

Date: 4 April 2023



# TRADING CONDUCT REPORT

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Market Monitoring Weekly Report

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## 1. Overview for week of 26 March – 1 April 2023

- 1.1. The HVDC pole 2 outage separated North and South Island prices between Monday and Wednesday, with prices in the South Island mostly below \$100/MWh and those in the North between \$0-\$200/MWh. From Wednesday onwards prices mostly stayed converged as cold temperatures saw demand increase.
- 1.2. A planned outage of a transformer at Islington substation coincided with unexpectedly high demand on 28 March resulting in a press release by Transpower which asked consumers in Christchurch, Rangiora and Kaiapoi to reduce electricity use in order to reduce the risk of power cuts.
- 1.3. A North Island low residual CAN notice was issued for Wednesday morning, however, prices remained relatively low. On Thursday morning North Island prices spiked above the 90<sup>th</sup> percentile due to low temperatures inducing high demand, low wind and continued the HVDC outage put pressure on reserves requires. During this time both Huntly 1 and 2 ran.
- 1.4. On Friday morning, the temperature and wind conditions were similar, however, the second HVDC pole had returned to service. A combination of factors however, including but not limited to, neither Huntly 1 or 2 running, a third Manapouri unit being on outage, higher than expected demand in the South Island, led to a tight energy supply in both islands. Trading periods 17 and 18 on Friday 31 March will continue to be analysed by the Market Monitoring team.

## 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 identifying 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 any node exceed its historical 90<sup>th</sup> percentiles. Note that this week, prices above the historic 90<sup>th</sup> percentile are highlighted with a translucent green line. Other notable prices, but which did not breach the 90<sup>th</sup> percentile, are marked in black dashed lines (if any).
- 2.2. Between 26 March – 1 April 2023:
  - (a) The average wholesale spot price across all nodes was \$114/MWh.
  - (b) 95 percent of prices fell between \$0/MWh and \$256/MWh.
- 2.3. Figure 1 shows spot prices at Benmore and Ōtāhuhu alongside their historic median and historic 10<sup>th</sup> - 90<sup>th</sup> percentiles adjusted for inflation.
- 2.4. Prices between the North and South Island were largely separated between Sunday and Tuesday, due to the second HVDC pole outage. Prices in both islands though remained mostly under \$200/MWh. Prices then mostly converged from Wednesday onwards, with prices mostly between \$100-\$200/MWh.
- 2.5. Spot prices at Otahuhu breached the 90<sup>th</sup> percentile of historic prices three times this week:
  - (a) This first occurred at 5 am on Thursday morning, with a \$168/MWh price at Benmore and a \$235/MWh price at Otahuhu.
  - (b) The second instance occurred at 8 am on Thursday morning, with a \$232/MWh price at Benmore and a \$548/MWh price at Otahuhu.

(c) The third instance occurred on Friday morning at 7:30 am, with a \$455/MWh price at Benmore and a \$535/MWh price at Otahuhu. This was a cold, low wind morning, where demand was high, no Rankine units were running, another Manapouri unit was on outage (bringing the total capacity of the unit down to 492) and there was issues with Ohau C (removing ~100 MW from its capacity). Whirinaki was constrained on to provide reserves. No CANS were issued.

2.6. Other high prices, but which did not breach the 90<sup>th</sup> percentile occurred:

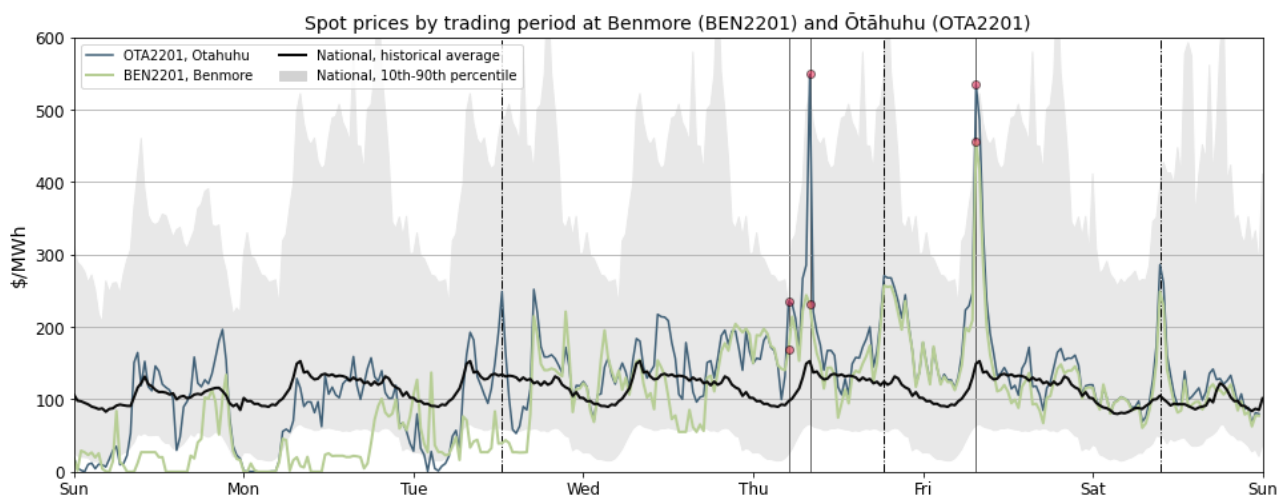
(a) Tuesday at 12:30 pm, with a \$251/MWh price at Otahuhu and a \$214/MWh price at Benmore.

(b) Thursday at 6:30 pm, with a \$270/MWh price at Otahuhu and a \$256/MWh price at Benmore.

(c) Saturday at 9:30 am, with a \$286/MWh price at Otahuhu and a \$246/MWh price at Benmore.

2.7. A CAN low residual notice was issued for the North Island for Wednesday 29 March (7:30-9:00 am). However, prices remained relatively low in both Islands.

Figure 1: Wholesale Spot Prices between 26 March (Sunday) – 1 April (Saturday) 2023.

