11 May 2022

Trading Conduct Report

Market Monitoring Weekly Report

1. Overview for the week of 1 to 7 May

1.1. Wholesale spot prices this week appear to be consistent with supply and demand conditions.

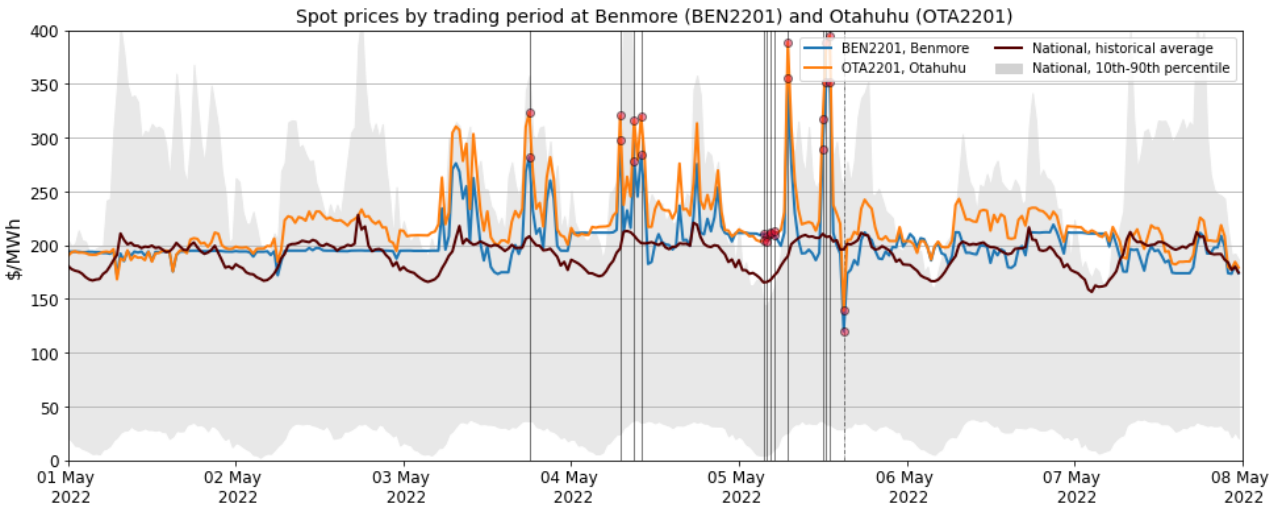
2. Spot Prices

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. To do this, we assess whether spot prices are behaving in line with market conditions. 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 Otahuhu nodes exceed their historical 90th percentiles. These historically high-priced trading periods are marked out by vertical lines in the majority of figures in this report.

2.2. Figure 1 shows wholesale electricity spot prices from the past week at Benmore and Otahuhu alongside their historic mean and historic 10th-90th percentiles. Spot prices between 1 and 7 May averaged $213.35/MWh, compared to the historical average of $138.71/MWh for the same period.

2.3. This week saw price spikes of over $500/MWh at certain nodes (not pictured) on 2,3 and 4 May, which were a result of price separation caused by local transmission constraints.

Figure 1: Wholesale Spot Prices



2.4. Excluding high prices caused by transmission outages the trading periods where prices exceeded their historical 90th percentile are listed below in Table 1. These trading periods primarily occurred in the middle of the week during high demand periods.

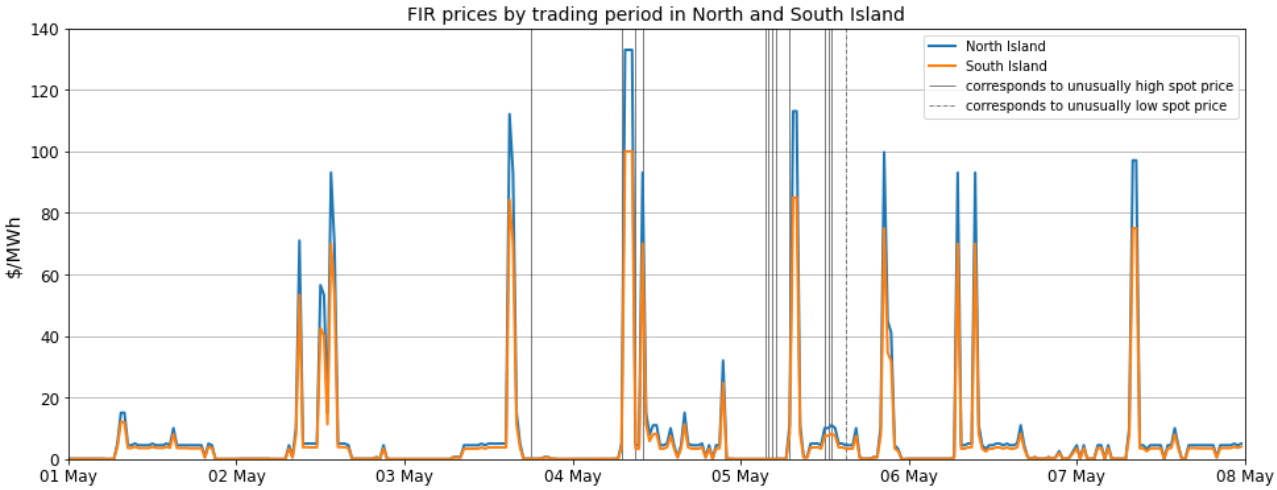
Table 1: High Priced Periods

Date	Trading Period	Historic Mean	10th percentile	90th percentile	Benmore	Otahuhu
3/05/2022 18:00	37	208.32	36.67	357.65	281.71	323.56
4/05/2022 7:00	15	196.89	24.42	301.07	297.22	320.58
4/05/2022 9:00	19	209.01	37.29	318.67	278.60	316.44
4/05/2022 10:00	21	202.07	35.12	264.60	283.84	320.08
5/05/2022 3:30	8	165.51	4.47	144.88	210.68	204.23
5/05/2022 4:00	9	165.84	4.95	143.85	207.91	203.82
5/05/2022 4:30	10	167.54	6.51	152.13	210.97	211.64
5/05/2022 5:00	11	171.46	10.31	159.69	209.39	212.58
5/05/2022 7:00	15	189.86	25.63	257.24	354.93	388.88
5/05/2022 12:00	25	210.62	36.72	304.04	289.75	317.91
5/05/2022 12:30	26	207.65	33.41	275.74	351.42	388.01
5/05/2022 13:00	27	208.28	33.50	316.12	351.82	394.79

