Market Operations Weekly Report - Week Ended 14 December 2025

Overview

New Zealand hydro storage decreased to 139% of the historic mean last week, but remains at just above nominal maximum capacity.

In this week's insight we look at the potential electromagnetic effects of Santa's high speed sleigh on NZ's power grid.

Security of Supply

Energy

National hydro storage decreased from 146% to now sitting at 139% of the historic mean. South Island hydro storage decreased from 147% to 140% of the historic mean, and the North Island storage decreased from 141% to 135%.

Capacity

Residuals were relatively healthy for most of last week, however residuals dropped for the first half of the week especially in the evenings. The lowest residual of 443 MW occurred during the evening peak on Monday 8 November due to unseasonably warm North Island weather as well as scheduled and unscheduled North Island generation outages.

We continue to monitor capacity closely as higher temperatures result in higher electricity demand due to cooling load. Outages, reduced thermal unit commitment, and the possibility of large swings in wind generation mean that capacity can be tight despite lower demand peaks than in winter.

The N-1-G margins in the NZGB forecast are healthy through to early February. Within seven days we monitor these more closely through the market schedules. The latest NZGB report is available on the NZGB website.

Electricity Market Commentary

Weekly Demand

Total demand last week increased to 760 GWh from 742 GWh the week before, and was in line with previous demand levels of the past few years. The highest demand peak of 5462 MW occurred at 5:30 pm on Tuesday 9 December.

Weekly Prices

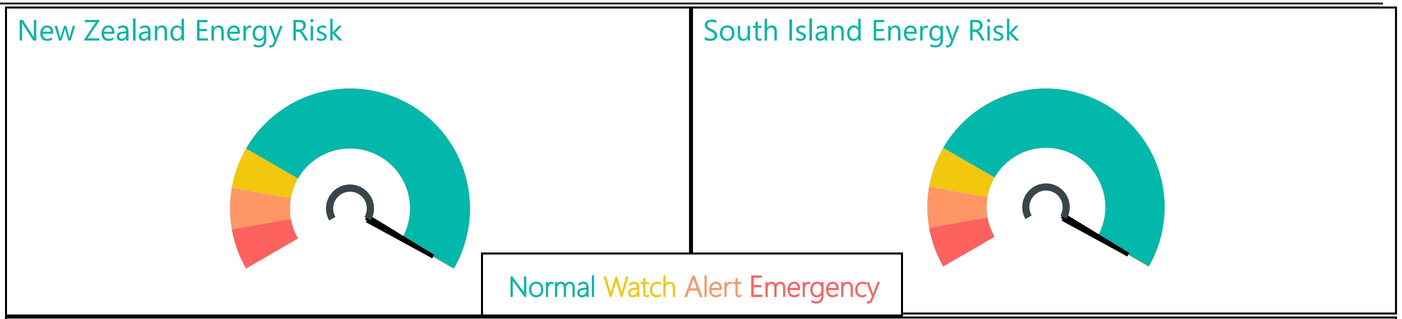
Average wholesale spot prices increased last week in line with higher weekly demand and multiple generation assets on outage. The average wholesale electricity spot price at Ōtāhuhu last week was $54/MWh, up from $8/MWh the week prior. Wholesale prices peaked at $942/MWh at Ōtāhuhu at 4:30 pm on Monday 8 December. There were several occurrences of price separation throughout the week as HVDC northward flow was limited by outages and North Island reserve requirements. Some price separation occurred between Ōtāhuhu and Haywards on Monday 8 December due to increased losses with a Whakamaru-Wairakei circuit on outage.

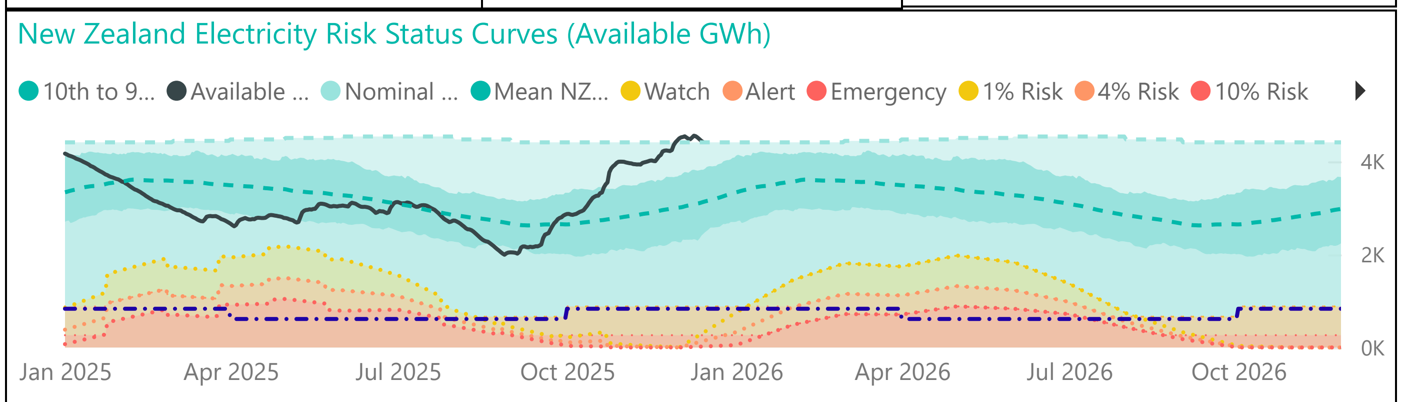
Generation Mix

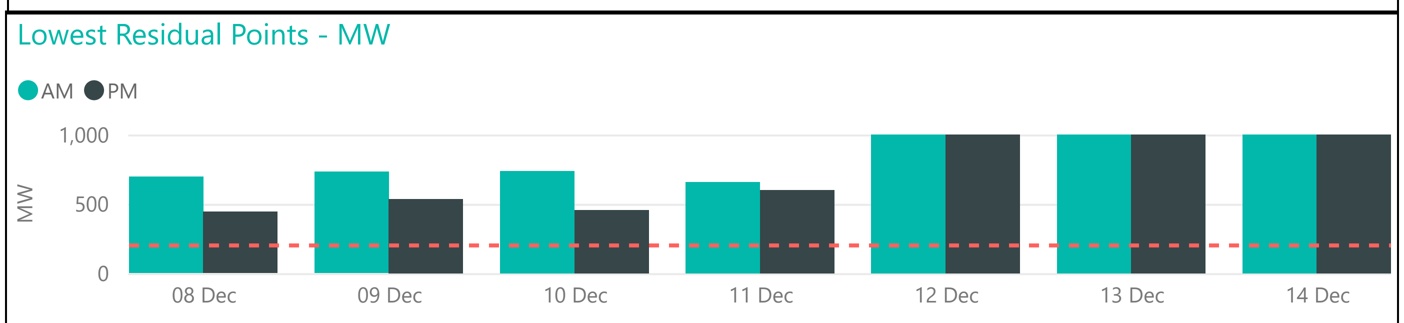
Wind generation decreased to 6% of the generation mix, below its average contribution of 9%. Hydro generation remained well above average at 71% of the mix. Thermal generation remained low but increased from last week to 2.3% of the mix, with co-generation also at 1% and solar generation at 1.6%. The geothermal share decreased to 18% of the mix and remains below its average contribution of 23% with multiple geothermal units on planned outage during the week. Total renewable contribution to the mix was 97%, the tenth consecutive week of at least 97% renewable generation.

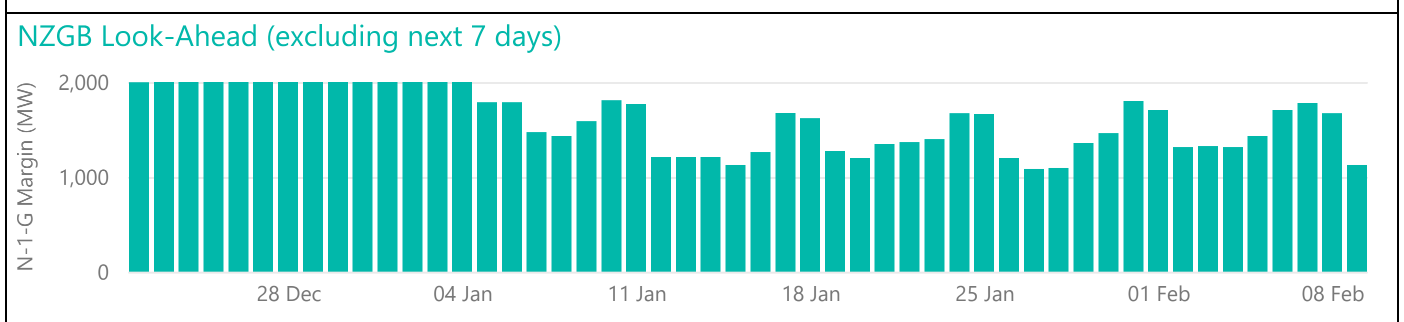
HVDC

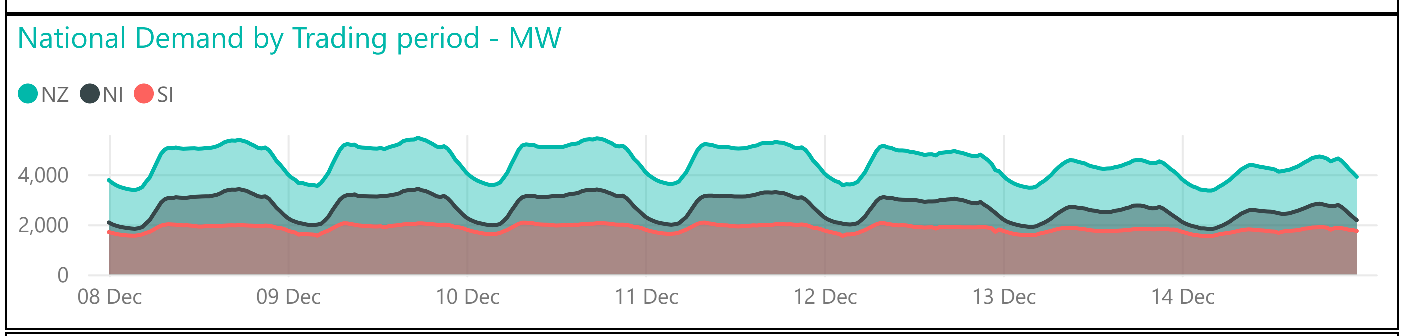
HVDC flow last week was entirely northward with high hydro generation, decreased geothermal generation, and higher demand in the North Island. In total, 113 GWh was transferred north. AC asset outages have reduced transmission capability, causing the northward limit to constrain flows at times.

