7 October 2024

Trading conduct report 29 September-5 October 2024

Market monitoring weekly report

Trading conduct report 29 September-5 October 2024

1. Overview

1.1. Prices increased slightly this week compared to last week, likely due to lower wind generation. Thermal generation remained low, with only Huntly 5 and one Rankine providing baseload generation. National controlled hydro storage increased slightly this week and is currently ~110% of 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. Suspected non-compliance situations may be passed onto the Authority's compliance team. In addition to general monitoring, this report also singles 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. Between 29 September-5 October:

(a) the average wholesale spot price across all nodes was $85/MWh.

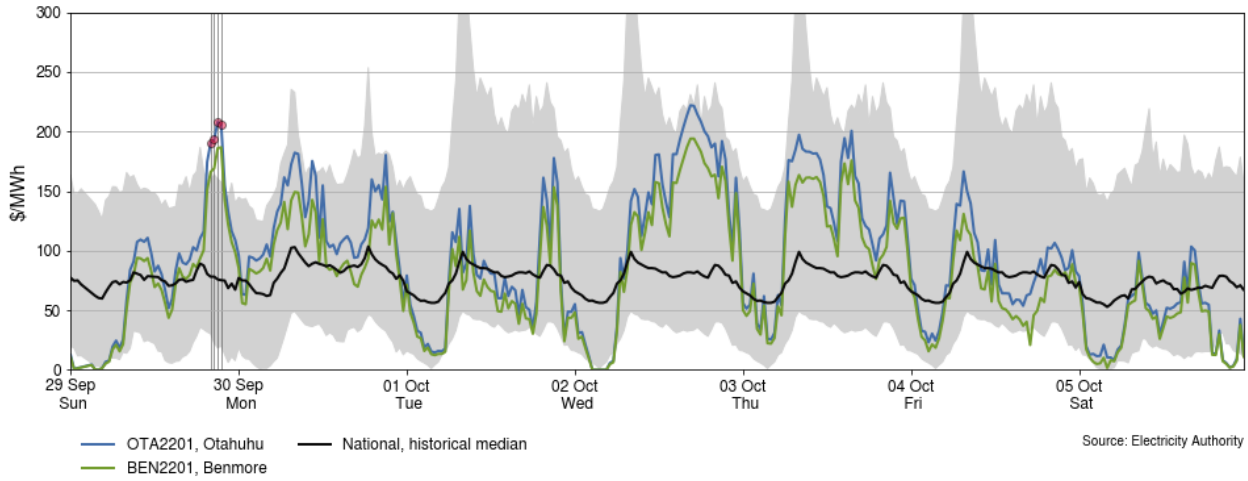
(b) 95% of prices fell between $1/MWh and $192/MWh.

2.3. Overall, the majority of spot prices were within $47-$123/MWh, with the weekly average spot price increasing by $12/MWh compared to the previous week.

2.4. The Ōtāhuhu spot price reached a maximum of $222/MWh at 4.30pm on Wednesday. It also exceeded $200/MWh during the period of highlighted prices on Sunday evening, as well as on Thursday afternoon. All prices above $200/MWh occurred at times of wind or demand forecasting inaccuracies, and/or low wind generation, requiring higher-priced hydro and thermal generation to be dispatched.

2.5. 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 of historic prices, plus the difference between this week's median and the historic median, are highlighted with a vertical black line. Other notable prices are marked with black dashed lines.

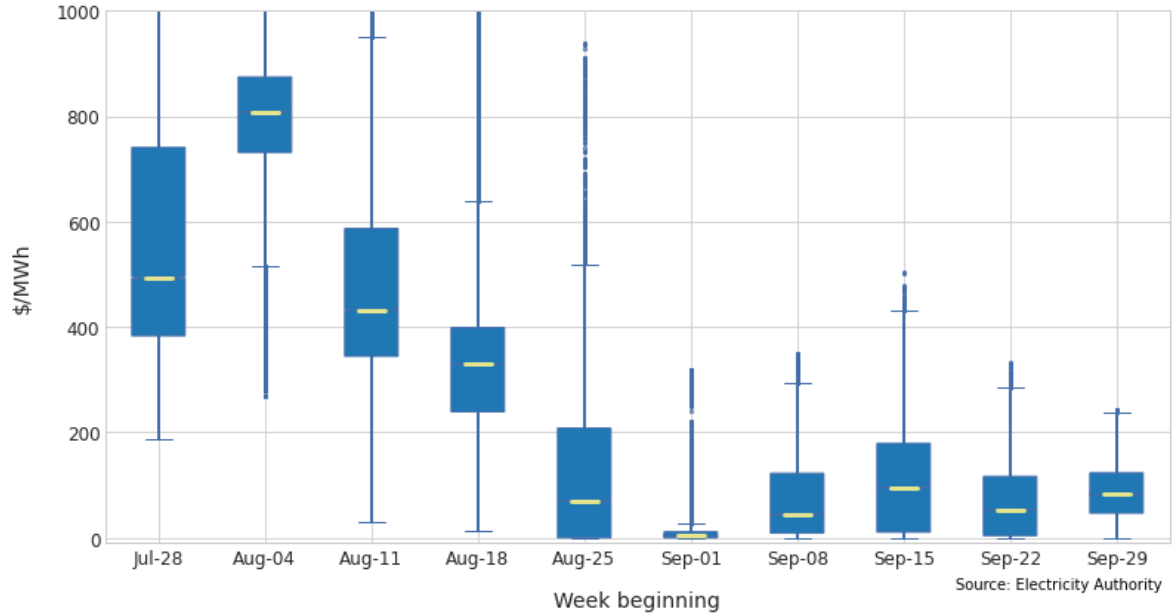
Figure 1: Wholesale spot prices at Benmore and Ōtāhuhu, 29 September-5 October



2.6. 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 blue box shows the lower and upper quartiles (where 50% of prices fell). The 'whiskers' extend to points that lie within 1.5 times of the interquartile range (IQR) of the lower and upper quartile. Observations that fall outside this range are displayed independently.

2.7. Compared to the previous week, the median price increased by $28/MWh. The interquartile range and overall spread decreased, indicating that while prices were higher than the previous week, they were also more stable.

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

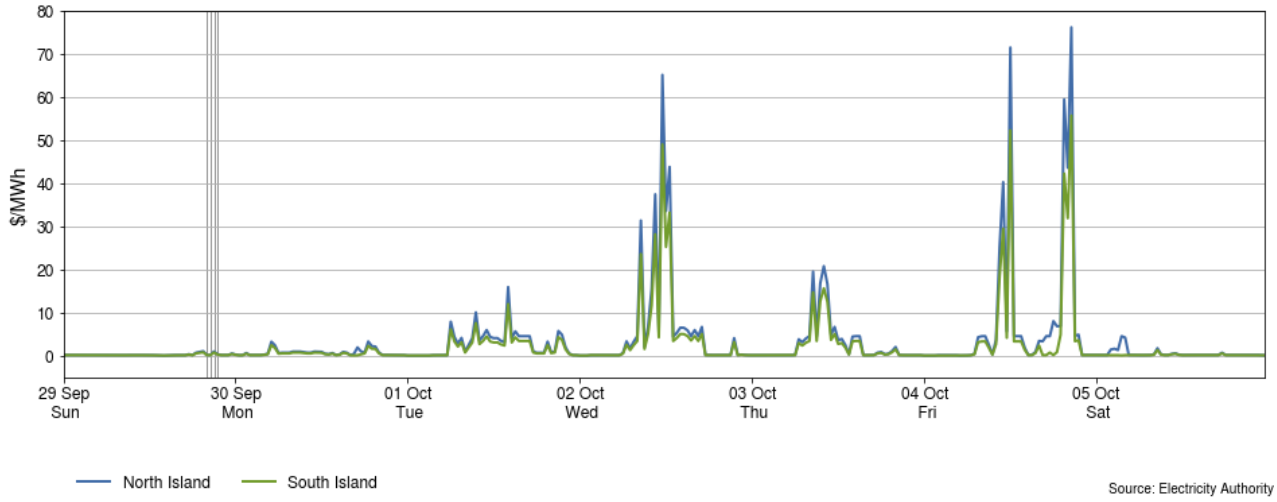


3. Reserve prices

3.1. Fast instantaneous reserve (FIR) prices for the North and South Islands are shown below in Figure 3. FIR prices were mostly below $5/MWh this week. However, they spiked above $60/MWh on Wednesday afternoon and on Friday afternoon and evening. This occurred as the amount of reserves required to cover the risk setter increased at these times. Lower