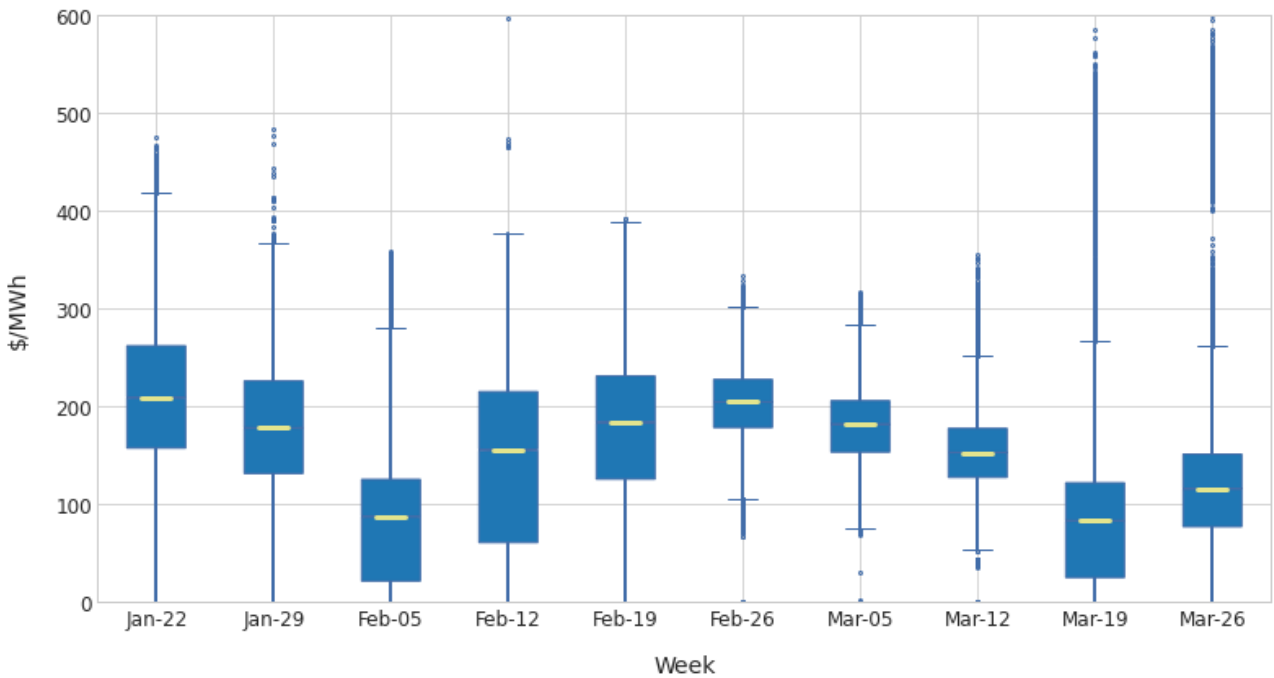


2.8. Figure 2 shows a box plot with the distribution of spot prices during this week and the previous nine weeks. The green line shows each week's median price, while the box part shows the lower and upper quartiles (where 50 percent of prices fell). The "whiskers" extend to points that lie within 1.5 times the inter-quartile range (IQR)<sup>1</sup> of the lower and upper quartile, and then observations that fall outside this range are displayed independently.

2.9. This week, the median was slightly higher when compared to the week before. The price increase was largely driven by the HVDC outage, which pushed up the requirement for reserves in the North Island, higher demand in both islands due to colder weather, and higher average South Island spot prices from mid-week onwards. However, prices were lower than prices in late February and early March, due to increased hydro generation as lake levels have recovered.

<sup>1</sup> [Quartile - Wikipedia](#)

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

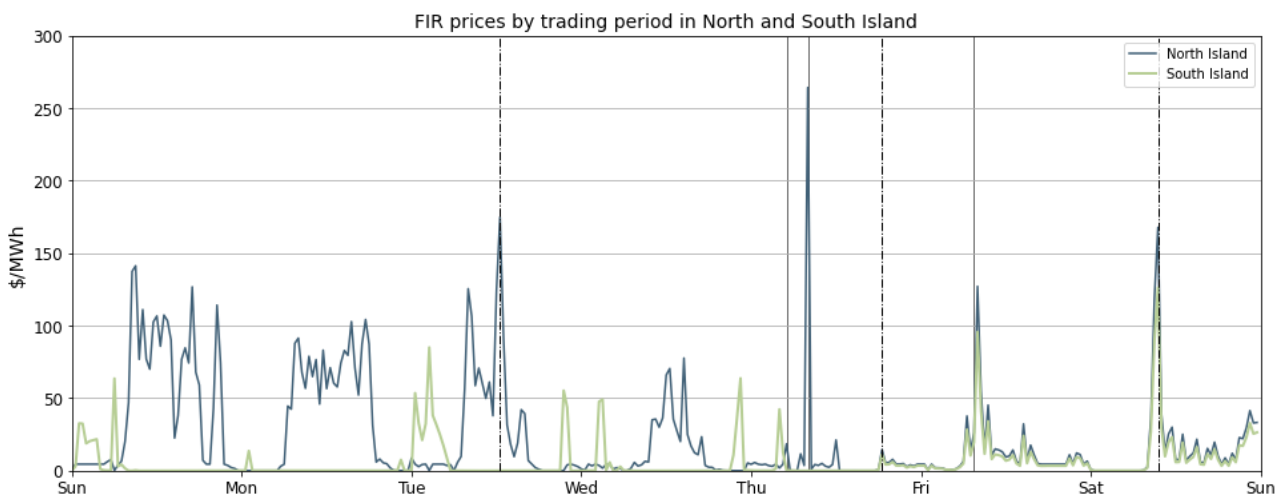


### 3. Reserve Prices

Fast instantaneous reserve (FIR) prices for the North and South Islands are shown below in

3.1. Figure 3. This week there were several instances where the North Island FIR prices were high. The highest North Island FIR price of \$264/MWh occurred on Friday at 8:00 am. The highest South Island FIR prices occurred at 9:30 am on Saturday 1 April. Higher FIR prices in the first half of the week were due to the HVDC outage which limited reserve sharing between the islands, so more reserves were needed in the North Island. The high North and South Island FIR prices on Friday morning reflect the high demand and tight energy supply which occurred in both islands at these times.

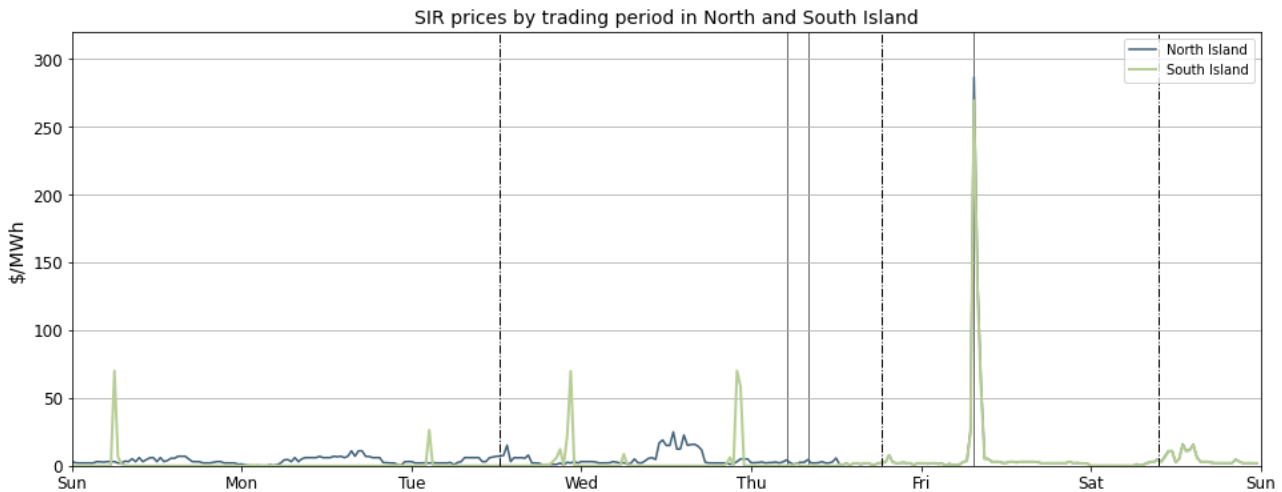
Figure 3: FIR prices by trading period and Island.



Sustained instantaneous reserve (SIR) prices for the North and South Islands are shown in

3.2. Figure 4. SIR prices were mostly below \$10/MWh. However, relatively high SIR prices in the South Island were observed due to the HVDC outage. These high SIR prices are still being looked into, with several highest South Island SIR prices occurring across Sunday, Tuesday and Wednesday. None of these prices co-occurred with the high prices outlined earlier in this report. The high North and South Island SIR price on Friday morning reflects the tight energy situation which occurred in both islands at the time.

Figure 4: SIR prices by trading period and Island.

