11 May 2022

Trading Conduct Report

Market Monitoring Weekly Report

1. Overview for the week of 8 to 14 May

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

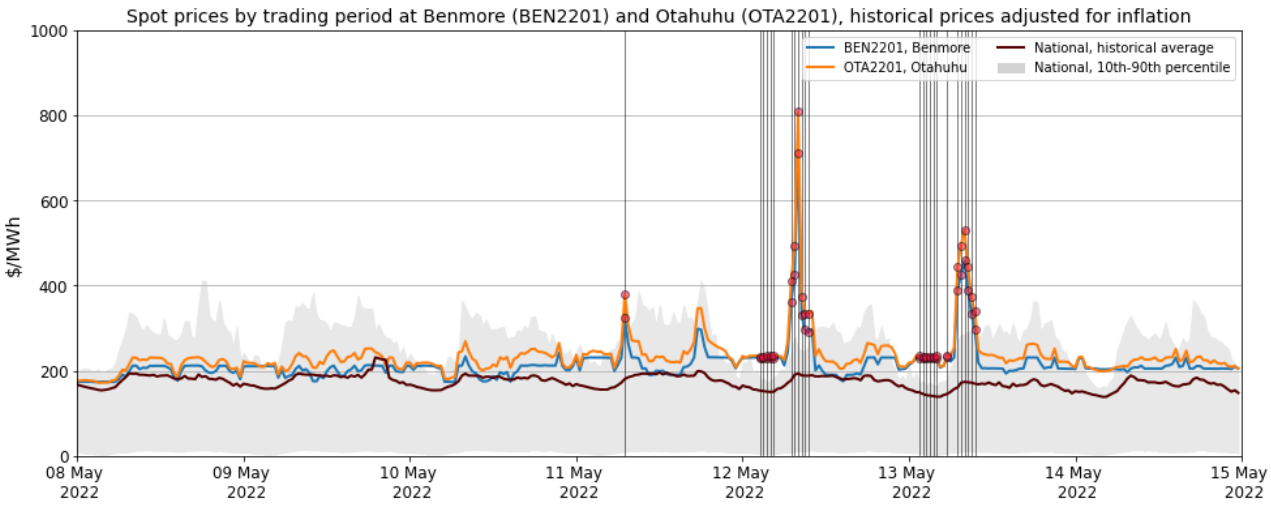
2. Spot Prices

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 adjusted for inflation. Spot prices between 8 and 14 May averaged $222.46/MWh.

2.3. Significant price spikes this week were mostly clustered around morning peak demand periods on 12 and 13 May. Prices spiked to over $800/MWh at 8am 12 May and to over $500/MWh at 8am 13 May.