3. Reserve Prices

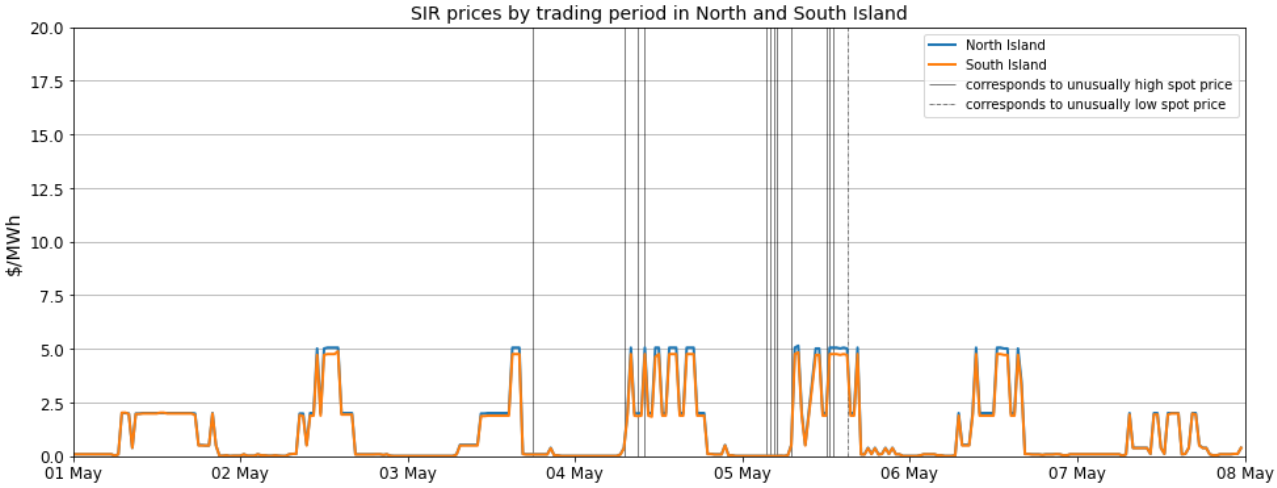
3.1. Fast instantaneous reserves (FIR) prices for the North and South Island are shown below in Figure 2. The mean national FIR price between 1 and 7 May was $8/MWh. While the majority of FIR reserve prices for the week were within normal range at below $20/MWh, prices occasionally spiked to between $50/MWh and $140/MWh. Some of these spikes coincided with peak wholesale prices but most were likely due to co-optimisation where lower priced reserves were dispatched when it looked like energy prices were going to be significantly higher in the area.

Figure 2: FIR prices by trading period and Island



3.2. Sustained instantaneous reserves (SIR) prices for the North and South Island are shown below in Figure 3. The mean national SIR price between 1 and 7 May was $2/MWh. SIR reserve prices this week remained within normal bounds at below ~$5/MWh.

Figure 3: SIR prices by trading period and Island



4. Regression Residuals

4.1. The Authority's monitoring team has developed two regression models of the 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[1] on the trading conduct webpage.

4.2. Figure 4 shows the residuals of autoregressive moving average (ARMA) errors from the daily model. Residuals were stable with few fluctuations indicating prices largely aligned with market conditions this week. The largest residuals occurred on 4 May indicating that prices in the middle of the week were the most unusual.

