Weekly Market Movements - Week Ended 17 December 2023

Overview

National hydro storage continued to decline last week and remains below average for the time of year. Residual generation margins remained healthy last week and looking ahead N-1-G margins are healthy for the rest of the horizon into mid February.

In this week's insight, we look at alternative sources of energy for Santa and his sleigh.

Security of Supply

Energy

National hydro storage continued to decline, dropping to 87% of the average for this time of year, down from 91% last week. South Island storage decreased to 84% of its historical mean, while North Island storage decreased to 108%.

Capacity

Residual generation margins were healthy last week, with a minimum residual of 545 MW on Wednesday morning. The Wednesday morning peak was the highest peak of the week at 5287 MW.

N-1-G Margins are healthy for the remainder of December and through January. The latest NZGB report is available on the NZGB website.

Electricity Market Commentary

Weekly Demand

National demand was 742 GWh last week, a 1 GWh decrease from the previous week. Demand peaked at 5,287 MW on Wednesday 13 December at 8:00 am. Next week is likely to have much lower demand as it will span Christmas day, Boxing day and New Years day, all traditionally low load days.

Weekly Prices

The average wholesale price at Haywards last week was $169/MWh, up from $149/MWh the previous week. Prices peaked at $413/MWh at Otahuhu on Wednesday 13 December at 08:30 during the morning demand peak.

Generation Mix

The renewable percentage of the generation mix last week remained steady at 89%. Thermal contribution remained at 9%. Wind generation increased from 9% to 13% and geothermal increased from 18% to 19.5%. Hydro generation backed off from 61% to 56%.

HVDC

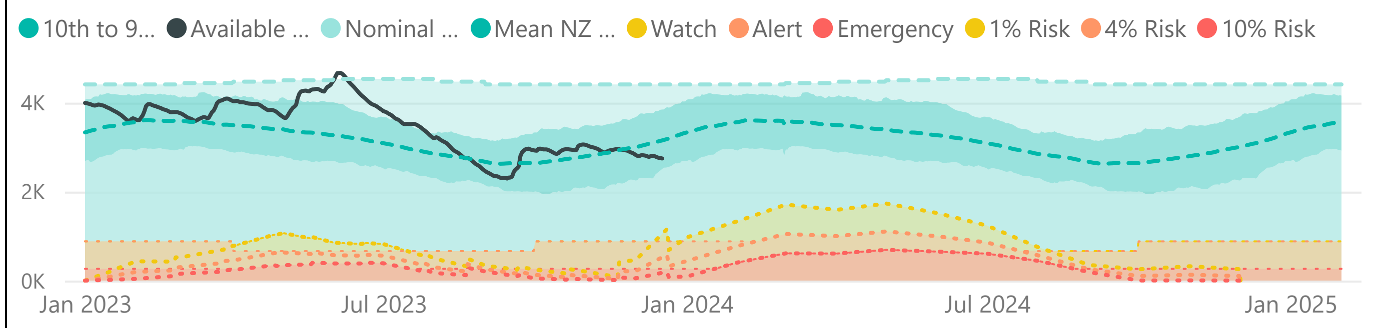
Net HVDC flows were northward for all daytime trading periods last week. There were multiple nights with net southwards flow overnight when North Island wind generation was high and demand was low.

New Zealand Energy Risk

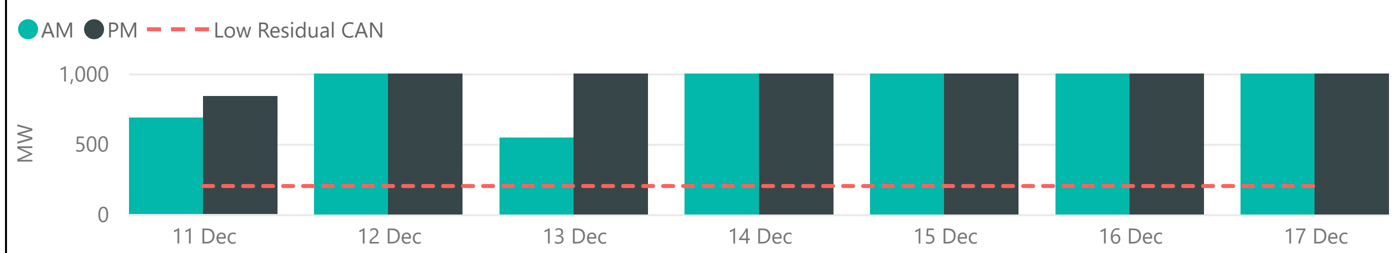
South Island Energy Risk

Normal Watch Alert Emergency

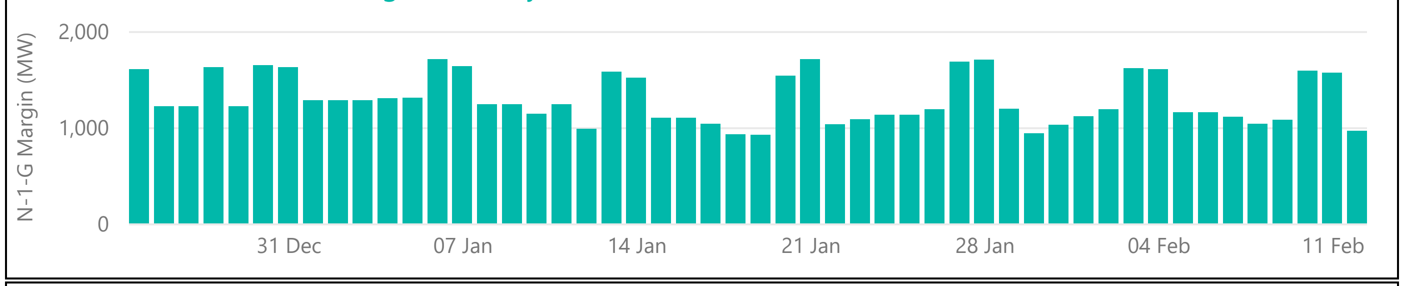
New Zealand Energy Risk Status Curves (Available GWh)



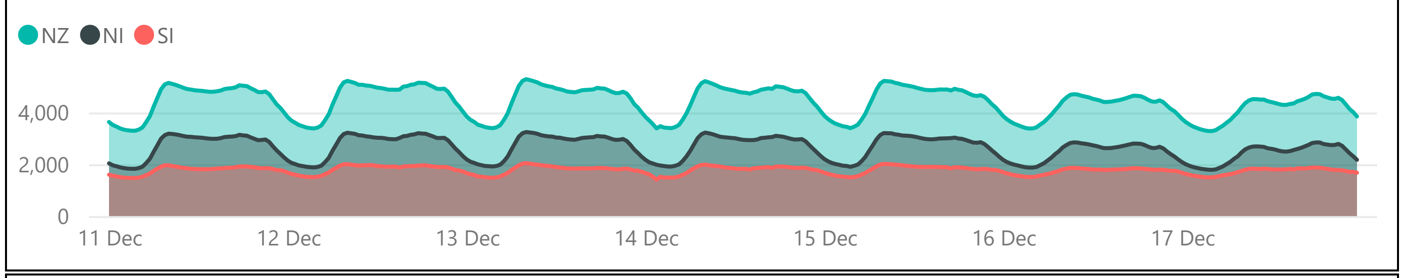
Lowest Residual Points - MW



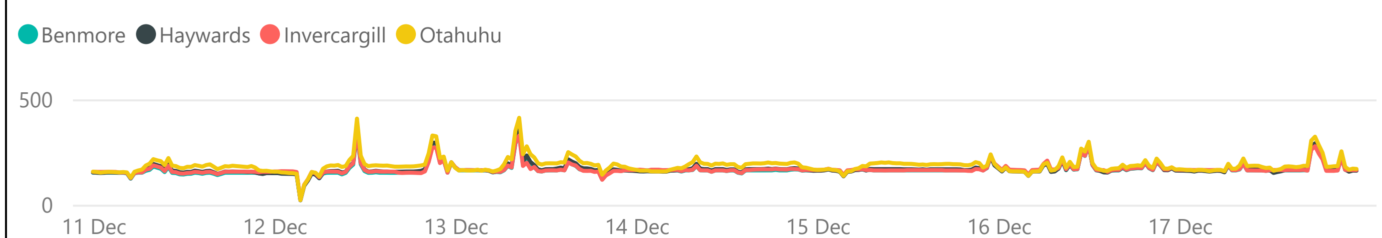
NZGB Look-Ahead (excluding next 7 days)



