

Trading Conduct Report

Market Monitoring Weekly Report

1. Overview for the week of 4 - 10 December

- 1.1. All wholesale spot prices between 4-10 December appear to be consistent with market conditions.

2. Spot Prices

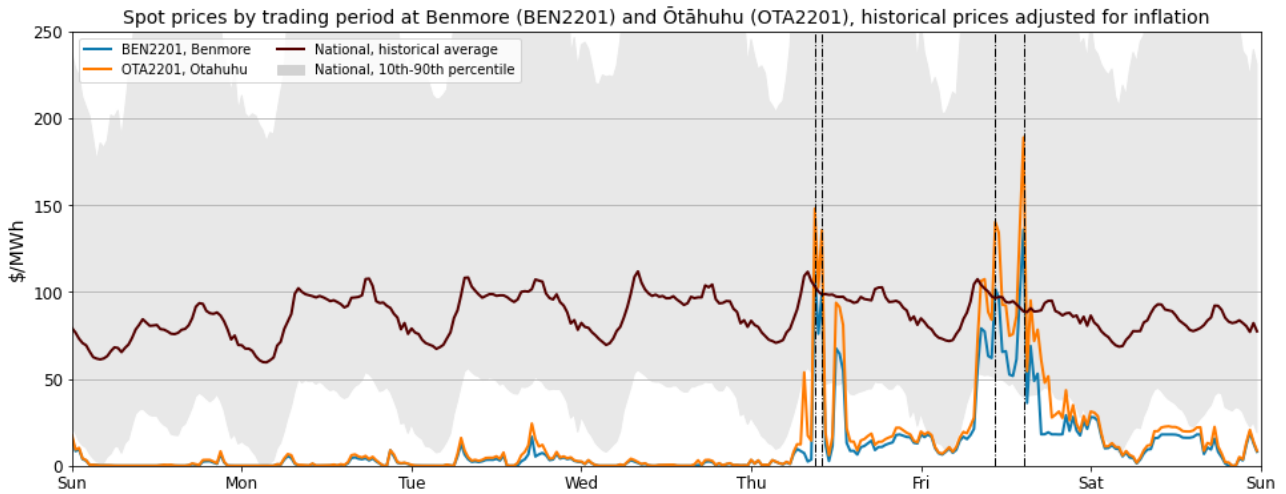
- 2.1. This report monitors underlying wholesale price drivers to assess whether there are trading periods that require further analysis for the purpose of considering potential non-compliance with the trading conduct rule. In addition to general monitoring, we also single out unusually high-priced individual trading periods for further analysis by identifying when wholesale electricity spot prices at Benmore and/or Ōtāhuhu nodes exceed their historical 90th percentiles.
- 2.2. Between 4 - 10 December:
- (a) The average wholesale spot price across all nodes was \$11.50/MWh.
 - (b) 95 per cent of prices fell between \$0.01/MWh and \$85/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. Average spot prices decreased again this week, with frequent instances of very low off-peak prices in both Islands between Sunday and Wednesday. Prices on Thursday and Friday were volatile - with price spikes, but these were all below the 90th percentile. The largest price spike occurred on:
- (i) Friday at 2:30 pm, with a \$188/MWh price at Ōtāhuhu and \$135/MWh price at Benmore.

Note this price, and the three others over \$140/MWh in the North Island, are marked by dotted lines in this report.

- 2.5. Price separation occurred less this week, with its magnitude diminished, compared to that seen in November. The largest and longest stints of price separation occurred on Thursday and Friday.
- 2.6. The instances of higher spot prices on Thursday and Friday were due to low wind generation – below 300 MW – coupled with outages of South Island hydro, North Island wind, and geothermal, thinning out the bottom of the offer stack in both Islands. Also, since less North Island thermal was running on Thursday and Friday, more South Island hydro generation was transported North, causing higher priced South Island offers to clear - with these higher prices in the South being exported North. Shoulder periods were more impacted by this, as fewer thermal units are generally committed, compared to peak periods. Higher shoulder load on Friday may also have contributed to the price spikes on

that day. Also, prices between Monday and Wednesday were likely dampened due to E3P running and high wind.

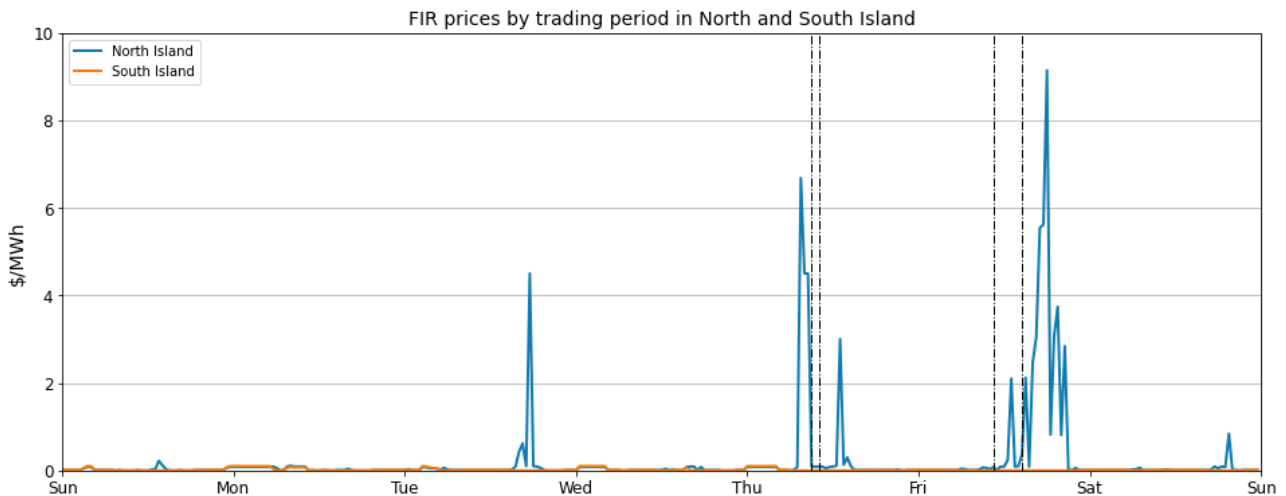
Figure 1: Wholesale Spot Prices



3. Reserve Prices

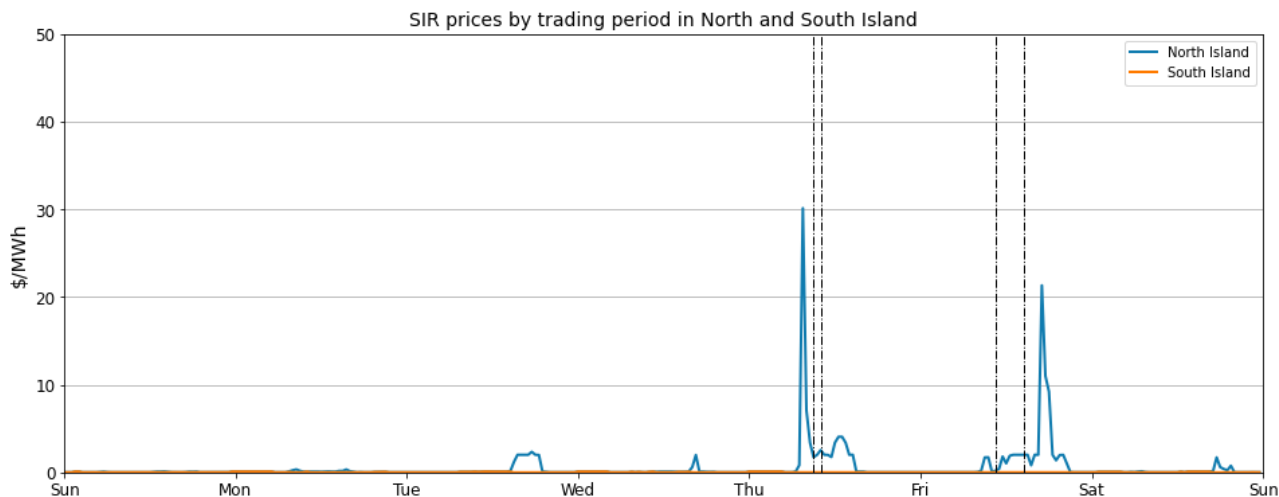
3.1. Fast instantaneous reserve (FIR) prices for the North and South Island are shown below in Figure 2. Most trading periods this week had FIR prices below \$5/MWh. There were, however, some North Island FIR price spikes above \$5/MWh on Thursday and Friday. However, none of these coincided with the spot prices spikes.