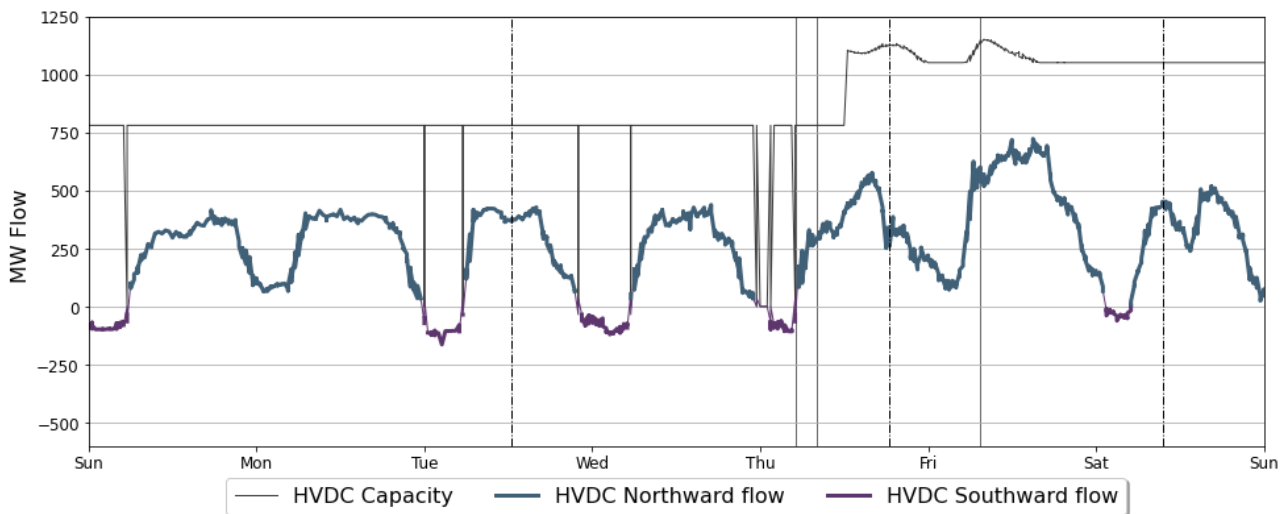


## 4. HVDC

4.1. Figure 5 shows HVDC flow between 26 March – 1 April. One of the HVDC poles went on outage<sup>2</sup> (from 21 March 2023 to 30 March 2023) and limited the maximum flow to around 750 MW. HVDC flows were mostly northward during the day from Sunday to Wednesday, and southward during the night. Between Thursday and Friday, flows were entirely Northward. There was some HVDC flow southward overnight on Saturday. The sudden dip in HVDC flow on Thursday afternoon, from ~540 MW at 4 pm to ~300 MW at 6:30 pm due to a Manapouri unit going on outage, may have contributed to the price spike on Thursday evening. Other changes in offers on Thursday afternoon are still being looked into further.

<sup>2</sup> This HVDC outage was an extension of the HVDC outage which occurred earlier in the month. The extension was necessary due to decreased resources available during the original outage from staff being deployed to help with the aftermath of cyclone Gabrielle.

Figure 5: HVDC northward flow and capacity.

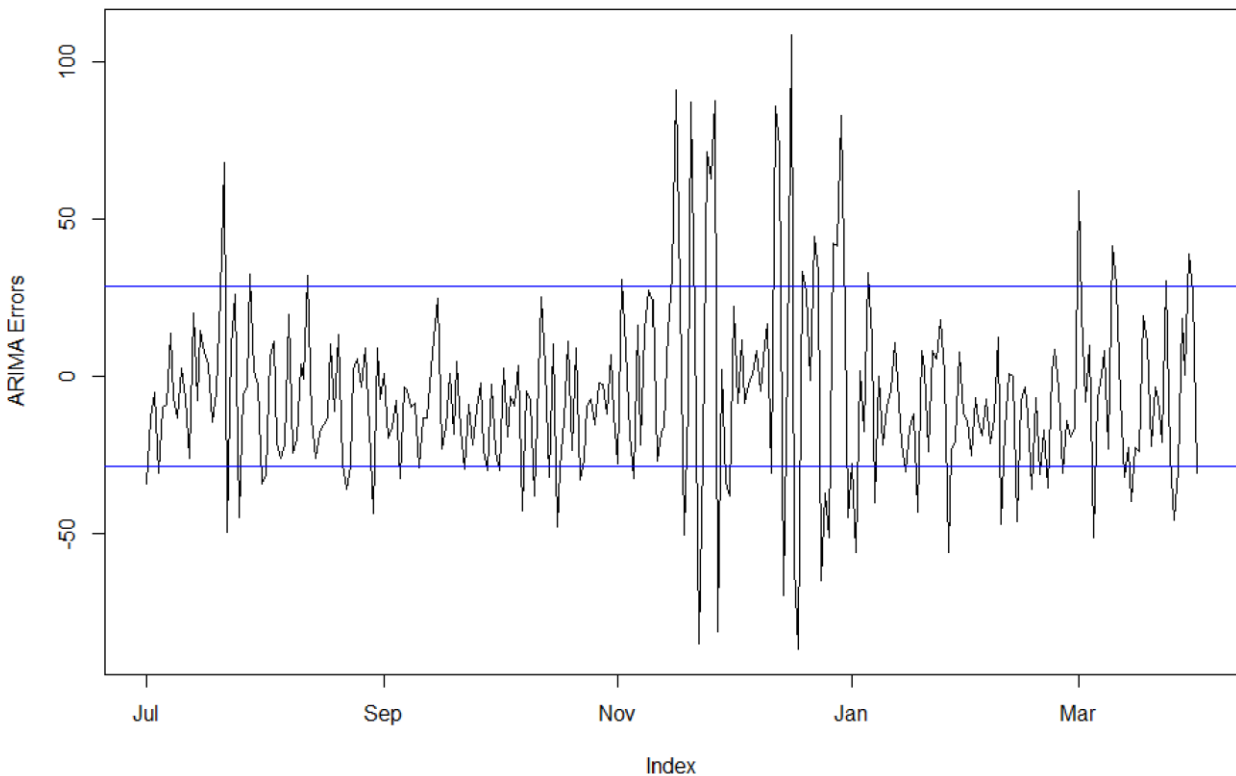


## 5. Regression Residuals

- 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 A<sup>3</sup> on the trading conduct webpage.
- 5.2. Figure 6 shows the residuals of autoregressive moving average (ARMA) errors from the daily model. Residuals were mostly relatively small, suggesting that prices on those dates appear to be largely aligned with market conditions. There was a residual above one standard deviation of the data, which occurred on Friday. Here the residual was positive, indicating that the modelled price was lower than the actual prices.

<sup>3</sup> <https://www.ea.govt.nz/assets/dms-assets/29/Appendix-A-Regression-Analysis.pdf>

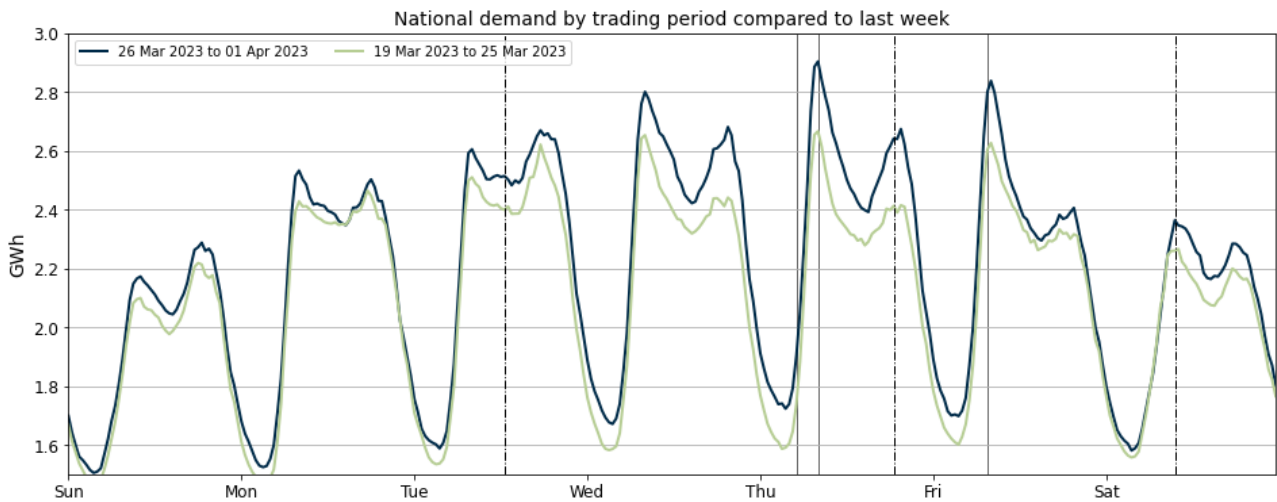
Figure 6: Residual plot of estimated daily average spot prices from 1 July 2022 – 1 April 2023. The blue lines show two standard deviations of the ARMA errors.