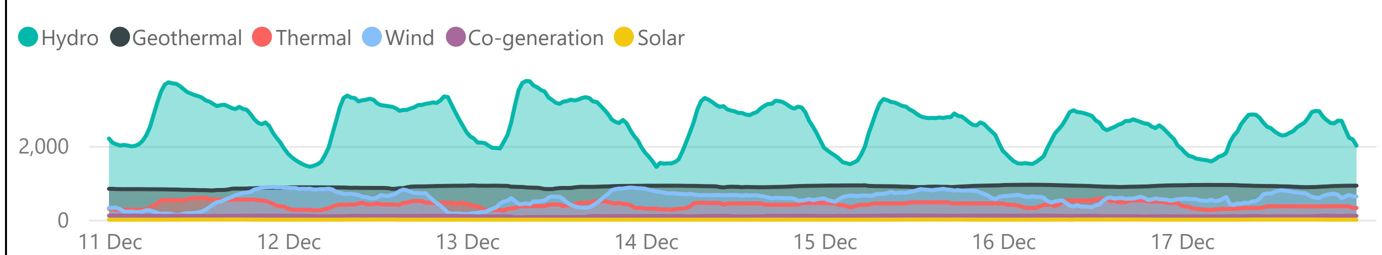
National Demand by Trading period - MW



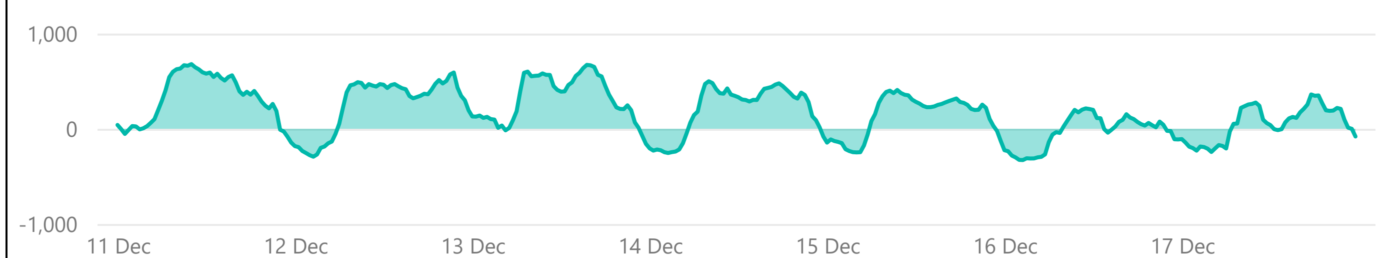
Weekly Prices - $/MWh



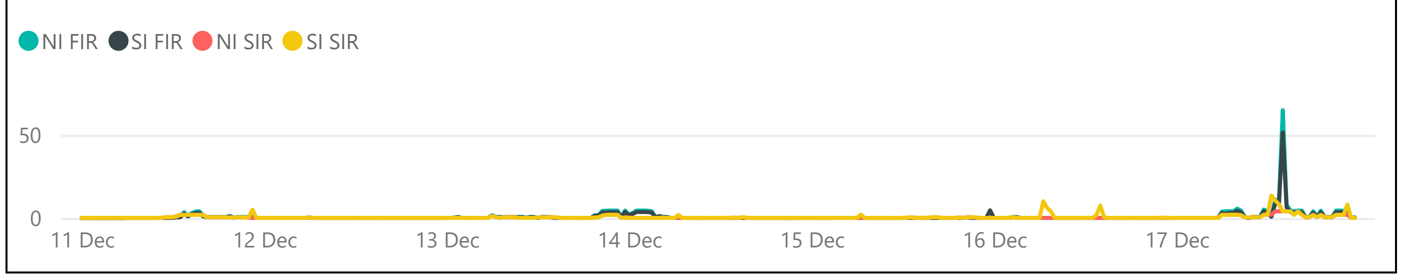
Generation - MW



Net HVDC Transfer - MW



Reserve Prices - $/MWh



Weekly Summary Insight - Alternative Energy Sources for Santa's Sleigh

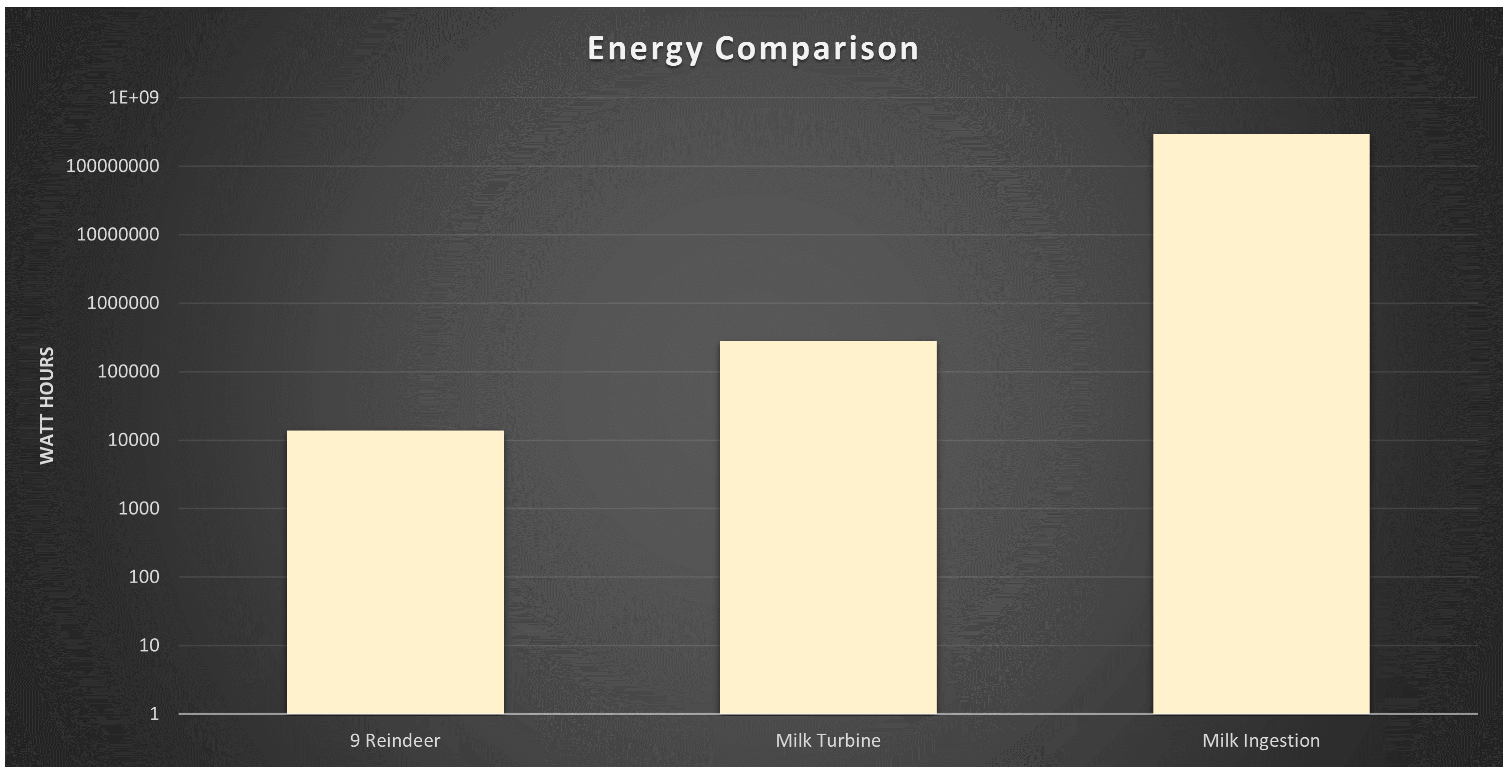
In our System Operator role, we have much to reflect on for our final weekly insight of 2023. As our control rooms prepare for their role balancing electricity supply and demand across New Zealand, we have seized the opportunity to take our attention away briefly from winter capacity and energy challenges to cover some less talked about, but equally important, insights.

As is traditional on Christmas Eve, many Kiwi families will be leaving out a glass of milk for Santa Claus this Sunday. In the spirit of our [reindeer analysis] last Christmas, the Transpower Market Operations team have calculated whether Santa could power his sleigh with a hydraulic turbine that operates on donated milk.

Through rigorous analysis it is estimated that if every family household in the country donates 300 mL of milk to Santa this Christmas and he pumped that milk through a hydraulic turbine much akin to the ones on New Zealand's hydro lakes, Santa could have his chubby hands on 281 kWh of milk-generated energy. Comparing this to the estimated reindeer output of 190 Watts from last year's analysis, the mobile milk dam could generate as much energy as 185 reindeer working tirelessly throughout the night. Obviously, this would make Rudolph and his eight reindeer colleagues udderly redundant.