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. Most SIR prices this week were below \$5/MWh. North Island SIR prices spiked on Thursday and Friday. The largest spike at ~\$30/MWh. However, none of these SIR price spike coincided with spot price spikes.

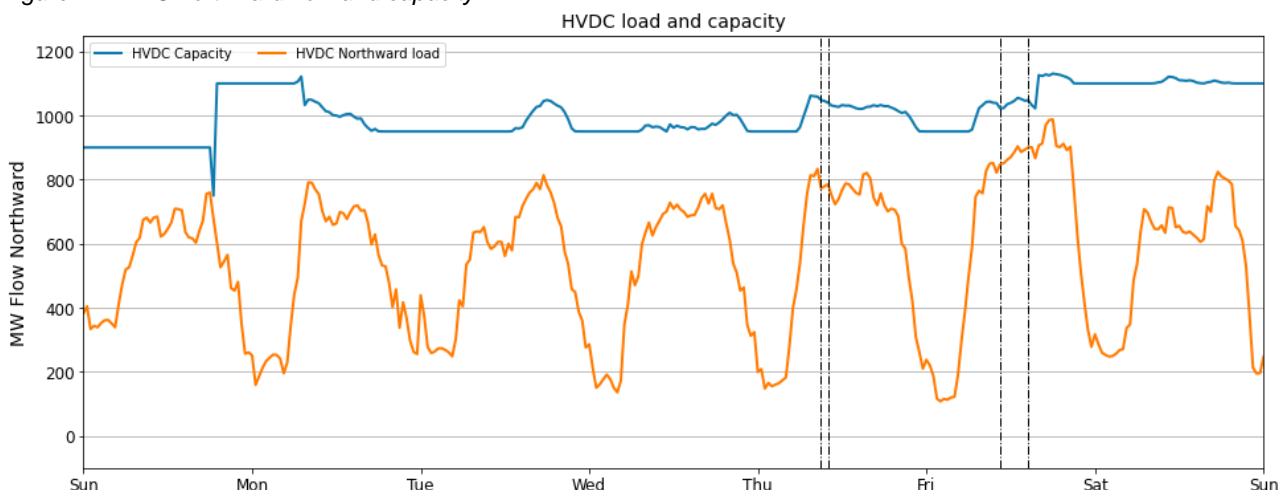
Figure 3: SIR prices by trading period and Island



4. HVDC

4.1. Figure 4 shows northward HVDC flow between 4-10 December. Northward HVDC flow reduced somewhat this week, staying mostly below 800 MW between Sunday and Thursday. The slightly higher Northwards flows on Thursday and Friday likely impacted to reserve prices – but to a lesser extent to that seen in previous weeks.

Figure 4: HVDC northward flow and capacity

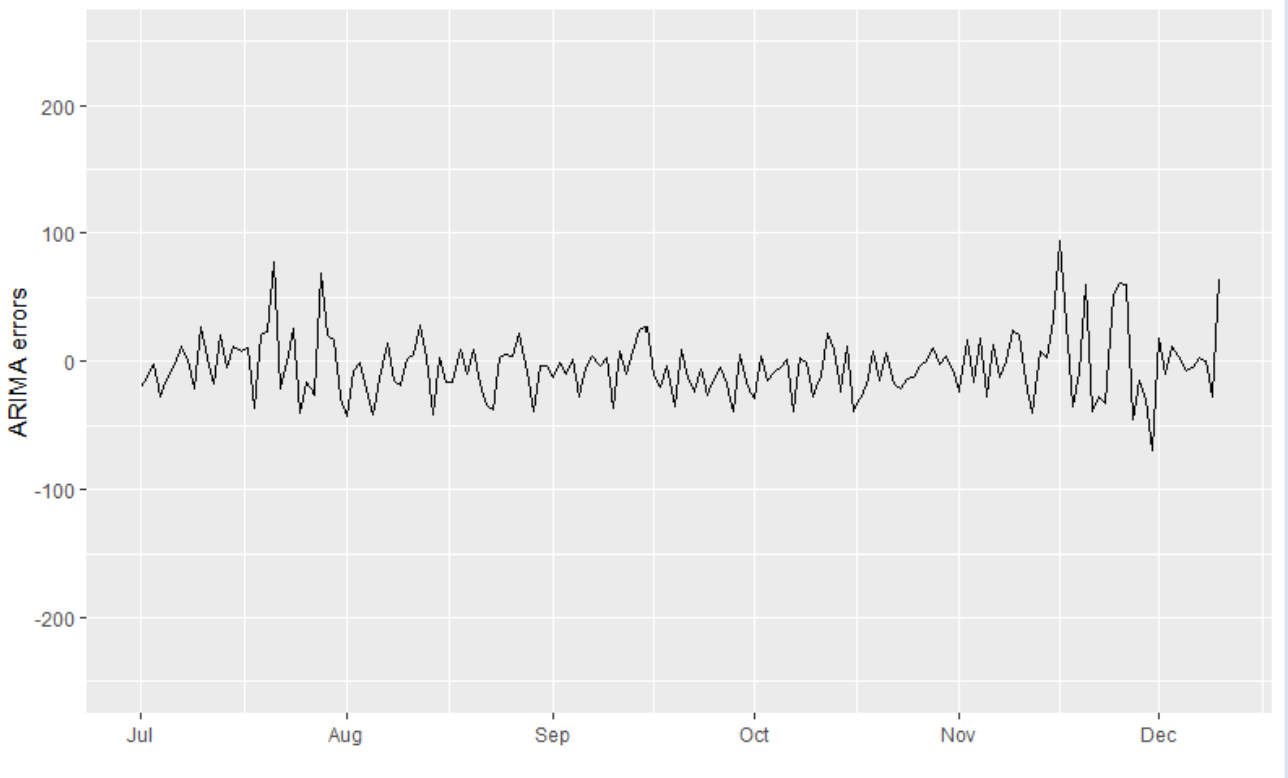


5. Regression Residuals

- 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 4-10 December were large on some days. The residuals for Sunday and Wednesday show the model overestimated the price, while the residual for Saturday shows the model underestimated the price. The remaining days had small residuals suggesting that prices on those dates appear to be aligned with market conditions.

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

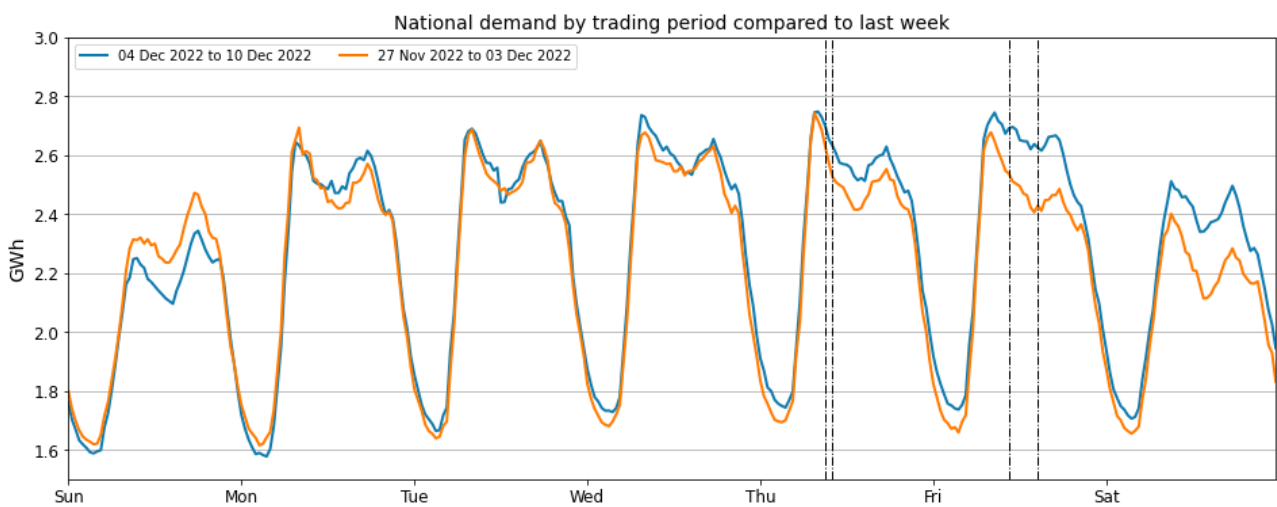
Figure 5: Residual plot of estimated daily average spot prices from 1 July – 10 December 2022