## 6. Demand

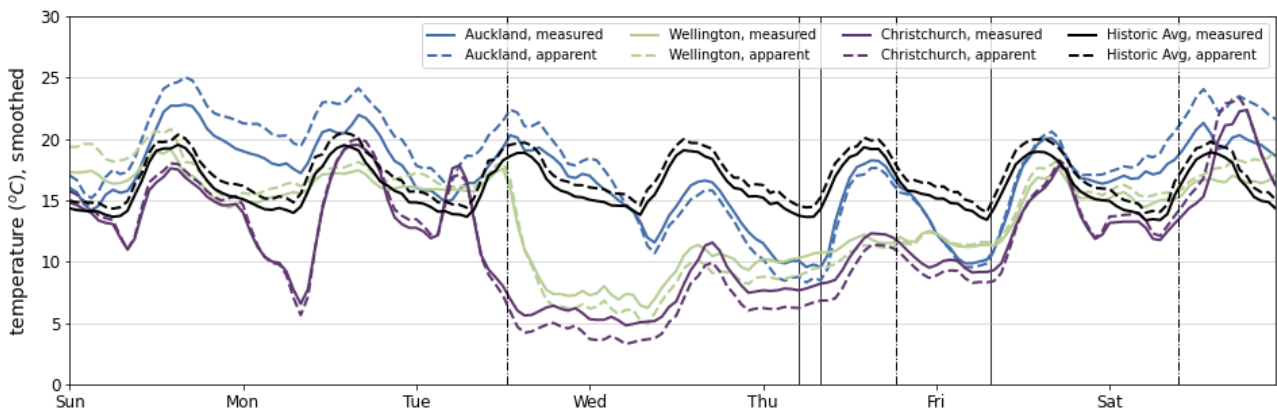
- 6.1. Figure 7 shows national grid demand between 26 March – 1 April, compared to the previous week. Daily demand was higher across all days when compared to the previous week. Between Wednesday and Friday, there was a large difference, especially during peak, as demand increased due to low temperatures. The highest demand of the week, being 2.9 GWh, occurred on Thursday at 8:00 am.
- 6.2. A planned outage of a transformer at Islington substation coincided with unexpectedly high demand on Tuesday 28 March resulting in a press release by Transpower which asked consumers in Christchurch, Rangiora and Kaiapoi to reduce electricity use in order to reduce the risk of power cuts.

Figure 7: National demand by trading period compared to the previous week.



- 6.3. Figure 8 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.
- 6.4. Between Tuesday and Friday, temperatures across Wellington and Christchurch were mostly below the historic average, with Christchurch dipping to around 6 degrees on Wednesday and Thursday morning. Temperatures were around average on Saturday afternoon. Apparent temperatures in Auckland were generally between 15 and 22 degrees, which is mostly around the historic average for the whole week.

Figure 8: Temperatures across main centres.



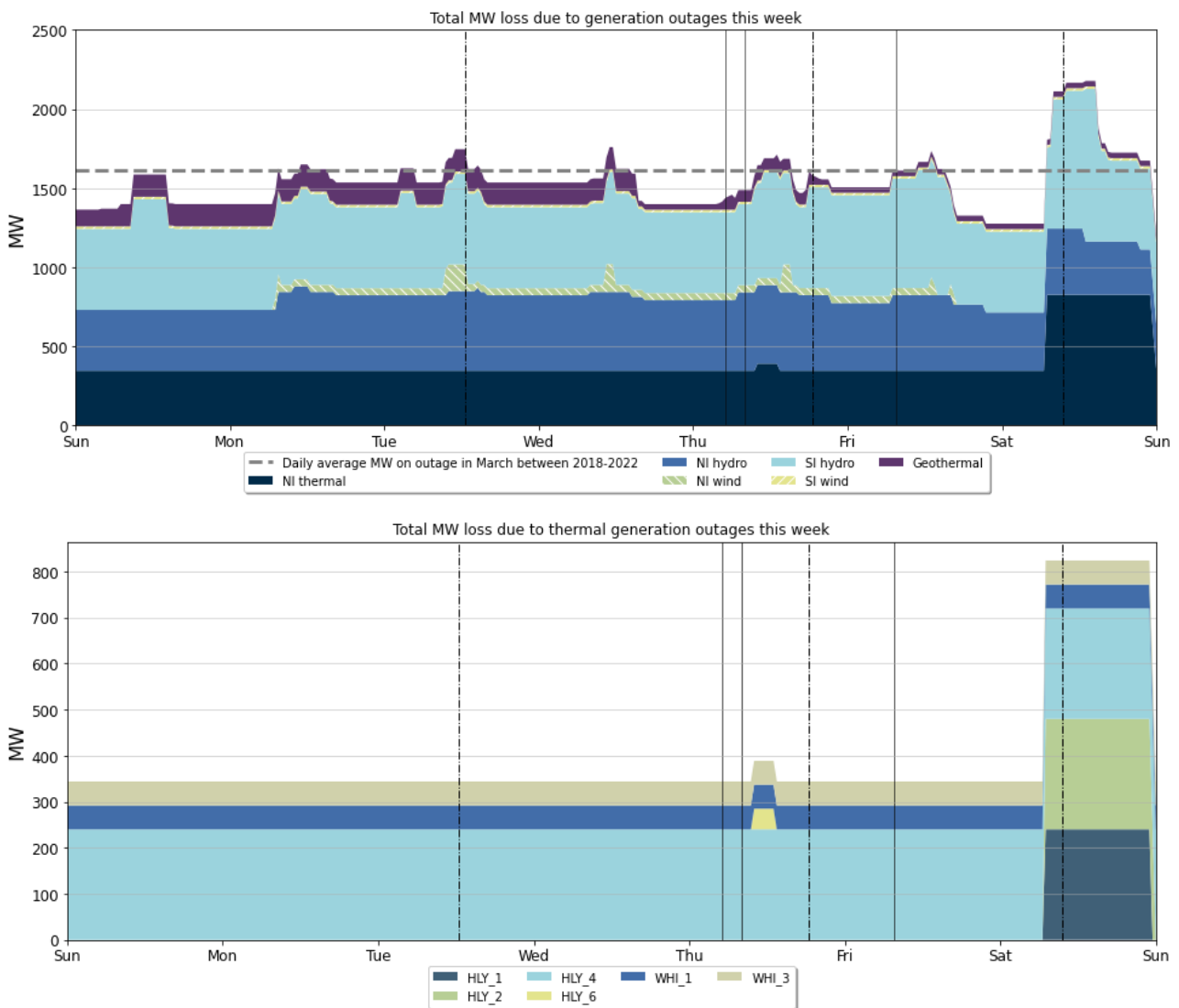
## 7. Outages

- 7.1. Figure 9 shows generation capacity on outage. Total capacity on outage between 26 March – 1 April ranged between ~1,400 – 2,100 MW. Outages were highest on Saturday.
- 7.2. Notable outages include:



- (a) Huntly 4 remains on outage until 28 April 2023.
- (b) Huntly 1 and 2 went on outage on Saturday.
- (c) Manapouri 6 went on outage on Thursday.
- (d) Ōhau B and C entered an outage on Saturday.
- (e) Two Whirinaki units are on outage until 11 April 2023.
- (f) The Geothermal plant Kawerau was on outage between 20 March to 29 March 2023.