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

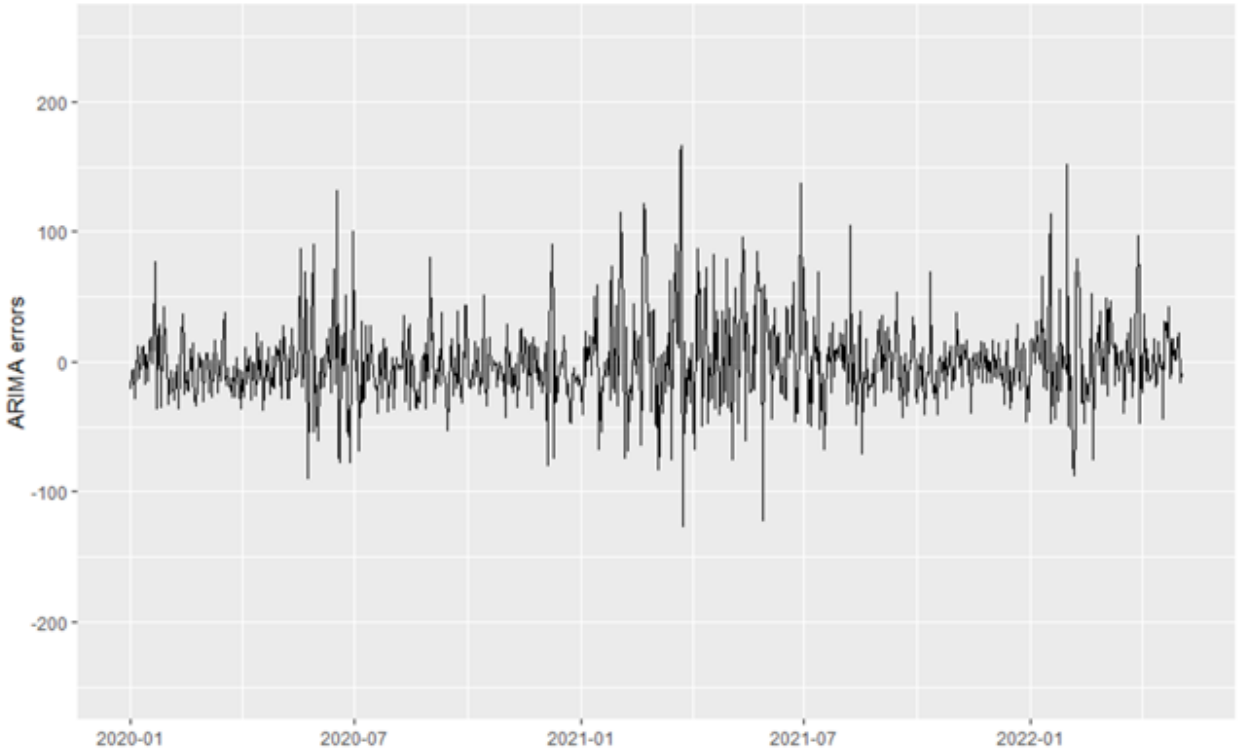


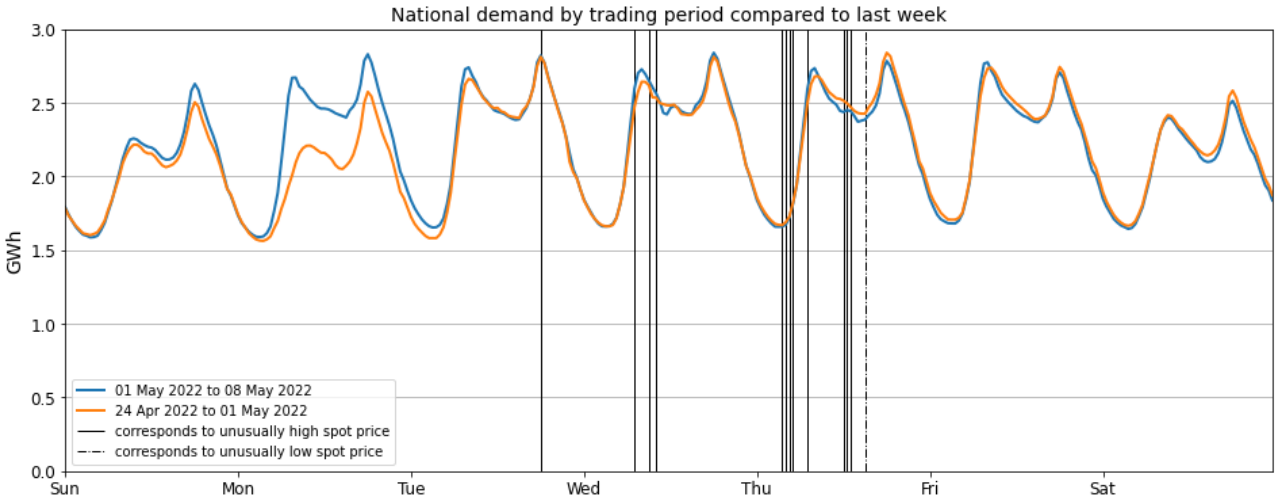
Figure 4: Residual plot of estimated daily average spot price YTD

5. Demand

5.1. Figure 5 shows national grid demand against national grid demand from the previous week. The large difference in demand on Monday between weeks was due to ANZAC falling on 25 April, resulting in a public holiday load profile.

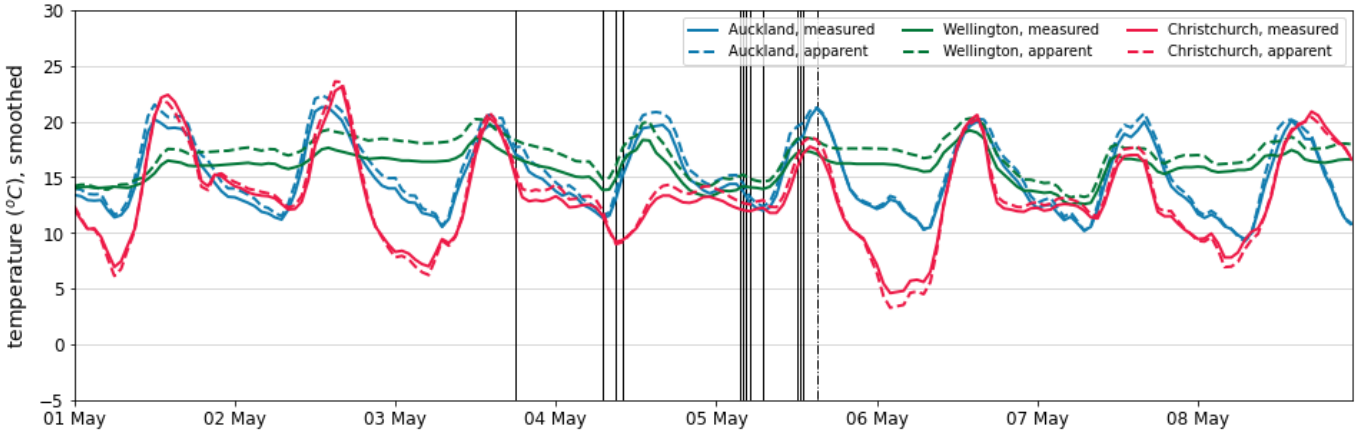
5.2. Morning peak demand in the week from 1 to 7 May has been consistently higher than morning peak demand in the week from 24 to 30 April. The increase in peak demand may go towards partially explaining high morning prices during the middle of the week.