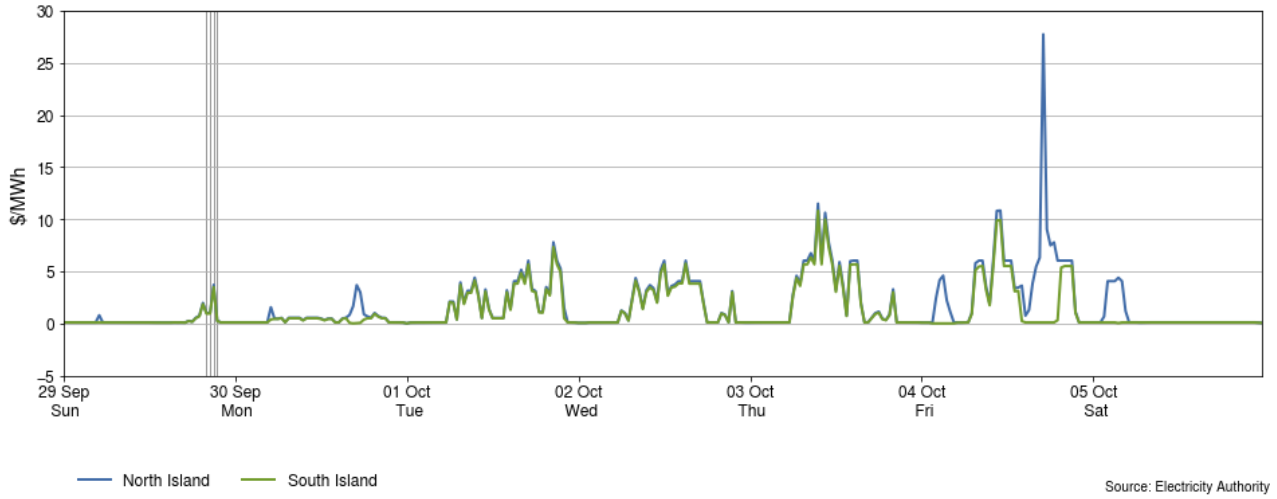
thermal commitment this week has also reduced the amount of reserve available in the market.

Figure 3: Fast instantaneous reserve price by trading period and island, 29 September-5 October



3.2. Sustained instantaneous reserve (SIR) prices for the North and South Islands are shown in Figure 4. SIR prices were mostly below $5/MWh this week but reached a maximum of $28/MWh in the North Island at 5:00pm on Friday while remaining at $0/MWh in the South Island. This occurred when high HVDC flow set the risk in the North Island, which requires domestic North Island reserves to cover the risk.

Figure 4: Sustained instantaneous reserve by trading period and island, 29 September-5 October



4. Regression residuals

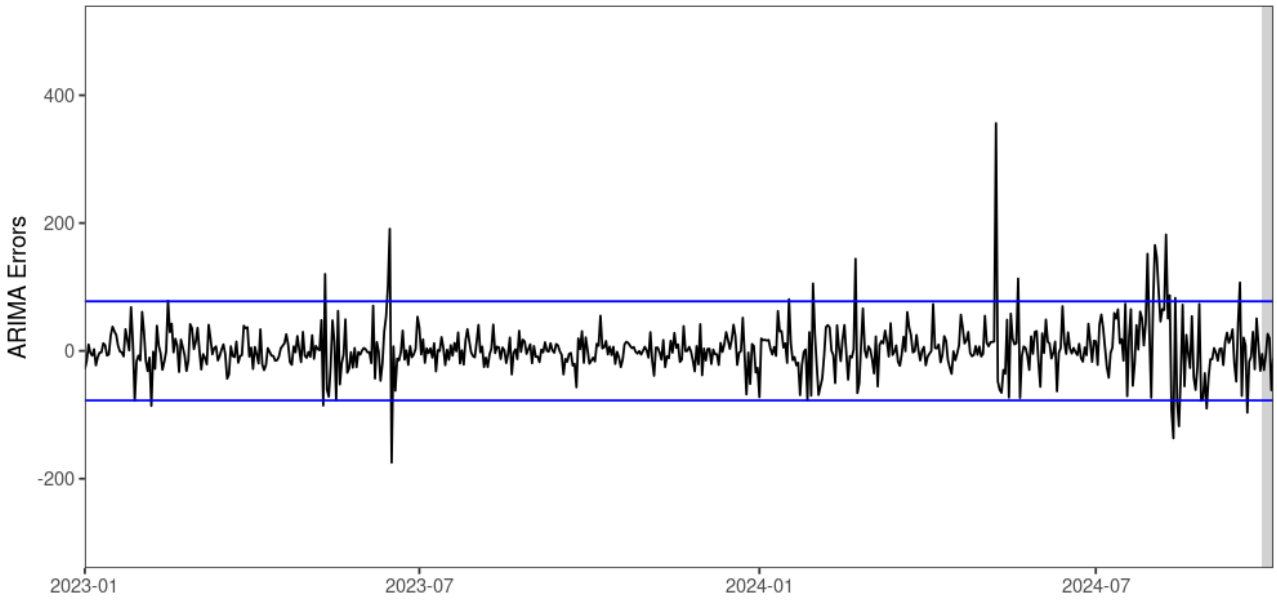
4.1. The Authority's monitoring team uses a regression model to model electricity spot prices. The residuals show how close predicted spot prices were to actual prices. Large residuals may indicate that prices do not reflect underlying supply and demand conditions. Details on the regression model and residuals can be found in Appendix A.

4.2. Figure 5 shows the residuals of autoregressive moving average (ARMA) errors from the daily model. Positive residuals indicate that the modelled daily price is lower than the 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 in the regression analysis.

4.3. This week, there were no residuals above two standard deviations of the data, indicating that prices were lower than or in line with what the model expected.

Figure 5: Residual plot of estimated daily average spot prices, 1 January 2023 – 5 October 2024

