



Future directions for electricity supply in New Zealand

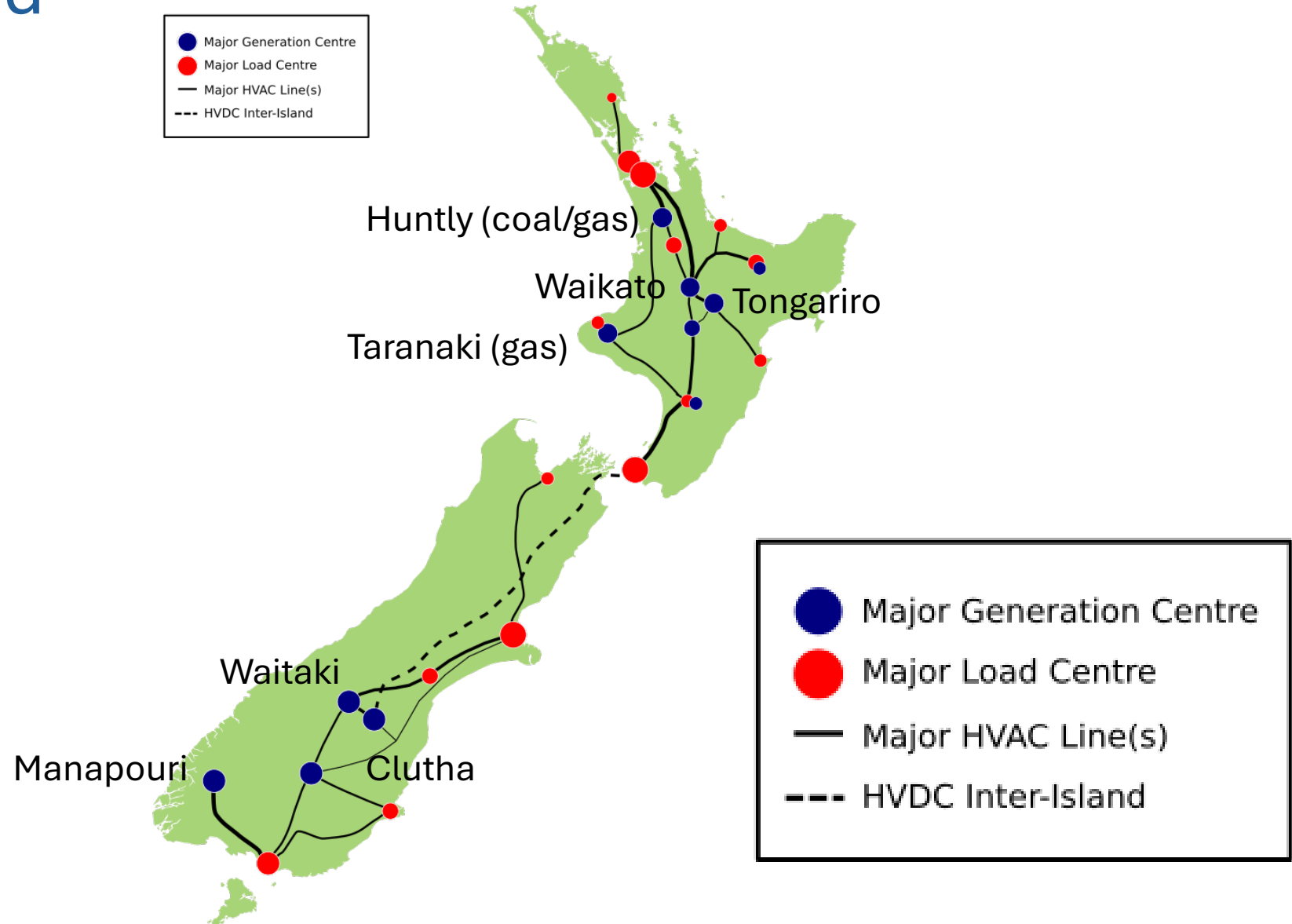
Andy Philpott

Director, Electric Power Optimization Centre

Director, Green Energy Engineering Centre

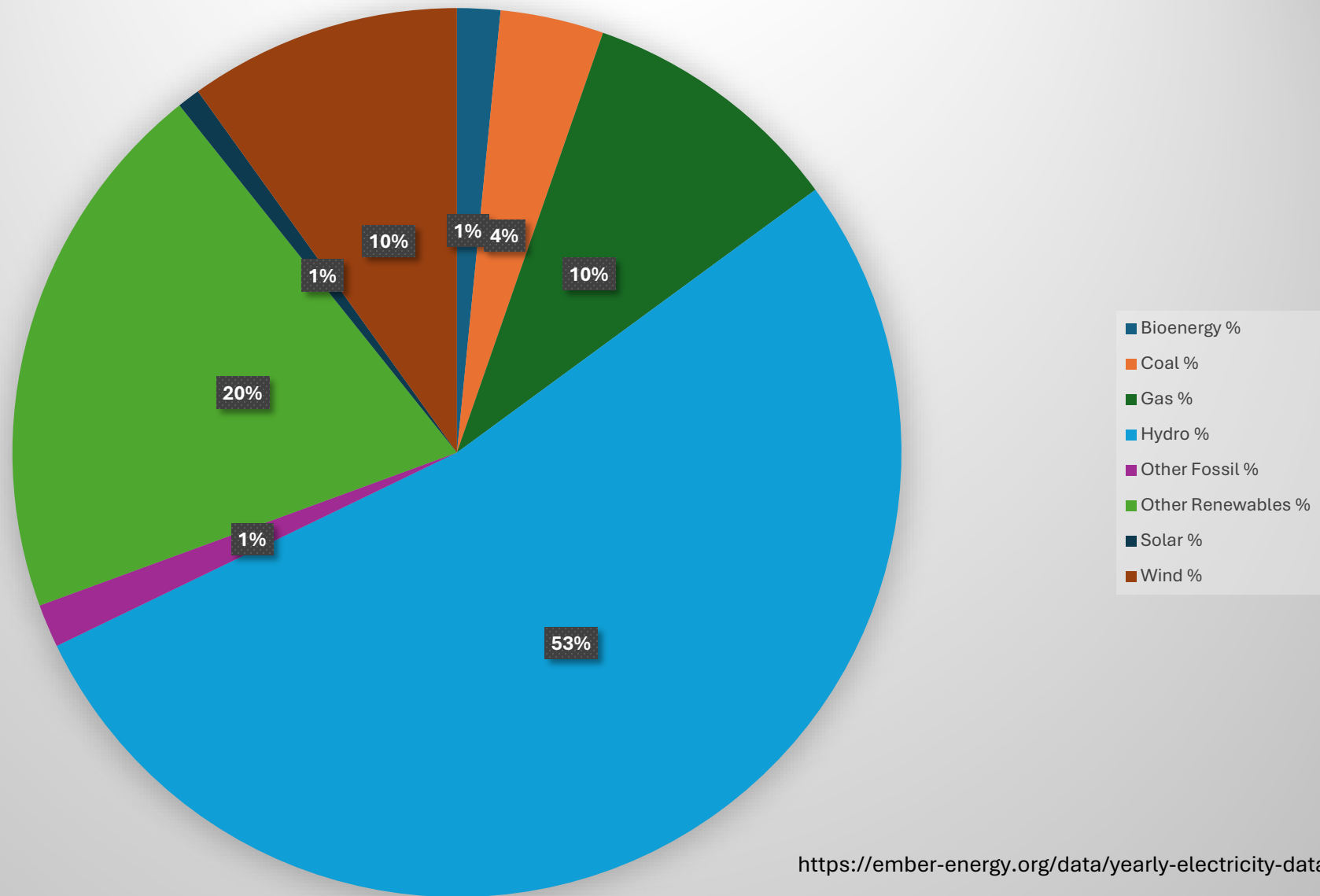
University of Auckland

New Zealand

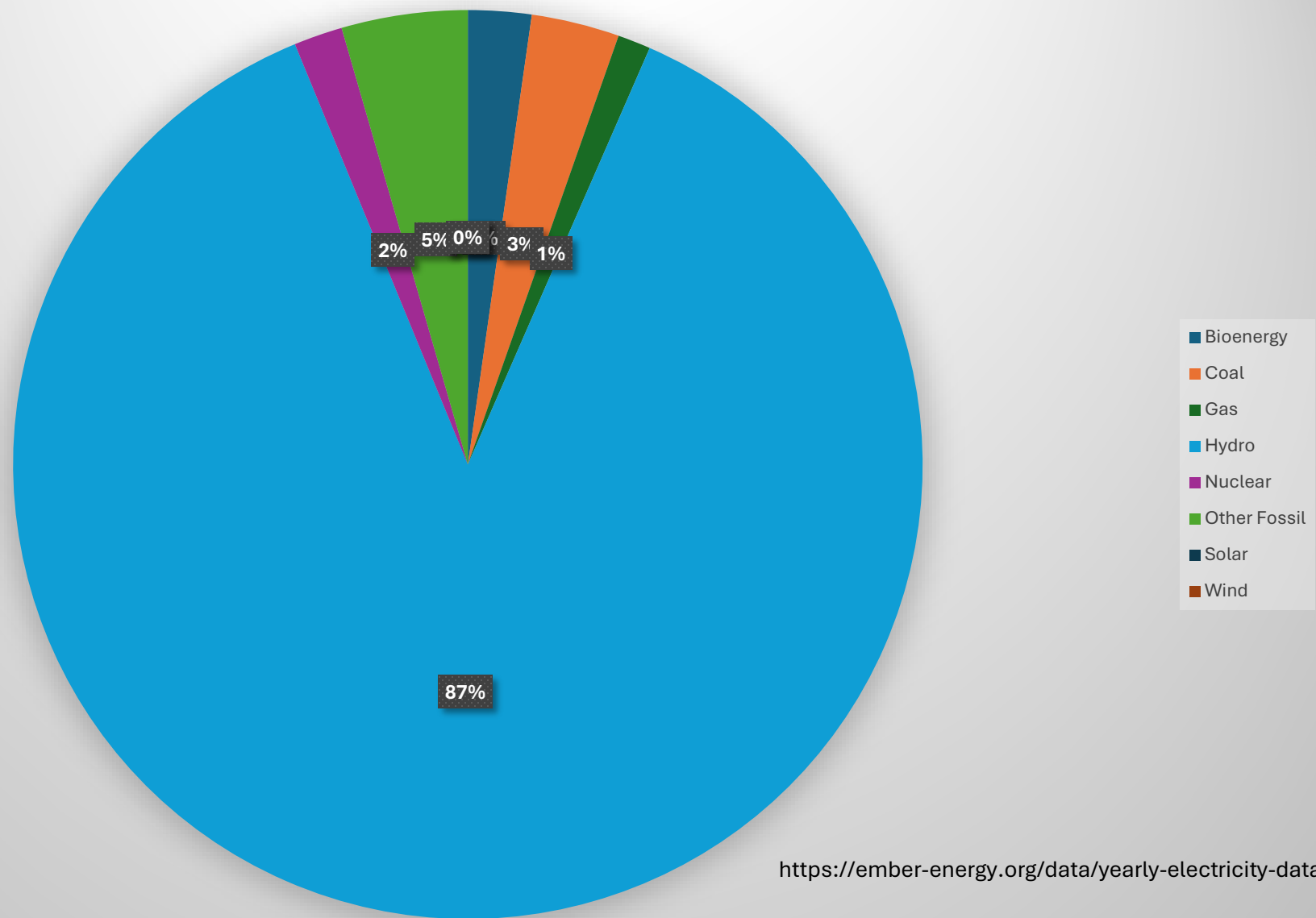


By Lcmortensen - Based from File:New Zealand locator map blank nobkgnd stdcolours.svg, edited in Inkscape to emulate