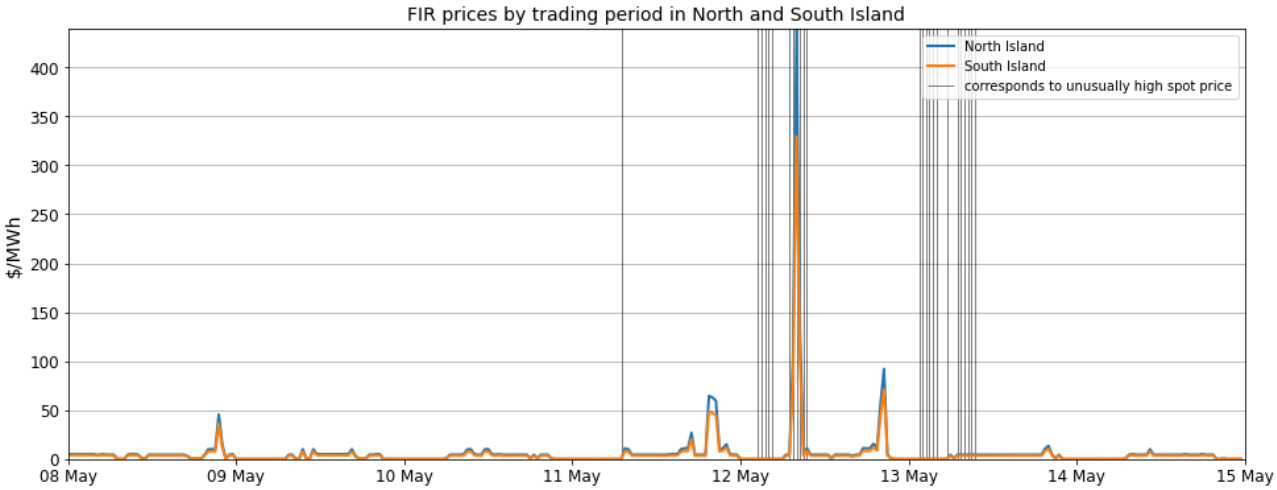
Figure 1: Wholesale Spot Prices



3. Reserve Prices

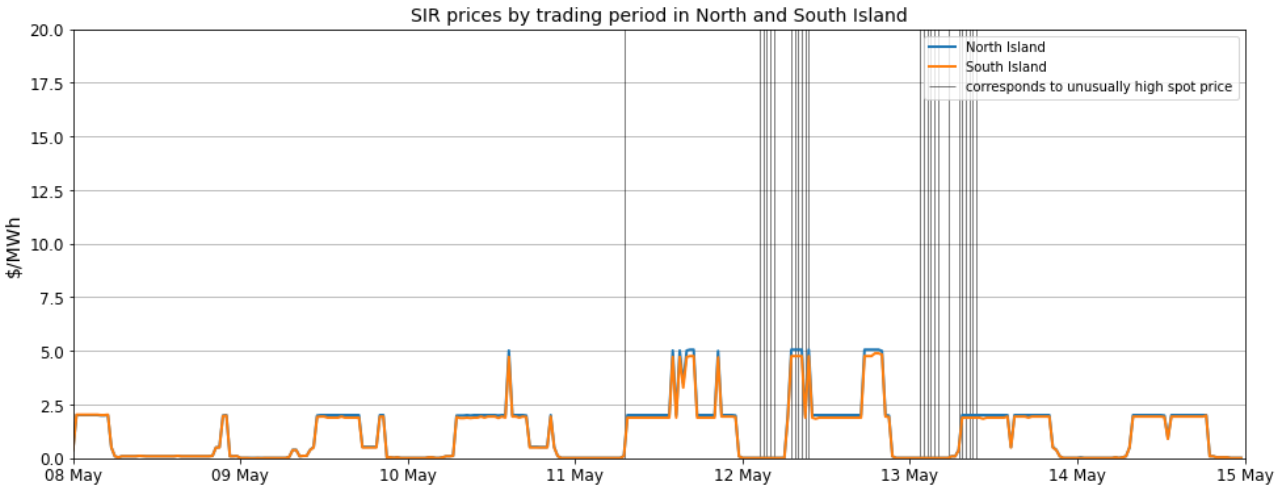
3.1. Fast instantaneous reserves (FIR) prices for the North and South Island are shown below in Figure 2. The mean national FIR price between 8 and 14 May was $6/MWh. The majority of FIR reserve prices this week were within normal range at below $20/MWh. There were some price spikes, reaching up to $450/MWh, which coincided with spot price peaks this week. The spikes in prices were most 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 8 and 14 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



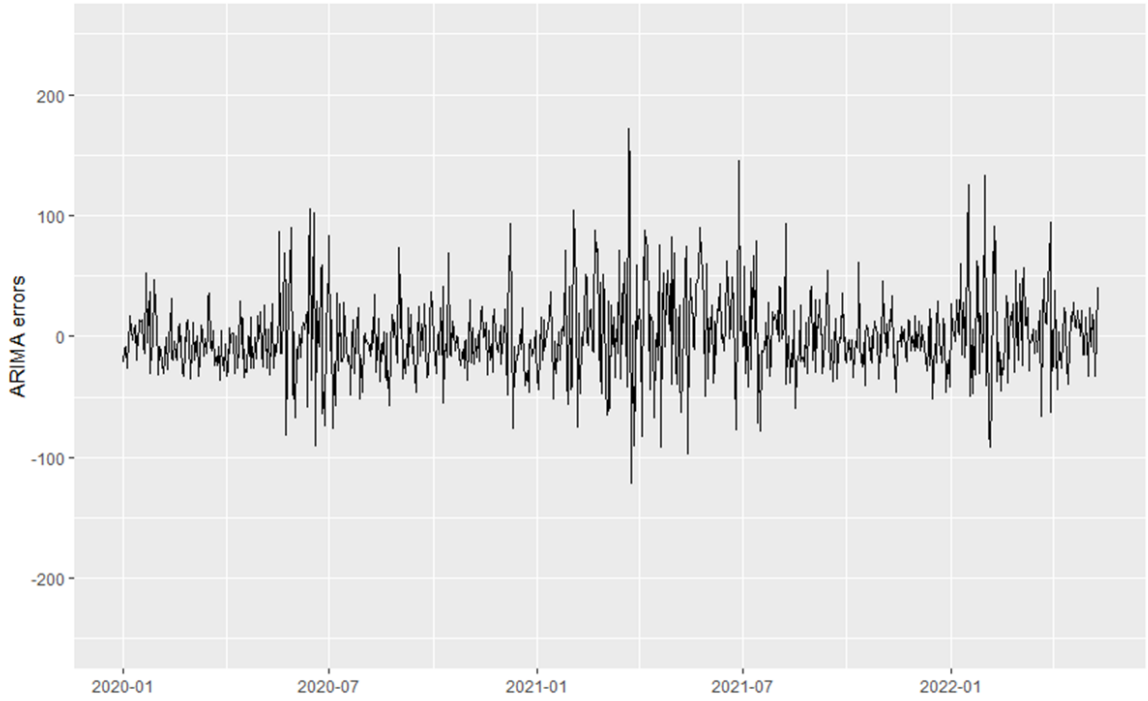
4. Regression Residuals

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.