6. Demand

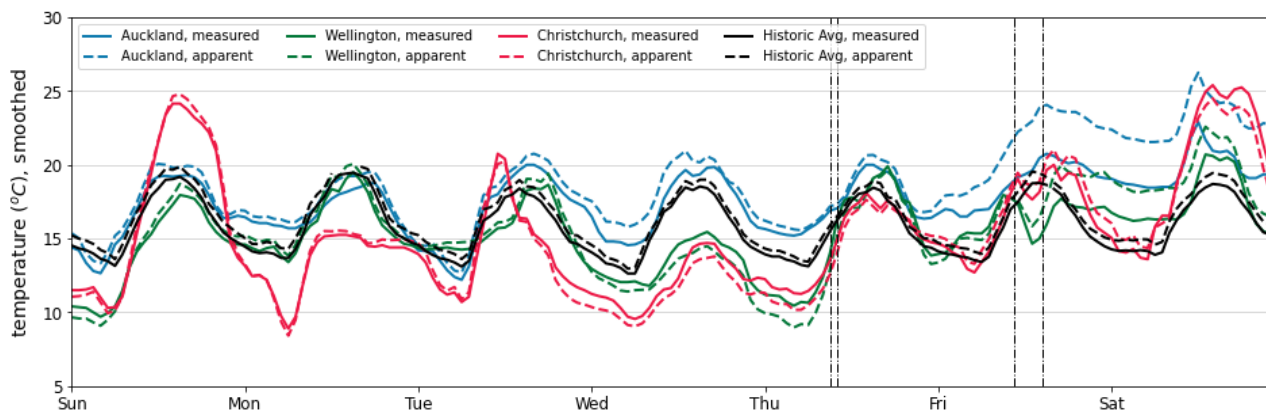
6.1. Figure 6 shows this week's national grid demand compared to the previous week. Demand between 20-26 November was similar to, or slightly greater than, the previous week due to the slightly cooler temperatures on Wednesday - Thursday, which generally increases demand. The higher demand seen on Friday could be from increased load from air conditioning, as temperatures in Auckland were above 20 degrees. This higher shoulder load may also have contributed to the price spikes.

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



- 6.2. 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.
- 6.3. Temperatures were mostly above the historic average in Auckland this week – with the apparent temperature almost reaching 25 degrees on Friday. However, temperatures in Wellington and Christchurch were below average on Tuesday and Wednesday, and then around average on Thursday and Friday. Temperatures were then high on Saturday, reaching 25 degrees in Christchurch.

Figure 7: Temperatures across main centres



7. Outages

- 7.1. Figure 8 shows generation capacity on outage. Total capacity on outage ranged between 1,000 – 1,600MW over the week. Outages stepped down from 1,600 MW on Sunday to 1,200MW on Monday. Outages during parts of the week reached 1,400 MW as some South Island wind and hydro went on outage.
- 7.2. Figure 9 shows that outages are usually around 1500 MW on average at this time of the year. The high capacity on outage this year is consistent with normal outage activity for this time of year. Monthly average outages per year for 2018 to 2021 are shown in Figure 9.
- 7.3. Outages of note include:
- The outage of Huntly 5 ended on Sunday.
 - Huntly 4 remained on outage.
 - Geothermal outages reduced to less than 100 MW from Wednesday onwards.
 - Over 100 MW of North Island wind was on outage between Wednesday and Friday.
 - Multiple Manapōuri units went on outage during the week.

Figure 8: Total MW loss due to generation outages

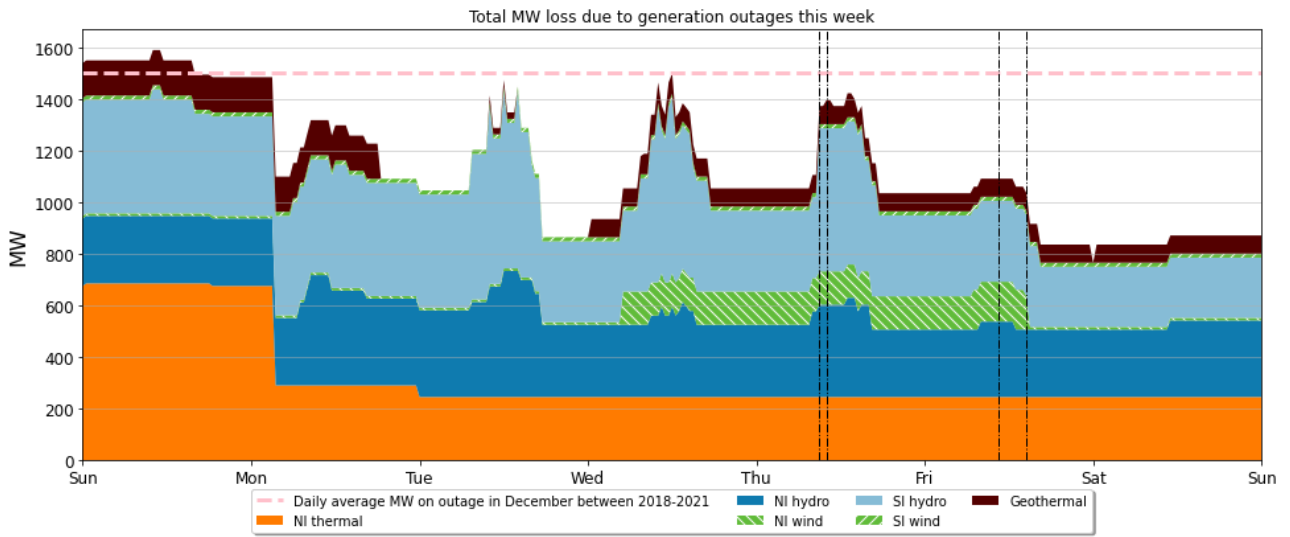
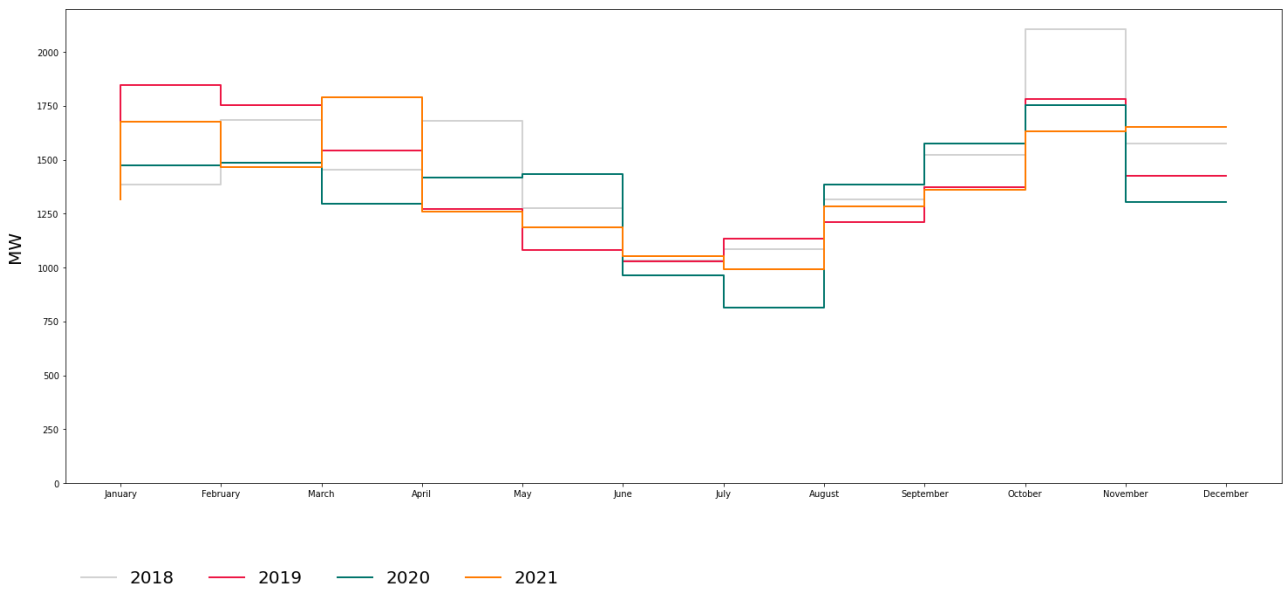