Generation and Load map at [1], CC BY-SA 3.0, <https://commons.wikimedia.org/w/index.php?curid=6727038>

New Zealand Electricity Generation 2024



Brazil Electricity Generation 2024



<https://ember-energy.org/data/yearly-electricity-data/>

New Zealand electricity generation companies

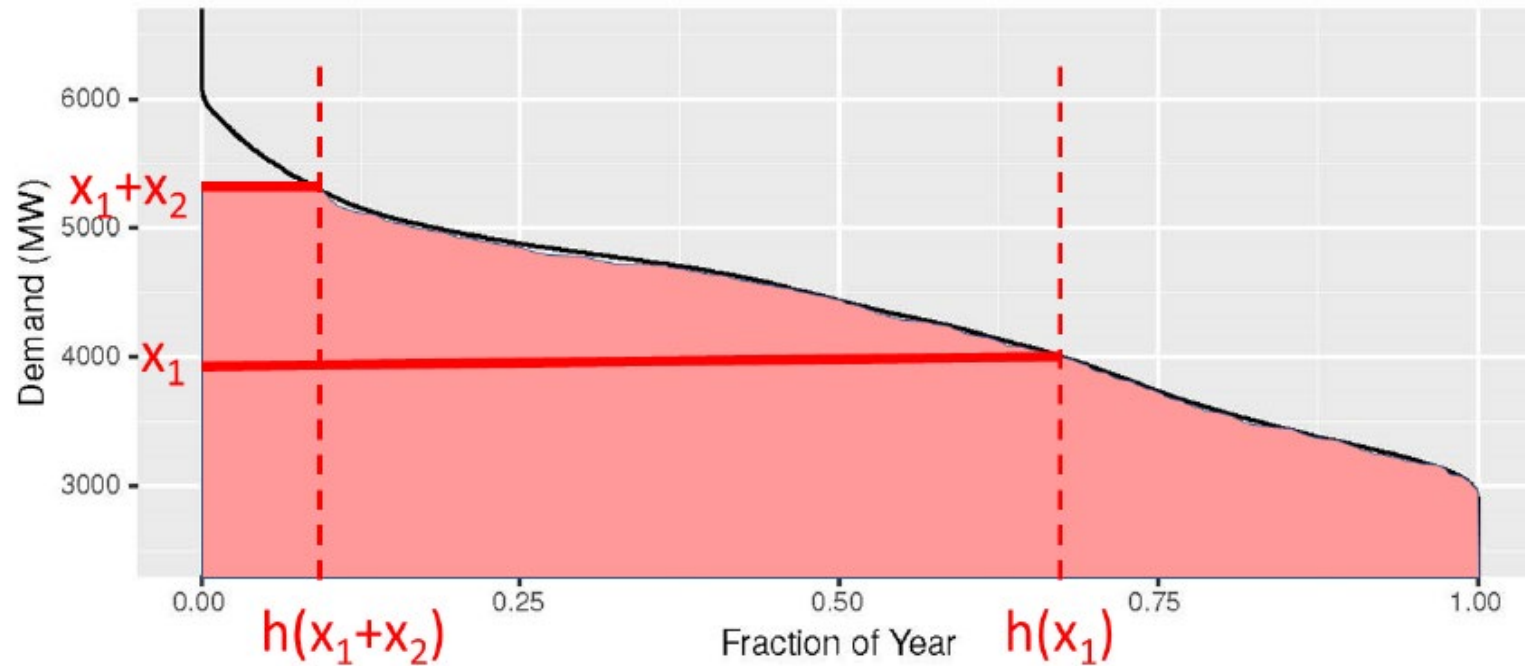
Meridian Energy	2,754 MW	Hydro (Waitaki River, Manapouri), Wind (e.g., West Wind, Harapaki)	51% Government-owned (Mixed Ownership Model)
Mercury Energy	2,155 MW	Hydro (Waikato River), Geothermal (Taupō region), Wind (e.g., Turitea, Tararua)	51% Government-owned (Mixed Ownership Model)
Contact Energy	2,022 MW	Geothermal, Hydro, Gas, Solar (e.g., Kōwhai Park)	Privately owned
Genesis Energy	1,942 MW	Hydro, Gas, Coal (e.g., Huntly Power Station)	51% Government-owned (Mixed Ownership Model)
Manawa Energy	593 MW	Hydro (formerly Trustpower assets)	Privately owned