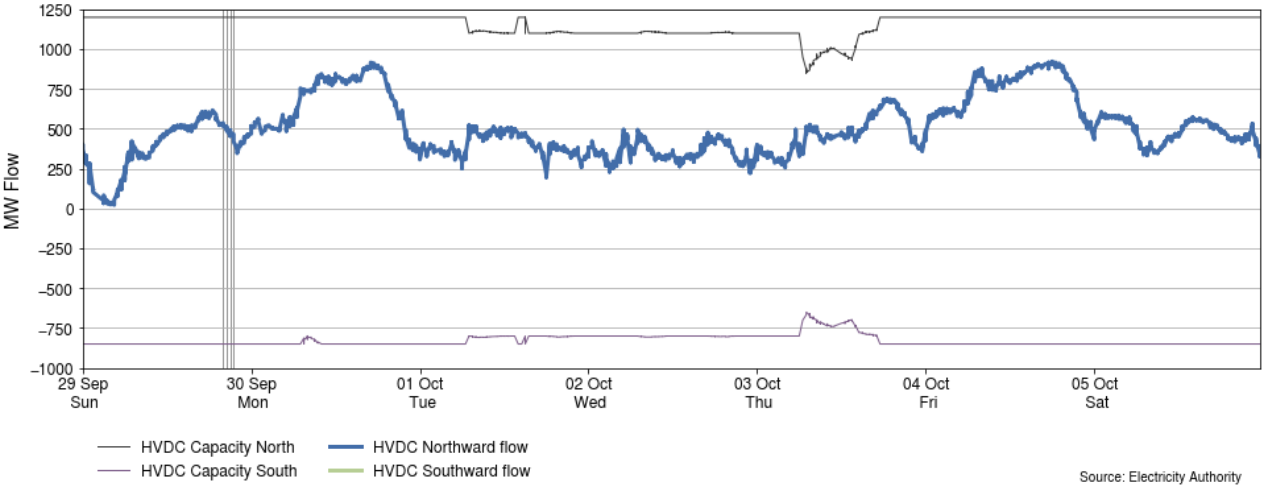


Source: Electricity Authority/see Appendix A

5. HVDC

5.1. Figure 6 shows the HVDC flow between 29 September-5 October. HVDC flow was entirely Northward this week. This was mainly due to increased hydro storage and generation. South Island demand also remained lower due to the Tiwai demand response.

Figure 6: HVDC flow and capacity, 29 September-5 October



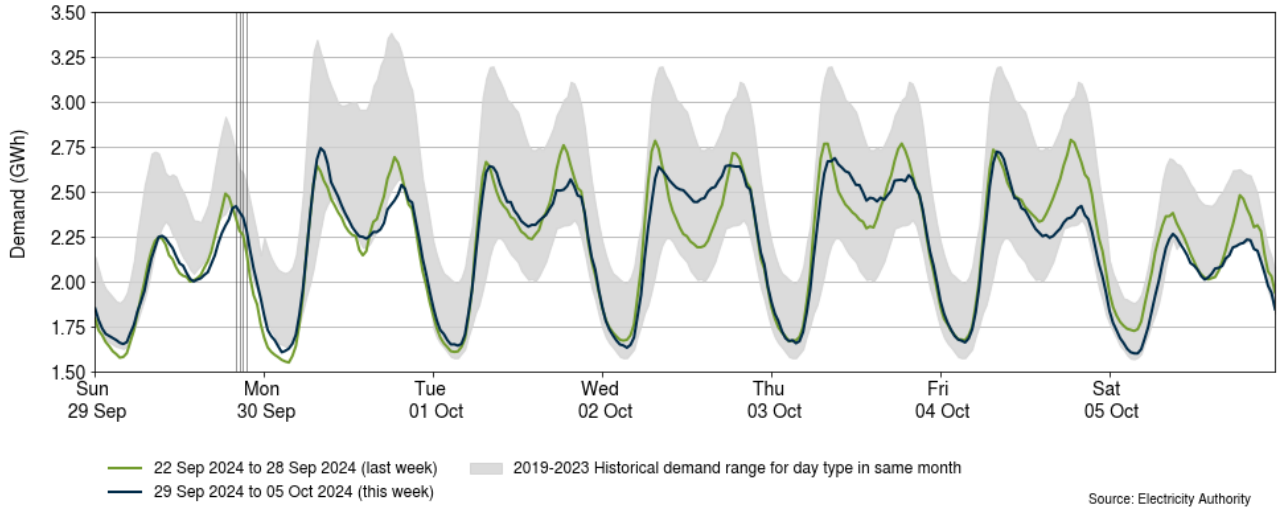
Source: Electricity Authority

6. Demand

6.1. Figure 7 shows national demand between 29 September-5 October, compared to the historic range and the demand of the previous week. Demand remained low this week,

being within or below the historical range for this time of year. It was highest on Monday morning, when temperatures were low, with the weekly maximum demand of 2.74GWh occurring at 8.00am.

Figure 7: National demand, 29 September-5 October compared to historic range and previous week

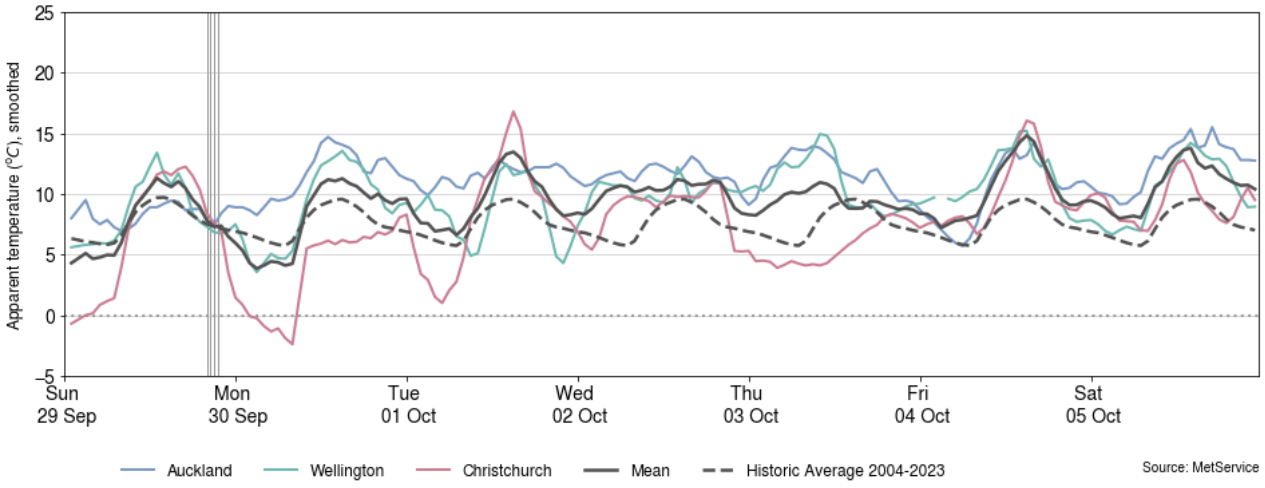


6.2. Temperatures were mostly above average this week, ranging from 6°C to 16°C in Auckland, 3°C to 16°C in Wellington, and -3°C to 18°C in Christchurch.

6.3. Figure 8 shows the hourly apparent temperature at main population centres from 29 September-5 October 2024. The apparent temperature is an adjustment of the recorded temperature that accounts for factors like wind speed and humidity to estimate how cold it feels. Also included for reference is the mean temperature of the main population centres, and the mean historical apparent temperature of similar weeks, from previous years, averaged across the three main population centres.

6.4. Temperatures were mostly above average this week, ranging from 6°C to 16°C in Auckland, 3°C to 16°C in Wellington, and -3°C to 18°C in Christchurch.

Figure 8: Temperatures across main centres, 29 September-5 October

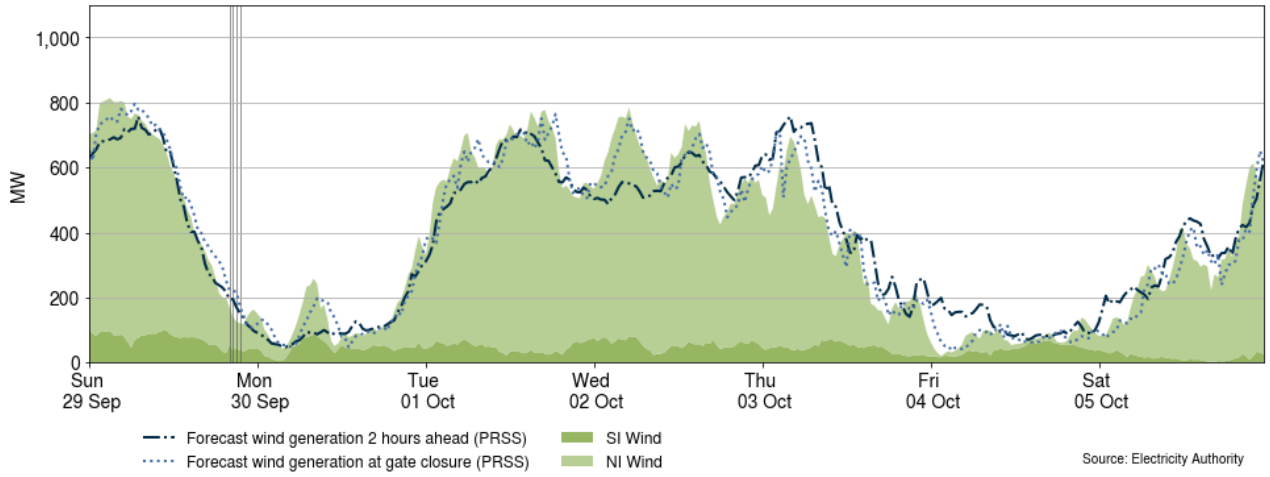


7. Generation

7.1. Figure 9 shows wind generation and forecast from 29 September-5 October. This week wind generation varied between 21MW and 813MW, with a weekly average of 374MW.