Unsurprisingly, there are some important ramifications to consider when employing milk in this way. Due to the viscosity of milk compared to water, it is estimated that for the same hydraulic turbine, a cubic meter of milk could produce only ~65% of the energy that the same volume of water would, making it less than ideal as an energy source. Despite this, a milk turbine approach does appear to be more effective than Santa's reindeer scheme.

So we've established that donated milk could put Santa's reindeer to shame in terms of energy output, but can we go further? When consumed, a glass of milk contains roughly 196 kilocalories. If Santa were to swig back every glass left for him throughout the country, he would gain 390 million Calories or 295 MWh of energy. This means it is roughly 1000 times more energy efficient for Santa (or anyone else) to drink the milk rather than pushing it through a hydraulic turbine. With such a sheer amount of energy at his disposal, Santa could comfortably pull his own sleigh across the country and have enough fat left over to last him through to the next Christmas.



Calculations:

Hydraulic Turbines:

1,300,000 family residences * 300 mL = 390,000 L of milk
390,000 L = 390 m^3
390 m^3 = 1010 MJ (1614 MJ if using water)
1010 MJ = 281 kWh
281 kWh = 185 reindeer for the night (at 190 Watts each for 8 hours)

Consuming Milk:

390,000 L = 254,000,000 kcal
390,000,000 kcal = 1,062,000 MJ
1,062,000 MJ = 295 MWh
>1000 times more efficient than turbines

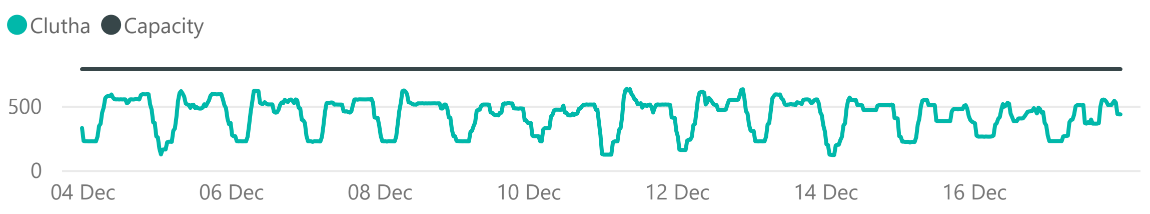
Assumptions/considerations:

- Beef milk only.
- Turbines are not optimised for milk.