New Zealand electricity market

- Energy only: no capacity mechanism
- No day-ahead market
- Security-constrained economic dispatch
- Locational marginal (nodal) pricing
- No subsidies for wind and solar
- Low solar penetration (c.f. Australia)

Energy only electricity market

- Base load: capital cost a , short-run marginal cost c
- Peaker: capital cost $b < a$, short-run marginal cost $C > c$
- Lost load at $VOLL = V$



$$= a / (V - C)$$

$$= (a - b) / (C - c)$$

What is currently exercising minds in New Zealand?

Security of
energy
supply

Meeting Paris
agreement
targets

Security of supply

- Capacity margin has reduced
 - Gas availability
 - Government policy: no new gas prospecting
 - Government policy: Lake Onslow pump hydro proposal
- Energy margin poor
 - Discouragement of coal
 - Gas supply decreasing
 - Dry winters with low inflows

NEW ZEALAND / BUSINESS

Transpower warns of higher blackout risk in winter 2026

5:24 am on 16 May 2025

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Eloise Gibson, Climate Change Correspondent
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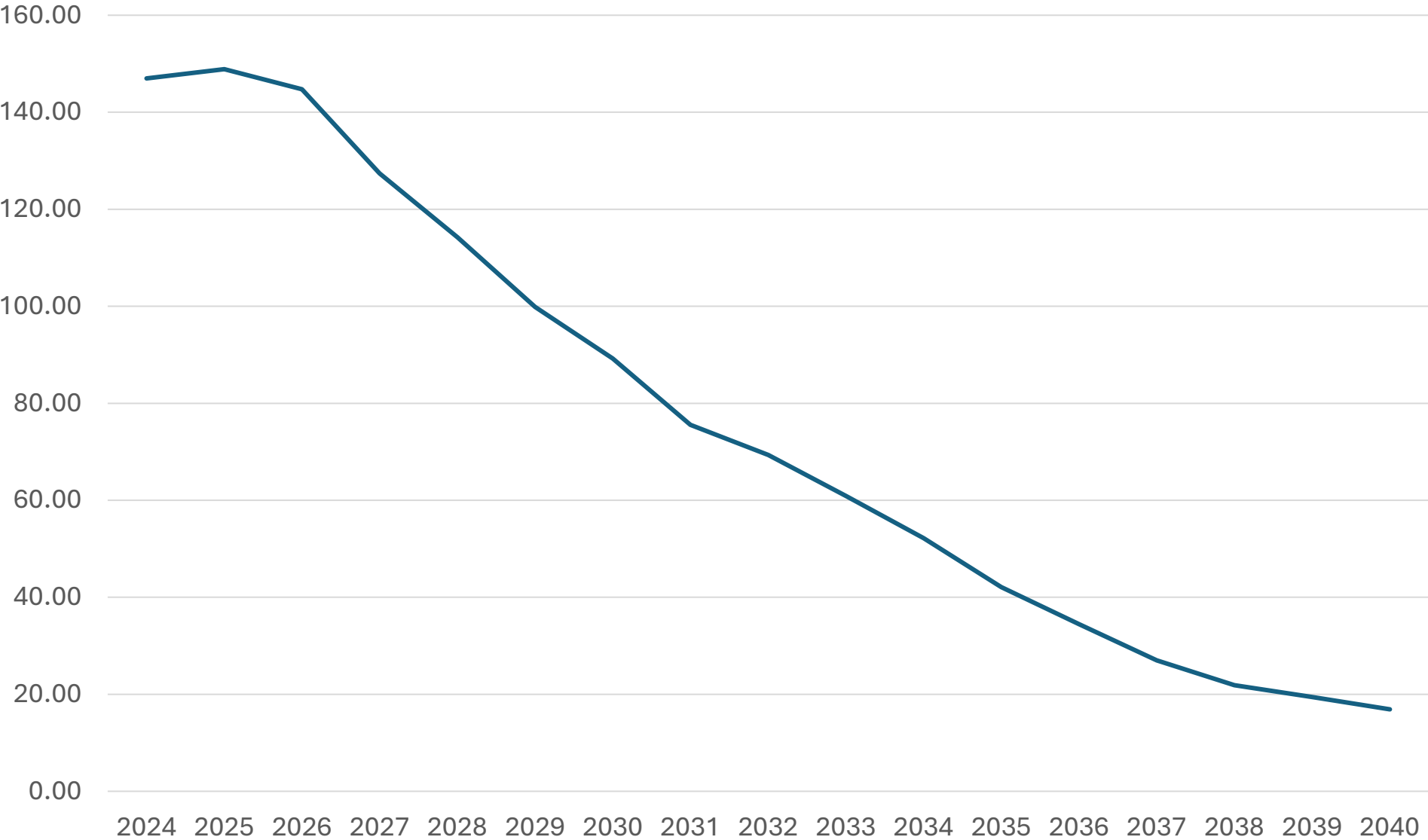