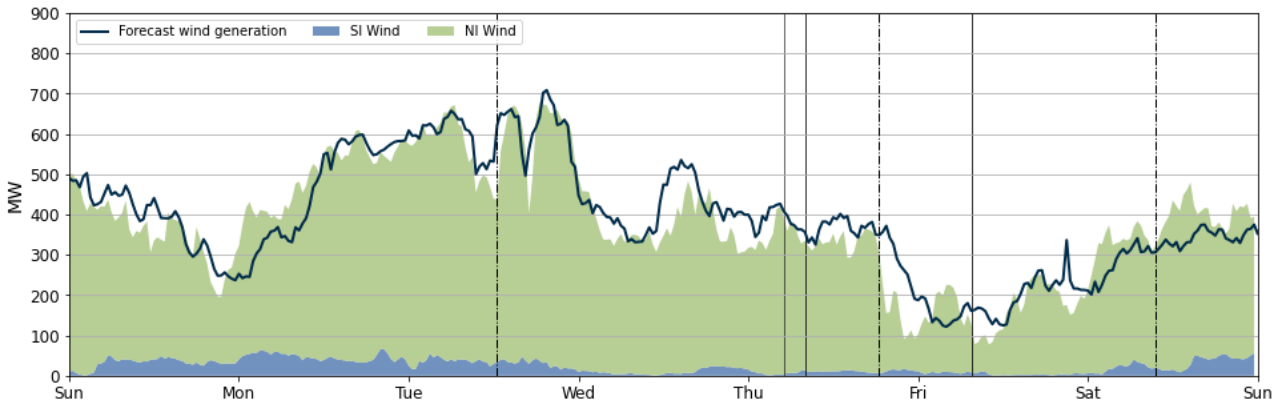
Figure 9: Total MW loss due to generation outages.



## 8. Generation

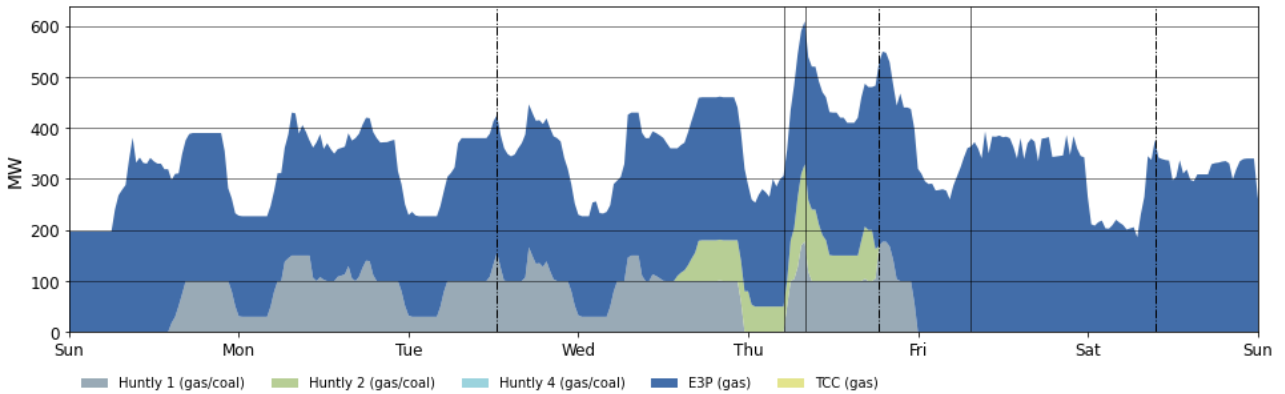
- 8.1. Wind generation, between 26 March – 1 April, varied between ~80-680 MW (Figure 10). Wind generation was highest on Monday and Tuesday – with generation mostly over 500 MW. The high price at mid-day Tuesday occurred when there was a relatively large difference between forecast and actual wind generation, with the largest divergence coming from West Wind II – with Meridian forecasting a ~60 MW higher output from the wind farm 1 hour ahead. From Wednesday onwards, wind generation decreased, and stayed mostly between 200-400 MW. Wind generation was lowest on Friday morning.

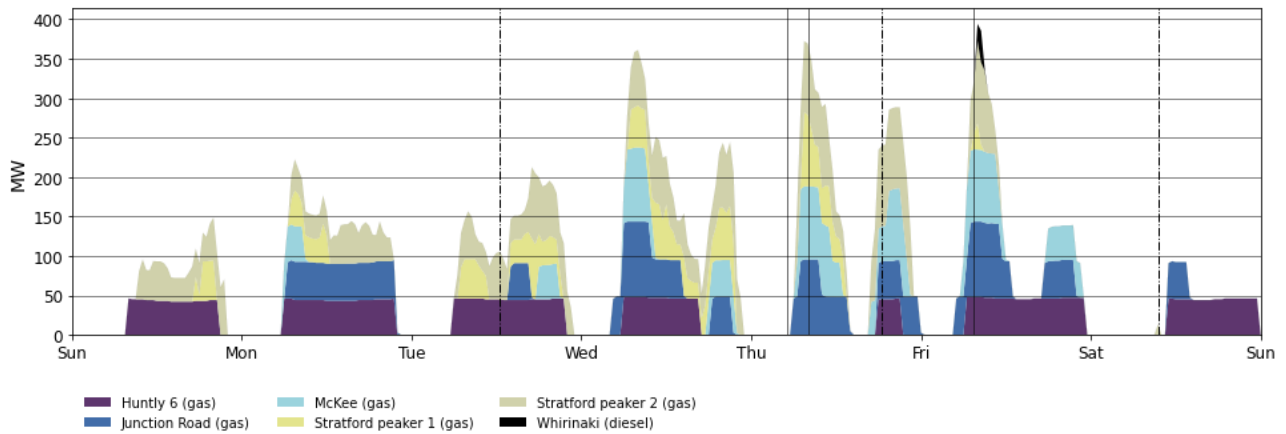
Figure 10: Wind Generation and forecast.



- 8.2. Figure 11 shows generation of thermal baseload and thermal peaker plants between 26 March – 1 April. E3P (Huntly 5) ran all week as baseload. Huntly 1 also ran from Tuesday to Thursday. Due to low forecast wind at Waipipi, Genesis brought Huntly 2 online between Wednesday evening and Thursday morning. There were no Rankines running on Friday morning, which may be related to the Saturday outage, though we will look into this further.
- 8.3. Generation from peakers this week was highest on Wednesday, Thursday, and Friday mornings- as there was high demand. Junction road, McKee, and Huntly 6 ran most days this week. Stratford peaker 1 ran on Sunday for the evening peak when wind generation was low. Stratford peakers 1 and 2 also ran from Tuesday to Friday to cover peak demand. On Saturday only Huntly 6 and Junction road peaker ran.