Figure 5: National demand by trading period compared to the previous week



5.3. Figure 6 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. As temperatures were not unusually low during peak morning demand and high-priced periods this week the increase in demand is unlikely to be due to weather and instead could be due to energy consumers resuming a normal pre-Covid profile following the recent ease in Covid restrictions.

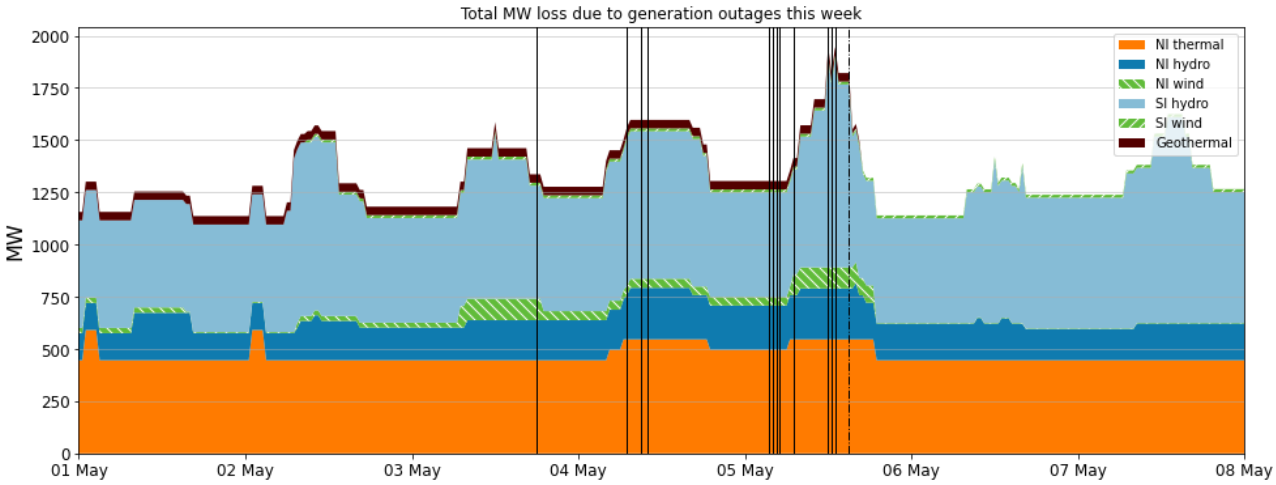
Figure 6: Temperatures across main centres



6. Outages

6.1. Figure 7 shows generation capacity lost due to outages by fuel type. Outages have not changed too much compared to the previous week. The maximum capacity lost due to generation outages remains at just above 1,750MW. The relatively high amount of South Island hydro outages continues to play a part in the current high opportunity cost of hydro generation.

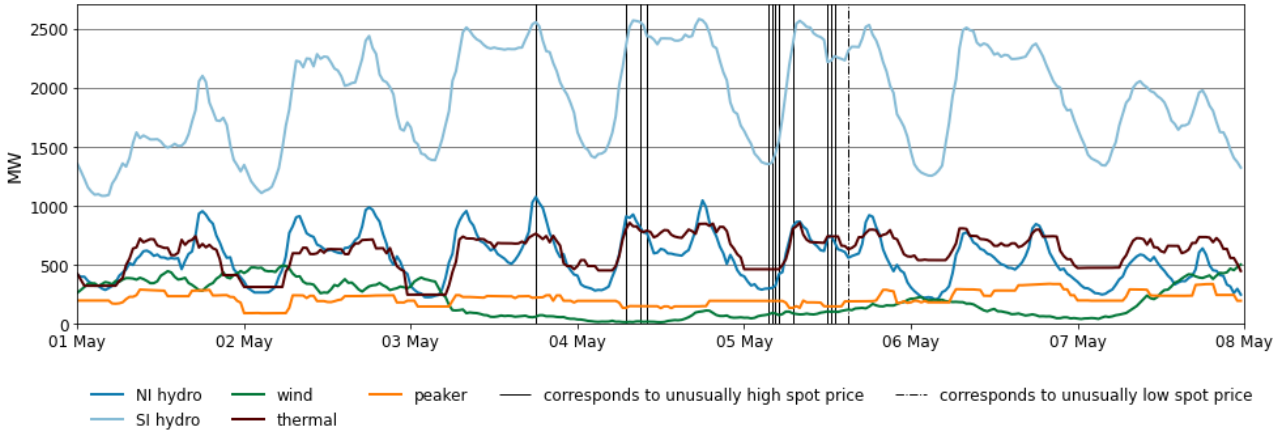
Figure 7: Total MW loss due to generation outages



7. Generation

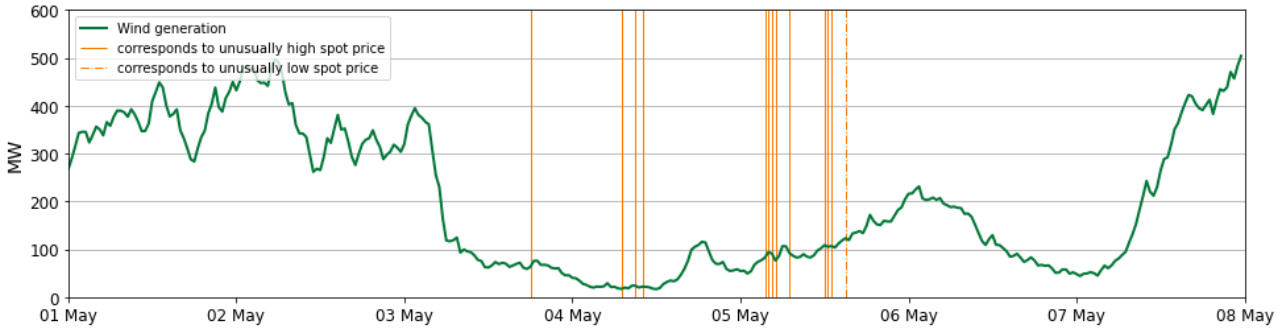
7.1. High prices this week coincided with periods of low wind generation, high hydro generation and high thermal and peaker generation.