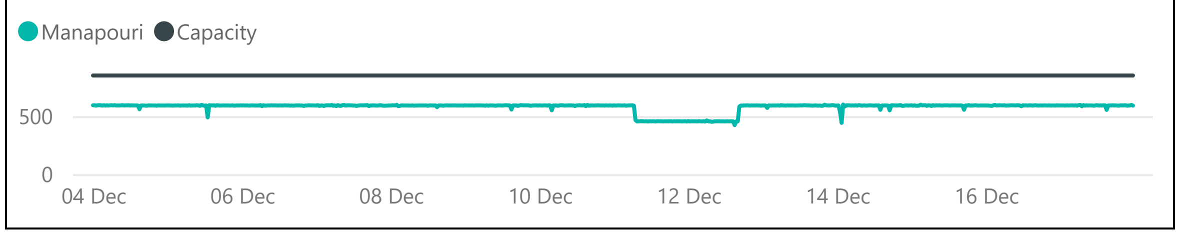
Generation Breakdown - Last Two Weeks

Measured in MW and displayed at trading period level for last 14 days

Clutha

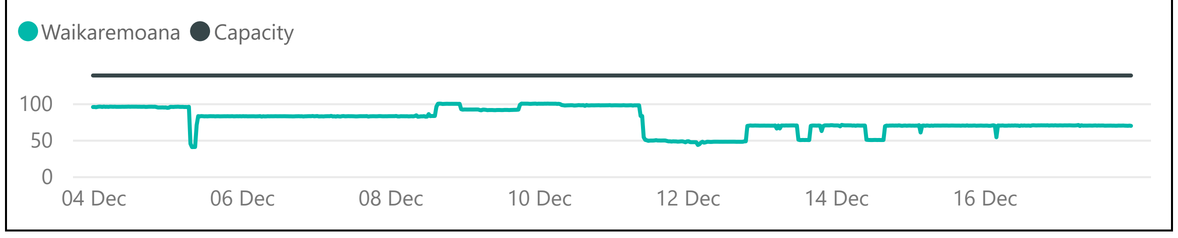


Manapouri



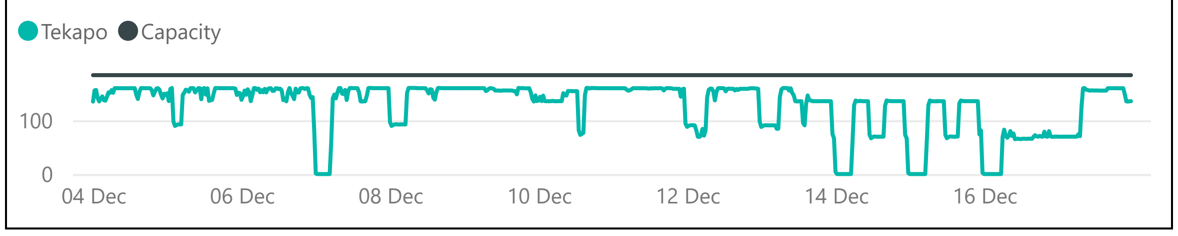
Waikato

Waikaremoana

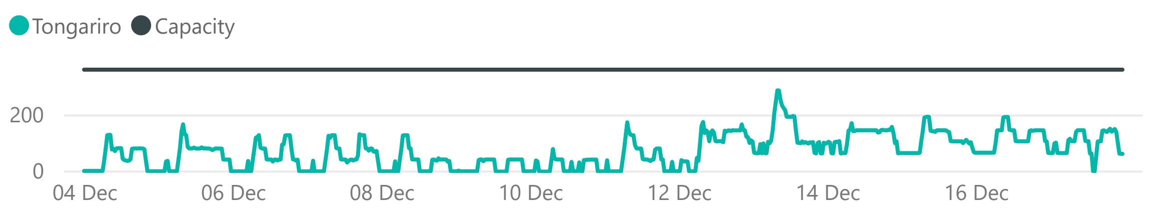


Waitaki

Tekapo

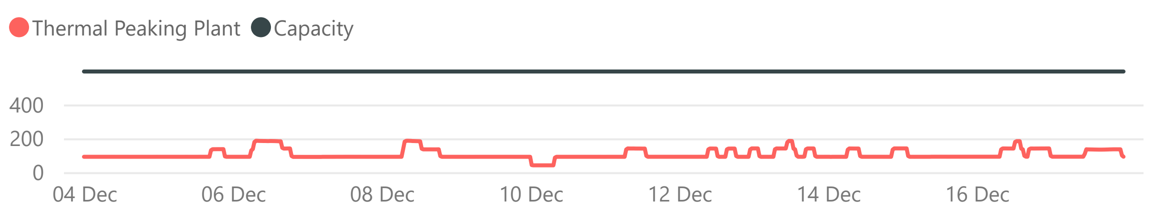


Tongariro



Other SI Hydro

Thermal Peaking Plant

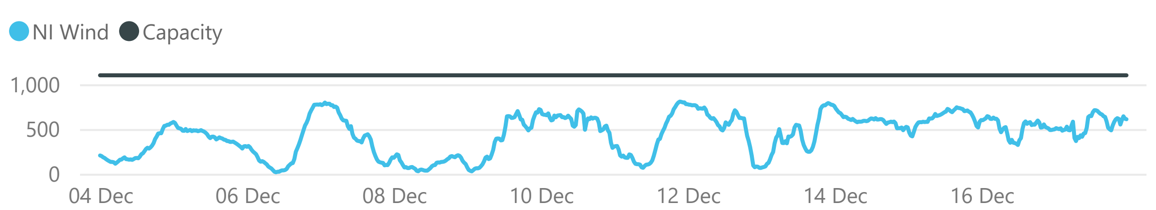


Stratford TCC

Huntly Rankines

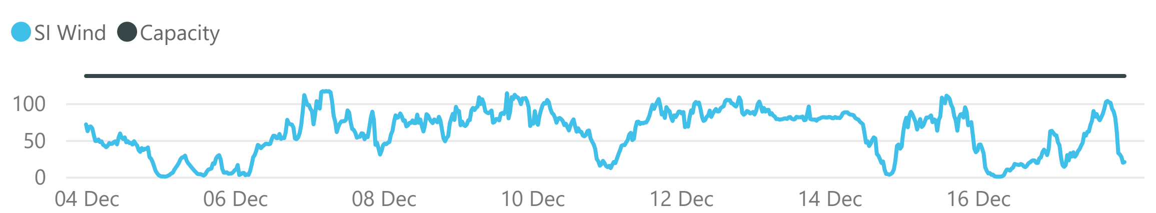
Huntly U5

NI Wind

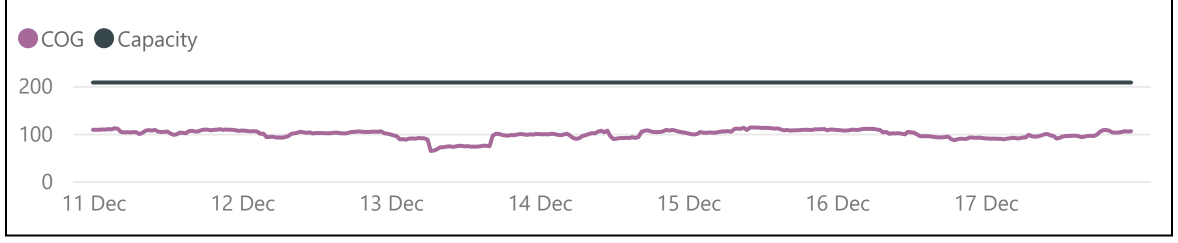


Geothermal

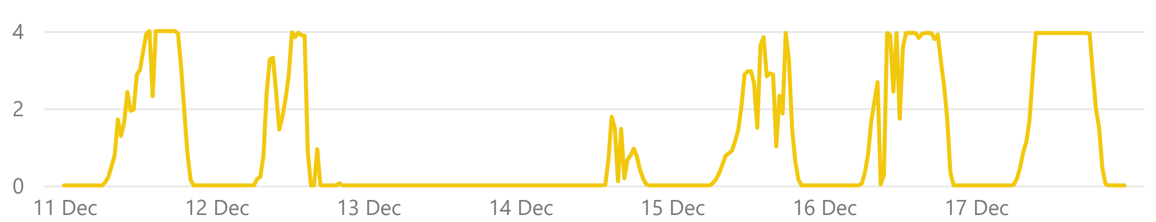
SI Wind



Co-Generation

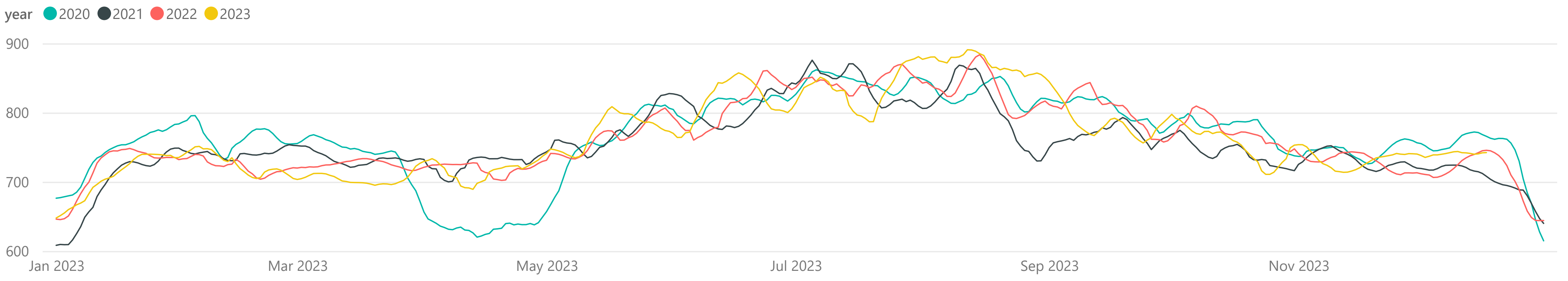


Solar

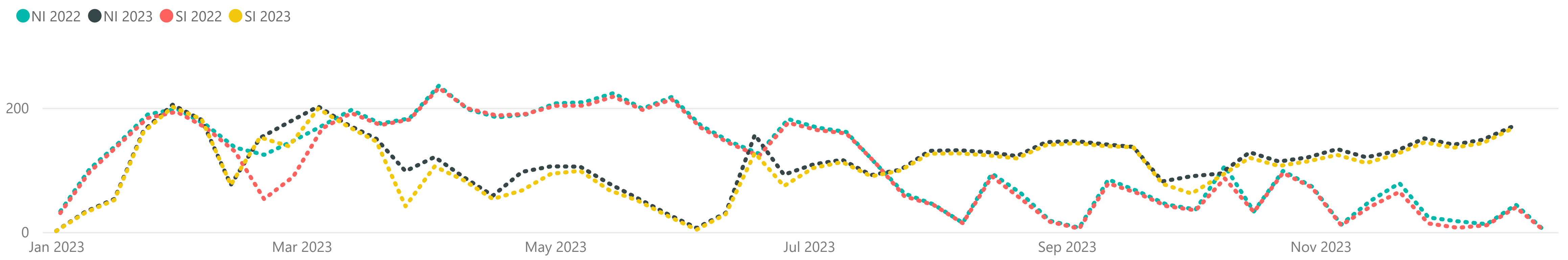


Weekly Profiles

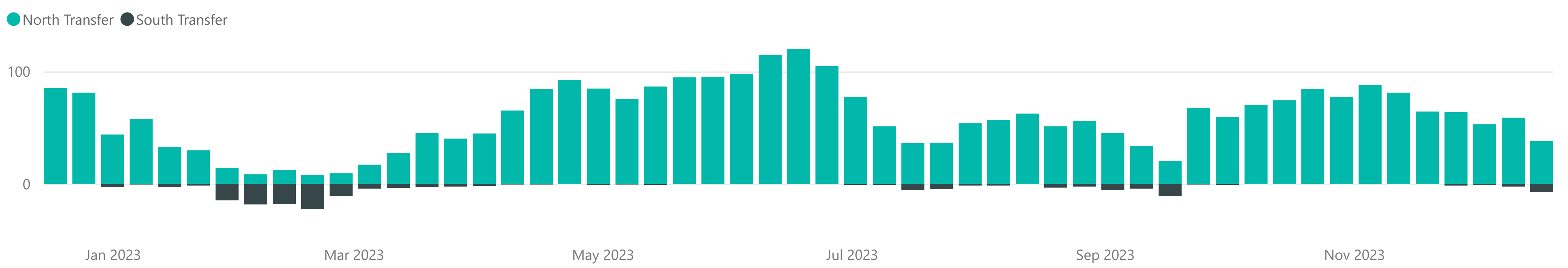
National Weekly Demand - GWh - 7 Day Rolling



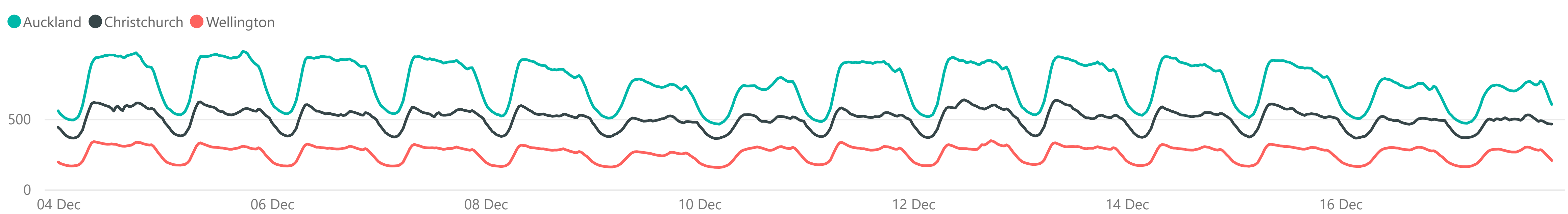
Weekly Spot Price - $/MWh



HVDC Transfer - Weekly GWh

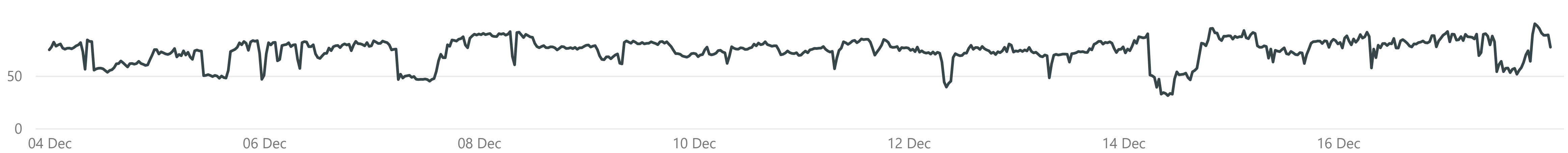


Conforming Load Profiles - Last Two Weeks *Measured in MW shown by region*



Non-Conforming Load Profiles - Last Two Weeks *Measured in MW shown by GXP*

GLN0331



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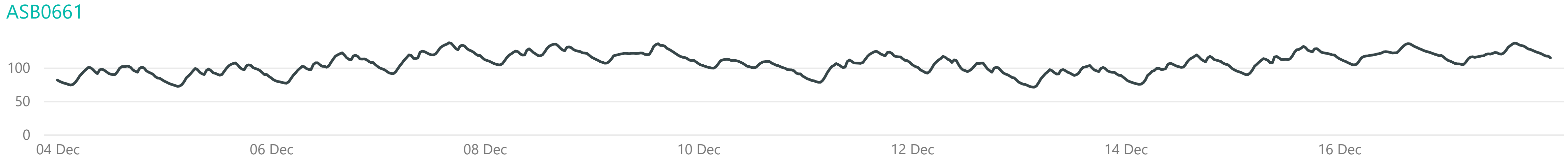