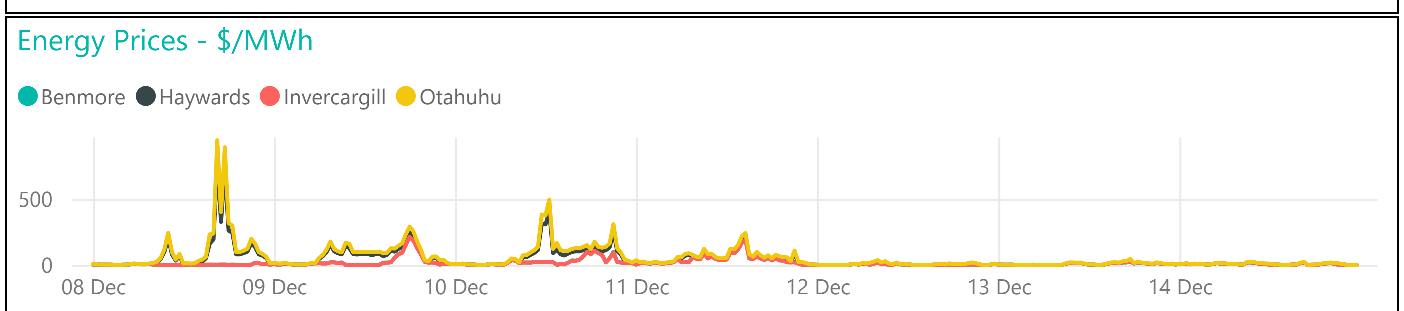


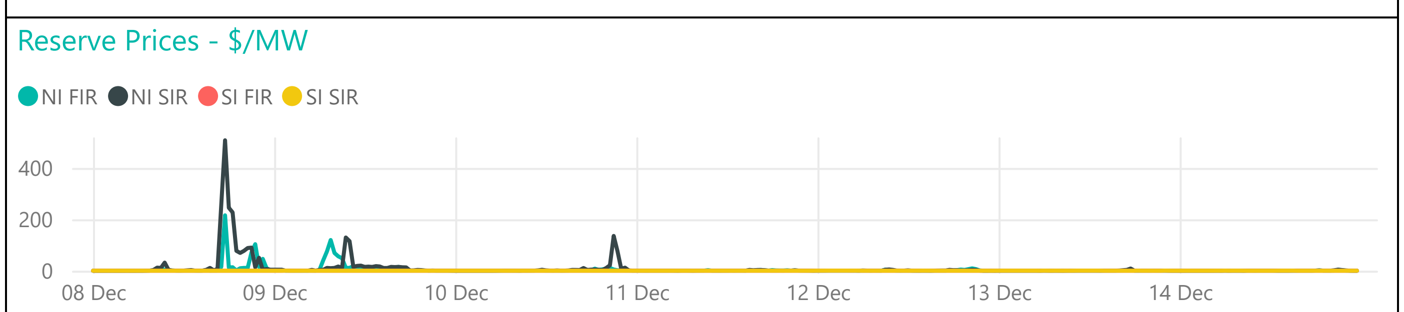


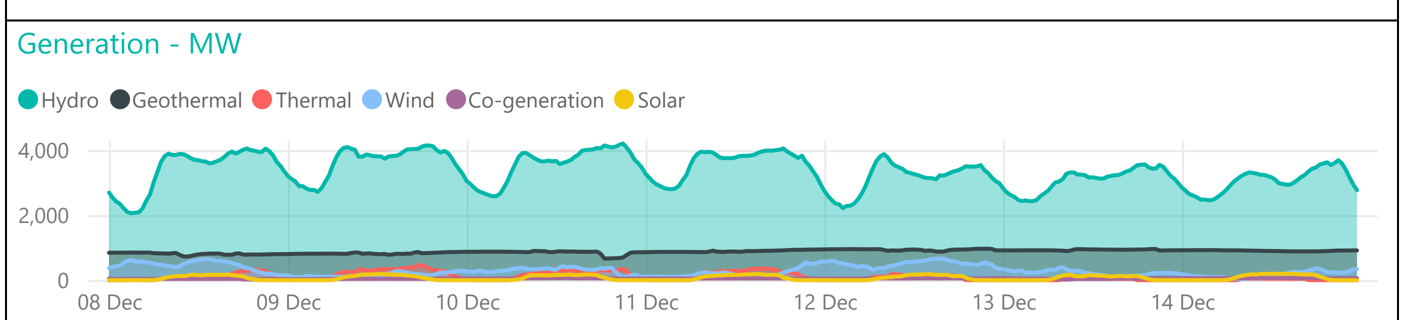


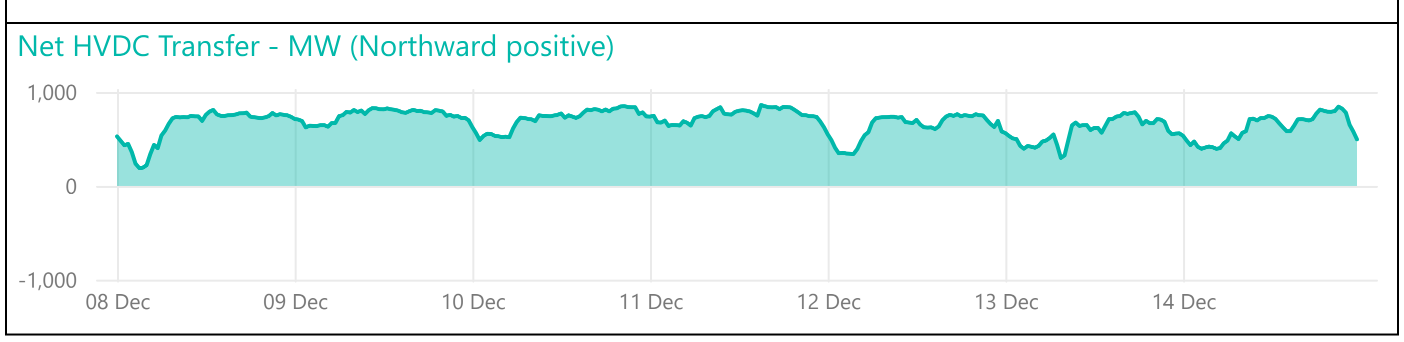












Christmas Insight - Non-standard Electromagnetic Externalities Arising from Christmas Eve Operations

Recent months have demonstrated the New Zealand electricity system's susceptibility to external electromagnetic disturbances, particularly those during dramatic intervals of elevated solar activity otherwise known as "Solar Storms." [Ref]

The fundamental physics behind this phenomenon are codified in Faraday's law:

$$E = \frac{dB}{dt}$$

Which asserts that a rapidly changing magnetic field *B*, such as that produced by the familiar 'solar storm', induces an electric field *E*.
Electric fields may also arise whenever a sufficiently heroic or irresponsibly fast charged object travels with velocity *v* through a magnetic field *E*, producing the motional electric field:

$$E = v \times B$$

With this in mind, and with Christmas fast approaching, we thought it prudent to assess the potential impacts of Christmas Eve operations on the security of electricity supply.

Under our most conservative and sober assumptions, Santa Claus himself is required to achieve velocities approaching hypersonic to relativistic levels just to deliver presents to every Kiwi household. At such prodigious speeds, the interaction between a high-velocity conductive object, ionised air, and Earth's magnetic field naturally raises the question: could Santa inadvertently weaponise the electromagnetic spectrum and wreak havoc on the national grid? Naturally, we have employed substantial intellectual resources to investigate these catastrophic considerations.

Taking an average sleigh velocity of 8.2 million km/h (≈ 2.28 million m/s) [Ref], the air around the sleigh becomes incandescently ionised, stripping electrons and forming a thin but lethal plasma sheath. Preliminary findings confirm our dreadful suspicions: Santa's sleigh could transform into a highly charged electromagnetic entity, capable of generating disturbances that, if unmitigated, might interfere with transmission lines.