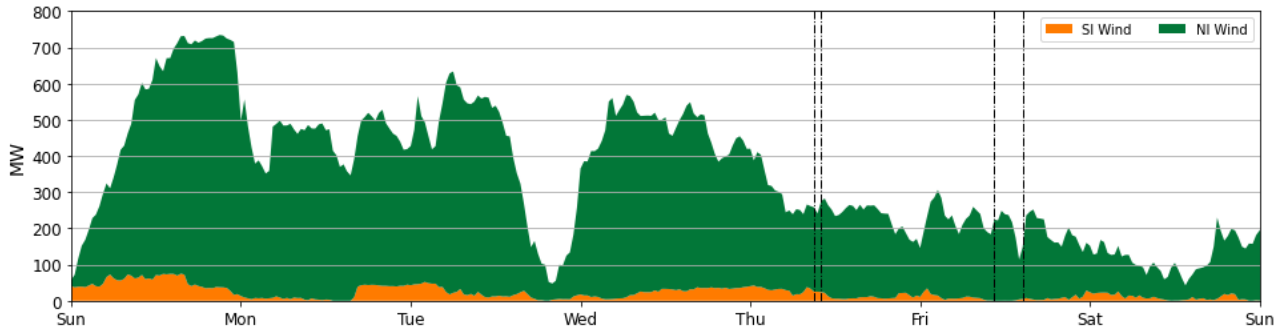
Figure 9: Monthly average MW losses due to generation outages, by year 2018-2021



8. Generation

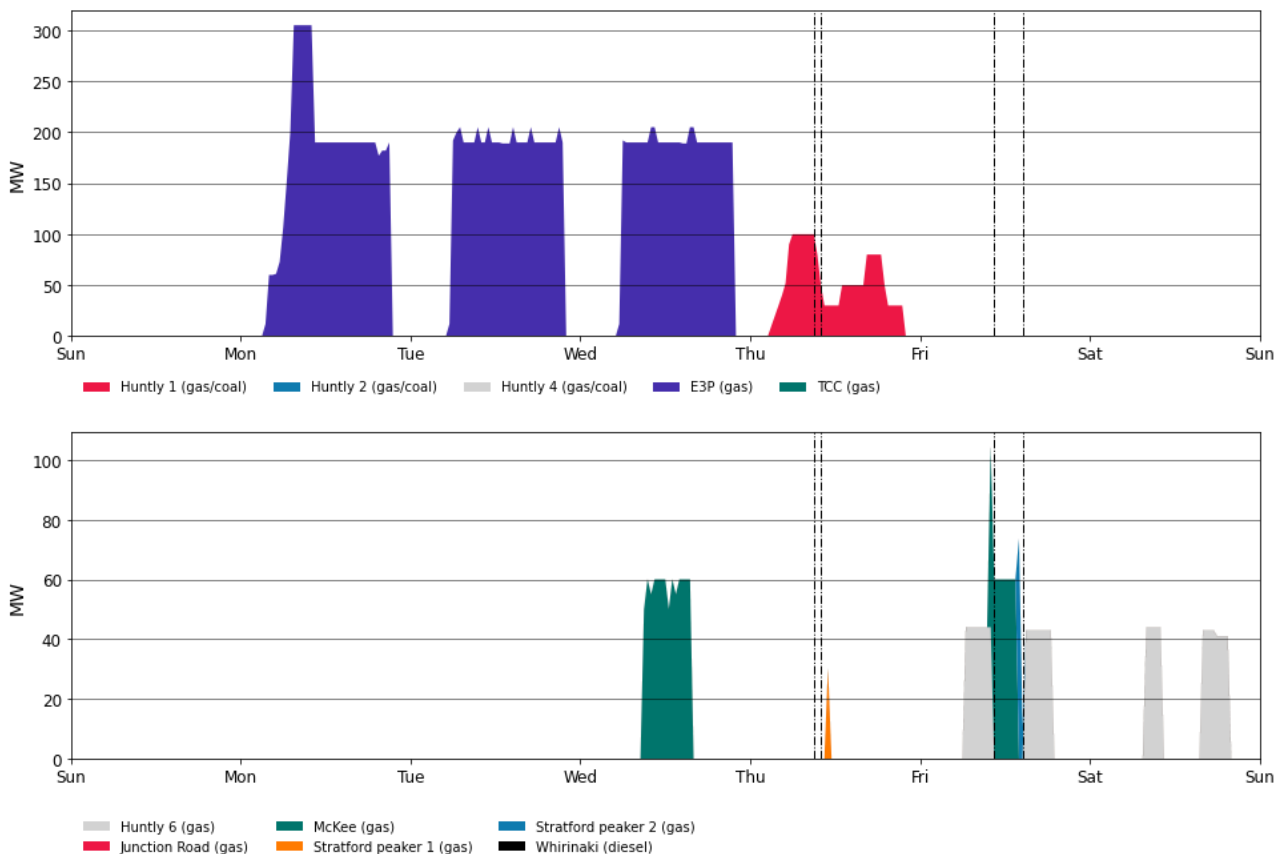
8.1. This week, wind generation varied between 50 and 700 MW, as seen in Figure 10. Wind generation was mostly between 400 - 700 MW between Sunday and Tuesday. It then decreased throughout Tuesday afternoon to less than 100 MW. Wind was again above 400 MW for most of Wednesday, before trailing off, staying below 300 MW, for the remainder of the week. Wind generation was below 300 MW during the four Thursday and Friday price spikes.

Figure 10: Wind Generation



8.2. Figure 10 shows generation of thermal baseload and thermal peaker plants between 4-10 December. Huntly 5 ran during the day as baseload, between Monday and Wednesday. Huntly 1 ran on Thursday, but stayed below 100 MW of output throughout the day.

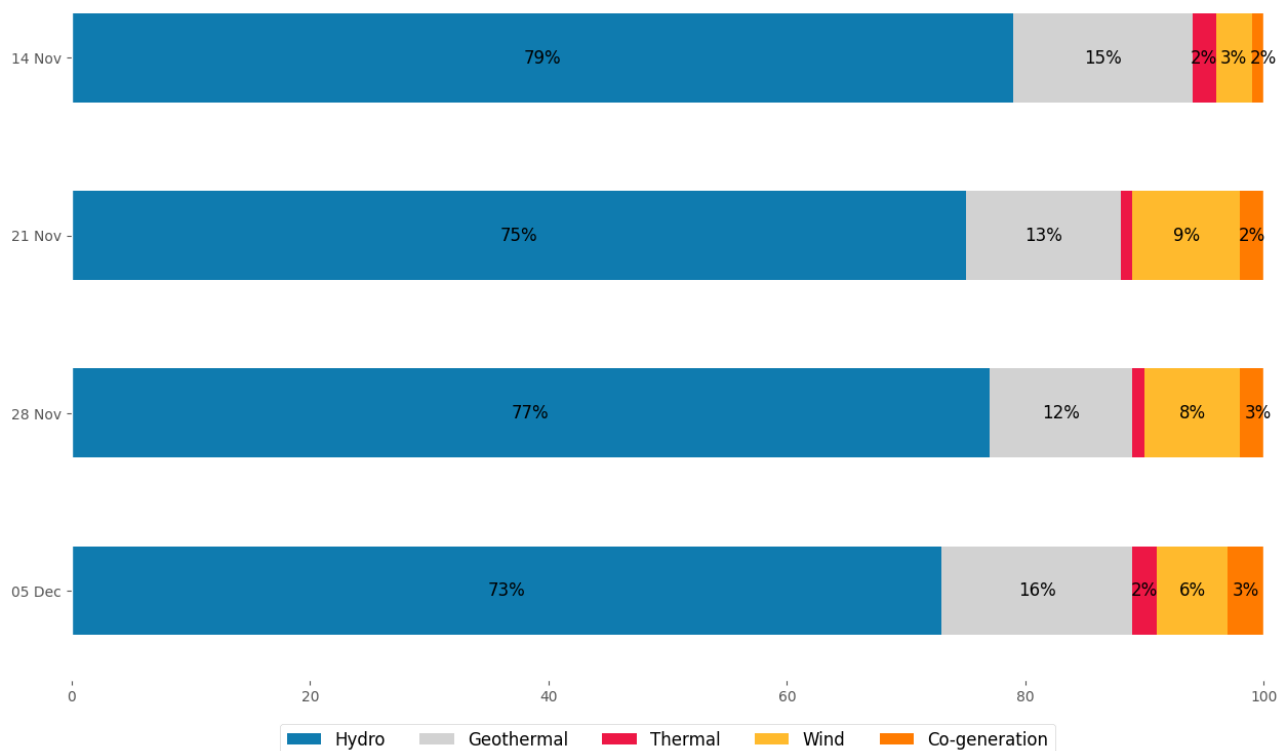
Figure 11: Thermal Generation



8.3. McKee ran during the day on Wednesday and Friday, to cover baseload. Stratford peaker one ran on Thursday afternoon, and Stratford peaker 2 ran on Friday afternoon, when it was likely constrained on for reserves. Huntly 6 ran on Friday and Saturday during peak times.