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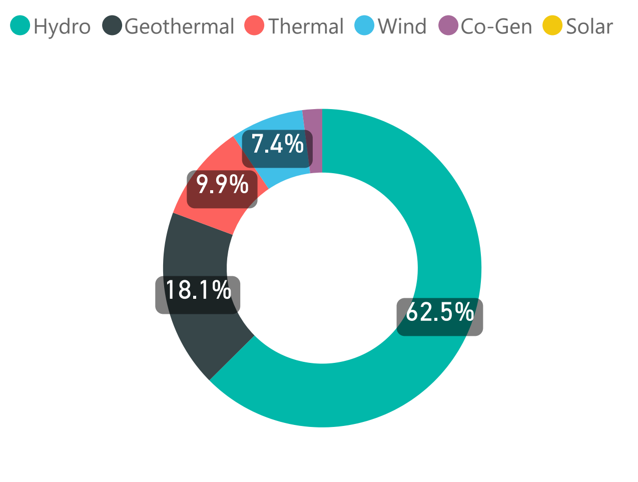
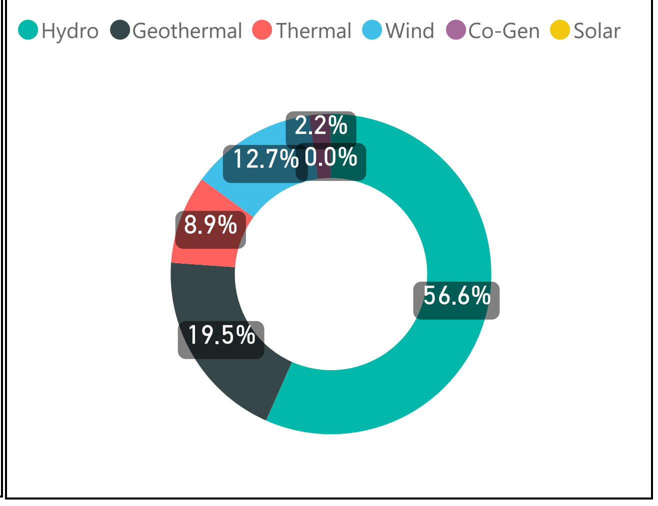
Generation Mix