Taking Earth's magnetic field as B ≈ 50 µT, the motional electric field induced by the plasma-laden sleigh can be calculated as:

$$E = v \times B = 2.28 \times 10^6 \text{ m/s} \times 50\ \mu\text{T}$$
$$\approx \mathbf{114\ V/m}$$

For context, this dwarfs the typical electric fields induced by solar storms, which barely manage 0.1 V/m (volts per metre). The saving grace here is that the electric field is concentrated across a much shorter distance, instead of spanning an entire 300 km transmission line. Conservative estimates of the size of Santa's sleigh ballpark around 10 metres in length, resulting in a potential difference of 1.14 kV (kilovolts) front to back. High-voltage lines (110–220 kV) remain largely unfazed, but this poses catastrophic stability issues to low voltage residential feeder lines of 230 V.

So why do New Zealanders not experience hundreds of localised blackouts each Christmas Eve? This question has led some controversial pundits to question the actual existence of Santa... but the faithful System Operator has applied its devoted intellect to land on quite a plausible theory.

In 2023, we determined that Santa consumes approximately 390,000 litres of milk generously left out by Kiwi residents [Ref]. Milk, of course, contains dissolved salts and ions, meaning it is technically a weakly conductive medium which has the ability to dampen perverse electromagnetic outcomes for the electricity grid. For maximum grid disruption, the sleigh's electric field would need to propagate in perfect phase with a given transmission line. By applying a non-uniform sloshing profile to this sheer volume of weakly conductive fluid in Santa's belly, the resulting dielectric chaos absorbs, phase-shifts, and sabotages the sleigh's EM potential, reducing peak interference and smoothing the overall electromagnetic footprint.

Certainly, a case could be made that leaving milk out for Santa this Christmas is not merely tradition - it is a national grid security measure.

Assumptions:

- Sleigh velocity is $2.28 \times 10^6\ ms^{-1}$
- Negligible acceleration/deceleration time
- Earth's magnetic field is 50 µT at travel altitude (near ground level)
- Sleigh length of 10 m
- Negligible electric field decay between sleigh and transmission lines
- Plasma sheath acts as a lossless, electrically charged, rigid object
- Milk acts as a single continuous body of weakly conductive fluid
- Beef milk only

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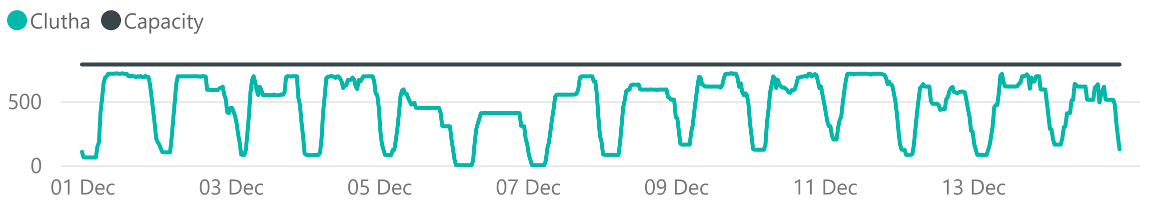
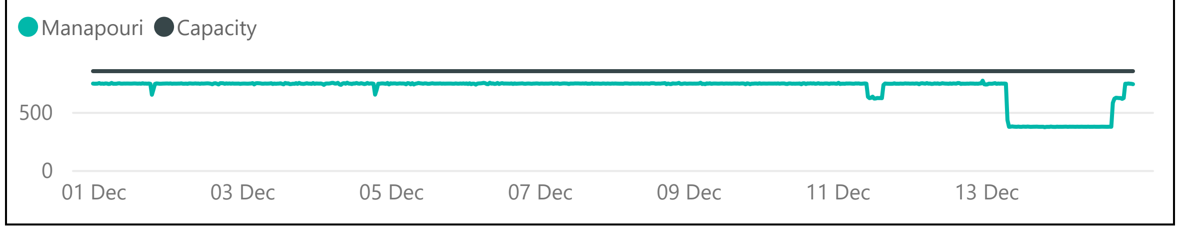
Generation Breakdown - Last Two Weeks