The draft Security of Supply Assessment makes sobering reading for power suppliers. Photo: 123rf.com

Transpower is warning of higher risks of electricity outages starting in winter 2026.

The national grid operator's draft Security of Supply Assessment predicts an elevated risk of shortages

New Zealand forecast gas production (PJ)

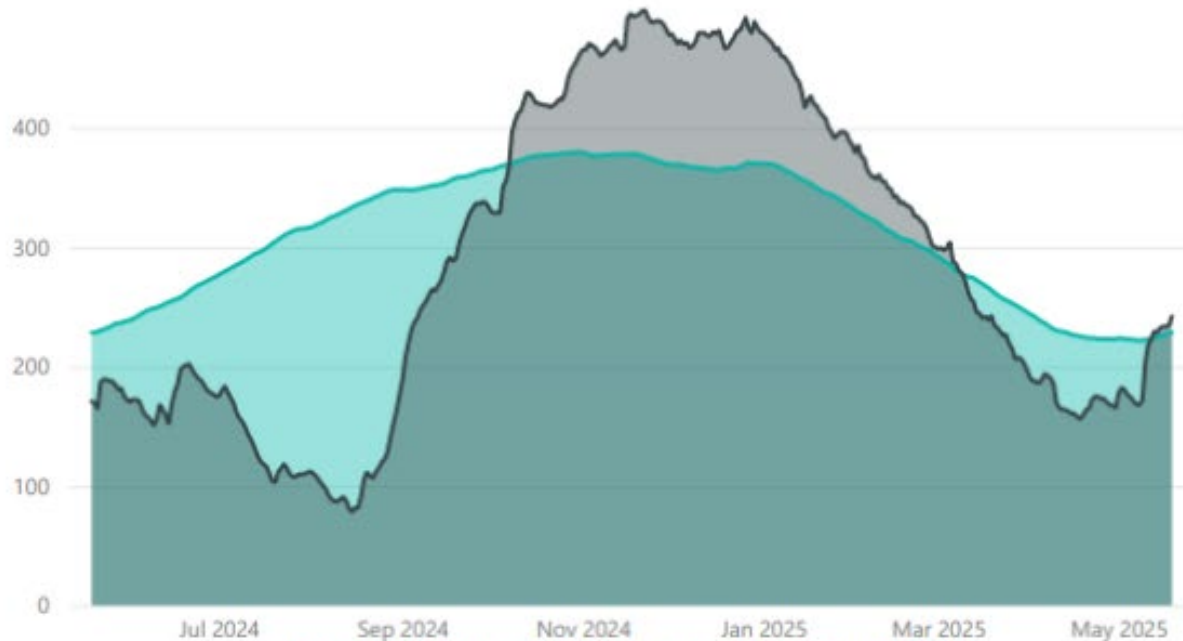


New Zealand hydro storage (GWh)

North Island

North Island Hydro Storage (Available GWh)