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

4.2. Figure 4 shows the residuals of autoregressive moving average (ARMA) errors from the daily model. Residuals were mostly stable this week indicating prices largely aligned with market conditions. The largest residual for the week occurred on 12 May correlating with the high morning prices seen on 12 May.

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

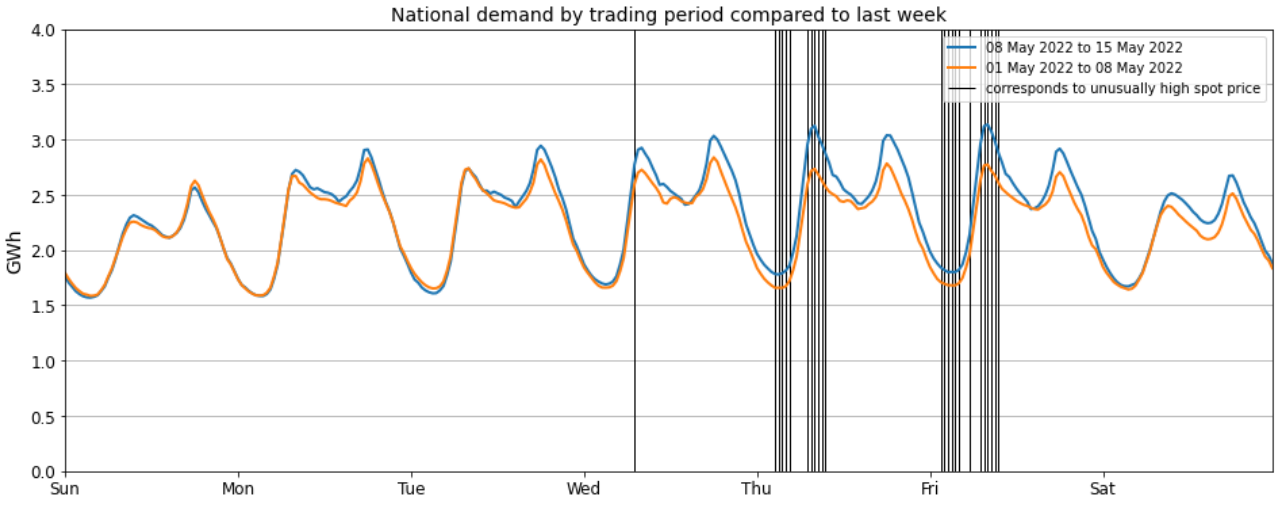


5. Demand

5.1. Figure 5 shows national grid demand against national grid demand from the previous week.

5.2. Daily demand from 8 to 14 May compared to the week prior showed a significant uptick from Wednesday onwards. During the highest priced period of the week, 8am 12 May, the difference between weeks in peak morning demand was 742 MW, an increase of around ~13 per cent. The growth in demand is likely to be the main factor behind high spot prices this week.

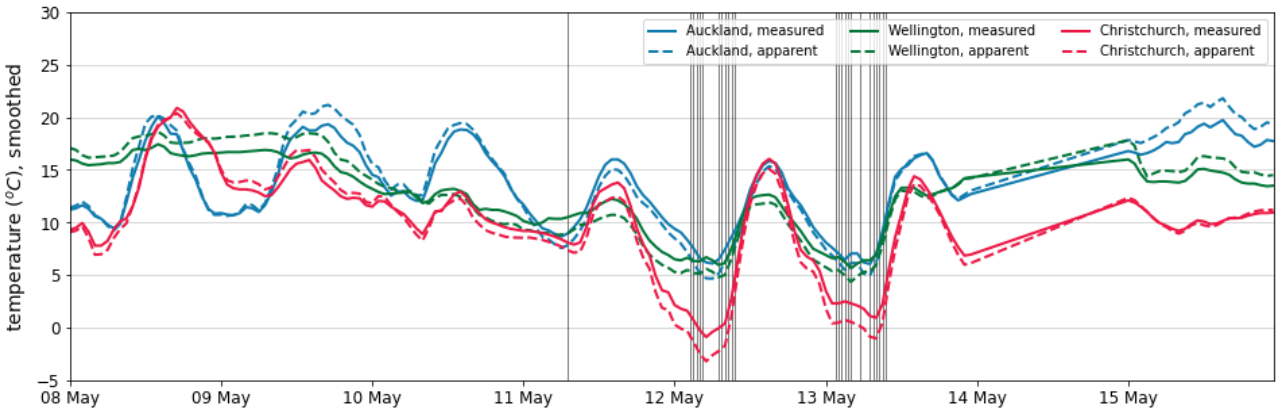
Figure 5: National demand by trading period compared to the previous week



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.

5.4. Temperatures took a visible drop in the middle of the week (to below 0°C in some areas) correlating with the increase in daily demand this week. The increase in demand is therefore highly likely to be from cold weather. Declining weather leading to higher demand and high spot prices are in line with what we would expect for this time of year.