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

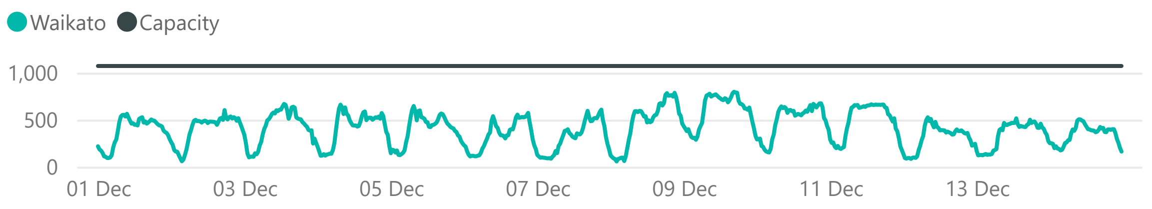
Clutha



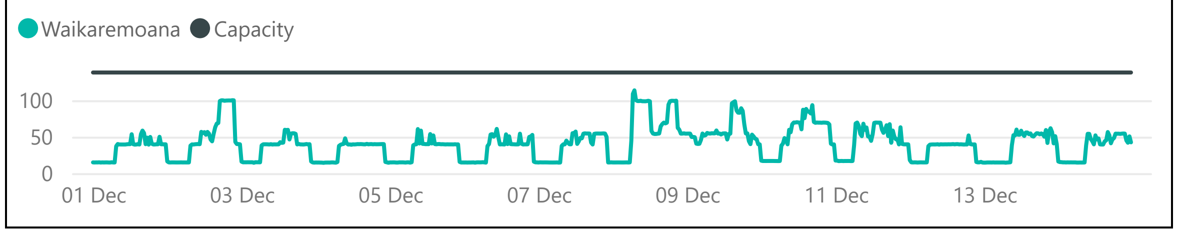
Manapouri



Waikato

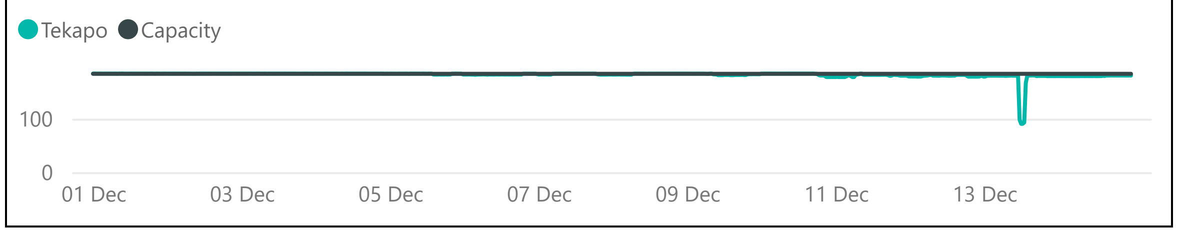


Waikaremoana

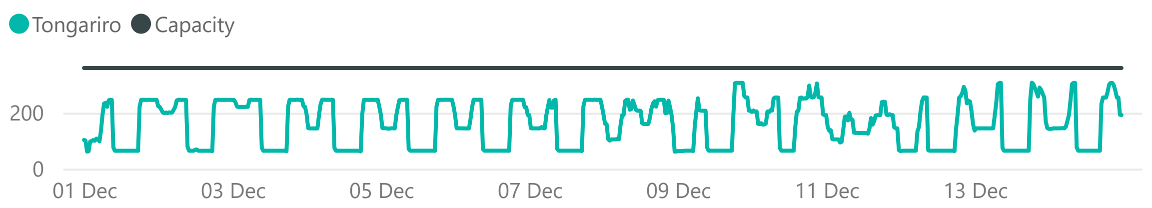


Waitaki

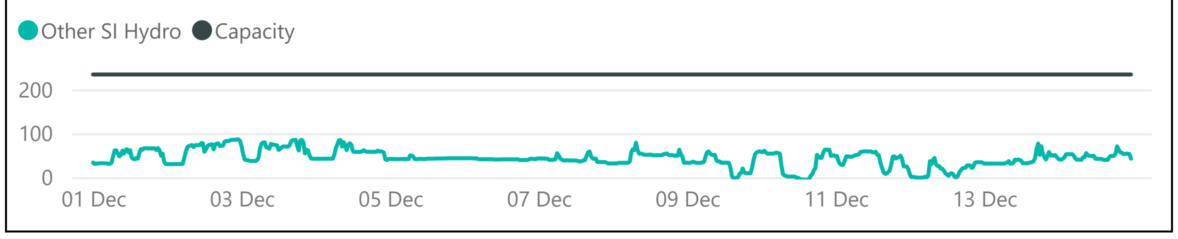
Tekapo



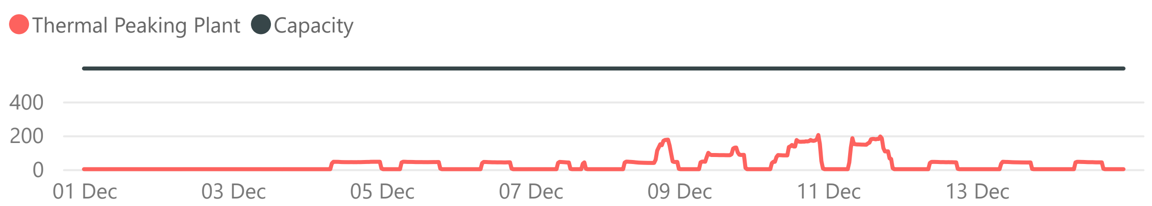
Tongariro



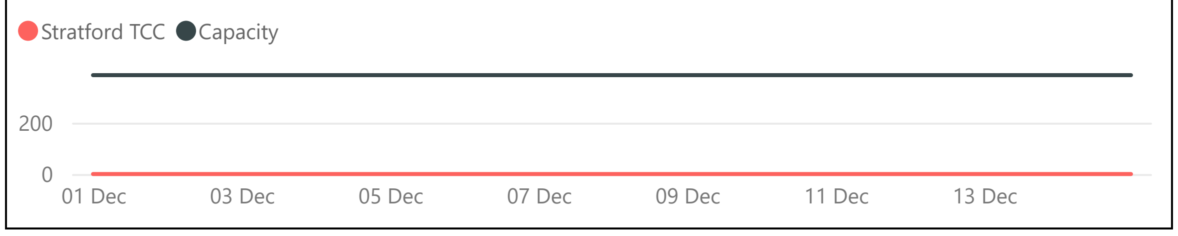
Other SI Hydro



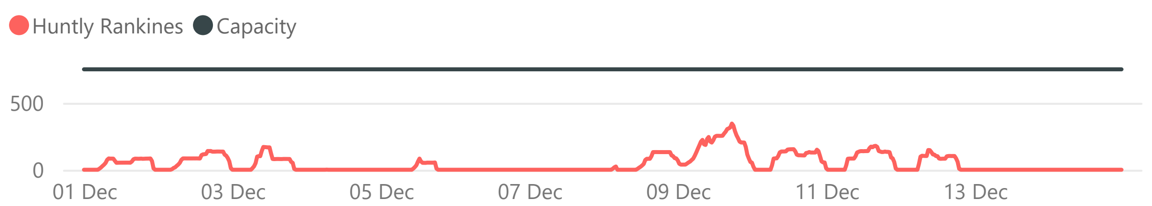
Thermal Peaking Plant



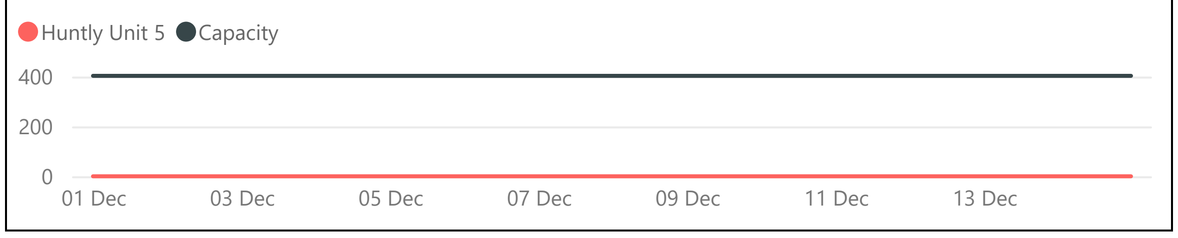
Stratford TCC



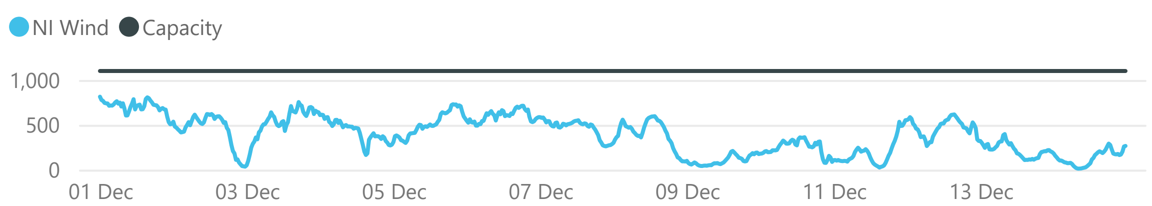
Huntly Rankines



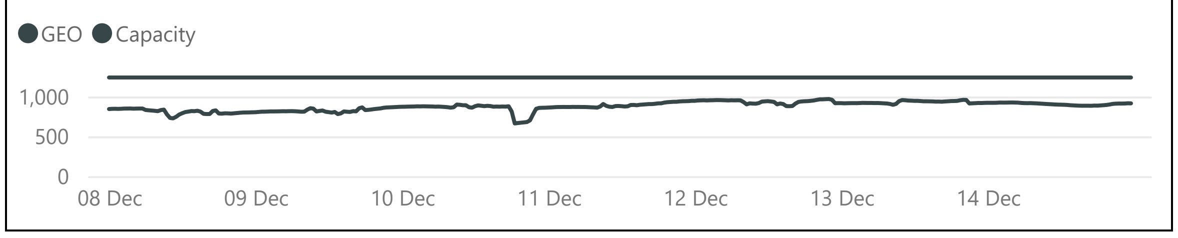
Huntly U5



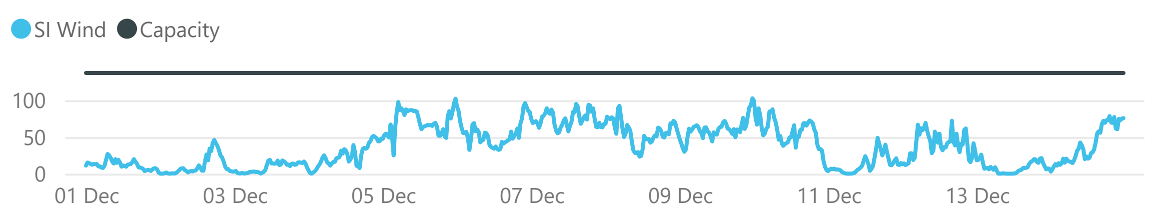
North Island Wind



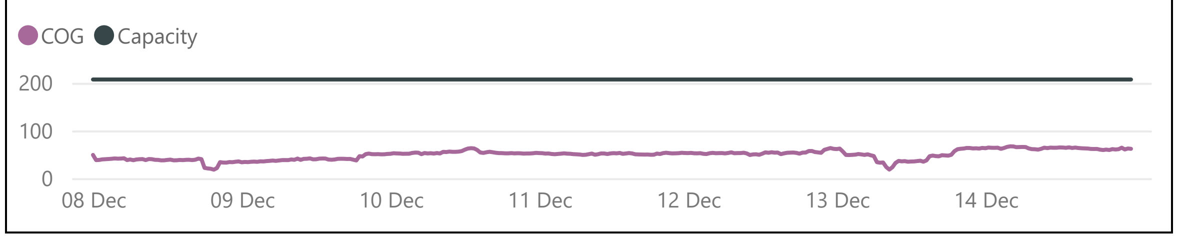
Geothermal