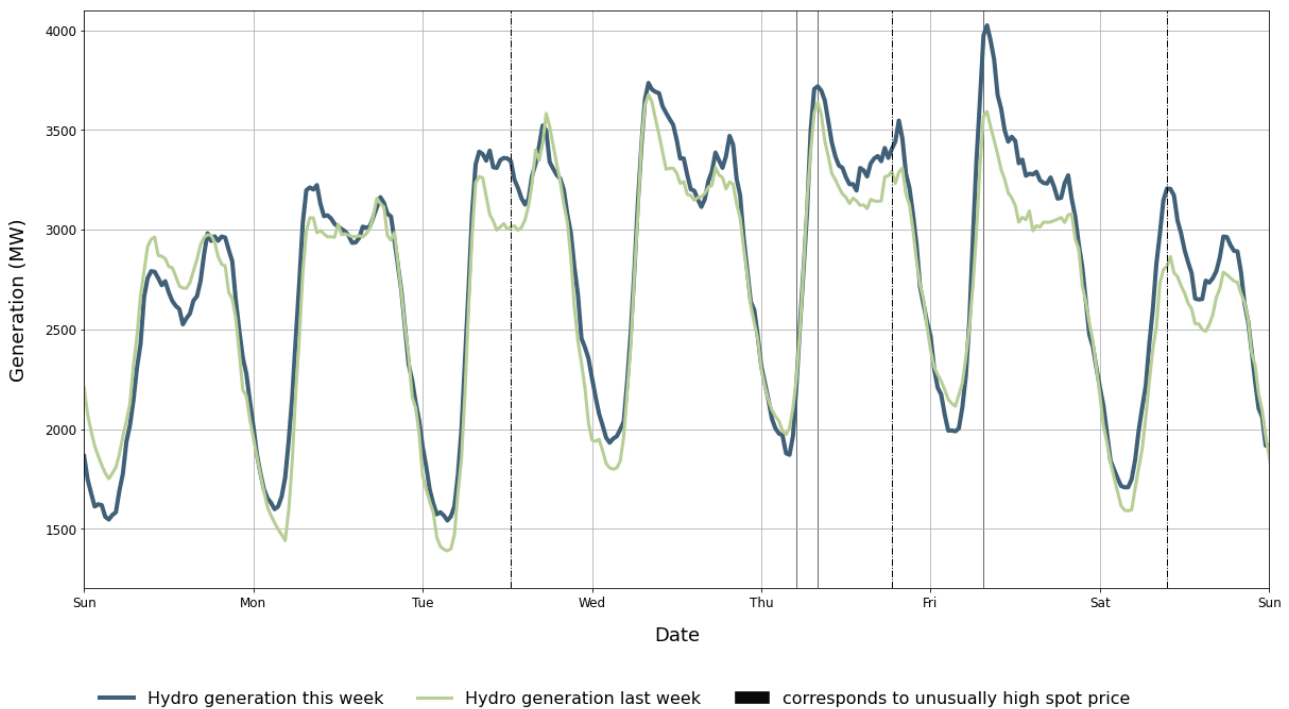
Figure 11: Thermal Generation.





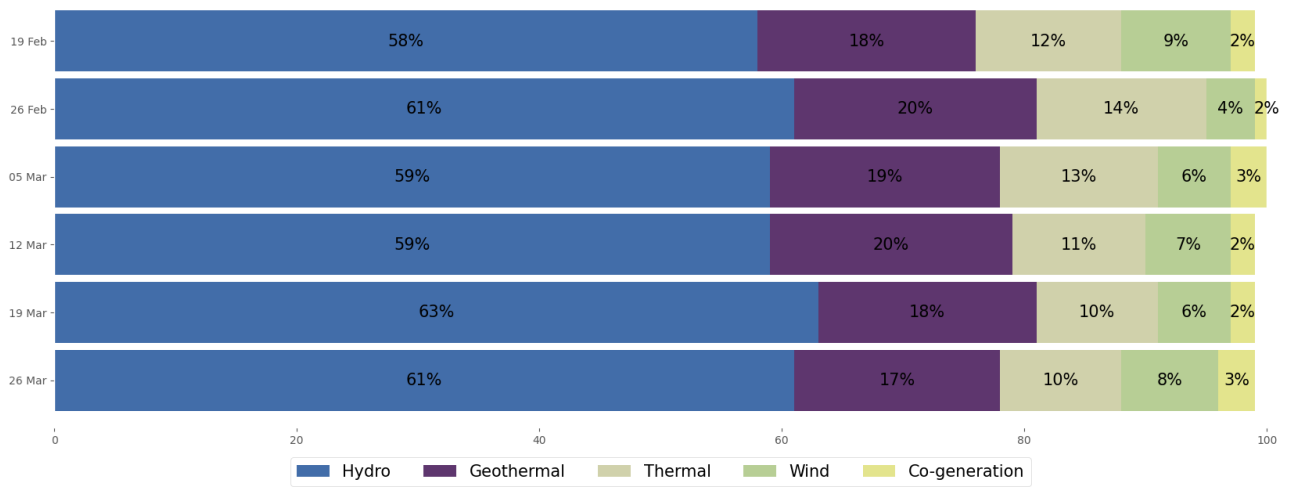
8.4. Figure 12 shows total hydro generation in MW produced each trading period, compared to the same time in the previous week. There was higher hydro generation compared to last week from Monday onwards. High amounts of hydro ran on Friday morning as there was low wind, high demand, and no Rankine units running.

Figure 12: Hydro generation between 26 March – 1 April compared to the previous week.



8.5. As a percentage of total generation, between 26 March – 1 April, total weekly hydro generation totalled 61 percent, geothermal 17 percent, thermal 10 percent, wind 8 percent, and co-generation 3 percent.