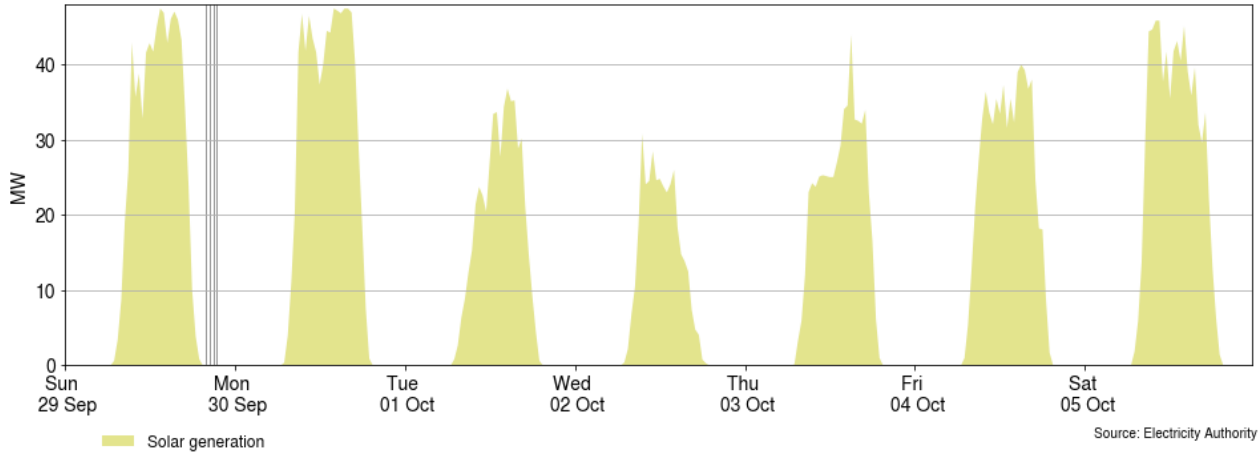
Wind generation was low and/or below forecast at many of the times prices exceeded $200/MWh this week. During the period of highlighted prices on Sunday evening, wind generation was below 200MW and over forecast by as much as 106MW.

Figure 9: Wind generation and forecast, 29 September-5 October



7.2. Figure 10 shows solar generation from 29 September-5 October. Solar generation peaked above 35MW every day this week except Wednesday.

Figure 10: Solar generation, 29 September-5 October

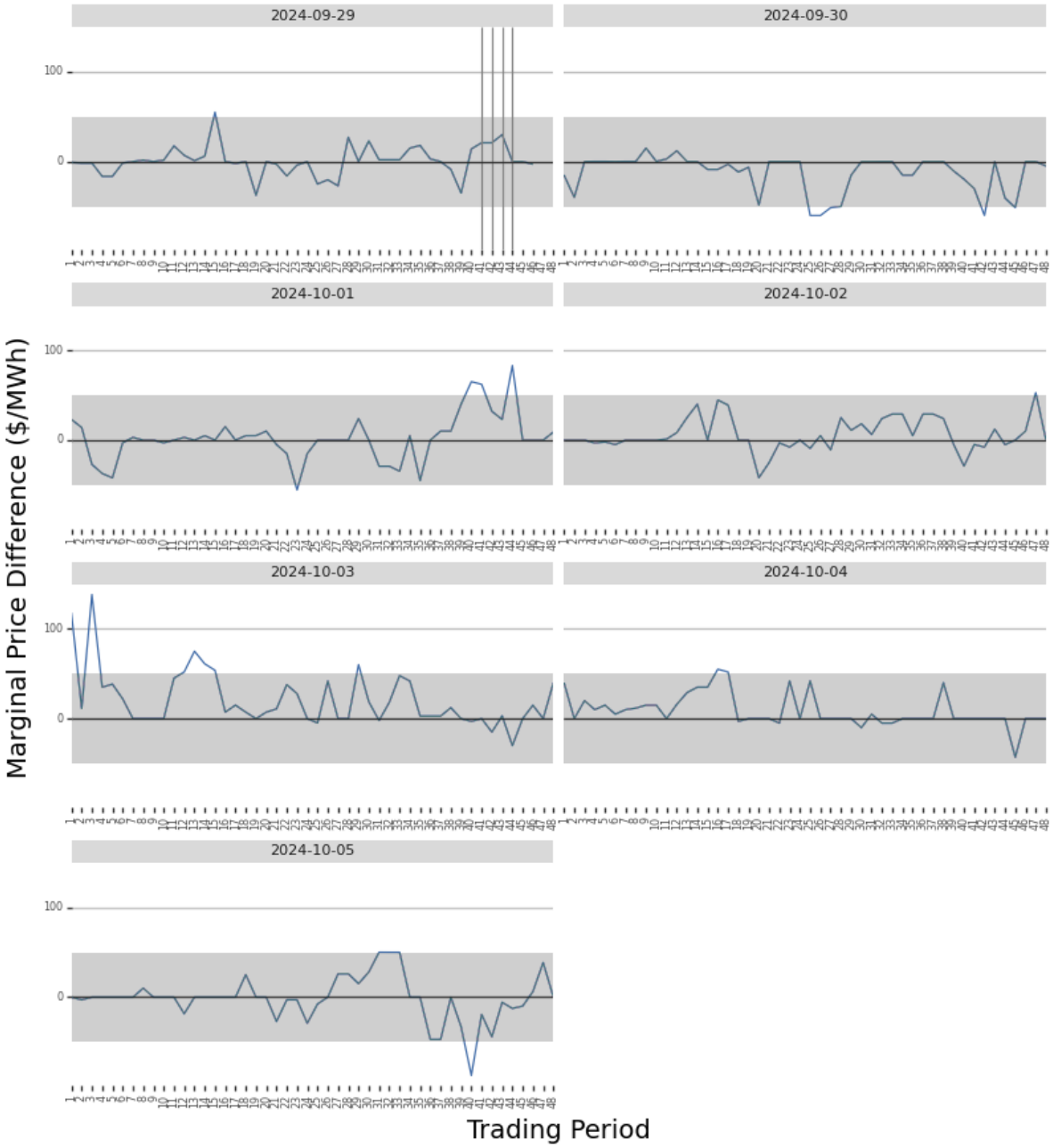


7.3. Figure 11 shows the difference between the national real-time dispatch (RTD) marginal price and a simulated marginal price where the real-time wind and demand matched the 1-hour ahead forecast (PRSS[1]) projections. The figure highlights when forecasting inaccuracies are causing large differences to final prices. When the difference is positive this means that the 1-hour ahead forecasting inaccuracies resulted in the spot price being higher than anticipated - usually here demand is under forecast and/or wind is over forecast. When the difference is negative, the opposite is true. Because of the nature of demand and wind forecasting, the 1-hour ahead and the RTD wind and demand forecasts will rarely be the same. Trading periods where this difference is exceptionally large can signal that forecasting inaccuracies had a large impact on the final price for that trading period.