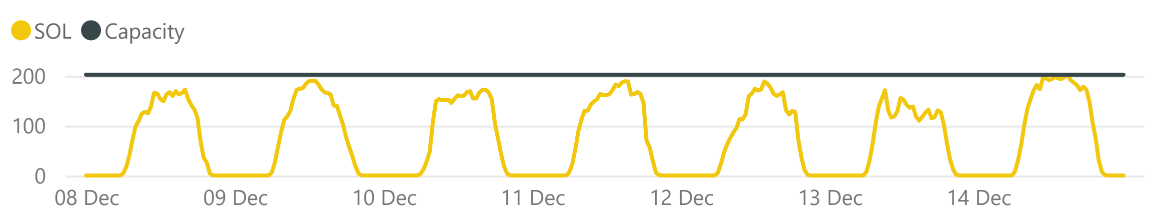
South Island Wind



Co-Generation

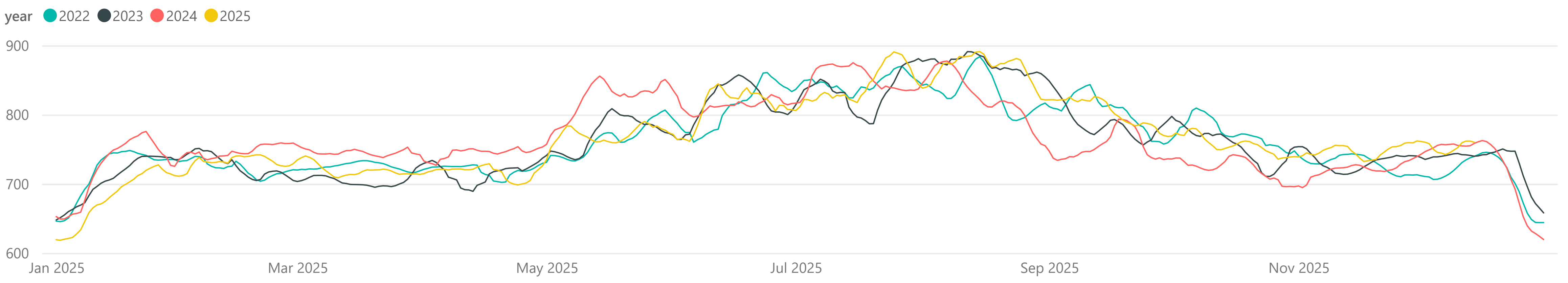


Solar

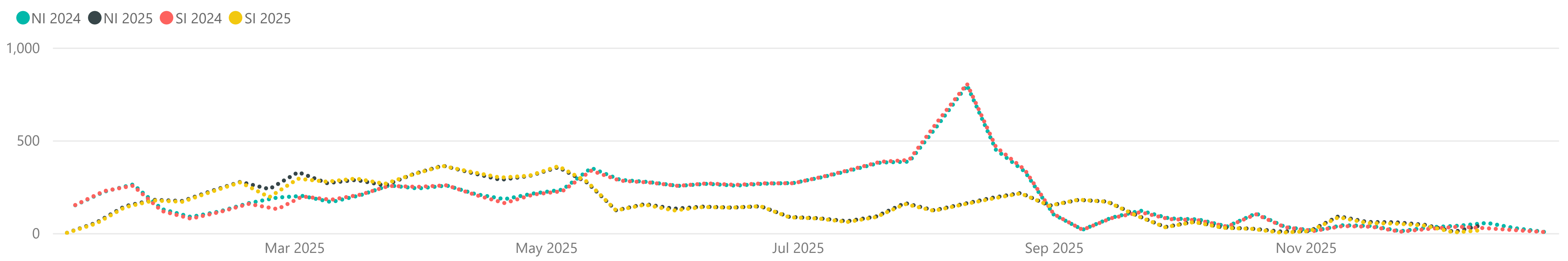


Weekly Profiles

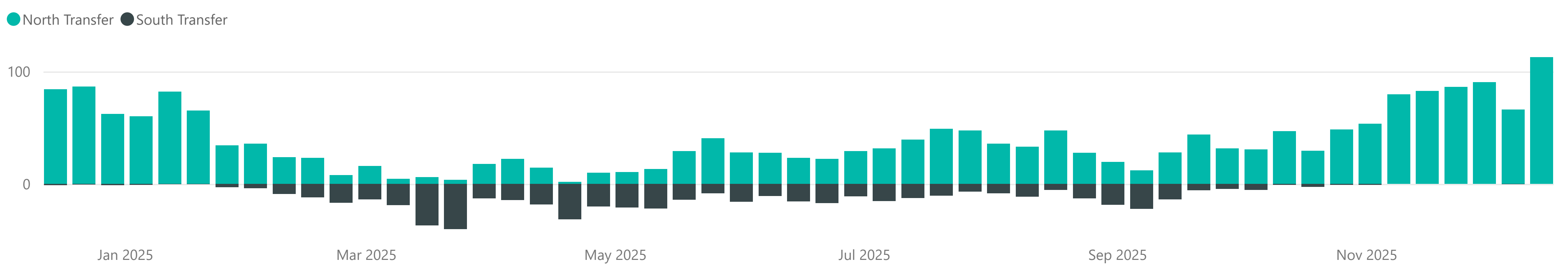
National Weekly Demand - GWh - 7 Day Rolling



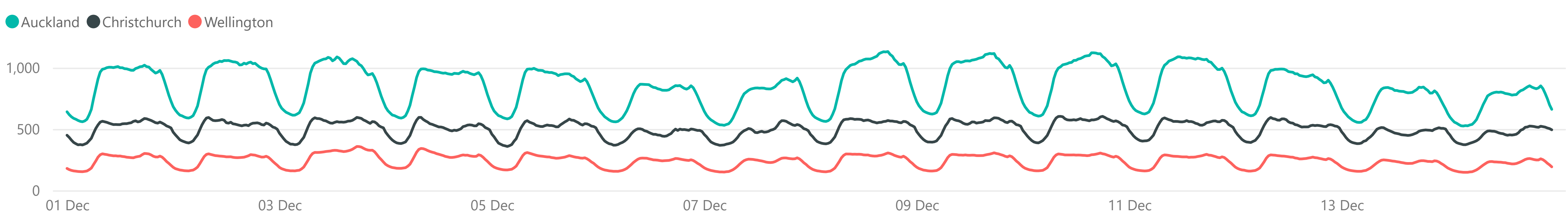
Weekly Spot Price - $/MWh



HVDC Transfer - Weekly GWh

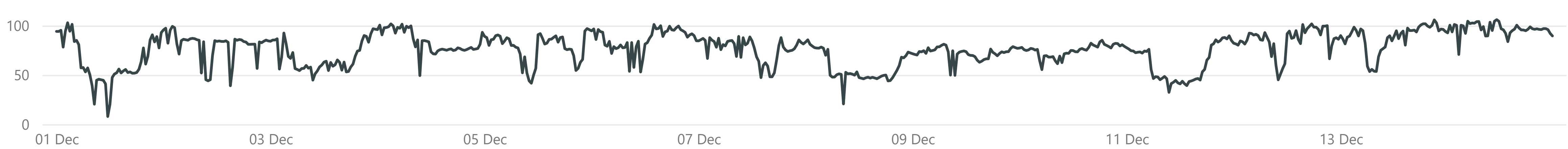


Conforming Load Profiles - Last Two Weeks *Measured in MW shown by region*

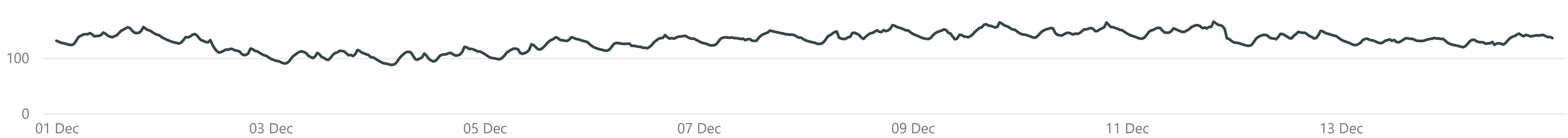


Non-Conforming Load Profiles - Last Two Weeks *Measured in MW shown by GXP*

GLN0331



ASB0661



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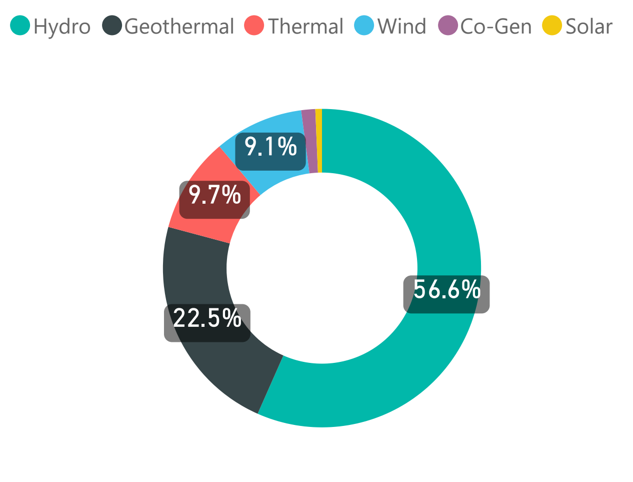
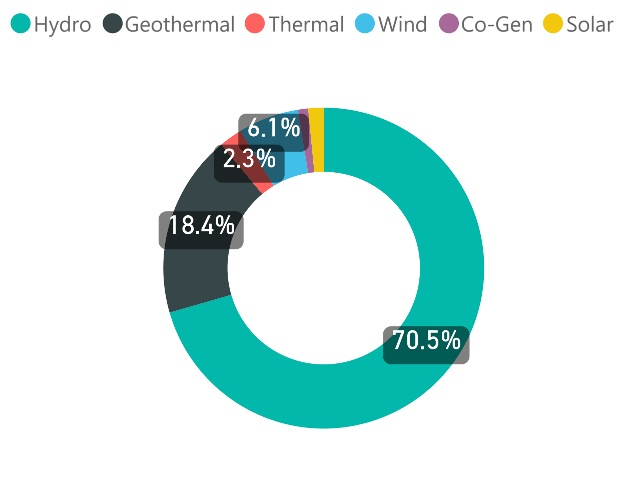
Generation Mix