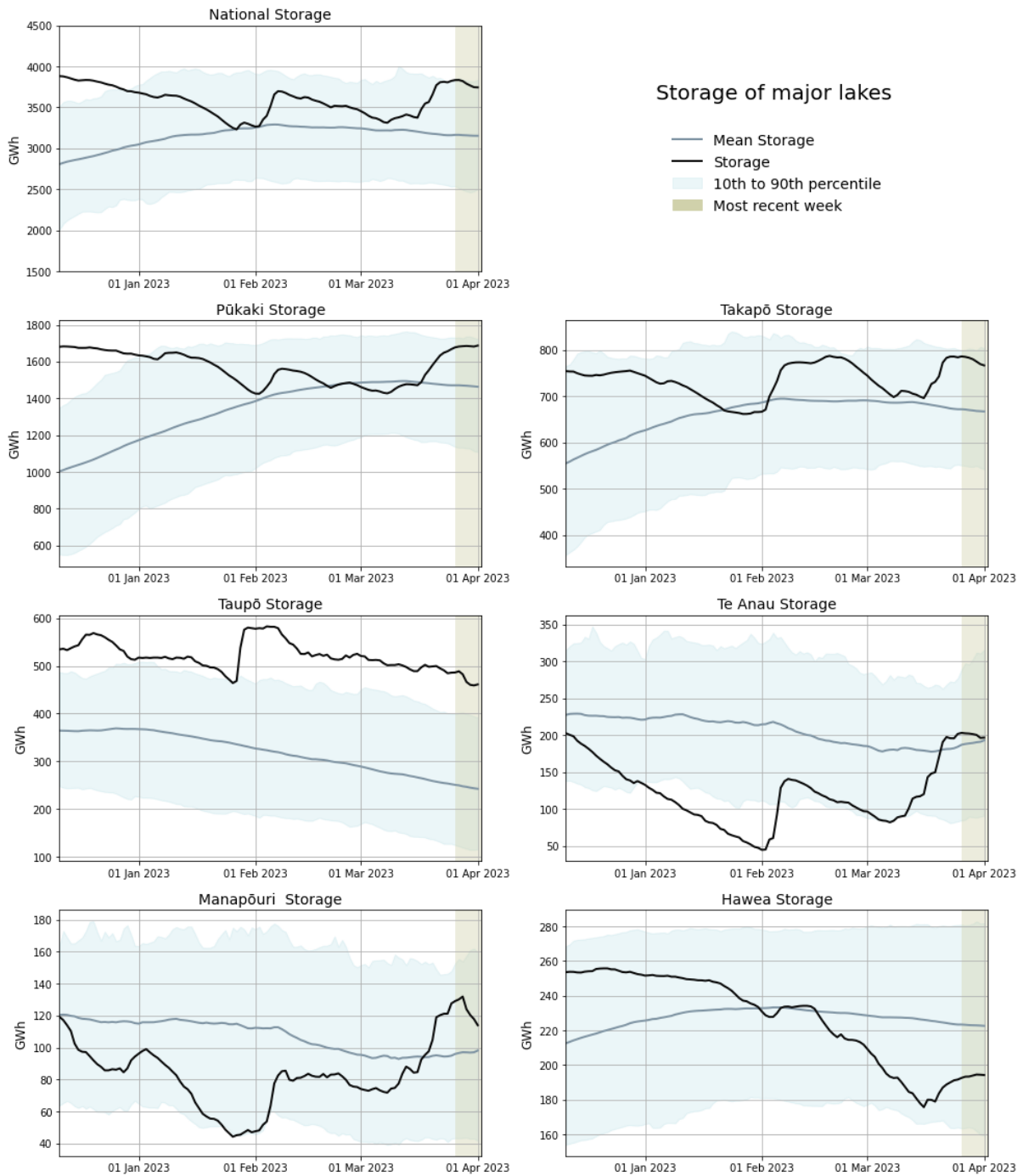
Figure 13: Total generation as a percentage each week between 26 March and 1 April 2023.



## 9. Storage/Fuel Supply

- 9.1. Figure 14 shows total controlled national hydro storage as well as the storage of major catchment lakes including their historical mean and 10<sup>th</sup> to 90<sup>th</sup> percentiles.
- 9.2. Overall, national hydro storage increased and by the end of the week touched its 90<sup>th</sup> percentile. Total national storage is around 91 percent of nominal full as of 1 April.
- 9.3. Storage at all South Island lakes increased with lakes Pūkaki, Takapō, and Manapōuri well above their historic average. Storage at Lake Te Anau increased and is slightly above its historic average. Lake Hāwea level had an uptick at the end of the week and is now well above its historic 10<sup>th</sup> percentile. In the North Island Taupō is still above its historic 90<sup>th</sup> percentile.

Figure 14: Hydro Storage.



## 10. JADE Water Values

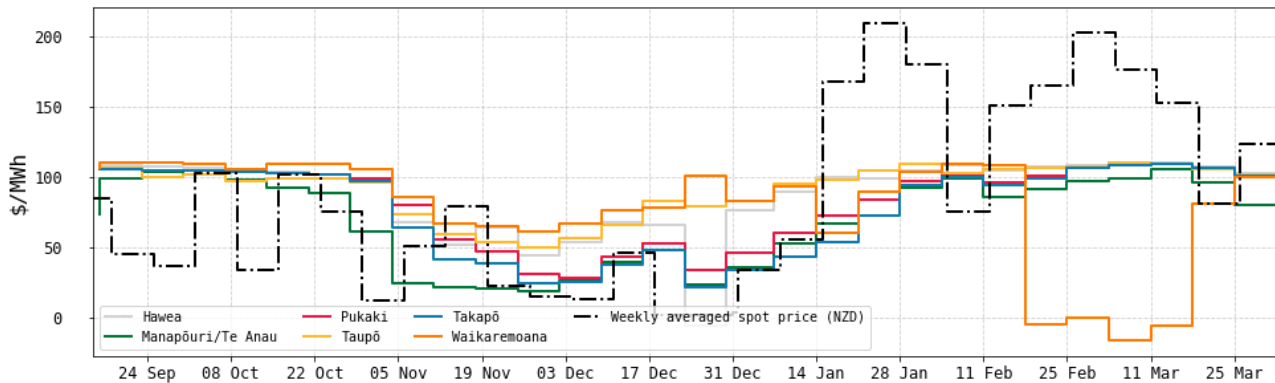
10.1. The JADE<sup>4</sup> model gives a consistent measure of the opportunity cost of water, by seeking to minimise the expected fuel cost of thermal generation and the value of lost load and provides an estimate of water values at a range of storage levels. Figure 15 shows the national water values between 15 September 2022 and 1 April 2023 using values obtained from JADE. These values are used to estimate the marginal water value at the actual

<sup>4</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.

storage level. More details on how water values are calculated can be found in Appendix B<sup>5</sup> on the trading conduct webpage.

- 10.2. At the beginning of 2023, water values were rising, as lake levels were declining. Water values across all lakes slightly decreased last week, with most lakes receiving moderate inflows prior to 18 March. Note that when the water value for Waikaremoana dropped to below zero indicated that it was full and was only able to supply energy to parts of Hawkes Bay. Waikaremoana storage decreased this week, as reflected in its water value. Water values at Manapōuri decreased, reflecting its increase in storage.

Figure 15: JADE water values across various reservoirs between 15 September 2022 and 1 April 2023.