[1] Price responsive schedule short – short schedules are produced every 30 minutes and produce forecasts for the next 4 hours.

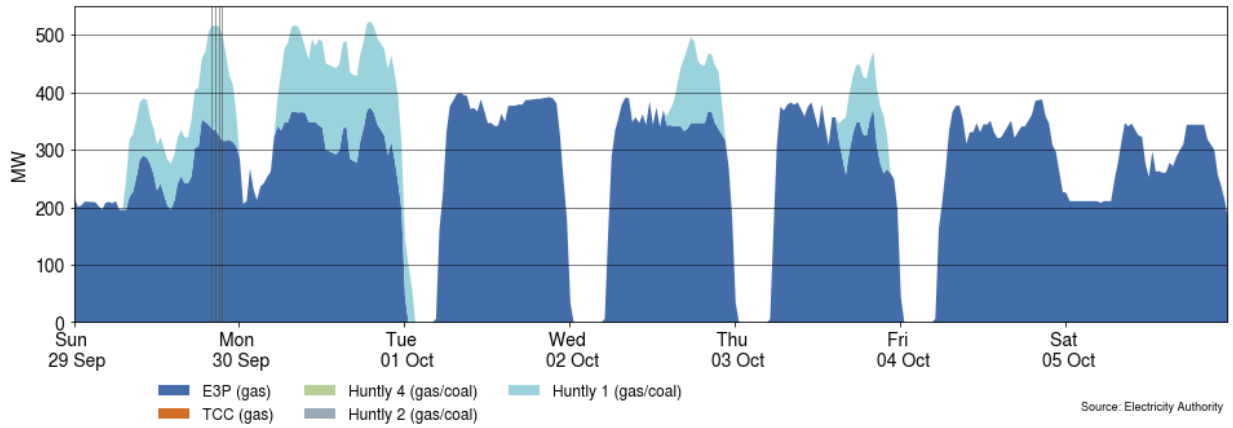
7.4. The most notable positive (marginal prices higher than simulation) difference this week was $138/MWh at 1.00am on Thursday, when wind generation was 136MW lower than forecast and demand was 44MW higher than forecast. The only other positive difference greater than $100/MWh also occurred early on Thursday. The differences throughout Thursday were mostly positive, which was when wind was consistently over-forecast. Throughout the rest of the week, prices were largely similar to those simulated.

Figure 11: Difference between national marginal RTD price and simulated RTD price, with the difference due to one-hour ahead wind and demand forecast inaccuracies, 29 September-5 October



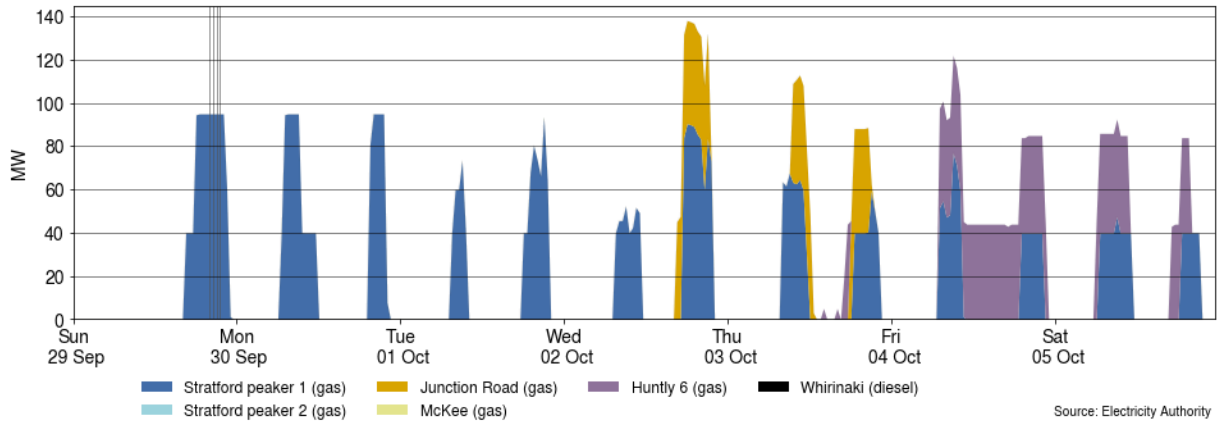
7.5. Figure 12 shows the generation of thermal baseload between 29 September-5 October. Huntly 5 (E3P) ran each day this week, shutting off overnight shortly after midnight between Tuesday and Friday. Huntly 1 also ran on Sunday, Monday, Wednesday and Thursday. Thermal generation was highest on Sunday night and Monday when wind was low.

Figure 12: Thermal baseload generation, 29 September-5 October



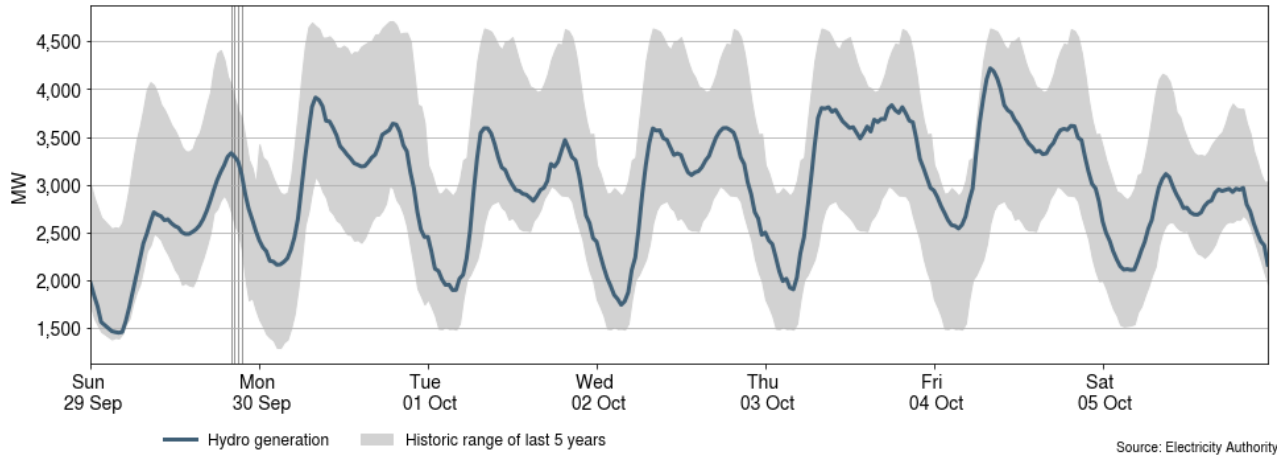
7.6. Figure 13 shows the generation of thermal peaker plants between 29 September-5 October. Stratford peaker 1 ran each day this week, mostly during peak and shoulder periods. It was joined by Junction Road on Wednesday evening and on Thursday. Huntly 6 ran briefly on Thursday, for most of Friday, and during peak periods on Saturday.

Figure 13: Thermal peaker generation, 29 September-5 October



7.7. Figure 14 shows hydro generation between 29 September-5 October. Hydro generation this week was within the historical range of the last five years. It was highest on Friday morning when wind generation was very low.