Last 52 Weeks Generation Mix - Weekly GWh



Last 7 Days Generation Mix - Weekly GWh



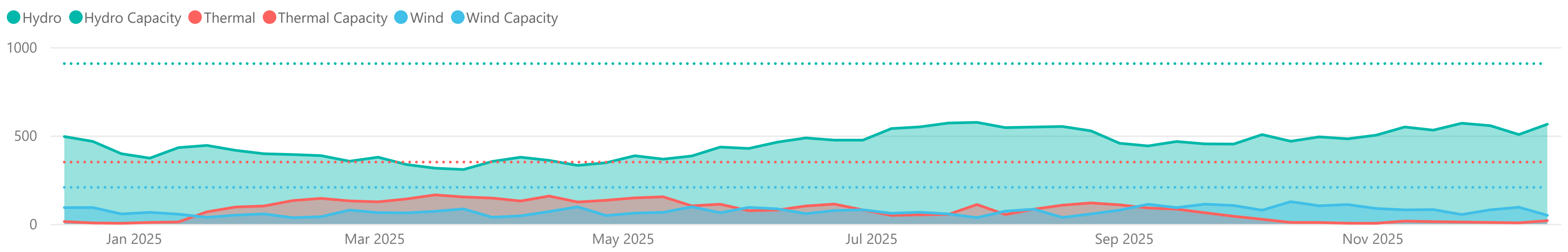
Average Metrics Last 7 Days

Renewable Percentage	CO2e Tonnes/Week	CO2e g/kWh
97%	21,438	25.6

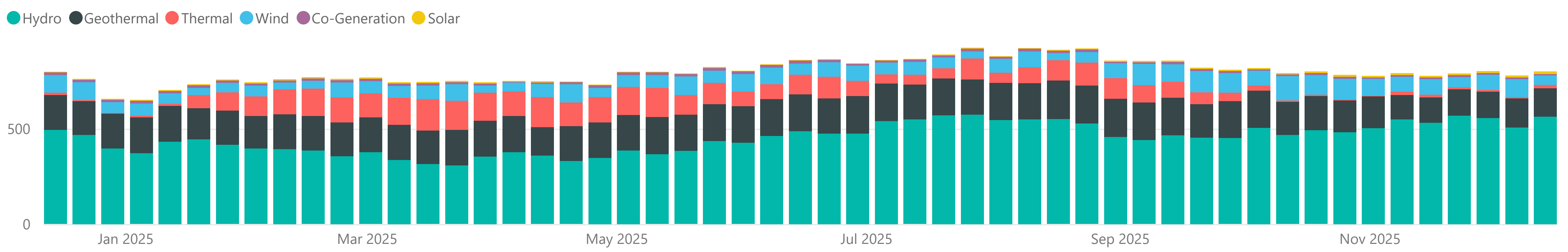
Average Metrics Last 52 Weeks

Renewable Percentage	CO2e Tonnes/Week	CO2e g/kWh
89%	64,516	81.1

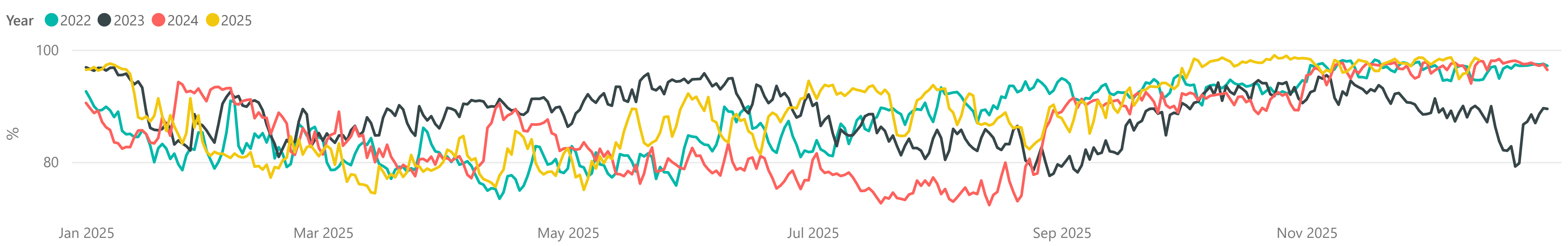
Weekly Generation Mix vs Capacity - GWh



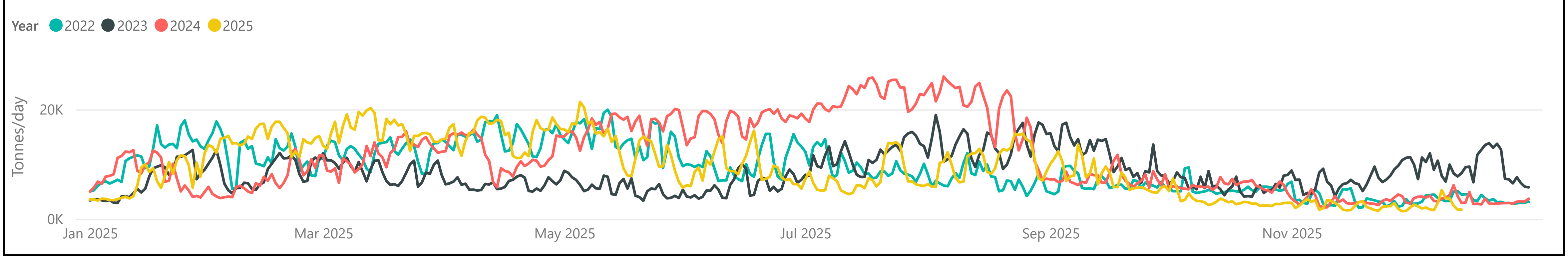
Weekly Generation Mix - GWh



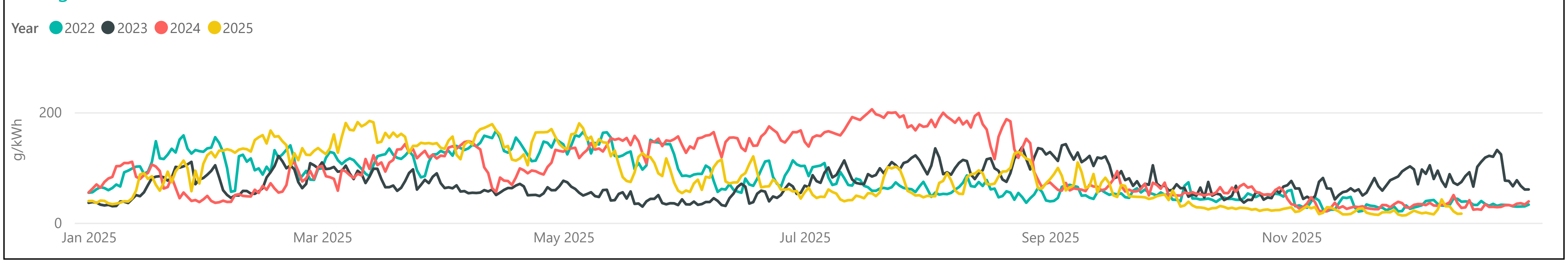
NZ Renewable Percentage



CO2 Tonnes/Day

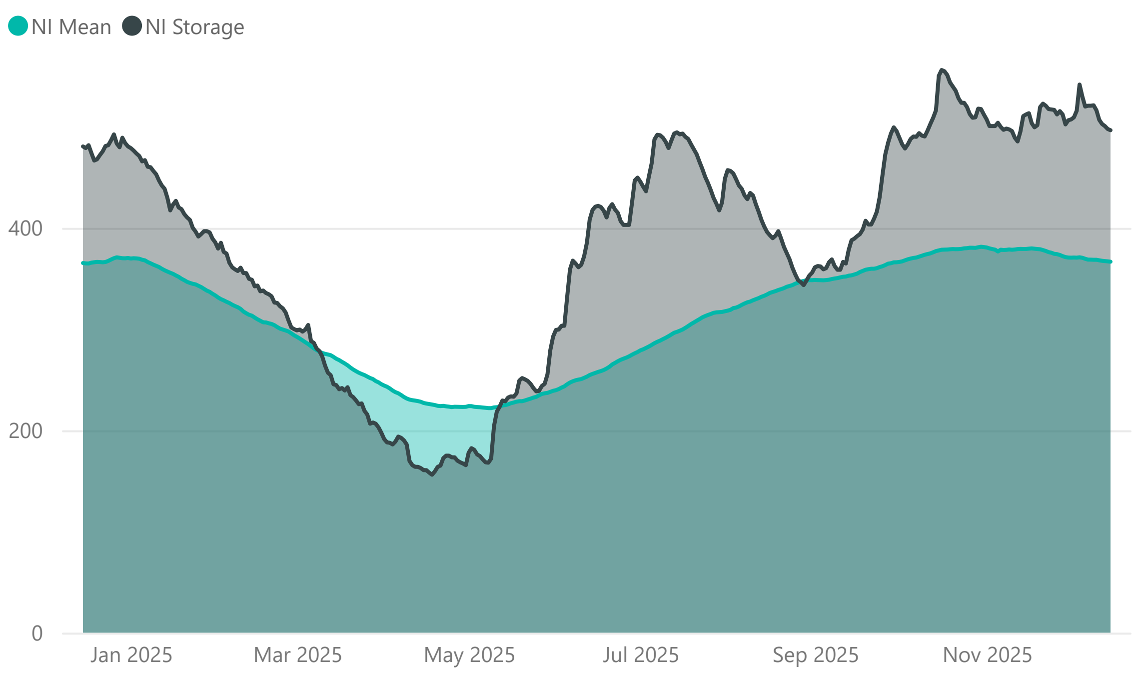


CO2 g/kWh



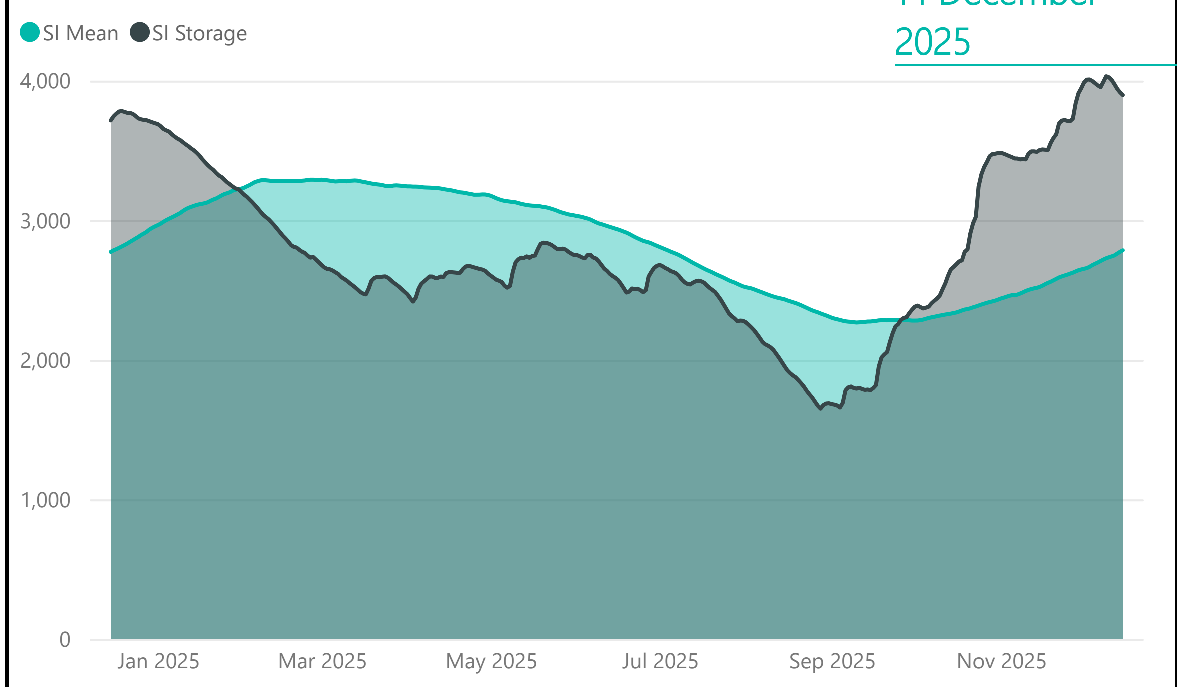
Hydro Storage

North Island Hydro Storage (Available GWh)