Last 52 Weeks Generation Mix - Weekly GWh



Last 7 Days Generation Mix - Weekly GWh



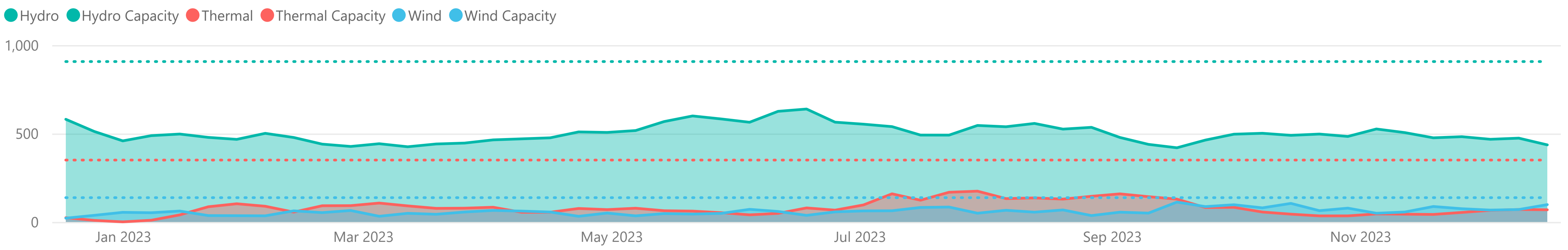
Average Metrics Last 7 Days

Renewable Percentage	CO2e Tonnes/Week	CO2e g/kWh
89%	59,940	77.8

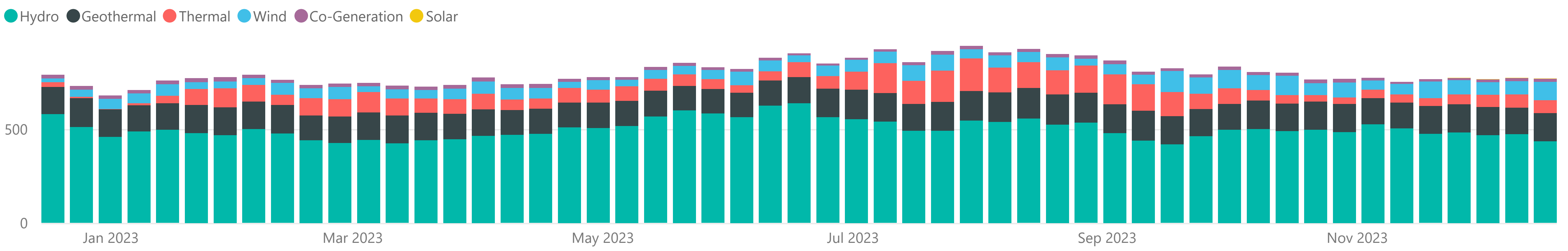
Average Metrics Last 52 Weeks

Renewable Percentage	CO2e Tonnes/Week	CO2e g/kWh
88%	57,969	71.0

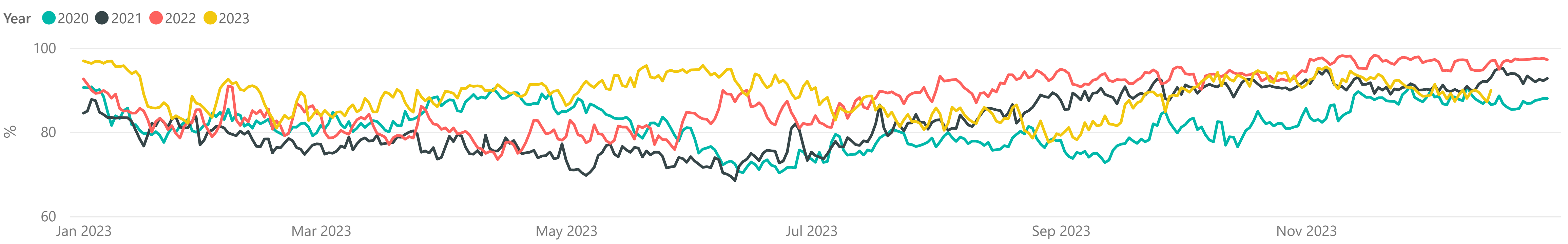
Weekly Generation Mix vs Capacity - GWh



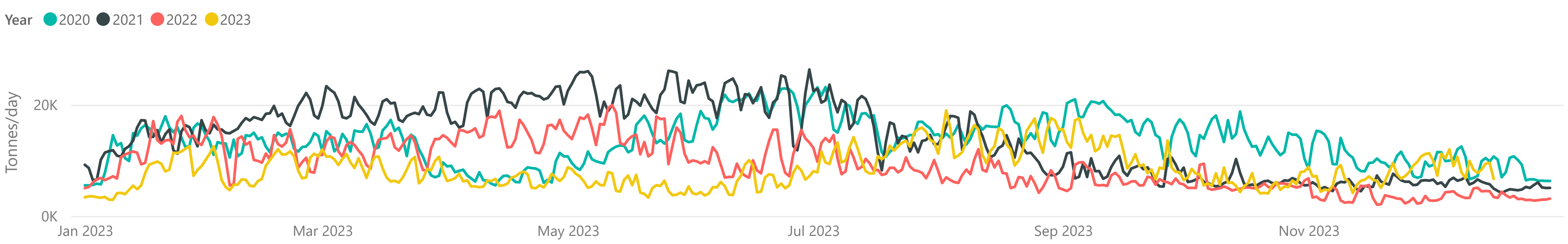
Weekly Generation Mix - GWh



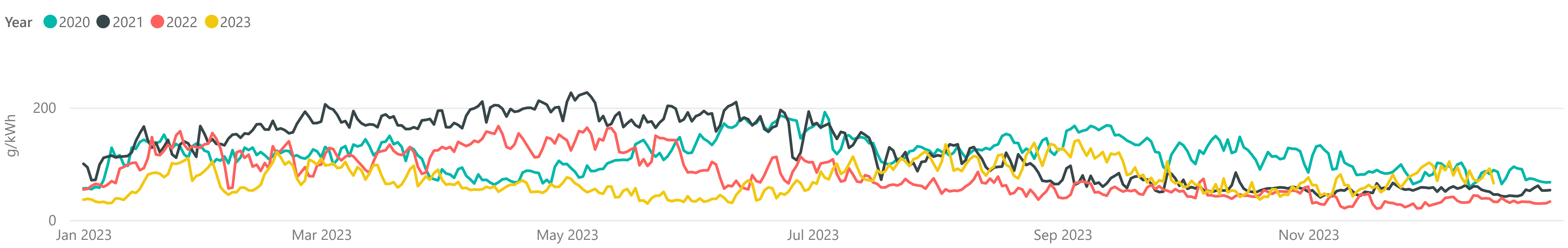
NZ Renewable Percentage



CO2 Tonnes/Day

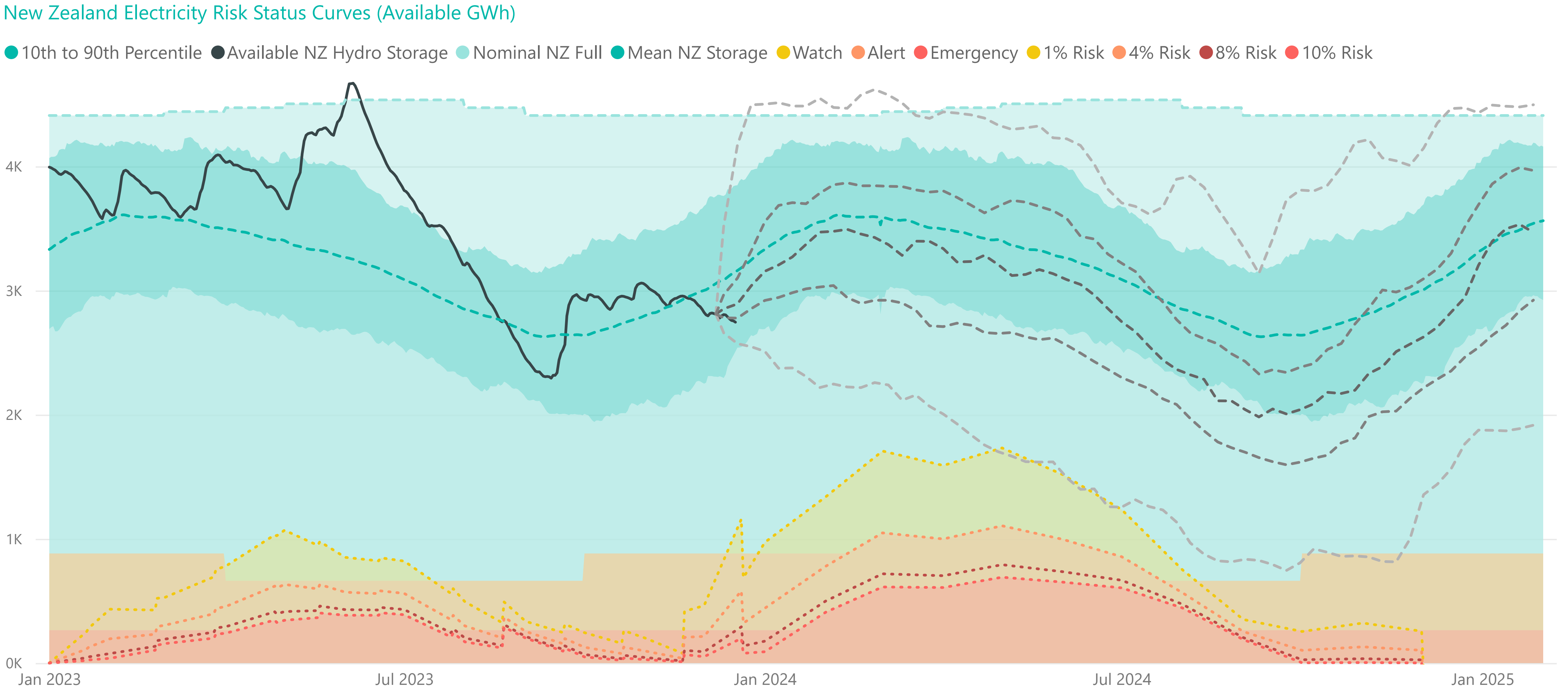


CO2 g/kWh

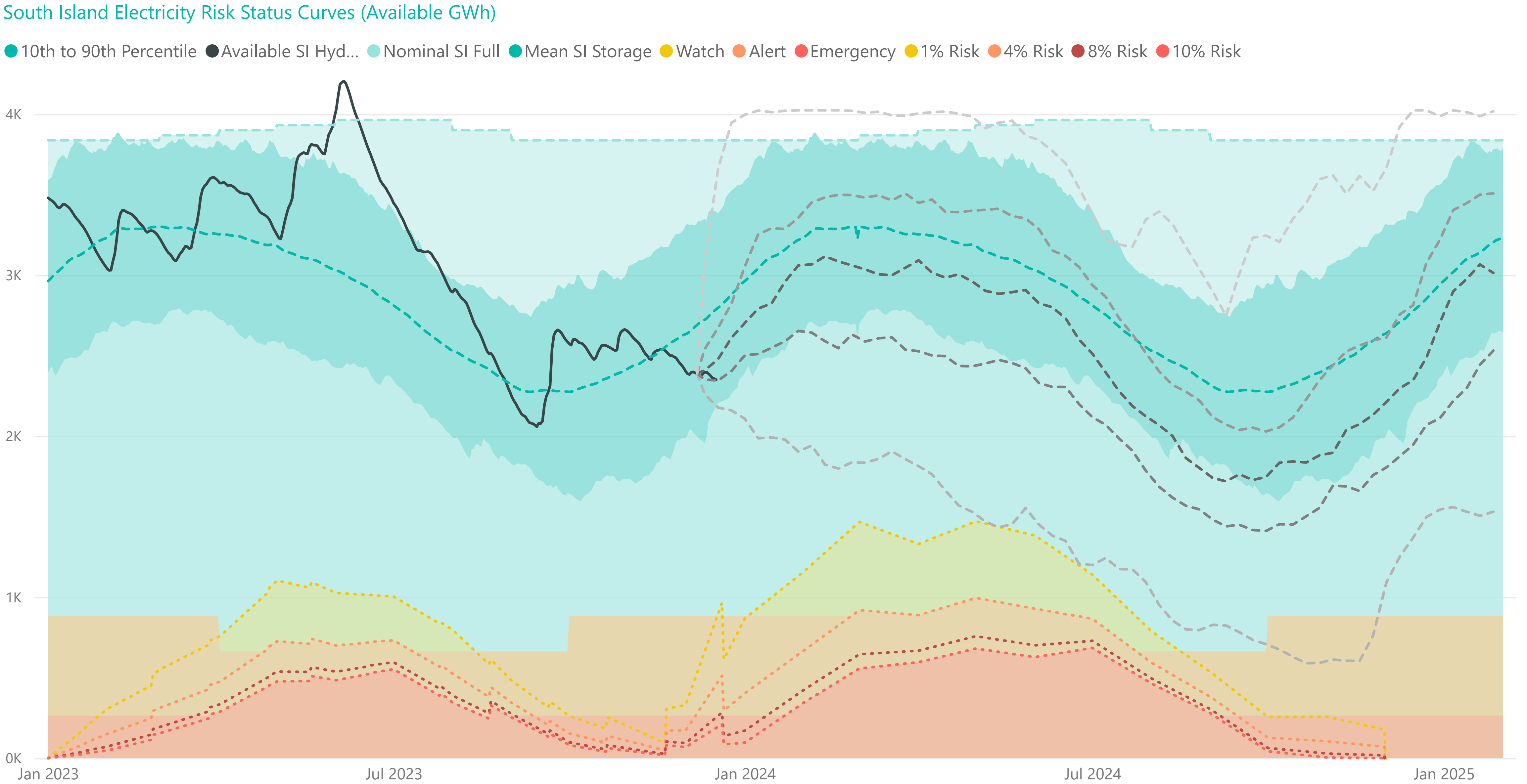


Electricity Risk Curves

New Zealand Electricity Risk Status Curves (Available GWh)



South Island Electricity Risk Status Curves (Available GWh)



Electricity Risk Curve Explanation:

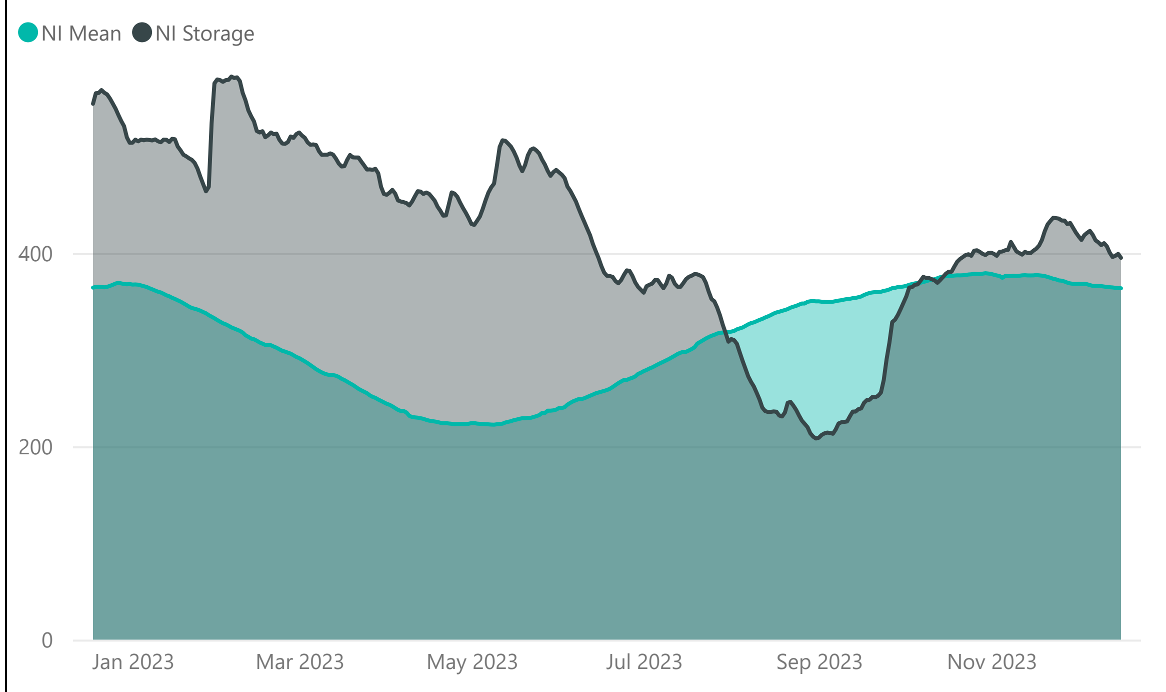
Watch Curve - The maximum of the one percent risk curve and the floor and buffer
Alert Curve - The maximum of the four percent risk curve and the floor and buffer
Emergency Curve - The maximum of the 10 percent risk curve and the floor and buffer
Official Conservation Campaign Start - The Emergency Curve
Official Conservation Campaign Stop - The maximum of the eight percent risk curve and the floor and buffer

Note: The floor is equal to the amount of contingent hydro storage that is linked to the specific electricity risk curve, plus the amount of contingent hydro storage linked to electricity risk curves representing higher levels of risk of future shortage, if any. The buffer is 50 GWh.

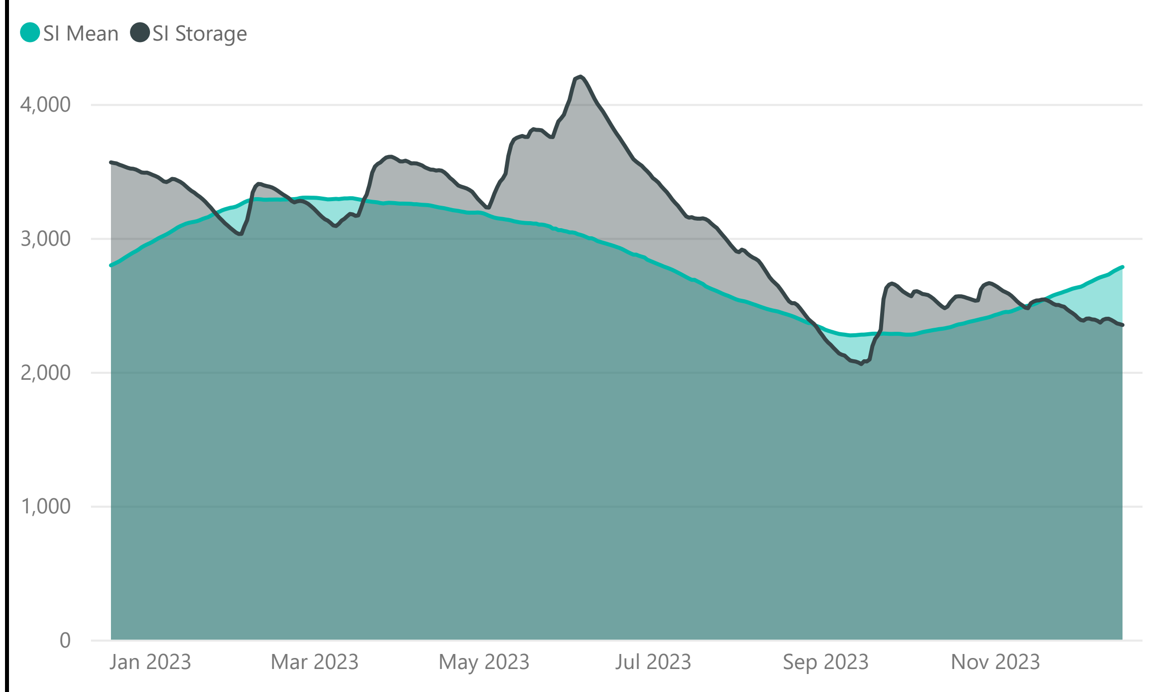
The dashed grey lines represent the minimum, lower quartile, median, upper quartile and the maximum range of the simulated storage trajectories (SSTs). These will be updated with each Electricity Risk Curve update (monthly).

Hydro Storage

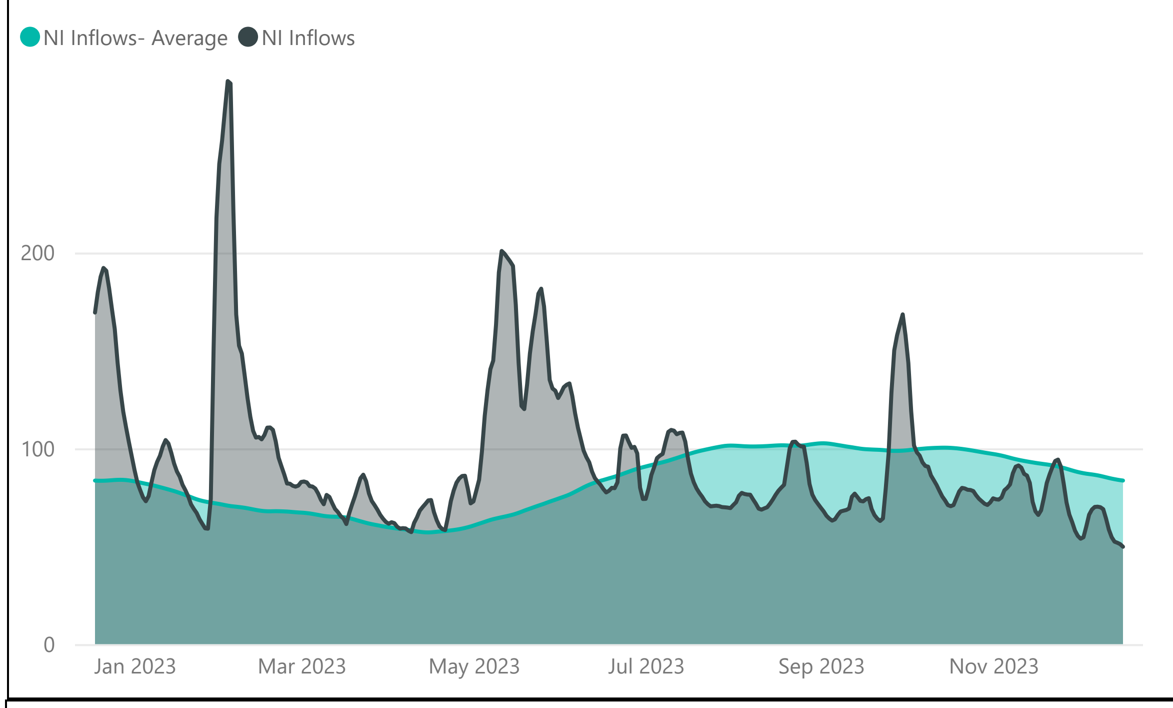
North Island Hydro Storage (Available GWh)