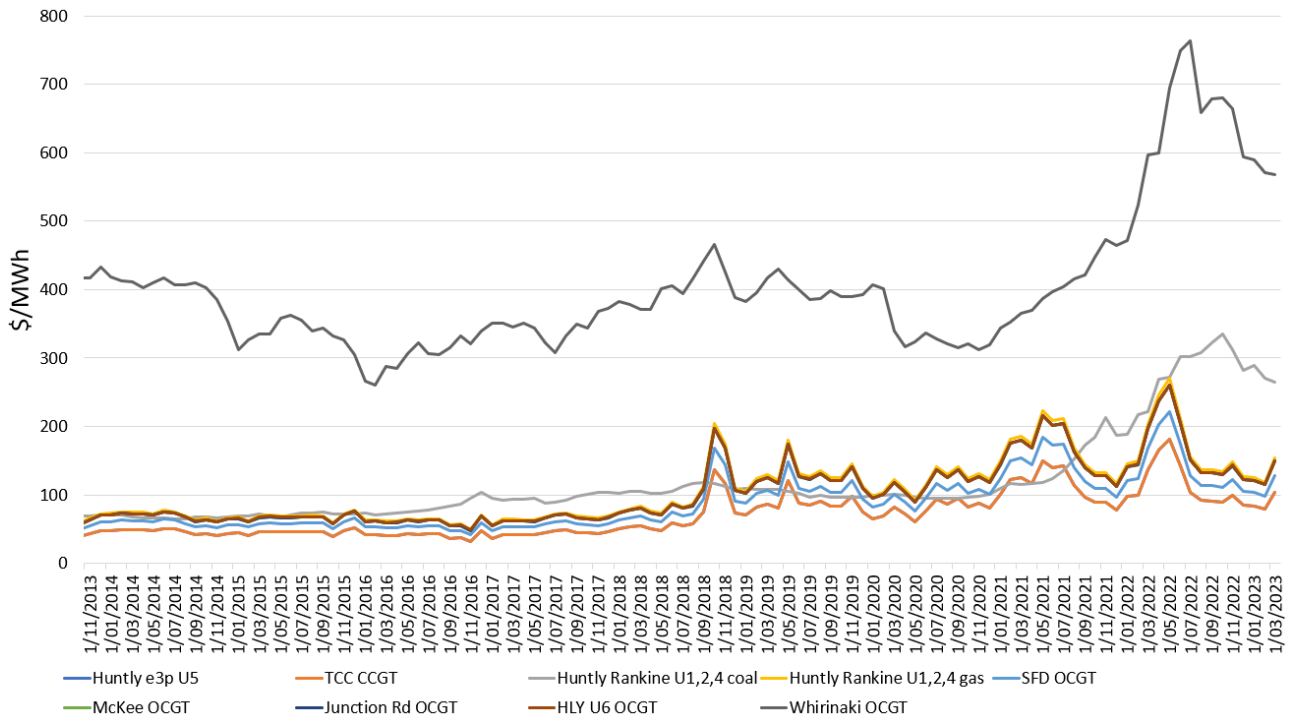
## 11. Prices versus estimated costs

- 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 16 shows an estimate of thermal SRMCs as a monthly average up to 1 March 2023. The SRMC of gas fuelled plants has increased, while the SRMC of diesel and coal has slightly decreased.
- 11.4. In early March Indonesian coal fell to around ~\$450/tonne (NZD) putting the latest SRMC of coal fuelled Huntly generation at ~\$265/MWh.
- 11.5. The SRMC of Whirinaki has decreased slightly to ~\$567/MWh.
- 11.6. The SRMC of gas run thermal plants increased to between \$105/MWh and \$150/MWh, likely due to an increase in gas demand.
- 11.7. More information on how the SRMC of thermal plants is calculated can be found in Appendix C<sup>6</sup> on the trading conduct webpage.

<sup>5</sup> <https://www.ea.govt.nz/assets/dms-assets/29/Appendix-B-JADE-water-value-model.pdf>

<sup>6</sup> <https://www.ea.govt.nz/assets/dms-assets/30/Appendix-C-Calculating-thermal-SRMCs.pdf>

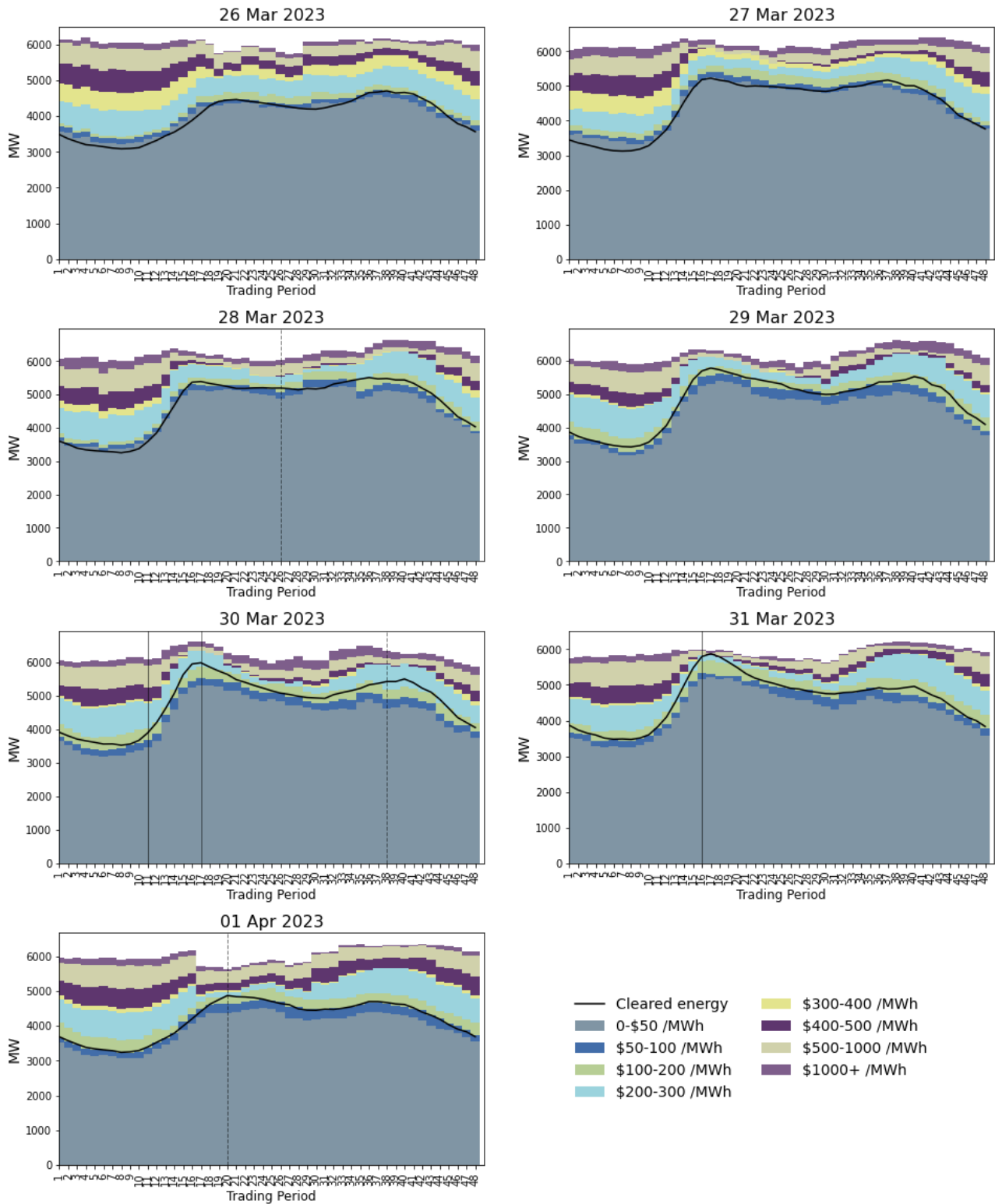
Figure 16: Estimated monthly SRMC for thermal fuels.



## 12. Offer Behaviour

12.1. Figure 17 shows this week's national daily offer stacks. The black line shows cleared energy, indicating the range of the average final price. Most of the energy was cleared in the \$100-200/MWh early in the week, before then mostly clearing in the or \$200-300/MWh from Wednesday onwards. During the mornings on Thursday energy in the \$200-\$300 band cleared, and on Friday morning, due to the decrease in offers between \$200-300/MWh, as neither Rankine was running, and some hydro offers had been removed due to outages, energy cleared in the \$500-1000/MWh band.

Figure 17: Daily offer stacks.





## 13. Ongoing Work in Trading Conduct

13.1. This week, prices generally appeared to be consistent with supply and demand conditions. However, further analysis will continue on trading periods 17 and 18 for Friday 31 March. 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>Notes</b>
07/10/2022	15-16	Further analysis	The Monitoring team is making enquires with Genesis regarding offer changes to final tranche prices at Huntly 5 for trading period 15-16.
13/12/2022- 16/12/2022	Several	Further analysis	The Authority will continue analysis into the high energy prices.
15/1/2023 4/2/2023	Several	Further analysis	The Authority will continue analysis into the high energy prices associated with high hydro offers.
21/3/2023	33	Further analysis	The Authority will continue analysis into the high energy and reserve prices.
22/3/2023	17-18	Further analysis	The Authority will continue analysis into the high energy and reserve prices in relation to the CAN notice.
23/3/2023	16-18	Further analysis	The Authority will continue analysis into the energy prices and participant response in relation to the CAN notice.
24/3/2023	17,28	Further analysis	The Authority will continue analysis into the high energy and reserve prices in relation to the CAN notice and for other high price TP.
31/3/2023	17,18	Further analysis	The Authority will continue analysis into the high energy and reserve prices.