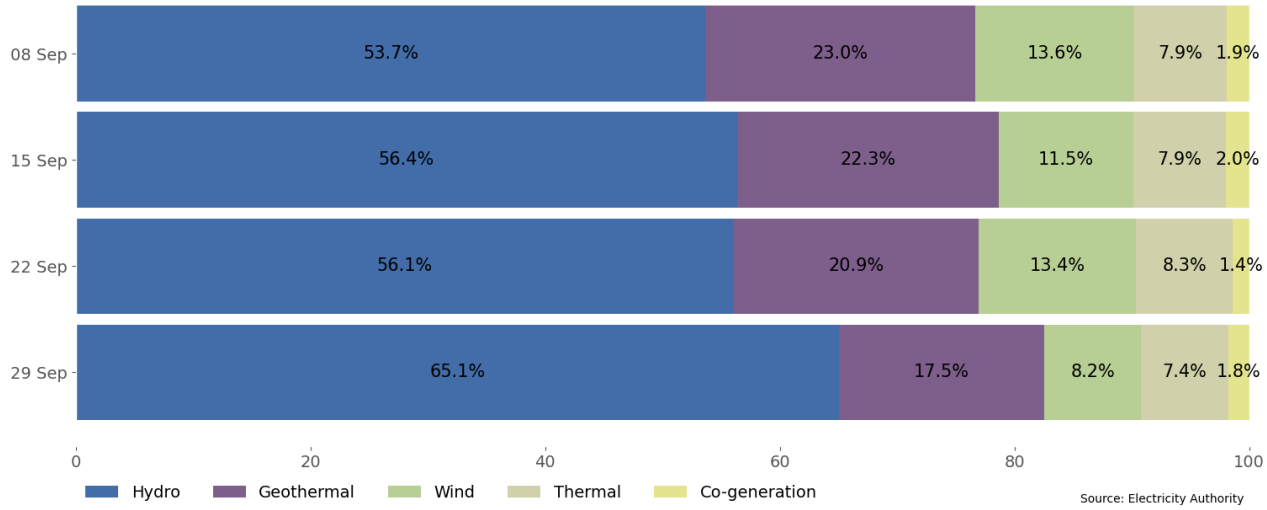
Figure 14: Hydro generation, 29 September-5 October



7.8. As a percentage of total generation, between 29 September-5 October, total weekly hydro generation was 65.1%, geothermal 17.5%, wind 8.2%, thermal 7.4%, and co-generation

1.8%, as shown in Figure 15. The proportion of wind generation decreased this week, as did the proportion of geothermal generation due to outages at Te Mihi. This, combined with increased hydro storage, led to a significant increase in the proportion of hydro generation.

Figure 15: Total generation by type as a percentage each week, 1-28 September 2024



8. Outages

8.1. Figure 16 shows generation capacity on outage. Total capacity on outage between 29 September-5 October ranged between ~1,320MW and ~2,050MW. Figure 17 shows the thermal generation capacity outages.

8.2. Notable outages include:

(a) Huntly 4 is on outage from 3-11 October.

(b) Huntly 2 was on outage until 6 December.

(c) Stratford unit 2 is on outage until 23 October.

(d) McKee has one unit on outage from 1-11 October.

(e) Huntly 6 was on outage from 7 September to 3 October.

(f) Junction Road had one unit on outage on 29 September.

(g) Te Mihi geothermal unit 1 is on outage from 22 September-19 October.

(h) Te Mihi geothermal unit 2 is on outage from 27 September-24 October.

(i) A number of South Island hydro units were also on outage this week, including units from Manapōuri, Benmore and Ōhau.

Figure 16: Total MW loss from generation outages, 29 September-5 October

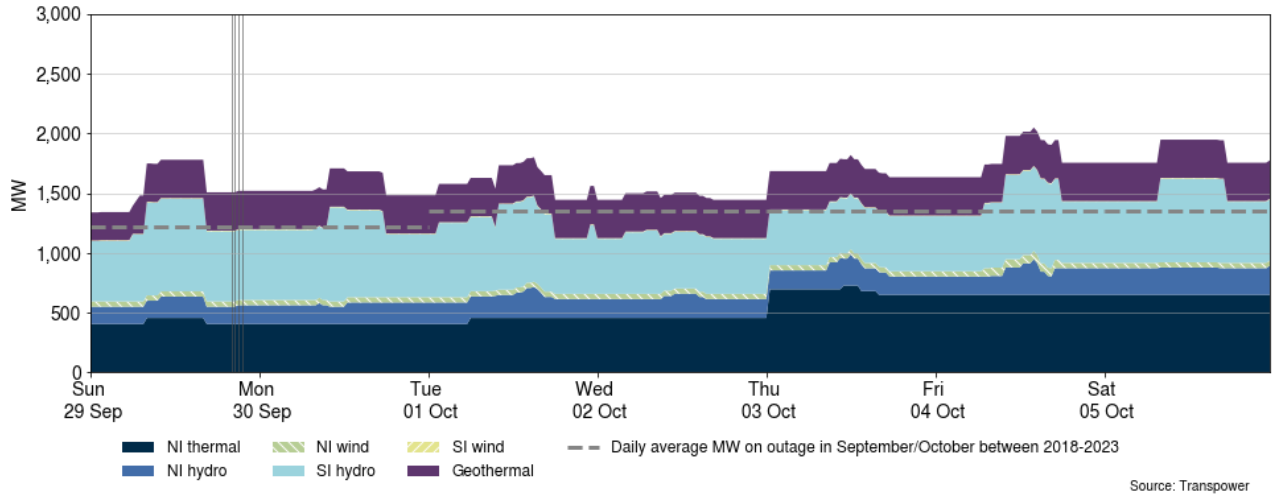
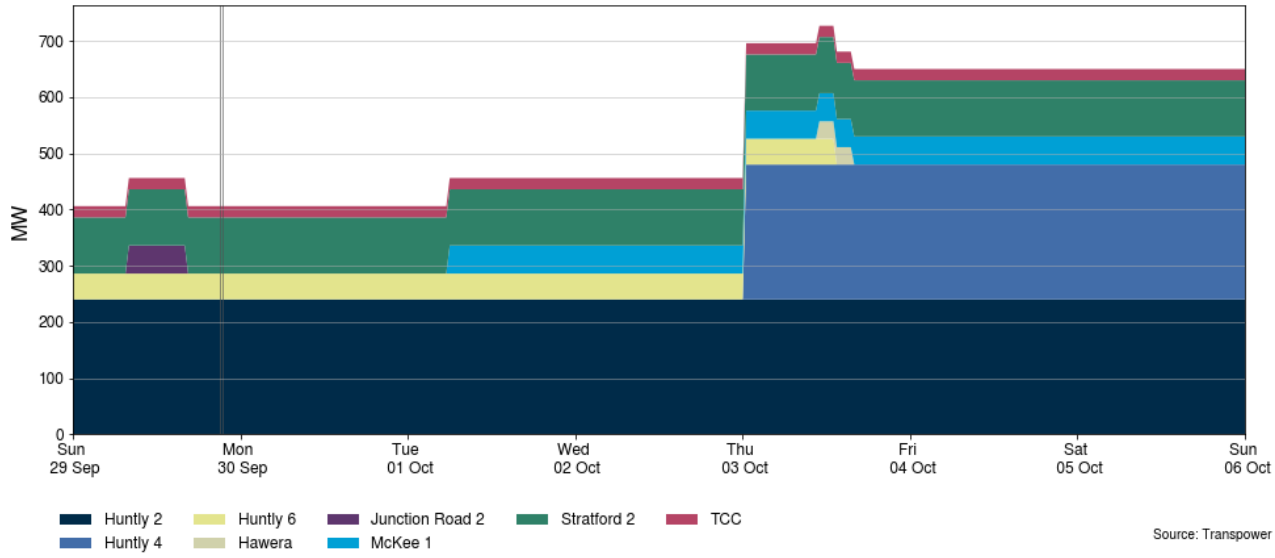