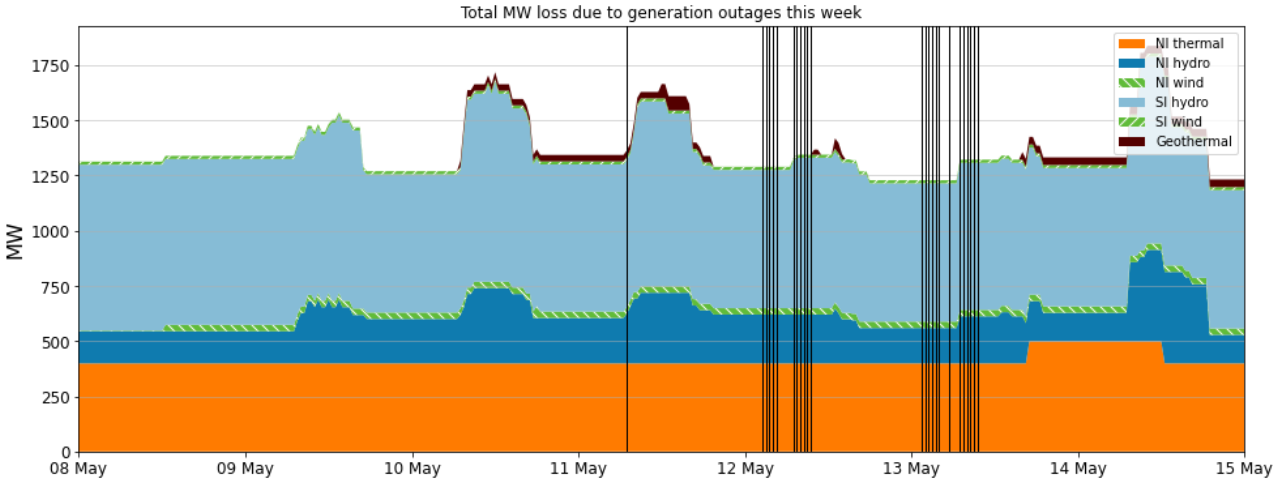
Figure 6: Temperatures across main centres



6. Outages

6.1. Figure 7 shows generation capacity lost due to outages by fuel type. Total generation capacity lost continues to hover around the 1,250 MW mark. The relatively high amount of South Island hydro outages for this time of year are likely due to generators managing historically low lake levels at South Island lakes.

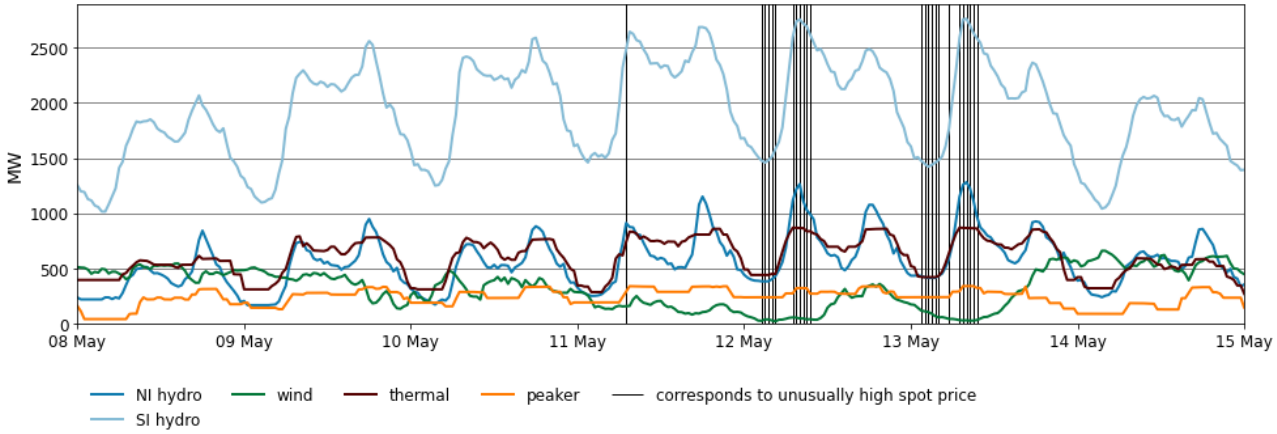
Figure 7: Total MW loss due to generation outages



7. Generation

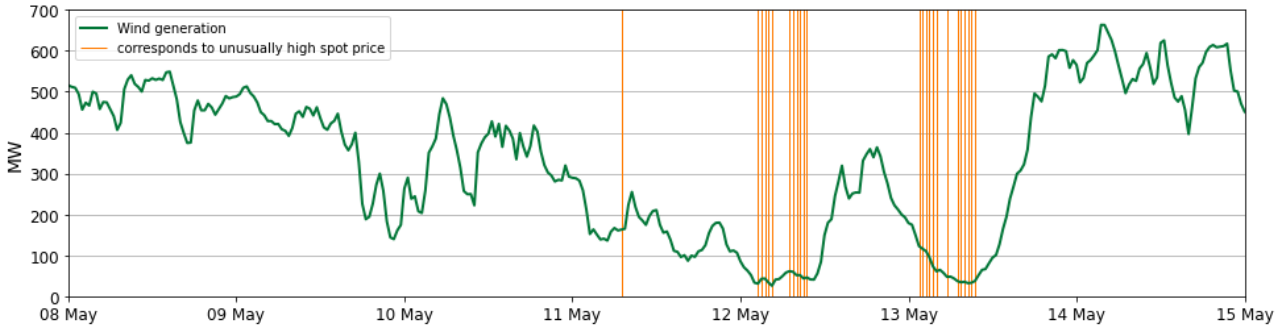
7.1. Low wind generation in the middle of the week coinciding with an increase in daily grid demand increased hydro and thermal generation this week pushing average spot prices up. Hydro generation was at its peak during this week's highest priced trading period.