Figure 8: Generation by Fuel



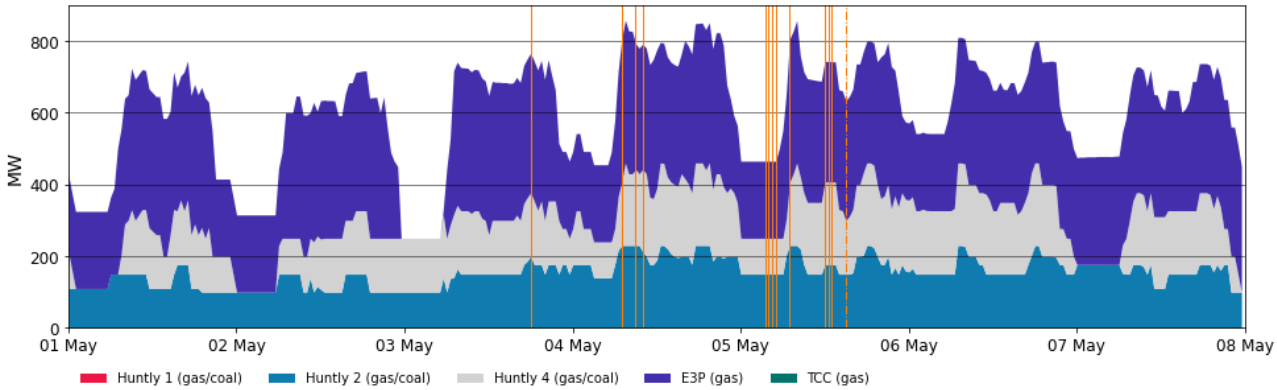
7.2. Figure 9 shows wind generation from 1 to 7 May. Low wind generation, dropping from 300-500 MW earlier in the week to between 0-200 MW later in the week would have been cause for high prices in the middle of this week as it would have decreased the amount of cheap generation on offer and increased the amount of cleared generation in higher priced tranches.

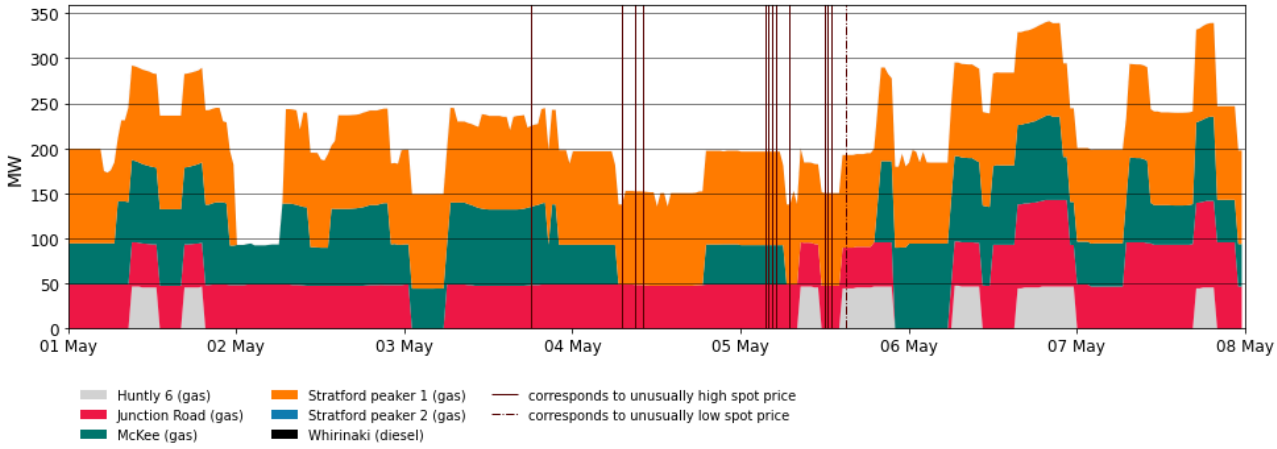
Figure 9: Wind Generation



7.3. Figure 10 shows generation at thermal and thermal peaker plants, which was high for most of the week with thermal generation consistently rising above 600 MW during the day and peaker generation consistently exceeding 200 MW. With the current high cost of thermal fuels, the high amount of thermal generation would have been a large contributor to high spot prices this week.