Figure 17: Total MW loss from thermal outages, 29 September-5 October

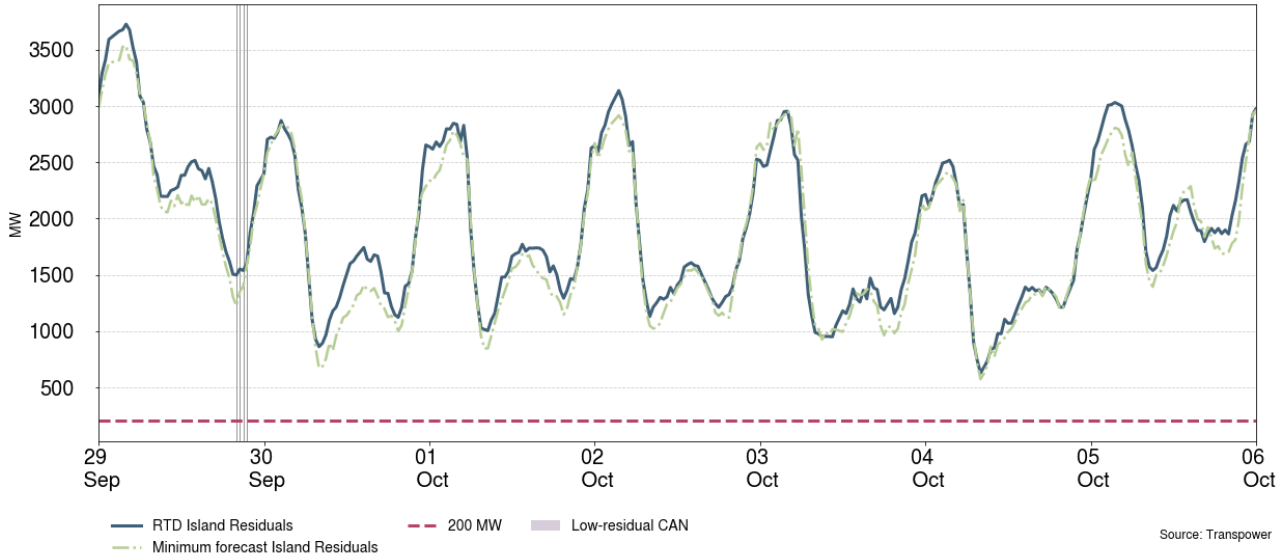


9. Generation balance residuals

9.1. Figure 18 shows the national generation balance residuals between 29 September-5 October. A residual is the difference between total energy supply and total energy demand for each trading period. 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 line represents the real-time dispatch (RTD) residuals.

9.2. Generation balances were healthy this week. The minimum North Island residual was 626MW at 8.00am on Friday.

Figure 18: National generation balance residuals, 29 September-5 October



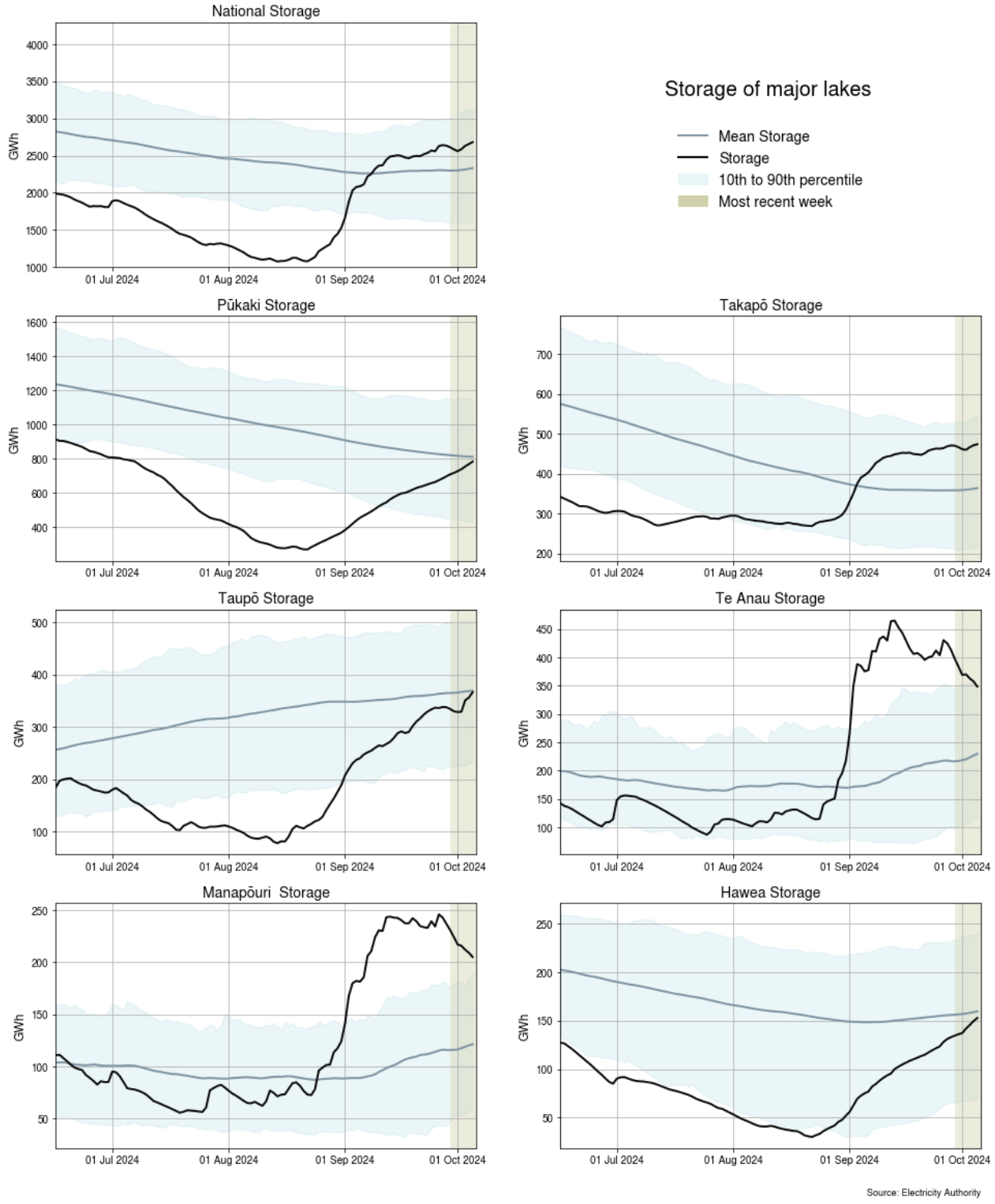
10. Storage/fuel supply

10.1. Figure 19 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.

10.2. National controlled storage increased slightly this week. As of 5 October, storage was 66% nominally full and ~110% of the historical average for this time of the year.

10.3. Storage increased at all major lakes this week, except Te Anau and Manapōuri. Te Anau is at its 90th percentile while Manapōuri remains above its 90th percentile. Taupō, Pūkaki and Hawea are now near their respective means. Takapō is above mean but below its 90th percentile.

Figure 19: Hydro storage



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 20 shows an estimate of thermal SRMCs as a monthly average up to 1 October 2024. The SRMC for gas has increased slightly from the previous month, while the coal SRMC and diesel SRMC have remained stable.