Figure 8: Generation by Fuel



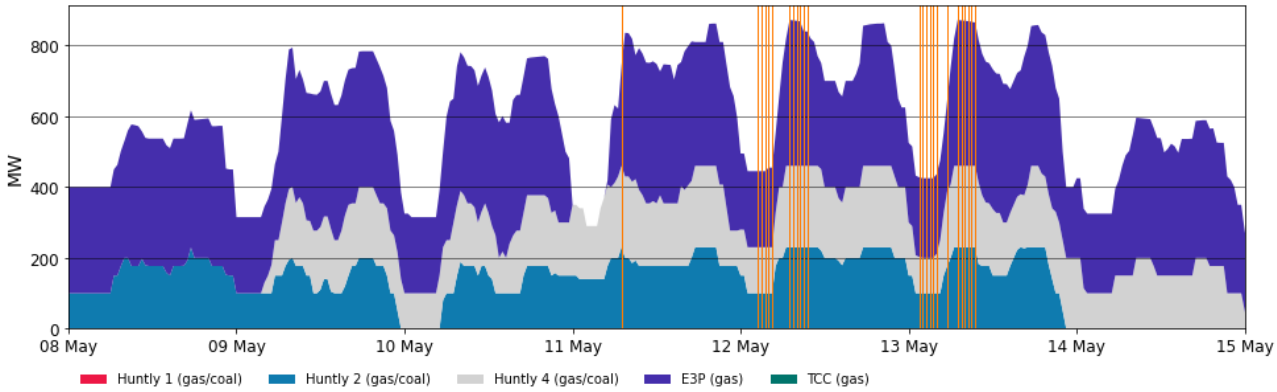
7.2. Figure 9 shows wind generation from 8 to 14 May. Wind generation dropped from ~500 MW at the beginning of the week to ~50 MW by 12 May, despite generation then rising it dropped to ~50 MW again on 13 May. On both occasions when wind was around ~50 MW prices hit their peaks for the week at $800/MWh and $500/MWh respectively on 12 and 13 May. Low wind generation decreases the amount of cheap generation on offer hence the high spot prices.

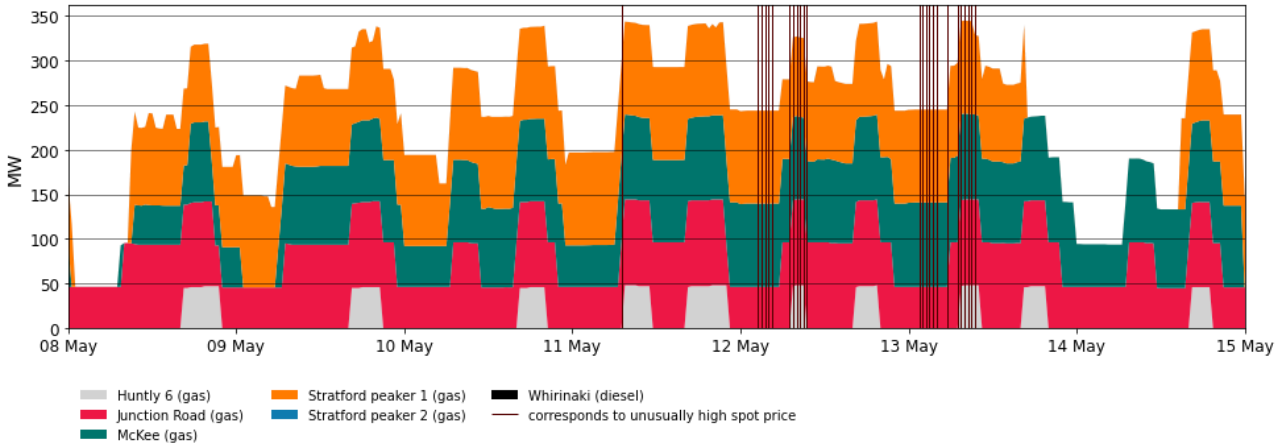
Figure 9: Wind Generation



7.3. Figure 10 shows generation at thermal and thermal peaker plants, which increased during the middle of week when grid demand increased and wind generation dropped. Thermal generation peaked to just over 800 MW and thermal peaker generation peaked to just under 350 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