8.4. As a percentage of total generation, between 5-10 December, hydro totalled 73.3 percent, geothermal 16.1 percent, thermal 1.6 percent, wind 5.8 percent and co-generation 3.2 percent.

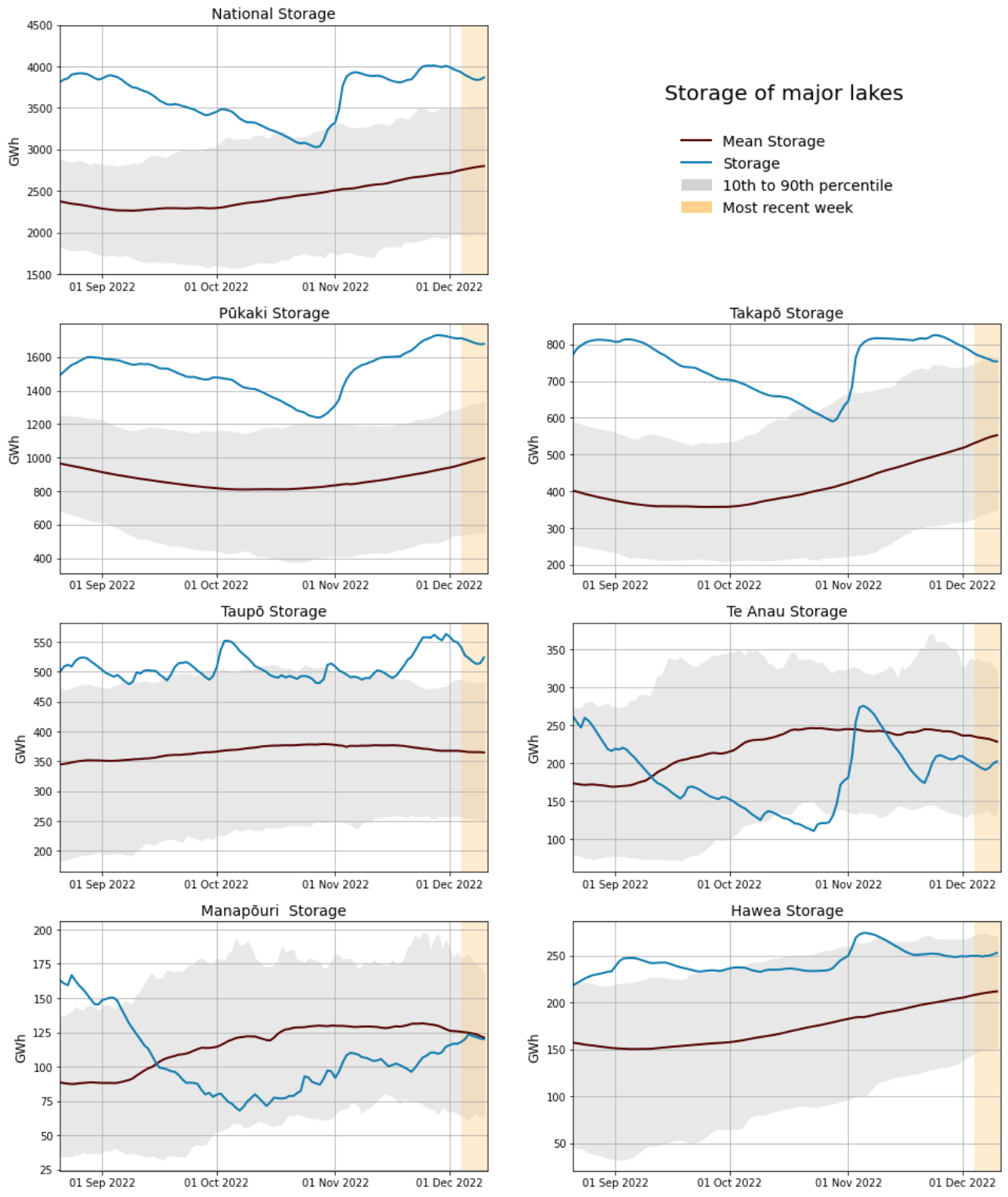
Figure 12: Total generation as a percentage each week between 7 November and 4 December



9. Storage/Fuel Supply

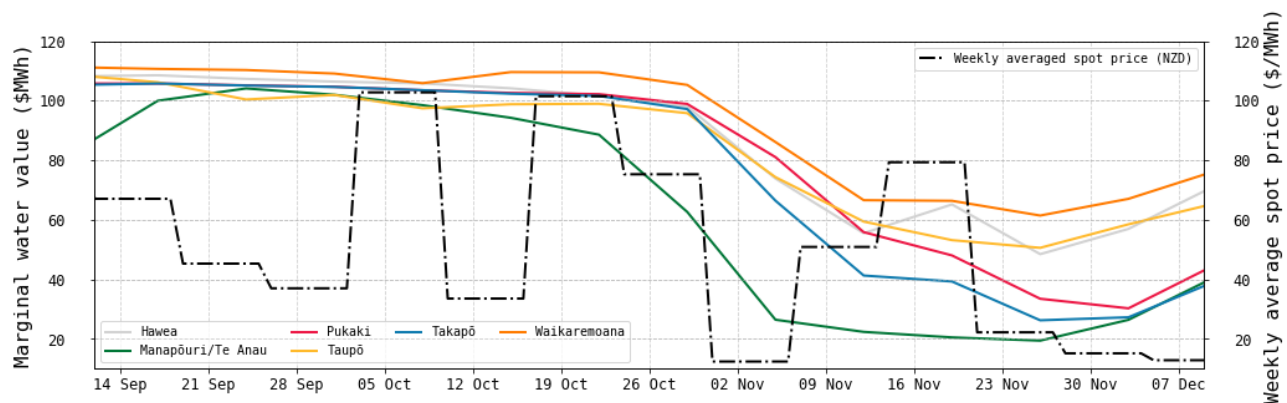
- 9.1. Figure 13 shows total controlled national hydro storage as well as the storage of major catchment lakes including their historical mean and 10th to 90th percentiles.
- 9.2. National hydro storage levels decreased slightly this week, but is still around 93.8 per cent of nominal full.
- 9.3. Lakes Taupō and Pūkaki remained well above their 90th percentiles this week. With Lake Hawea now below its 90th percentile, and lake Takapō having declined to its 90th percentile this week. Storage at Lake Te Anau and Manapōuri increased last week, but both lakes remain below their respective historic means.

Figure 13: Hydro Storage



10. JADE Water Values

Figure 14: JADE water values across various reservoirs between 9 September and 9 December 2022



- 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 14 shows the national water values between 9 September and 10 December 2022 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. In general, marginal water values have increased when total national hydro storage has decreased and decreased when total national hydro storage has increased.