Figure 10: Thermal Generation

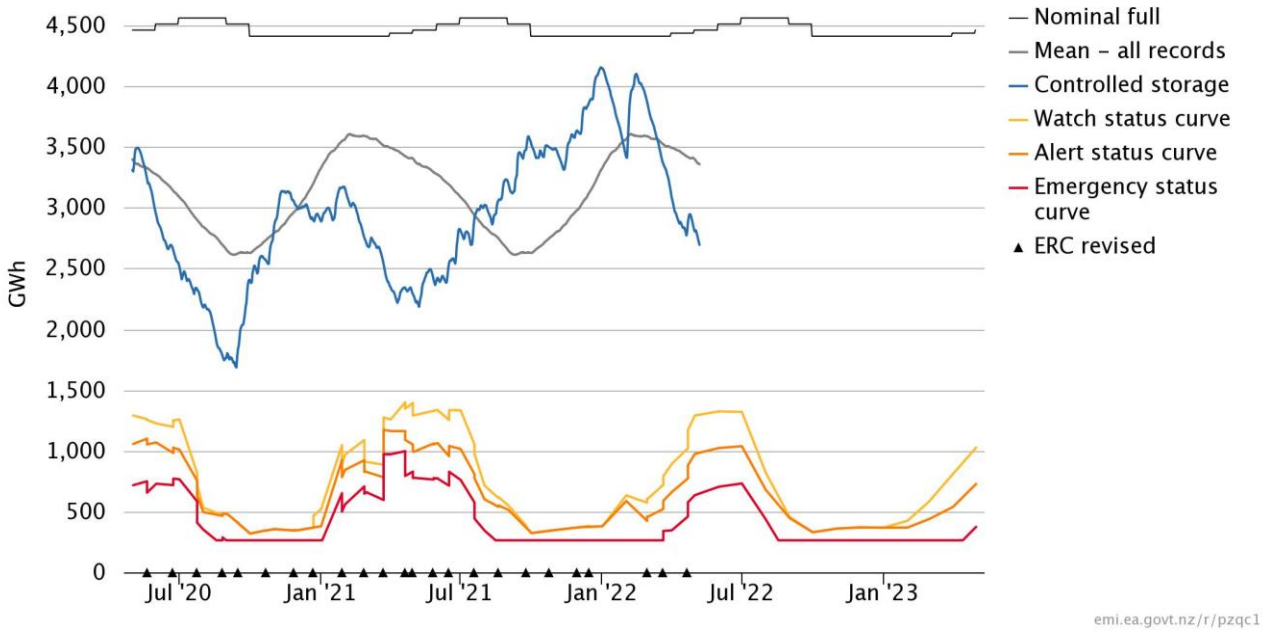




8. Storage/Fuel Supply

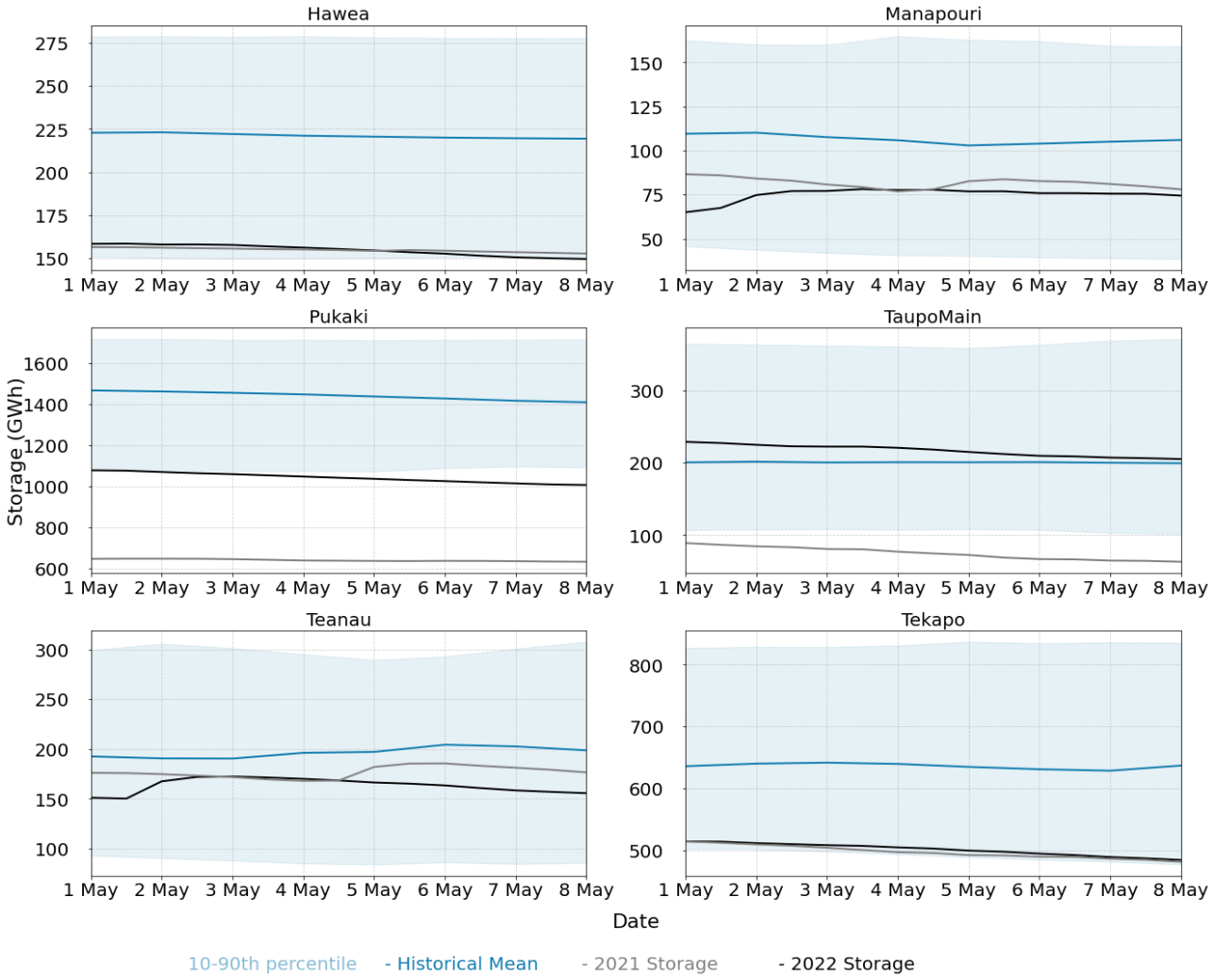
8.1. Figure 11 shows total controlled national hydro storage. Total hydro storage continues to decline on the back of low inflows despite conservative generator behaviour. The decline in storage pushing up the opportunity cost of hydro generation is also one of the main reasons for high spot prices this week.