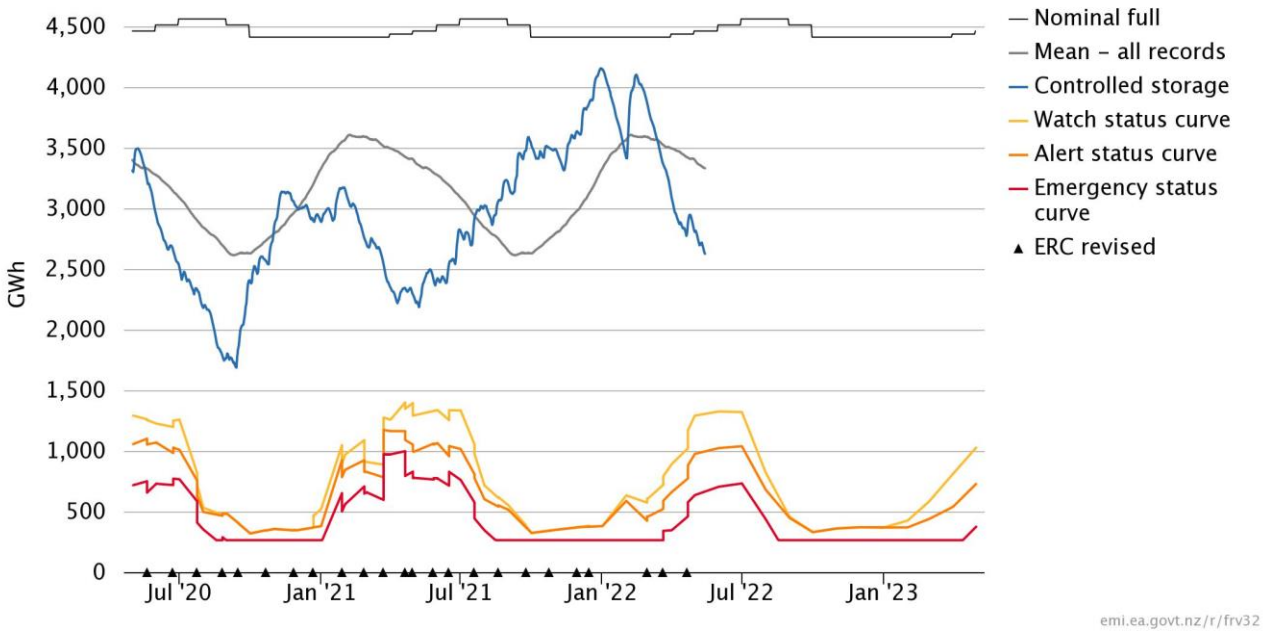


7.4. Our estimations show that Huntly units 1-4 are running almost exclusively on coal.

8. Storage/Fuel Supply

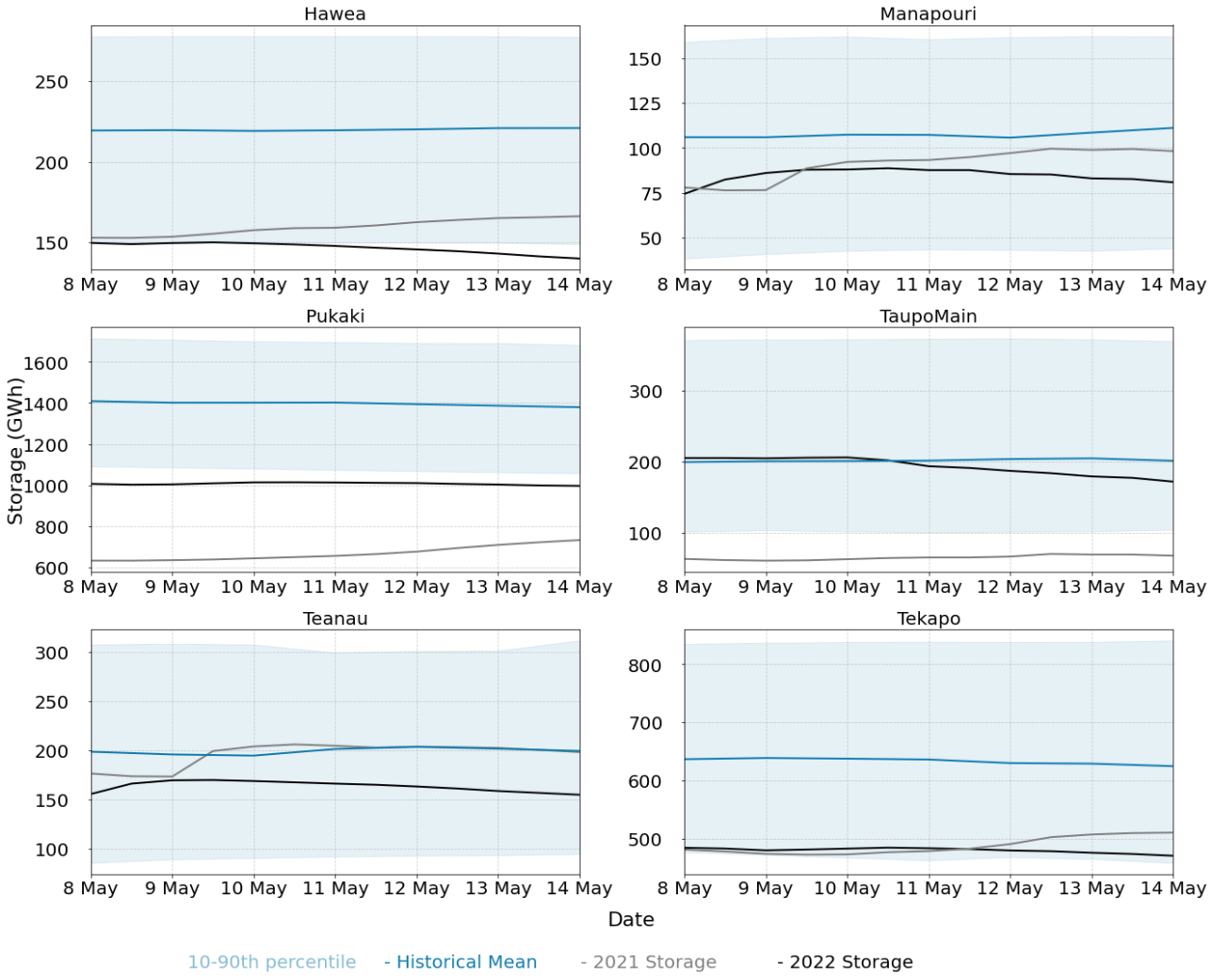
8.1. Figure 11 shows total controlled national hydro storage. Total hydro storage continues to decline on the back of low inflows despite conservative generator behaviour with hydro generation having to increase in the face of increasing demand. The decline in hydro storage continues to push up the opportunity cost of hydro generation and so subsequently prices in the wholesale market.

