12.1. Figure 20 shows the generation balance residuals for 21-27 January. The red dashed line represents the 200MW residual mark which is the threshold at which Transpower issues a customer advice notice (CAN) for a low residual situation. The green dashed line represents the forecast residuals and the blue the real time data (RTD) residuals.
- 12.2. A number of the high prices at the start of the week occurred where the generation balance was lower. However, all week there was a balance of over 500MW of residual generation.

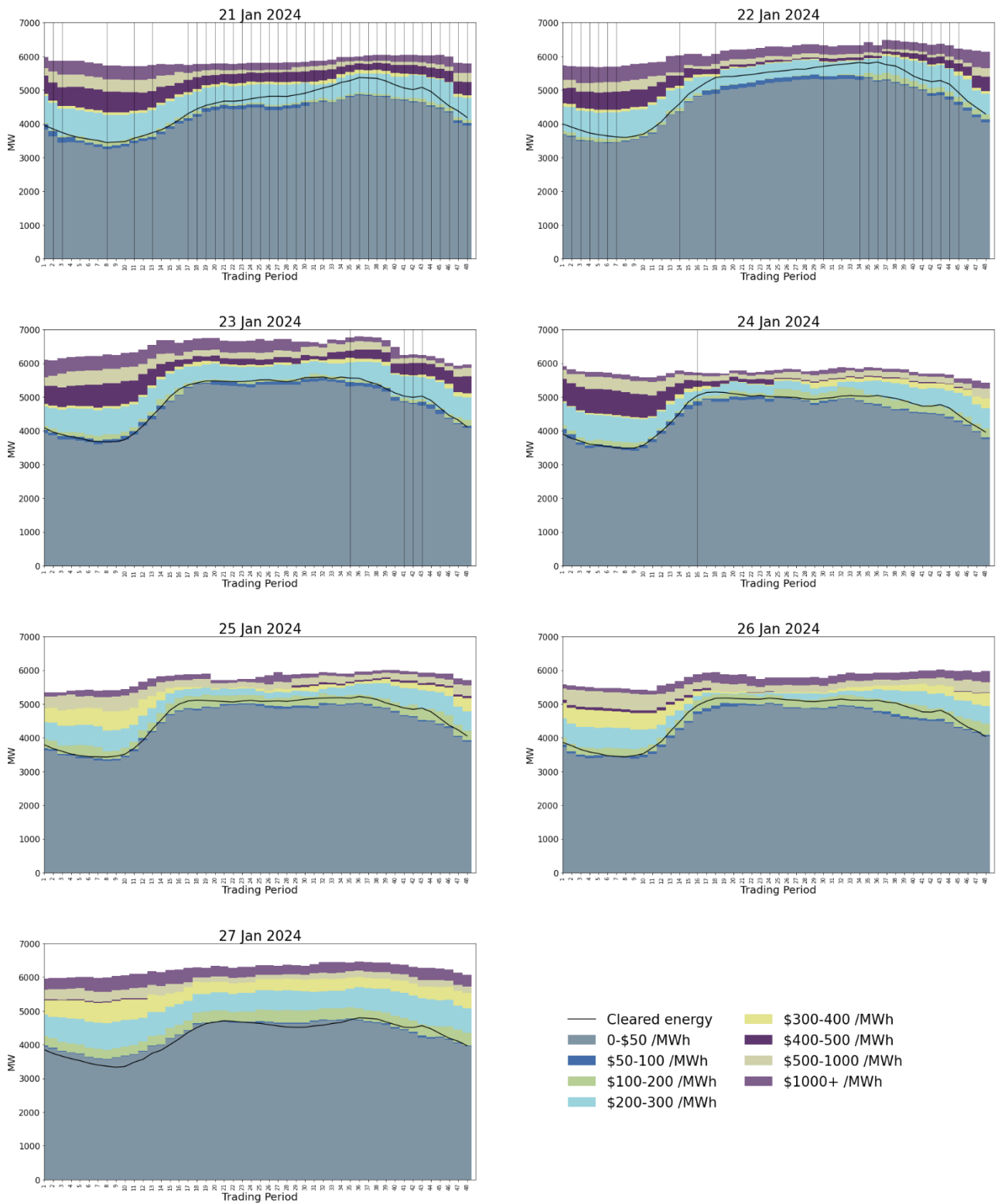
**Figure 20: Generation balance residuals 21-27 January**



### 13. Offer behaviour

- 13.1. Figure 21 shows this week's national daily offer stacks. The black line shows cleared energy, indicating the range of the average final price.
- 13.2. Prices at the start of the week were clearing in the \$200-\$300/MWh region, with market conditions driving higher prices.
- 13.3. The increase to hydro storage this week meant the latter part of the week saw offers clearing in the \$100-\$200/MWh region, with a lot of Saturday offers clearing under \$50/MWh.
- 13.4. There was still a number of offers in the \$200-\$400/MWh region in the second half of the week, although the amount offered in the \$0-\$200/MWh range was sufficient to meet the lower demand.

**Figure 21: Daily offer stacks**



Source: Electricity Authority



## 14. Ongoing work in trading conduct

- 14.1. This week there were high prices over Sunday and Monday, as well as high hydro offers over the week. We will do further analysis of offers to check this is consistent with supply and demand conditions.
- 14.2. 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>Participant</b>	<b>Location</b>	<b>Enquiry topic</b>
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	Genesis, Contact	Multiple	High energy prices associated with high energy offers.
21/01/2024-27/01/2024	Several	Further analysis	Mercury	Waikato hydro dams	High hydro offers.