● NI Mean ● NI Storage

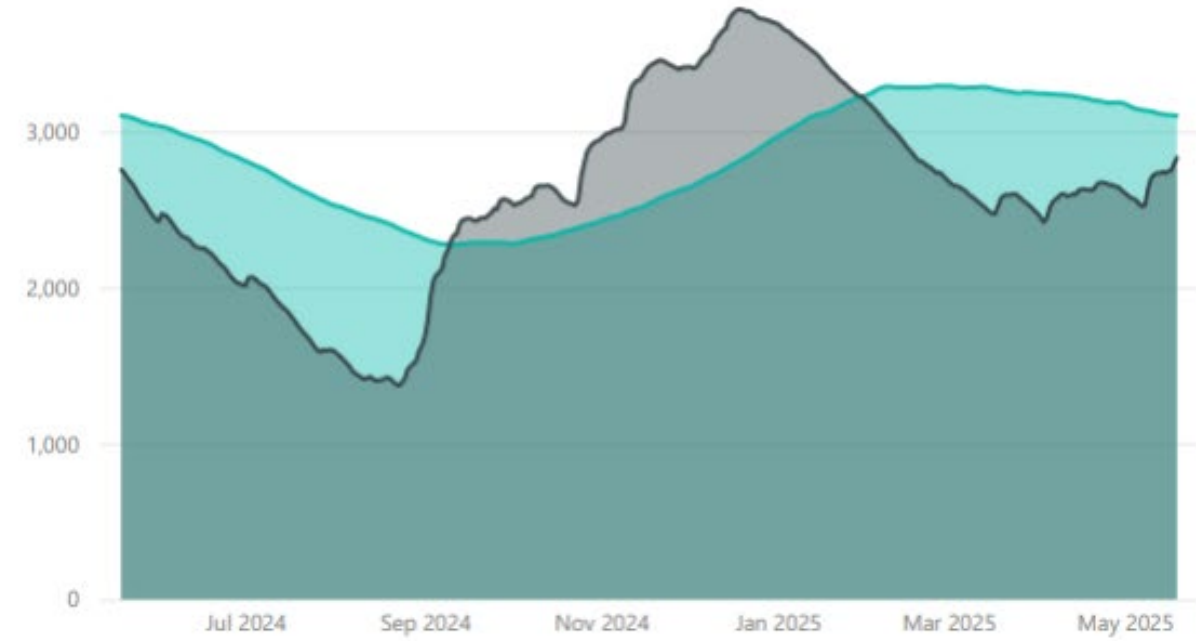


South Island

South Island Hydro Storage (Available GWh)