11. Price versus estimated costs

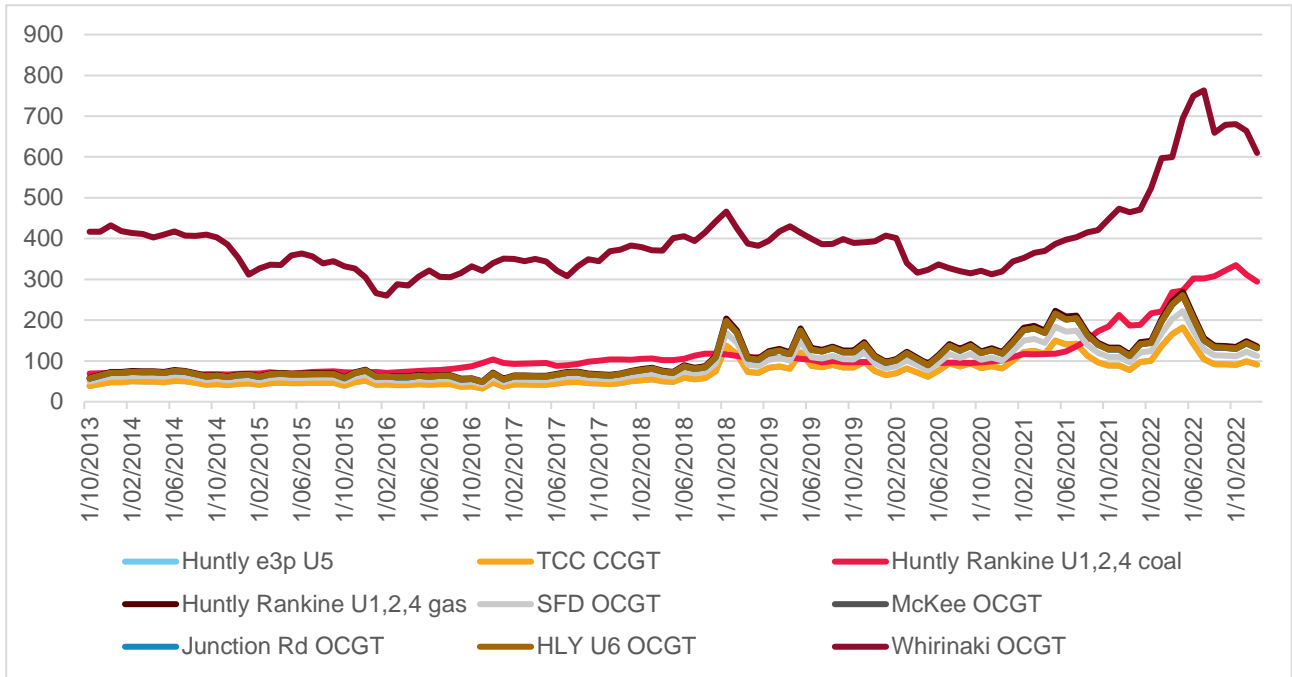
- 11.1. In a competitive market, prices should be close to (but not necessarily at) the short run marginal cost (SRMC) of the marginal generator (where SRMC includes opportunity cost).
- 11.2. The SRMC (excluding opportunity cost of storage) for thermal fuels is estimated using gas and coal prices, and 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 15 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.
- 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 [Copy-of-Appendix-B-JADE-water-value-model1375326.4.docx \(live.com\)](#)

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

Figure 15: Estimated monthly SRMC for thermal fuels



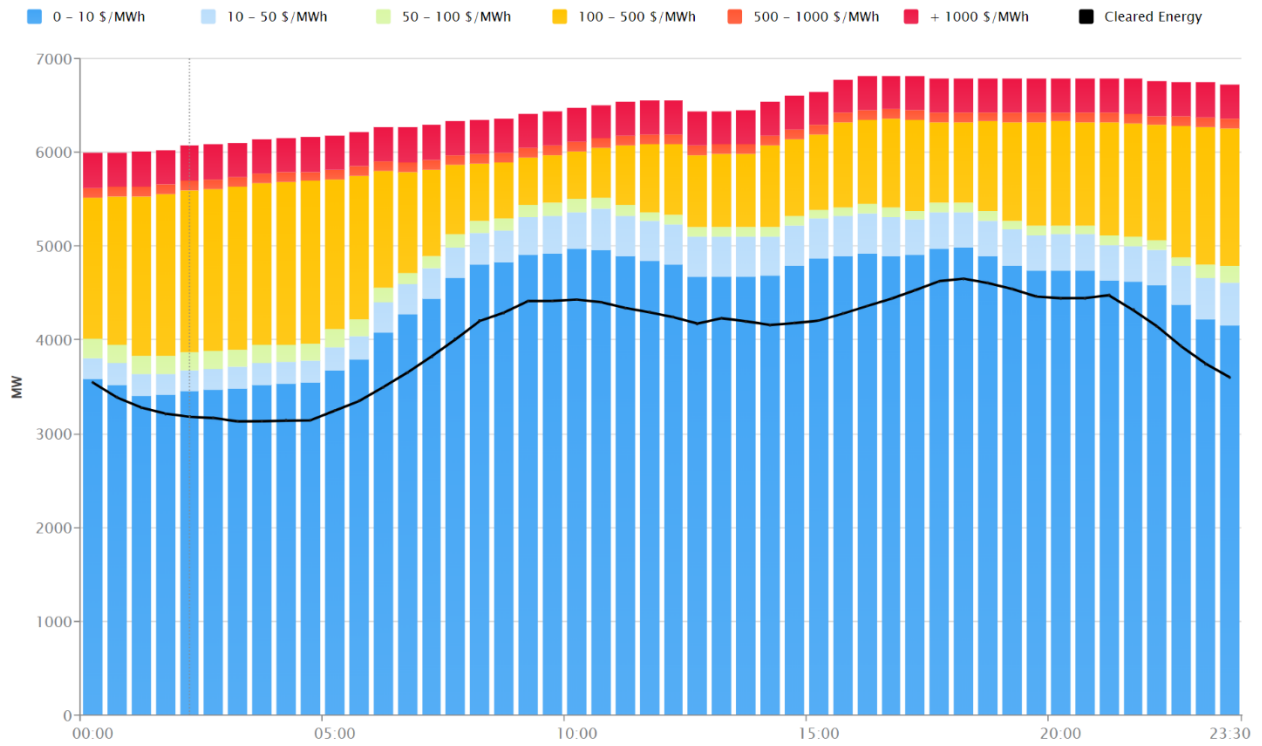
12. Offer Behaviour

12.1. Figure 16 shows this week's national daily offer stacks from WITS⁵. The black line shows cleared energy, indicating the range of the average final price. The majority of energy in this week was cleared in the \$0-10/MWh or \$10-50/MWh band - with jumps into the \$50-100/MWh band during the price spikes. These jumps in clearing price reflects the tighter supply of energy during the times of low wind and higher South Island hydro outages, North Island wind outages and the geothermal outages.

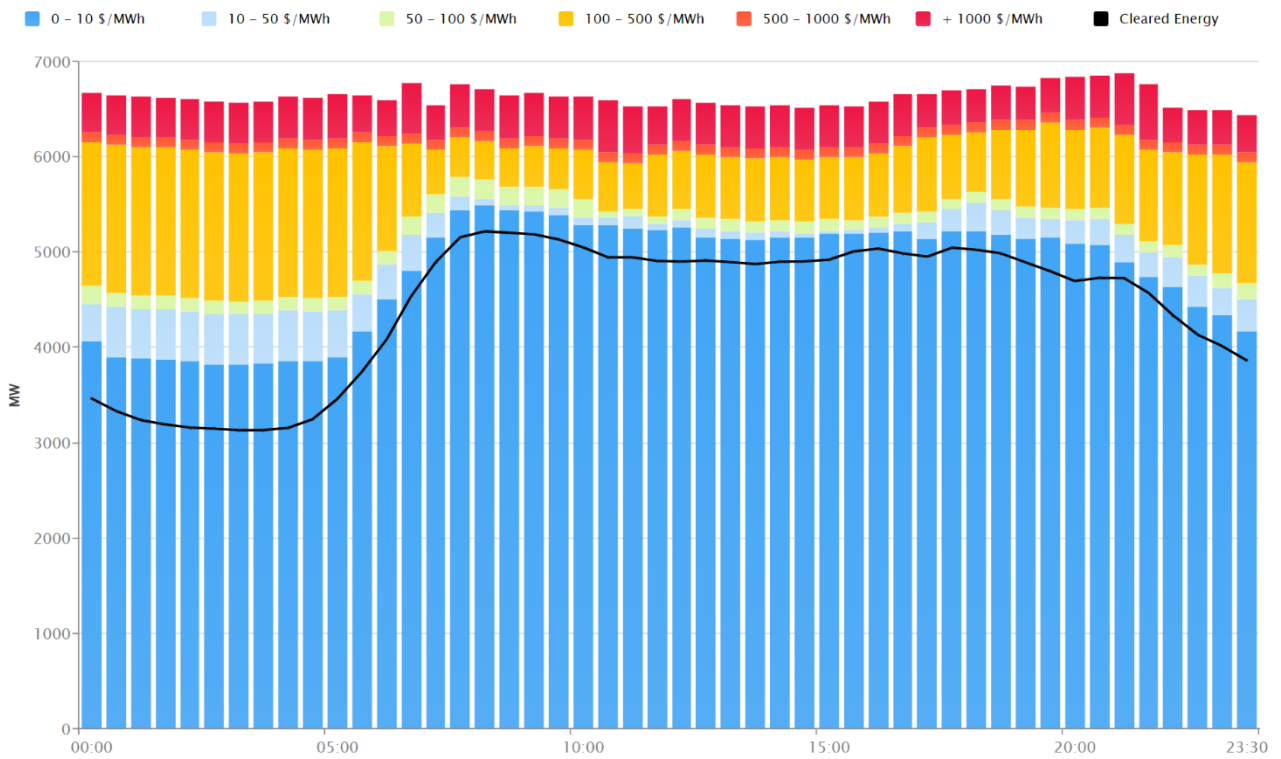
⁵ Cleared Energy Stack | WITS (electricityinfo.co.nz)