Figure 11: Hydro Storage



8.2. Figure 12 shows hydro storage at major lakes compared to the previous year, historic average and historic 10th-90th percentiles. All lakes have shown a slight decline in storage. Lake Hawea, Lake Pūkaki and Lake Tekapo levels continue to hover around their 10th percentiles. Lake Taupo has finally dipped below historical mean. Lake Manapōuri and Lake Te Anau though below their historic mean levels remain comfortably above their 10th percentiles.

Figure 12: Major Lake Storage



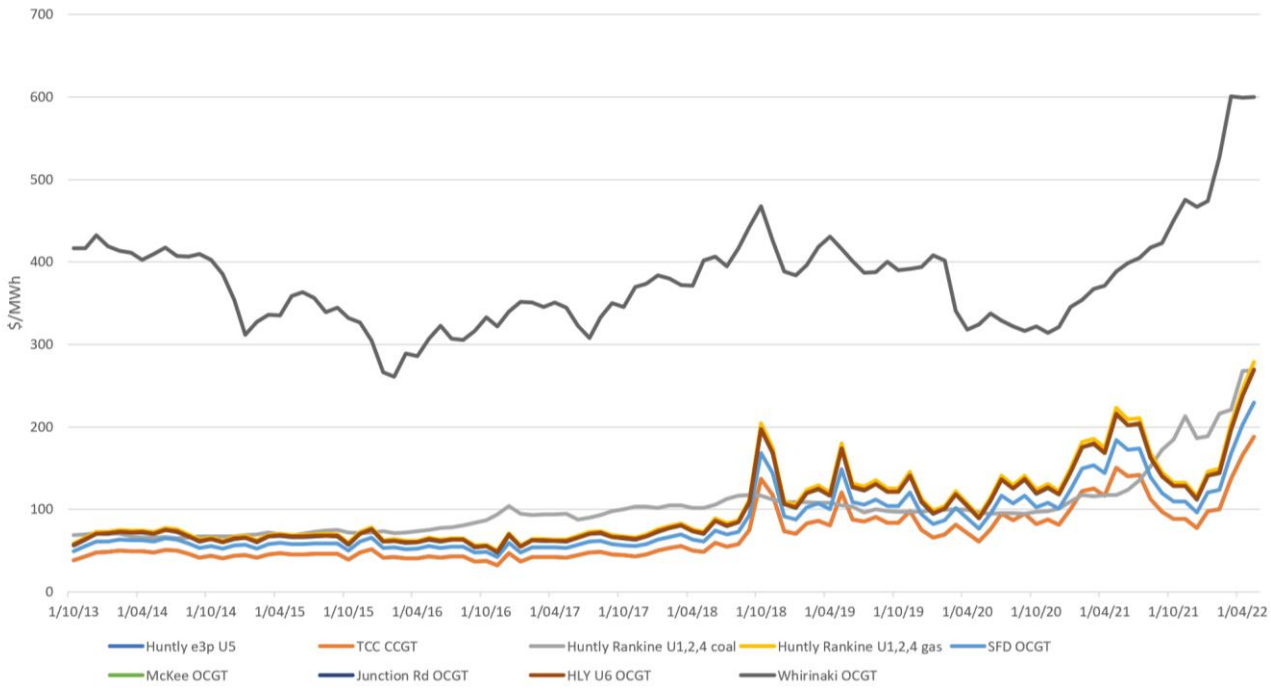
9. Price versus estimated costs

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.