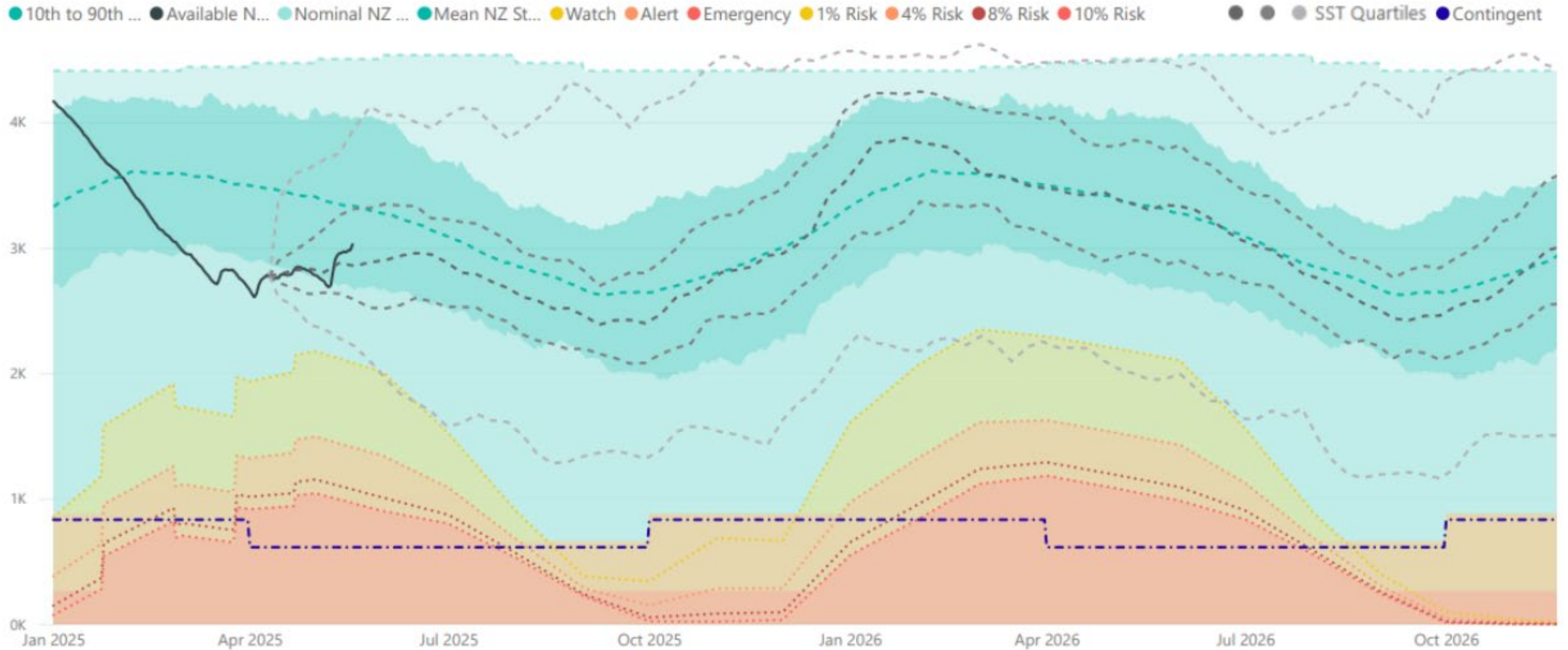
18 May 2025

● SI Mean ● SI Storage



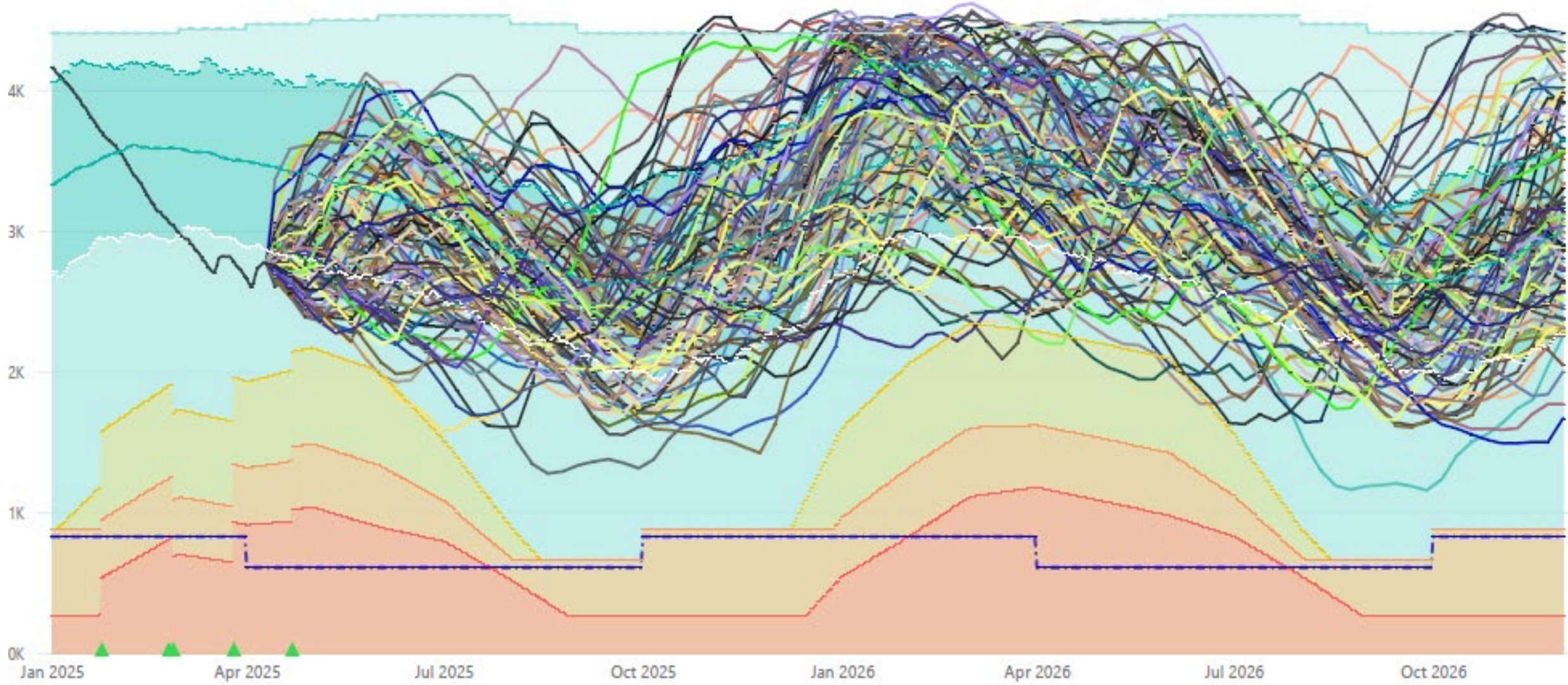
New Zealand electricity risk curves

New Zealand Electricity Risk Status Curves (Available GWh)