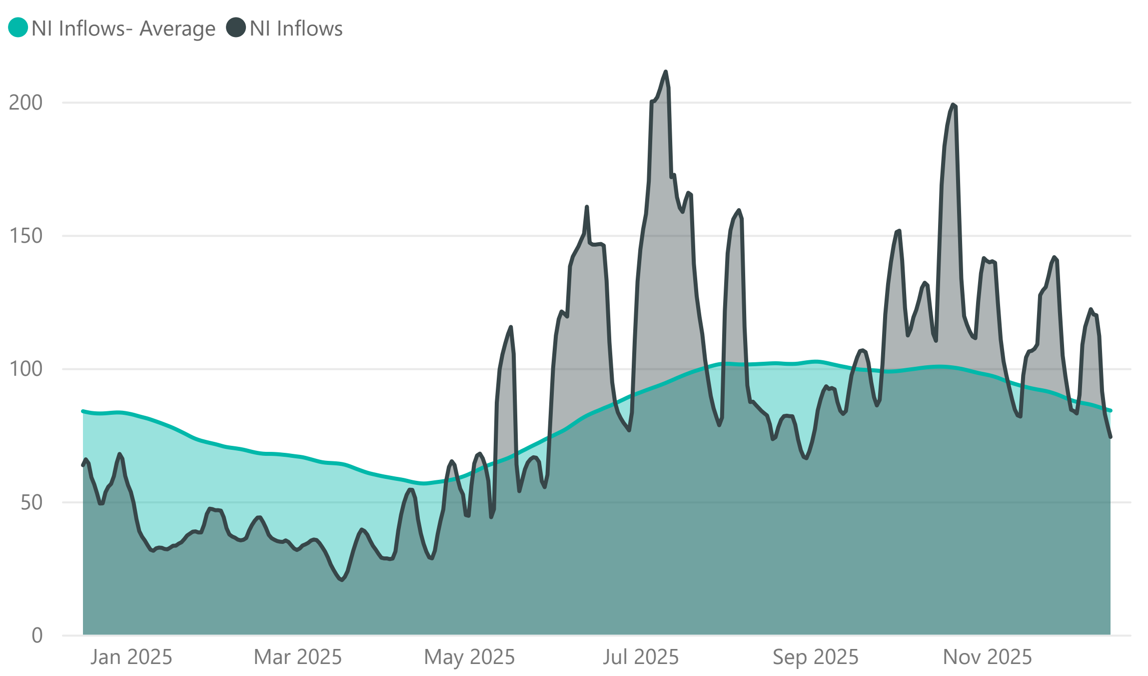


South Island Hydro Storage (Available GWh)

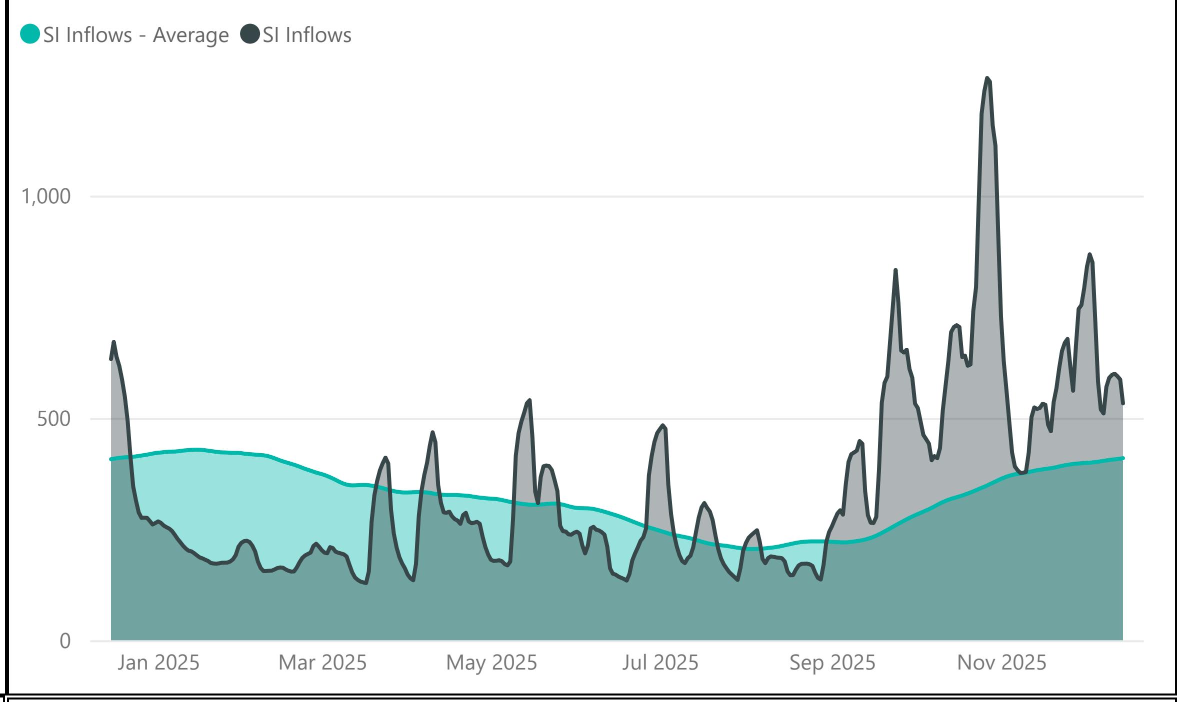
14 December 2025



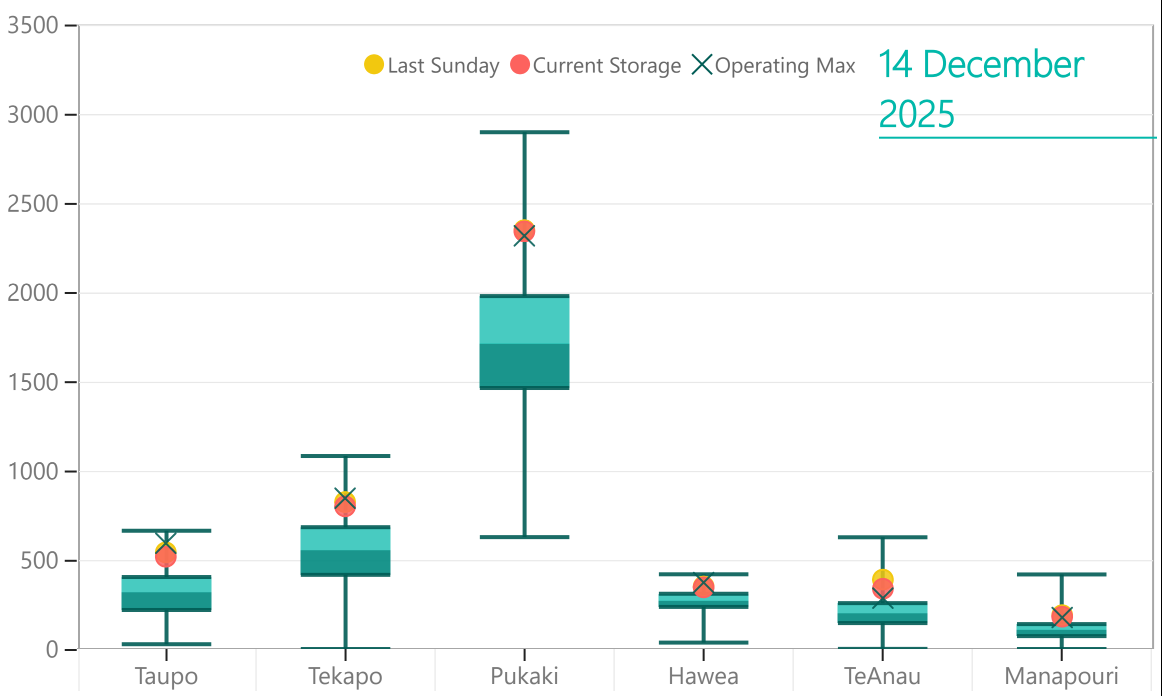
North Island Mean 7 Day Inflows (Available GWh)