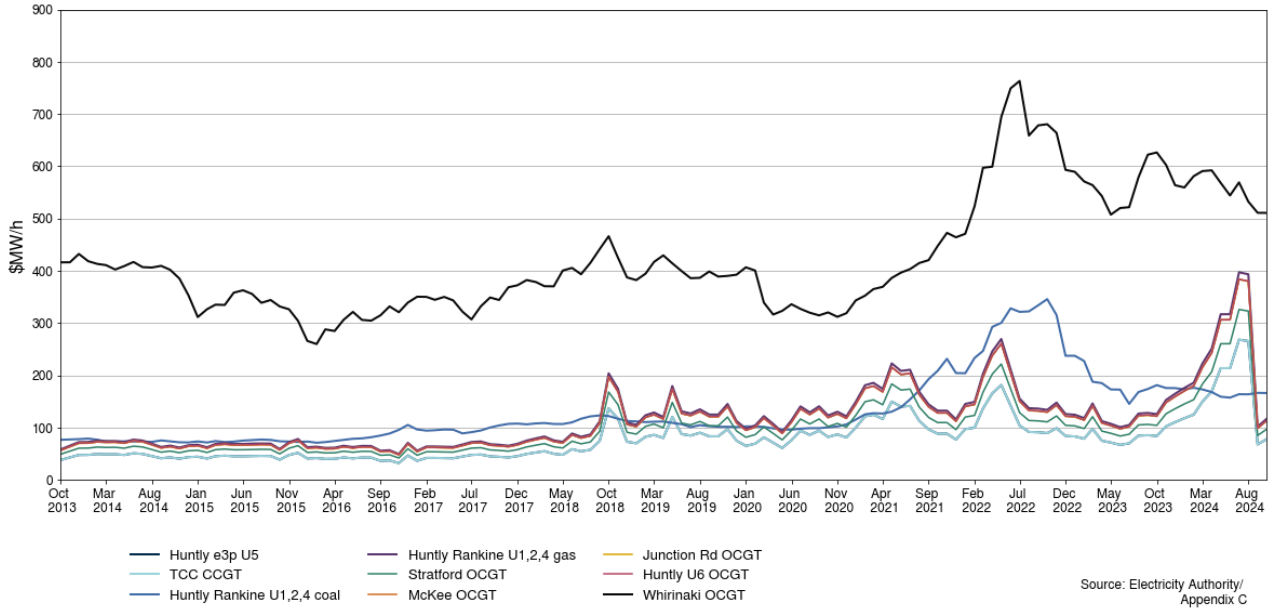
11.4. The latest SRMC of coal-fueled Rankine generation is ~$167/MWh. The cost of running the Rankines on gas remains less expensive at ~$117/MWh.

11.5. The SRMC of gas fuelled thermal plants is currently between ~$78/MWh and ~$117/MWh.

11.6. The SRMC of Whirinaki is ~$511/MWh.

11.7. More information on how the SRMC of thermal plants is calculated can be found in Appendix C.

Figure 20: Estimated monthly SRMC for thermal fuels

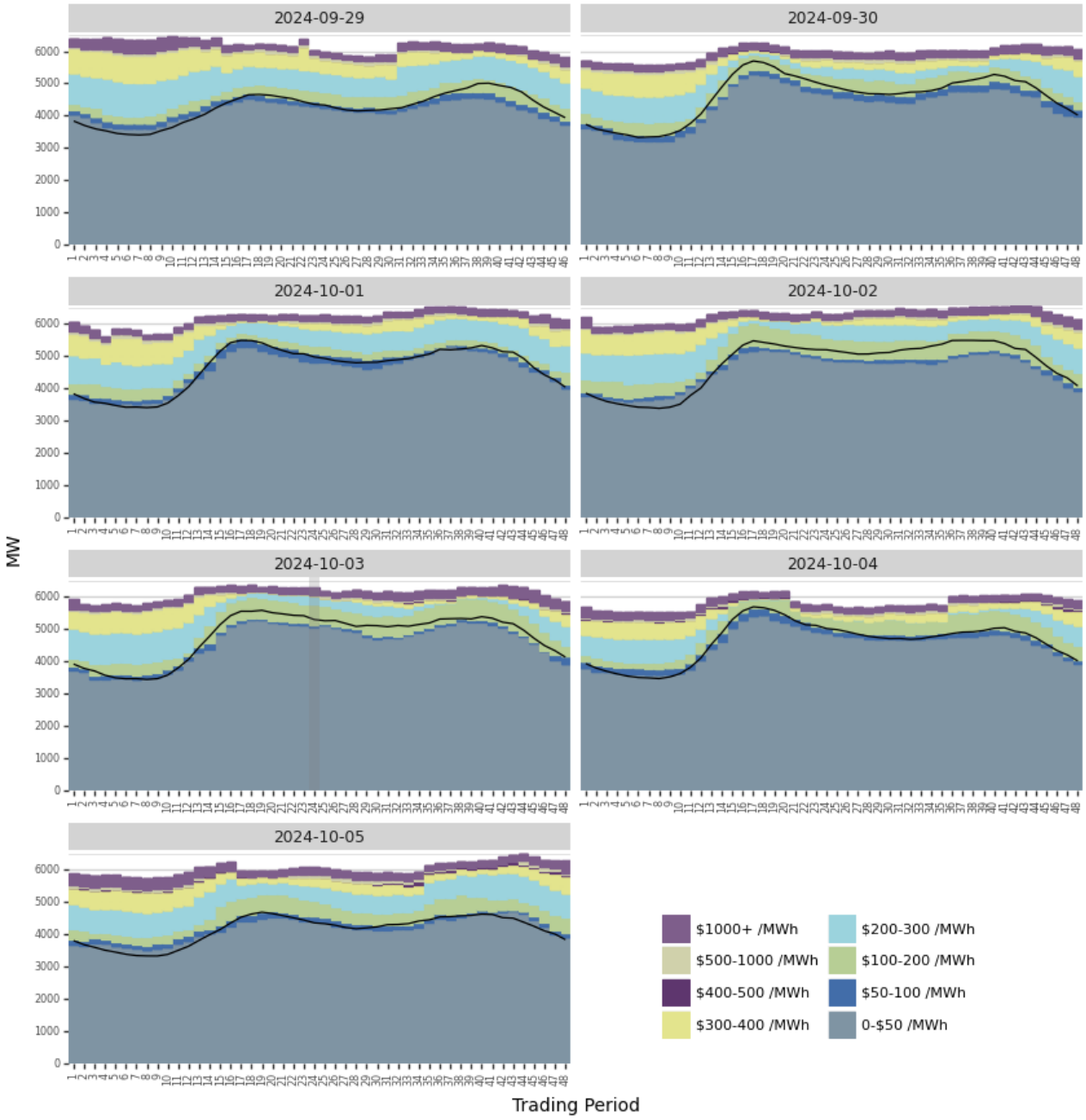


12. Offer behaviour

12.1. Figure 21 shows this week's national daily offer stacks. The black line shows cleared energy, indicating the range of the average final price.

12.2. Most offers cleared below $200/MWh this week. There has been an increase in the volume offered within $100-$200/MWh this week as hydro storage has increased. This has seen a reduction to the size of the offer stack above $400/MWh.

Figure 21: Daily offer stacks[2]



13. Ongoing work in trading conduct

13.1. Prices generally appeared to be consistent with supply and demand conditions this week, however, some offers are being analysed further to ensure compliance with the trading conduct rule.

13.2. Further analysis is being done on the trading periods in Table 1 as indicated.

[2] PRSS data has been used for trading periods where RTD data was not available. These stacks will be highlighted within the offer stack and may be slightly higher than the adjusted offers

Table 1: Trading periods identified for further analysis

Date	Trading period	Status	Participant	Location	Enquiry topic
14/06/2023-15/06/2023	15-17/ 15-19	Passed to Compliance for advice	Genesis	Multiple	High energy prices associated with high energy offers
22/09/2023-30/09/2023	Several	Passed to Compliance for advice	Contact	Multiple	High hydro offers
1/07/2024-23/08/2024	Several	These trading periods are now part of a s16 review	N/A	N/A	High energy prices
26/08/2024-26/08/2024	Several	Further analysis	Manawa	Tararua wind farms	Wind forecasting
3-4/09/2024 and 13-18/09/2024	Several	Further analysis	Contact Energy	Clutha scheme	Hydro offers