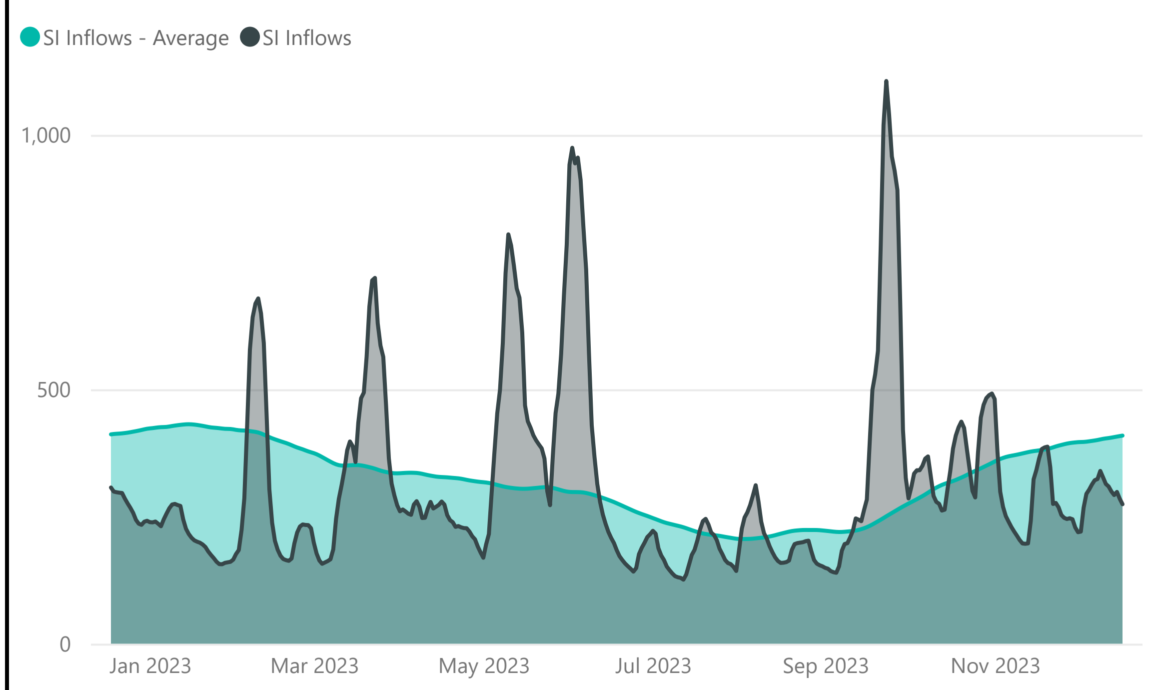
South Island Hydro Storage (Available GWh)



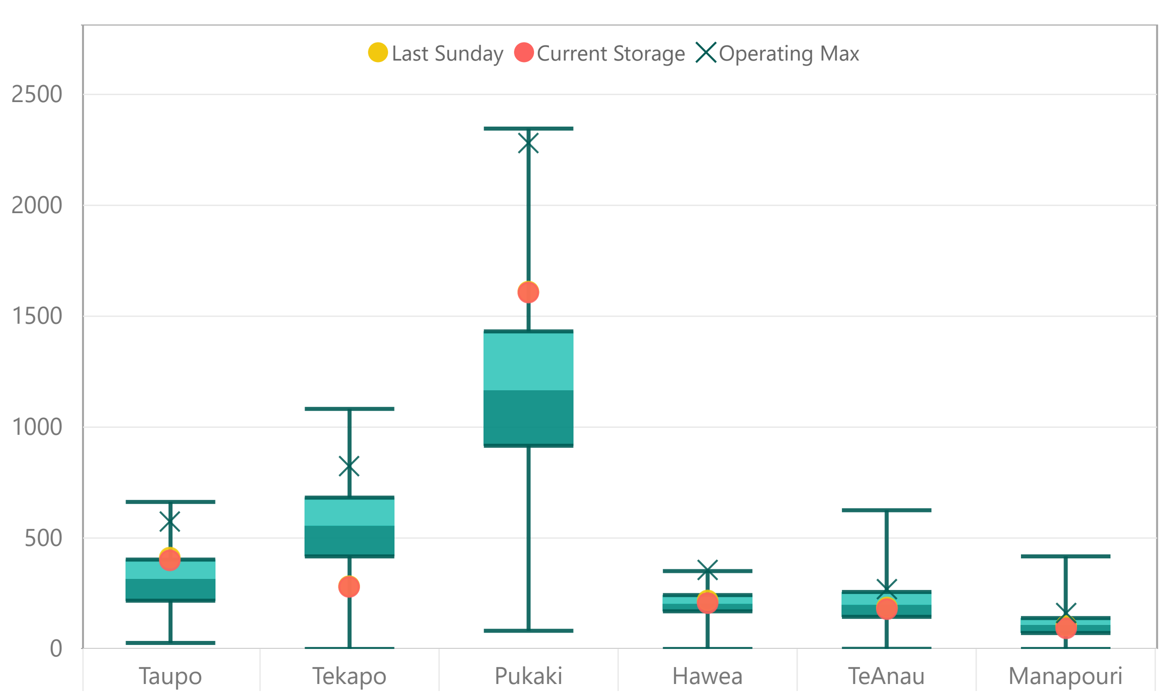
North Island Mean 7 Day Inflows (Available GWh)



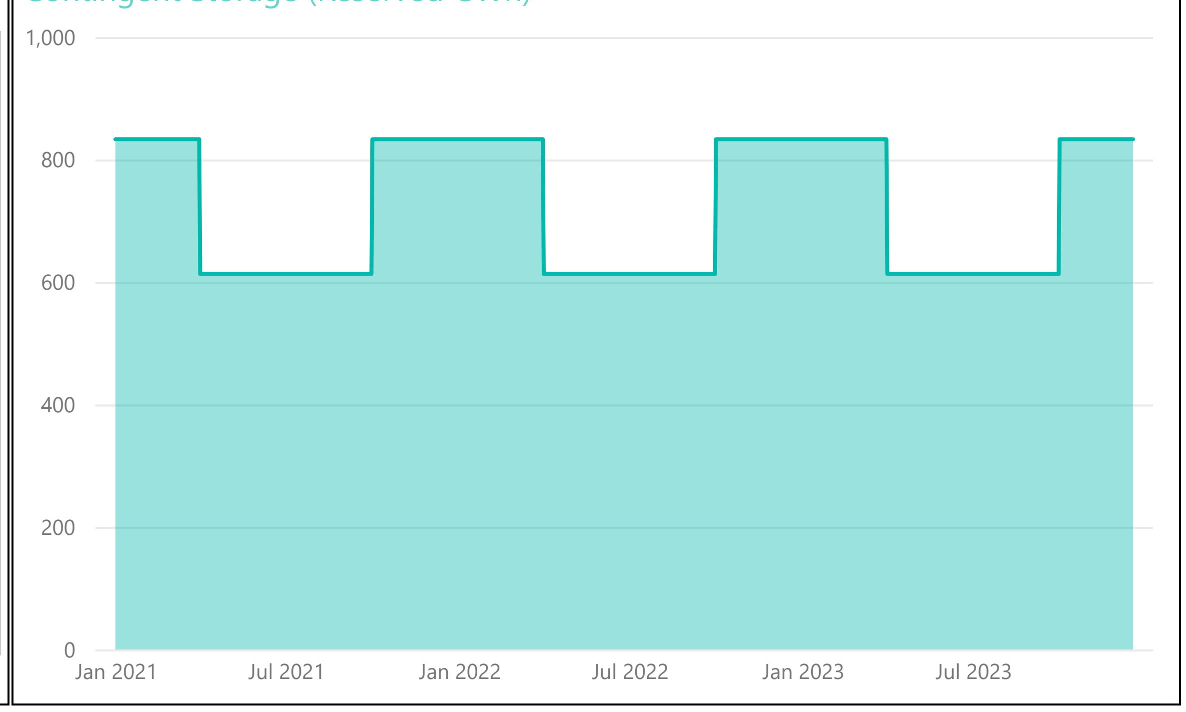
South Island Mean 7 Day Inflows (Available GWh)



National Lake Storage (Available GWh) Against Historic Levels



Contingent Storage (Reserved GWh)



For further information on security of supply and Transpower's responsibilities as the System Operator, refer to our webpage here: https://www.transpower.co.nz/system-operator/security-supply

For any inquiries related to security of supply contact market.operations@transpower.co.nz

Hydro data used in this report is sourced from *NZX Hydro*.

Electricity risk curves have been developed for the purposes of reflecting the risk of extended energy shortages in a straightforward way, using a standardised set of assumptions.

Further information on the methodology of modelling electricity risk curves may be found here: https://www.transpower.co.nz/system-operator/security-supply/hydro-risk-curves-explanation