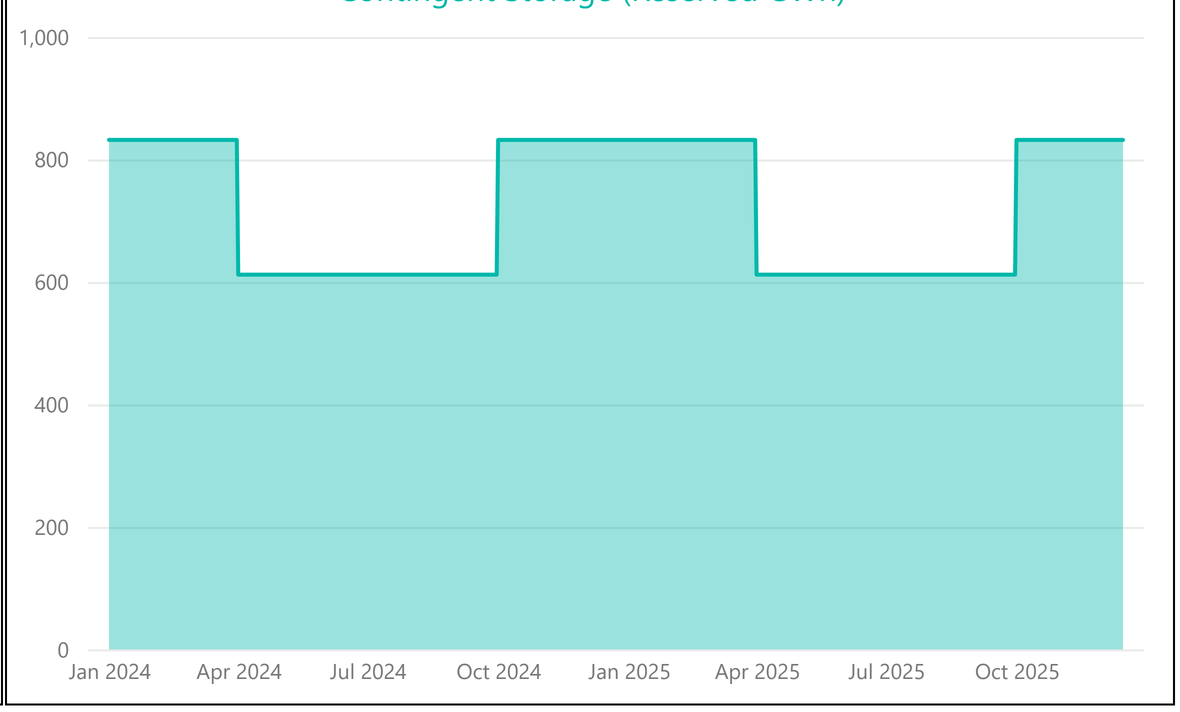
South Island Mean 7 Day Inflows (Available GWh)



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

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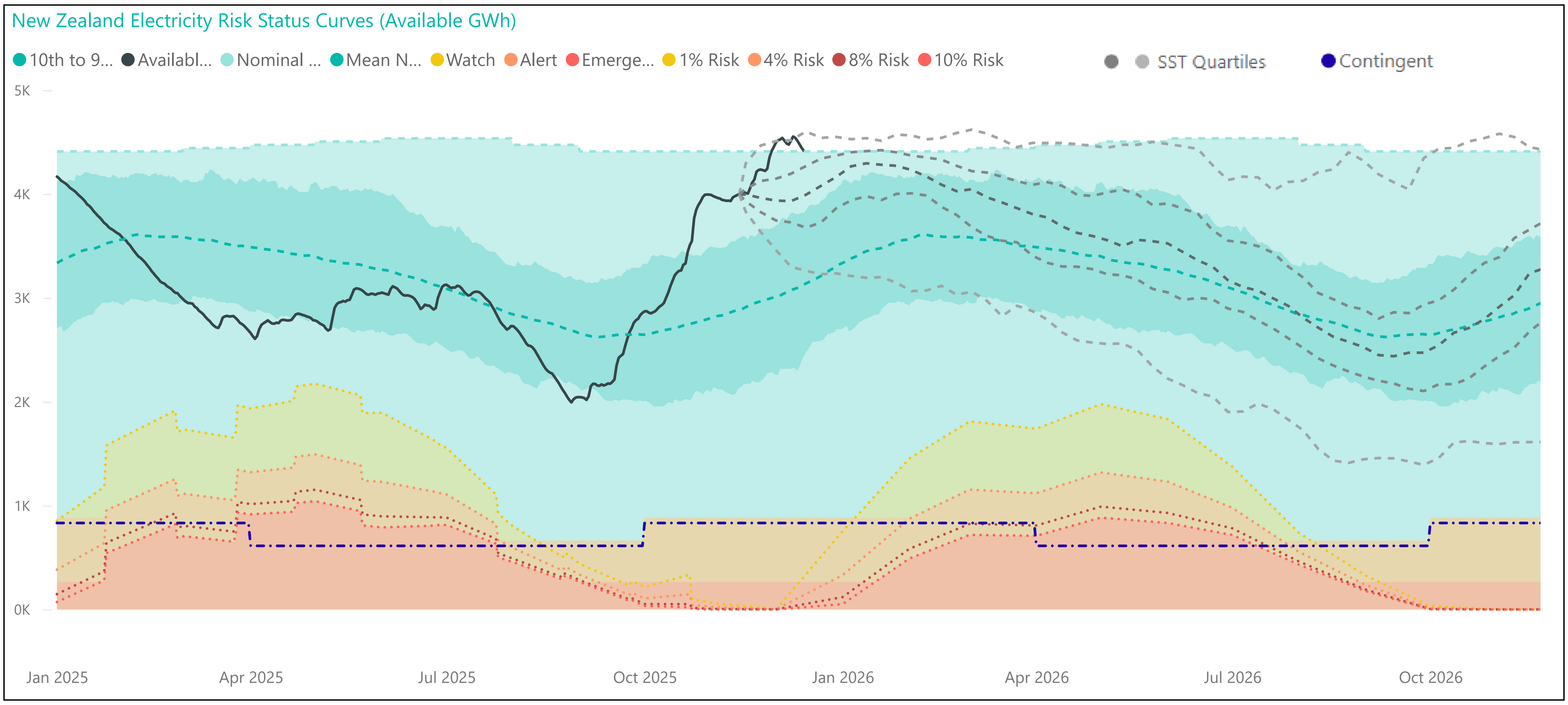
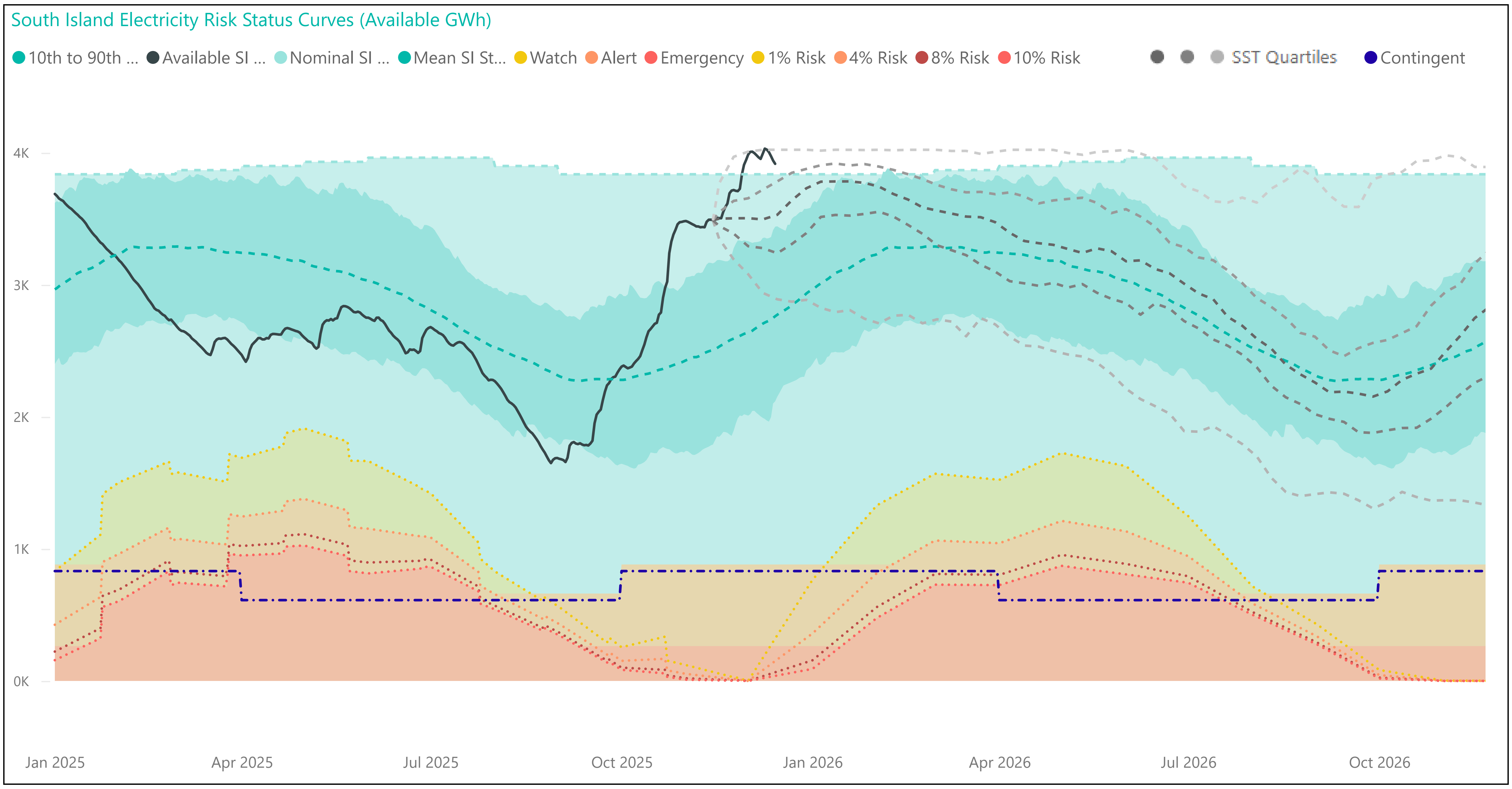
Electricity Risk Curves





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).