Figure 11: Hydro Storage



8.2. Figure 12 shows hydro storage at major lakes. Storage at all major storage lakes this week has been decreasing. Lake Taupo is just above its historical mean. Lake Hawea, Lake Pūkaki and Lake Tekapo are all near their 10th percentiles. Lake Manapōuri and Lake Te Anau levels continue to remain low despite conservative generation behaviour maintaining recent gains.

Figure 12: Major Lake Storage



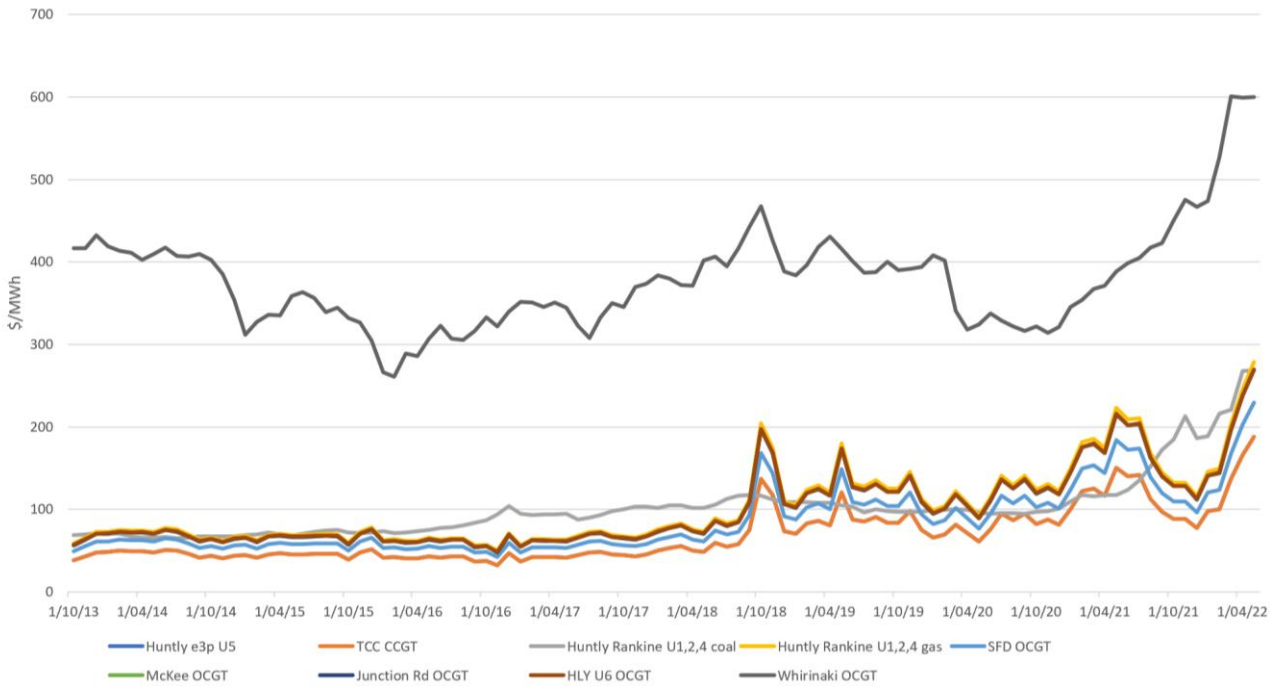
9. Price versus estimated costs

9.1. 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).

9.2. The SRMC (excluding opportunity cost of storage) for thermal fuels can be 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. Figure 13 shows an estimate of thermal SRMCs as a monthly average up to 1 May 2022. The SRMC of all plants has increased sharply since the beginning of 2022.

9.3. The SRMC of coal and diesel have both increased due to global supply and demand conditions. As well as supply disruptions caused by Covid, the Russian-Ukraine conflict has increased the premium on all international coal due to sanctions placed on Russia. Indonesian coal prices are currently around $415/tonne. Limited local gas production has also put a premium on gas spot prices with the current month long full field outage at Maui gas field (14 May-6 June) pushing gas spot prices to above $20/GJ. High historical carbon prices have also affected thermal generation costs with prices on the secondary market currently averaging ~$75/tonne and only set to increase. This puts the latest SRMC of Huntly generation at around ~$270/MWh.

Figure 13: Estimated monthly SRMC for thermal fuels



10. JADE Water values

10.1. The JADE[2] 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 to 31 March 2022 using values obtained from JADE. The outputs from JADE closest to actual storage levels are shown as the yellow water value range. 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 B[3] on the trading conduct webpage.

10.2. In general, marginal water values have increased when total national hydro storage has decreased. For the last two months water values have been gradually increasing as hydro storage has declined and despite the recent bump in hydro storage water values have almost reached $150/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.
[3] https://www.ea.govt.nz/assets/dms-assets/29/Appendix-B-JADE-water-value-model.pdf

Figure 14: Water Values

11. Offer Behaviour

11.1. Figure 15 shows this week's daily offer stacks, adjusted to take into account wind generation, transmission constraints, reserves and frequency keeping.[4] The black line shows cleared energy, indicating the range of the average final price.