Figure 16: Daily offer stack from WITS

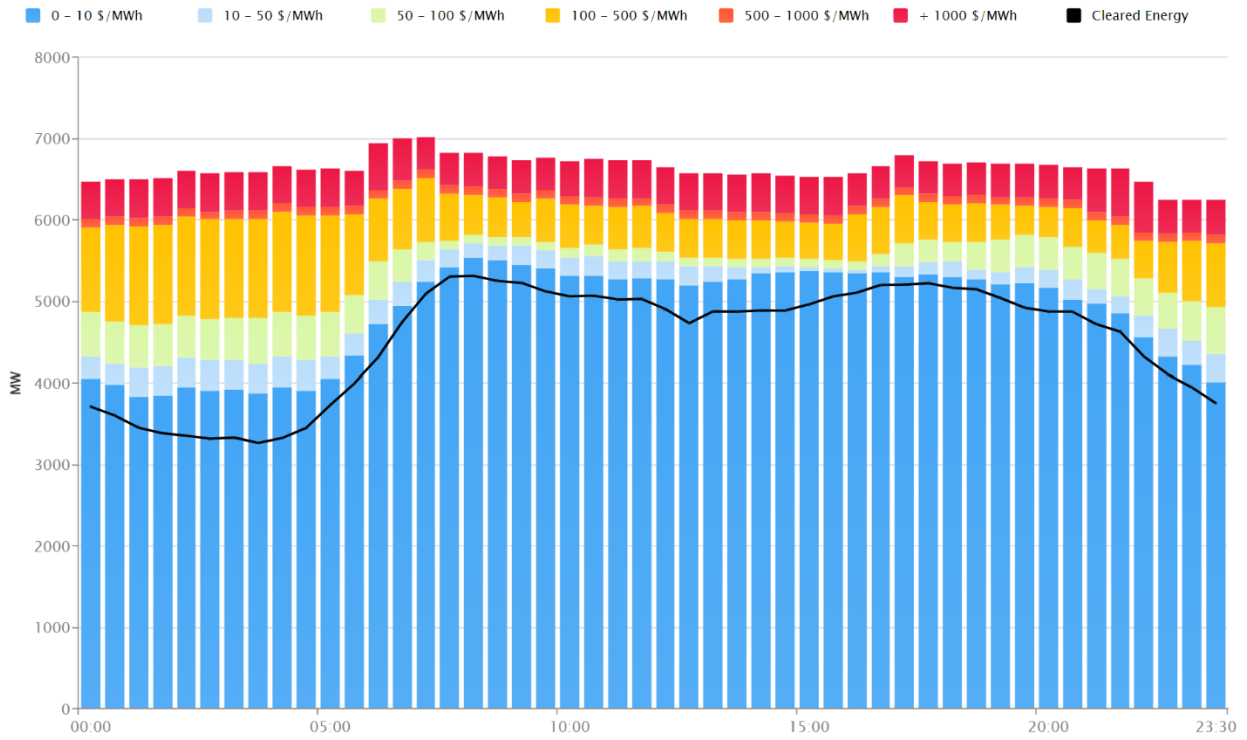
Sunday 4 December



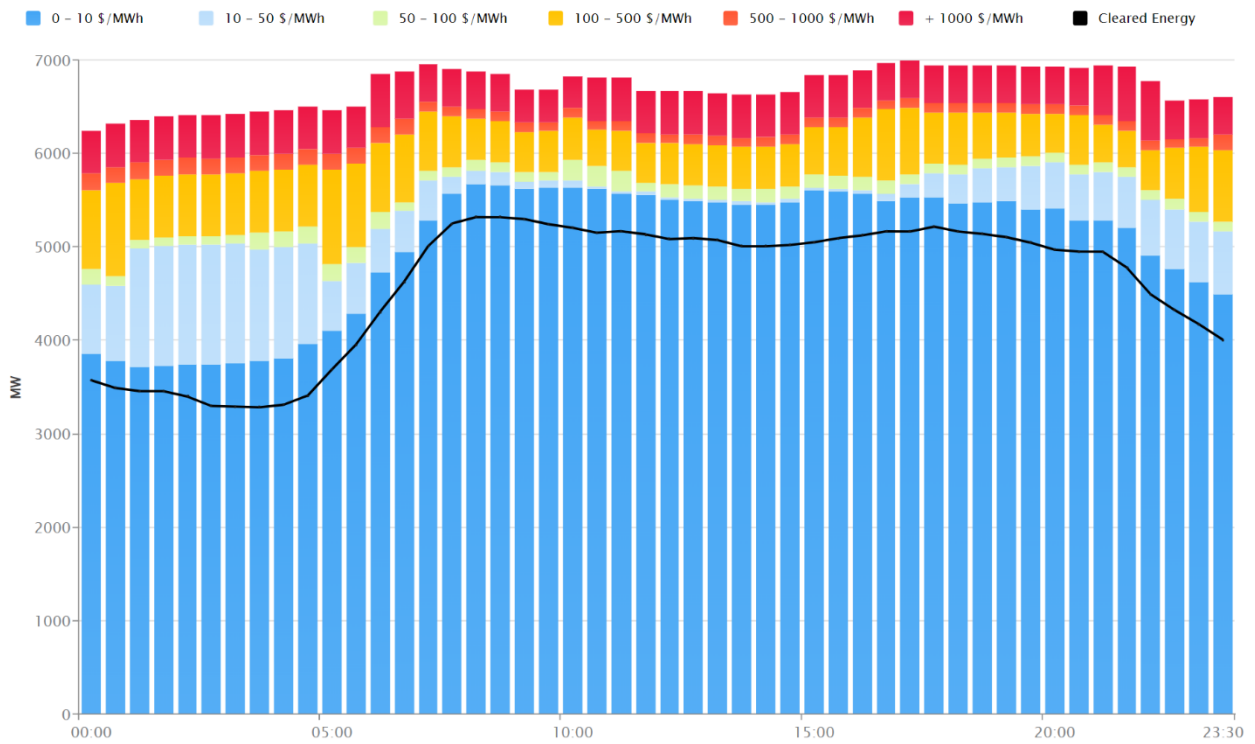
Monday 5 December



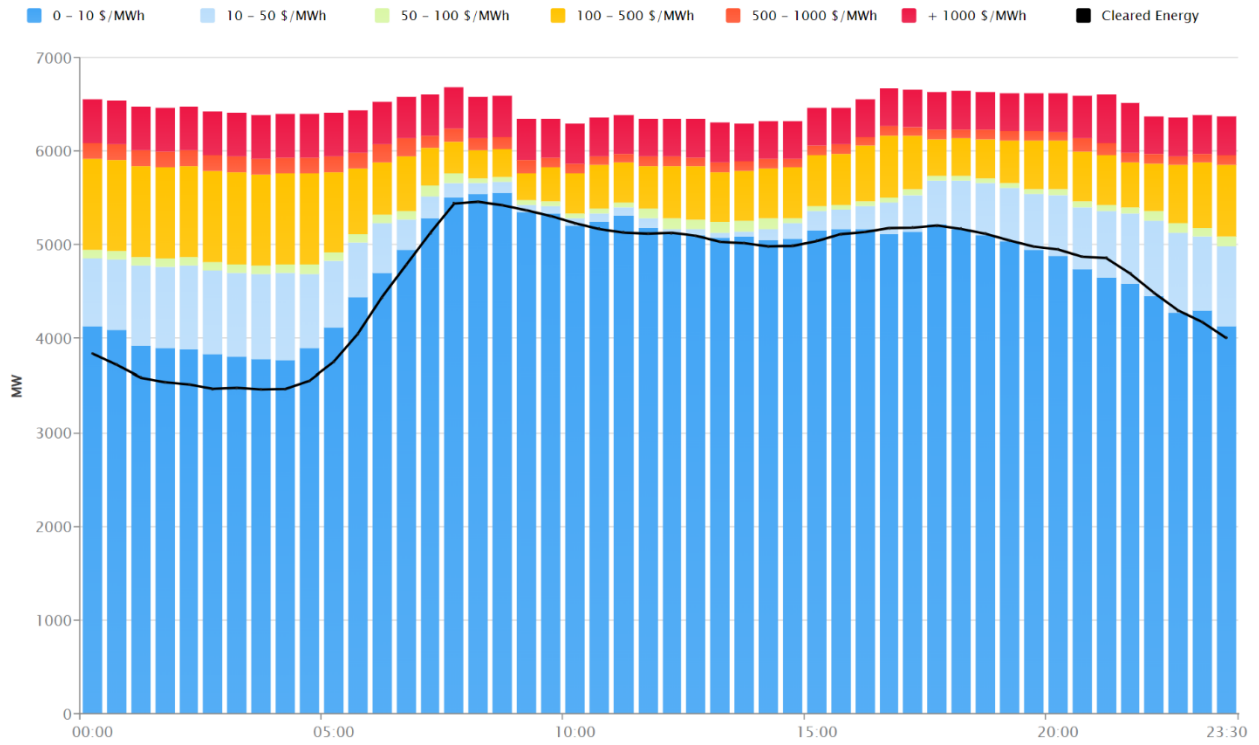
Tuesday 6 December



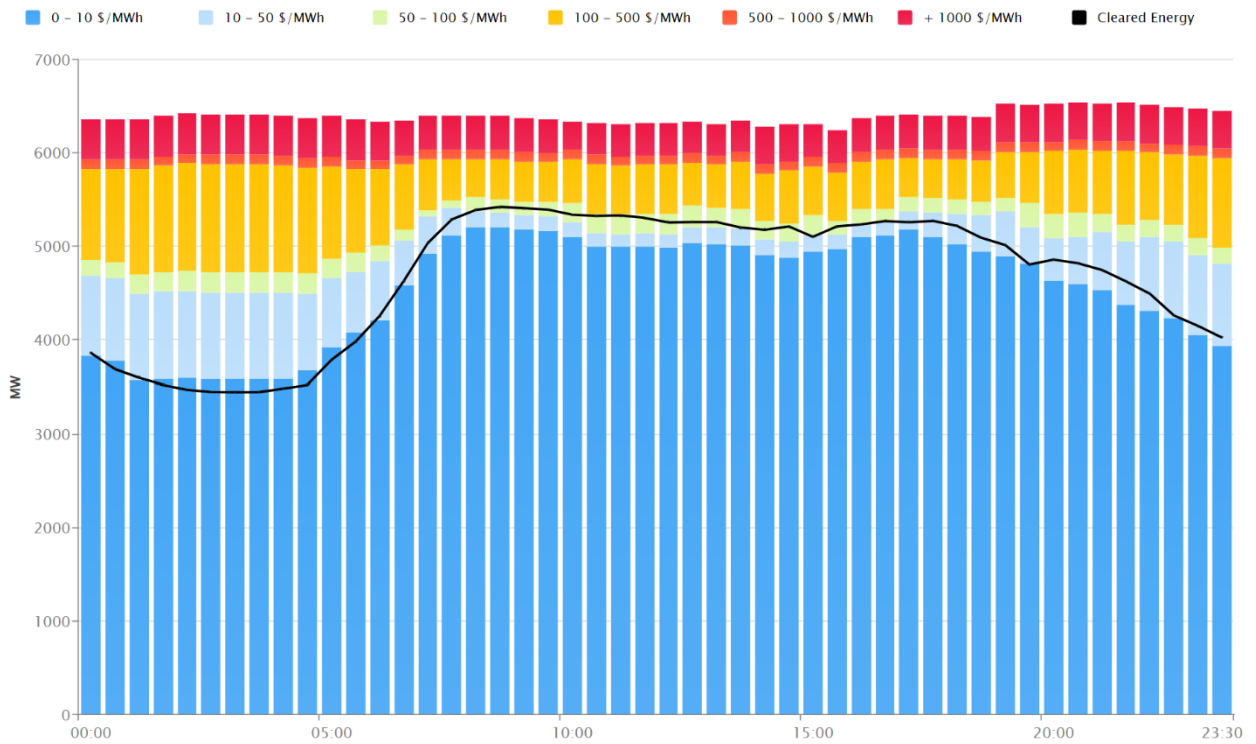
Wednesday 7 December



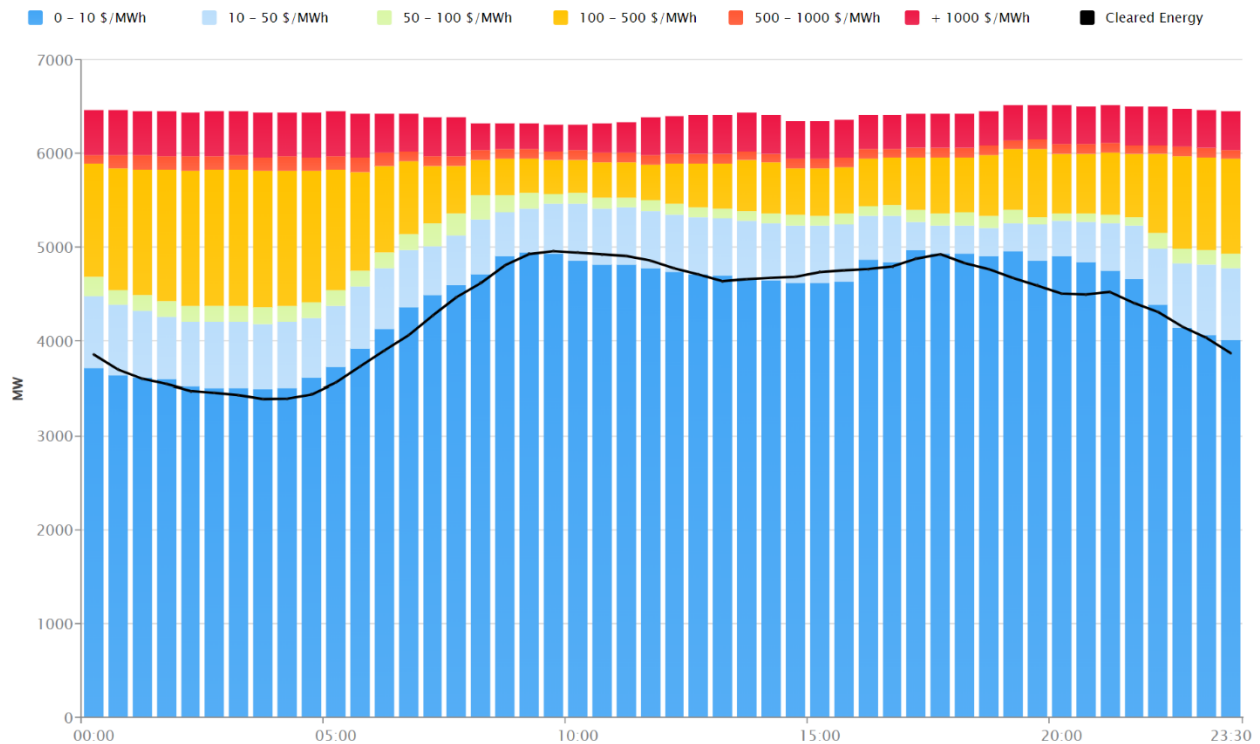
Thursday 8 December



Friday 9 December



Saturday 10 December



13. Ongoing Work in Trading Conduct

- 13.1. This week, all prices appeared to be consistent with supply and demand conditions, however a few trading periods from previous weeks are still undergoing further analysis.
- 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	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.