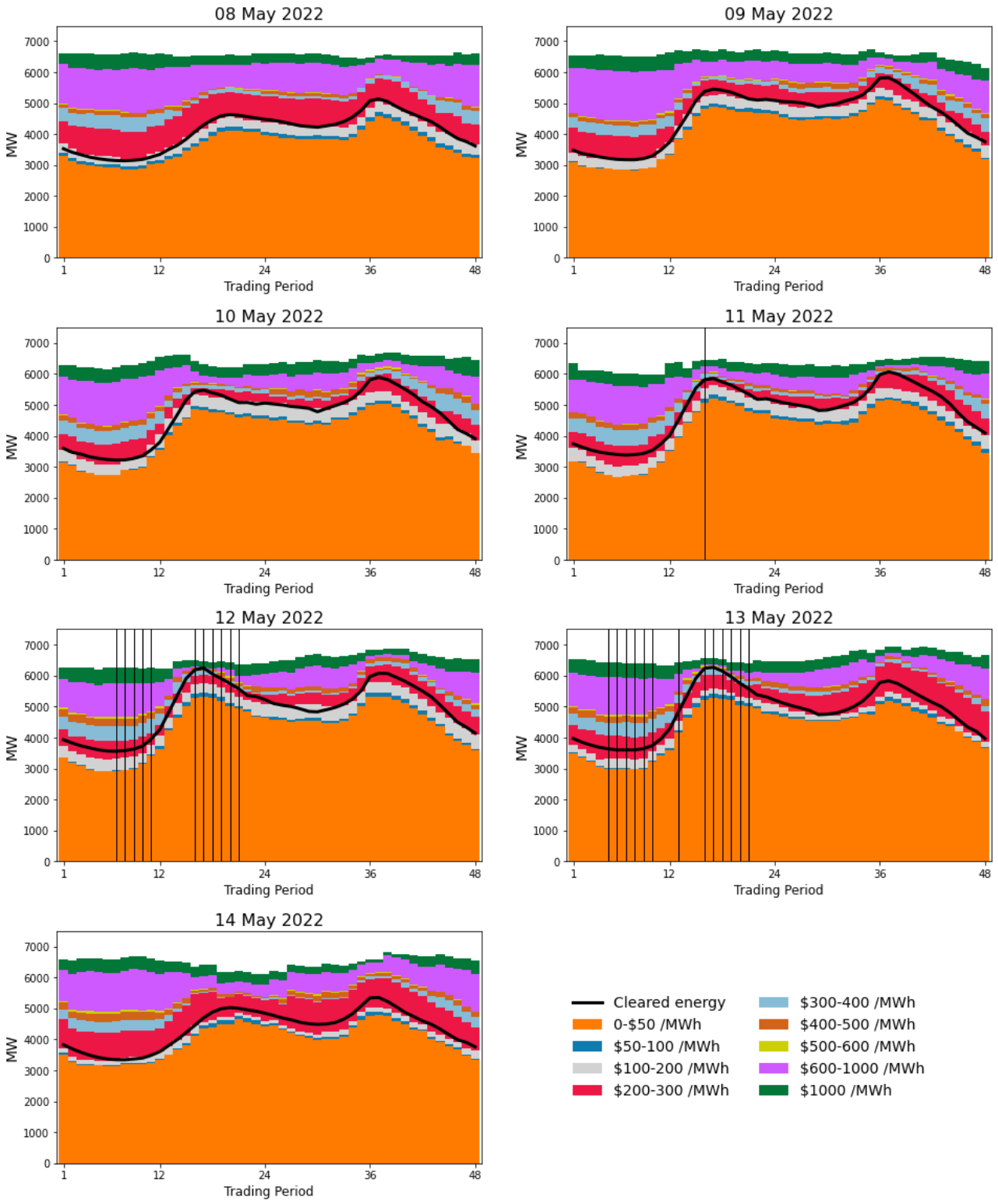
11.2. High thermal and hydro generation opportunity costs as detailed above continue to drive a steep offer curve.

11.3. Following the trend of the previous week mid-range offers continue to shrink with more generation shifting up price brands and steepening the offer curve. The number of $1,000+/MWh offers appears to have slightly increased indicating generators are attempting to conserve more generation from dispatch.

11.4. The steepening offer curve is in line with what we would expect for current conditions with less hydro storage from low inflows, less thermal fuel available with the current month-long outage at Maui gas field and increasing grid 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 11,12 and 13 May this week were due to unusually high demand and low wind generation during peak demand periods. When combined with a steepening offer curve this resulted in the high prices observed this week.

12.2. The enquiry into high prices for several trading periods between 8 and 12 February has been resolved.

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

Table 1: 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	Resolved	High inflows resulted in lower offers at Waitaki and Clyde stations. Inflows at Te Anau and Manapouri were not enough to significantly increase storage and inflows in North Island were predominantly after 12 February, so overall supply was still constrained, so prices remained high.
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.
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