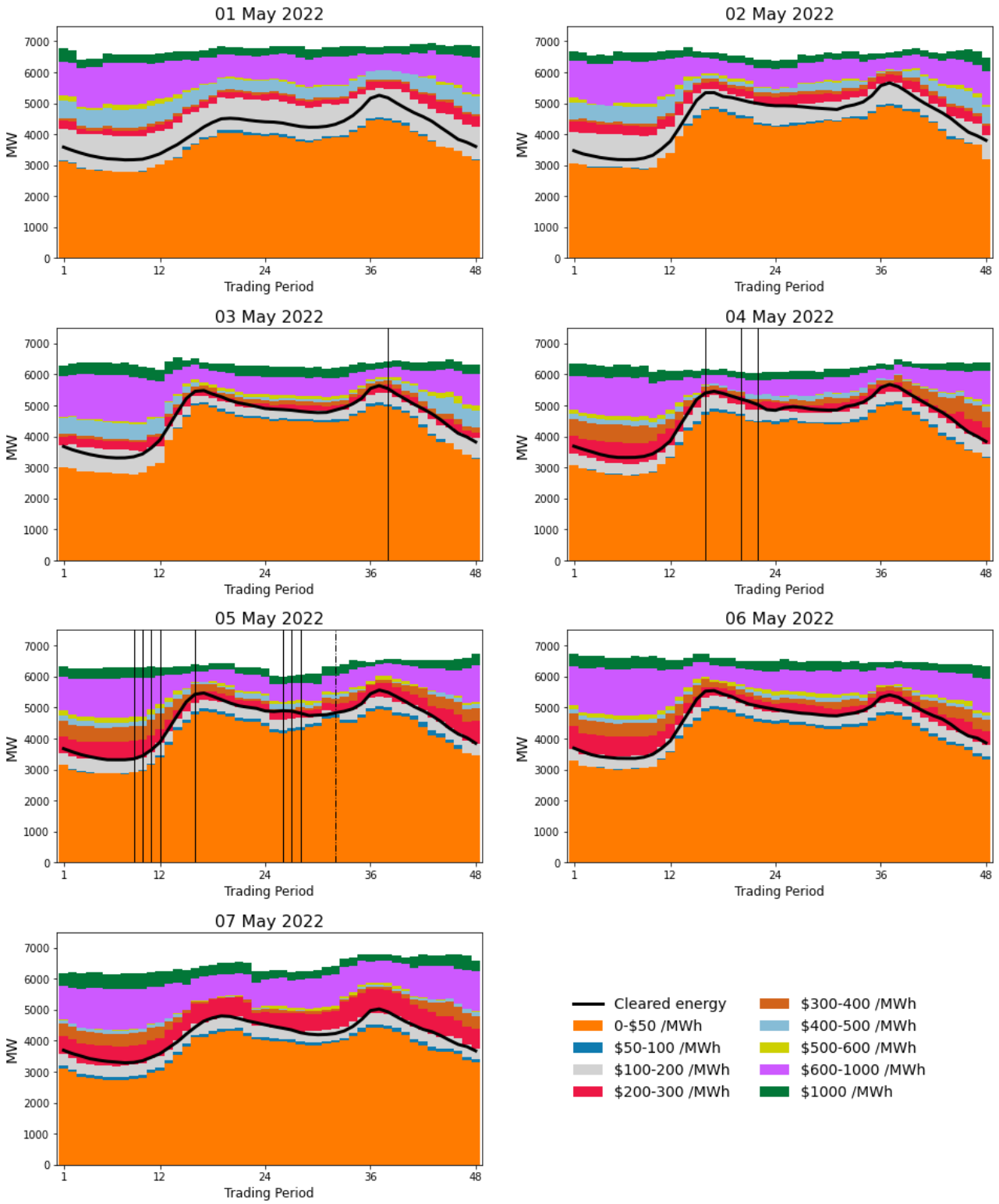
11.2. High thermal and hydro generation opportunity costs as detailed above continue to drive a steep offer curve.

11.3. From the previous week the number of $200-300/MWh offers has shrunk, with the number of $300-400/MWh offers increasing in their place. The number of $400-500/MWh offers has increased with the number of $500-600/MWh offers shrinking. The amount of $1,000/MWh offers also appears to have increased indicating generators are attempting to conserve more generation from dispatch.

11.4. Overall the offer curve has become steeper around mid-range prices which is in line with what we would expect with less hydro storage in the face of increasing demand going into winter.

[4] The offer stacks show all offers bid into the market (where wind offers are truncated at their actual generation and excluding generation capacity cleared for reserves) in price bands and plots the cleared quantity against these.

Figure 15: Daily offer stack



12. Ongoing Work in Trading Conduct

12.1. High prices on 3 May appeared to be driven by high evening peak demand and low wind generation.

12.2. High prices on 4 May appeared to be driven by high peak morning demand and low wind generation.

12.3. High prices on 5 May appeared to be driven by low wind generation and were in line with prices for most of the week with the exception of trading period 15 and 27. The high prices in trading period 15 appear to have been exacerbated by high peak morning demand. The high prices on trading period 27 appear to be due to the loss of some offers from Meridian outages which resulted in a reduction in generation at Manapouri shortly before 1.00pm.

12.4. All instances of peak demand coincided with low wind generation, resulting in the dispatch of more hydro and thermal pushing spot prices up. The pre-dispatch offers in the short term lead up to high prices showed no changes that would suggest generators were trying to take advantage of market conditions.

12.5. Further analysis is being done on the trading periods in Table 2 as indicated.

Table 2: Trading periods identified for further analysis

Date	TP	Status	Notes
19/02-24/02		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.
19/02-21/02	Several	Further Analysis	Further information has been received and will be further analysed
08/02-12/02	Several	Further Analysis	High inflows but continued high prices
30/06/21-20/08/21	Several	Compliance enquiries in progress	The Authority's compliance team has obtained information regarding withdrawn reserve offers and high energy prices. Further clarification and analysis is under way to consider compliance with the Code.
30/06/21-21/08/21	Several	Compliance enquiries in progress	The Authority's compliance team has obtained information regarding withdrawn reserve offers and high energy prices. Further clarification and analysis is under way to consider compliance with the Code.