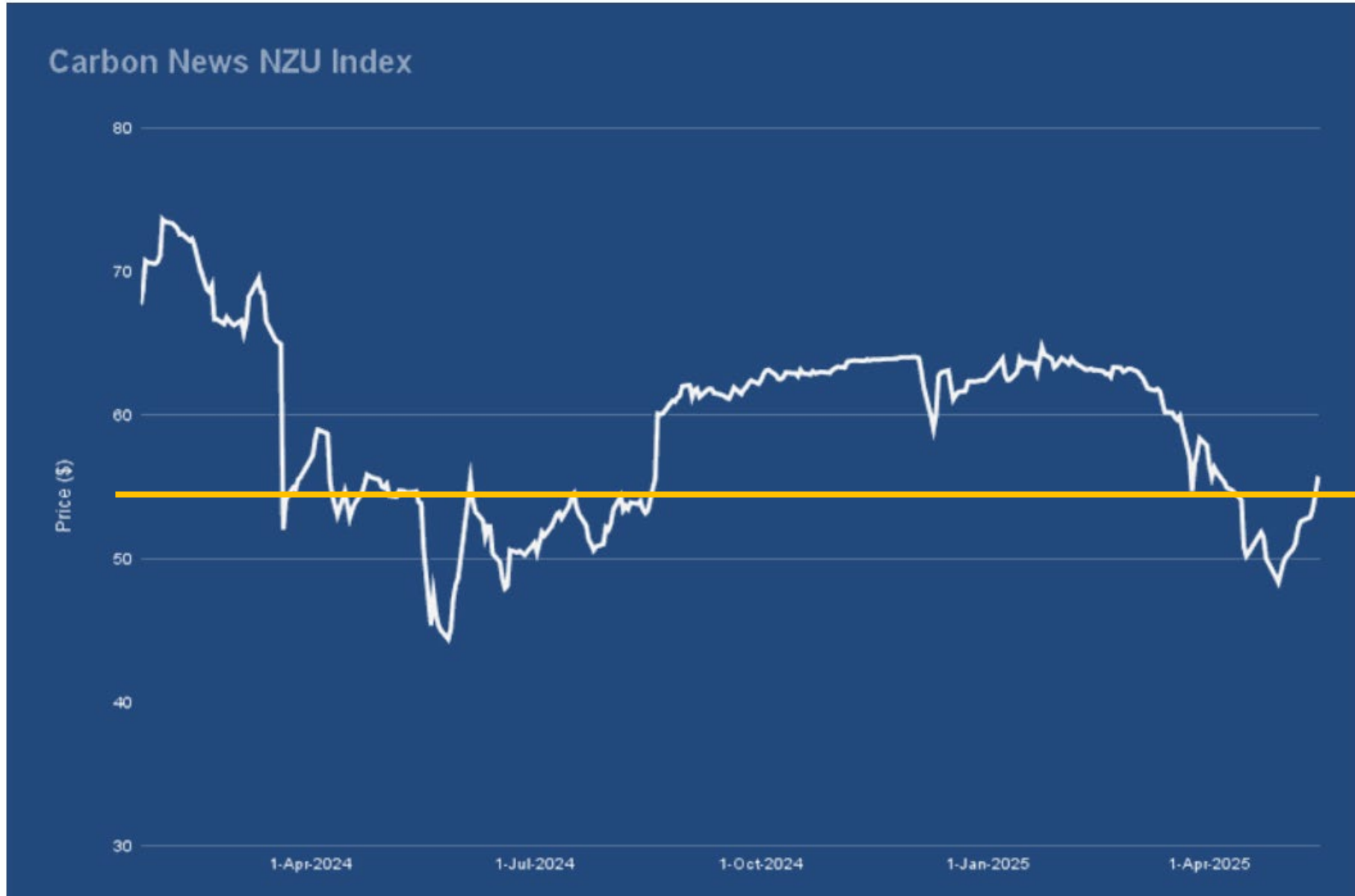
New Zealand electricity risk curves

— 10th to 90th Percentile — Available NZ Hydro Storage — Nominal NZ Full — Mean NZ Storage — Watch — Alert — Emergency — Contingent



Modest decarbonization

- We have a cap-and-trade emissions trading (ETS) scheme.
- Climate change commission recommends carbon budgets to government who sets ETS cap.
- Forestry earns credits when planted.
- ETS prices low (60 NZD/tonne CO₂) compared with Europe and do not incentivize meeting budgets.
- Government buys credits abroad to meet Paris commitments.



55 NZD/t

EU carbon prices (Euro)

EU Carbon Permits

Chart Quotes Alerts ↴ Export ▼

EU Carbon Permits (EUR) 73.180 +2.760 (+3.92%)



(140 NZD/t)

NEW ZEALAND / POLITICS

Government won't buy overseas carbon credits to meet targets, Todd McClay says

2:29 pm on 5 December 2024

Eloise Gibson, Climate Change Correspondent

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The Climate Change Commission say efforts to meeting a new target need to begin soon. P

Sha

According to the latest calculations the government would be more than 90 million tonnes - over a year's worth of the whole country's greenhouse gases - short of meeting its international promises under the Paris Agreement target if it doesn't buy help from overseas but the minister repeatedly told *Morning Report* spending money overseas was off the cards.

"No we don't have to go and buy credits overseas to meet our obligations and we're working very hard to make sure we don't.

"The idea of sending billions overseas is not palatable to anybody in New Zealand."

December 5, 2024

Energy Panel Discussion, Florianopolis, May 21, 2025

BUSINESS / ENVIRONMENT

Carbon capture: Pivotal project for cutting greenhouse gas emissions looks shaky

12 minutes ago

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The Kapuni Gas Treatment Plant. Photo: RNZ / Robin Martin

A critical part of the government's plan for cutting greenhouse gas emissions over the next five years appears to have fallen over.

A huge chunk of the government's climate success rests on a single project, which the owner now says probably won't happen because it doesn't stack up commercially.

Energy, Environment, Technology, Transport, May 19, 2025

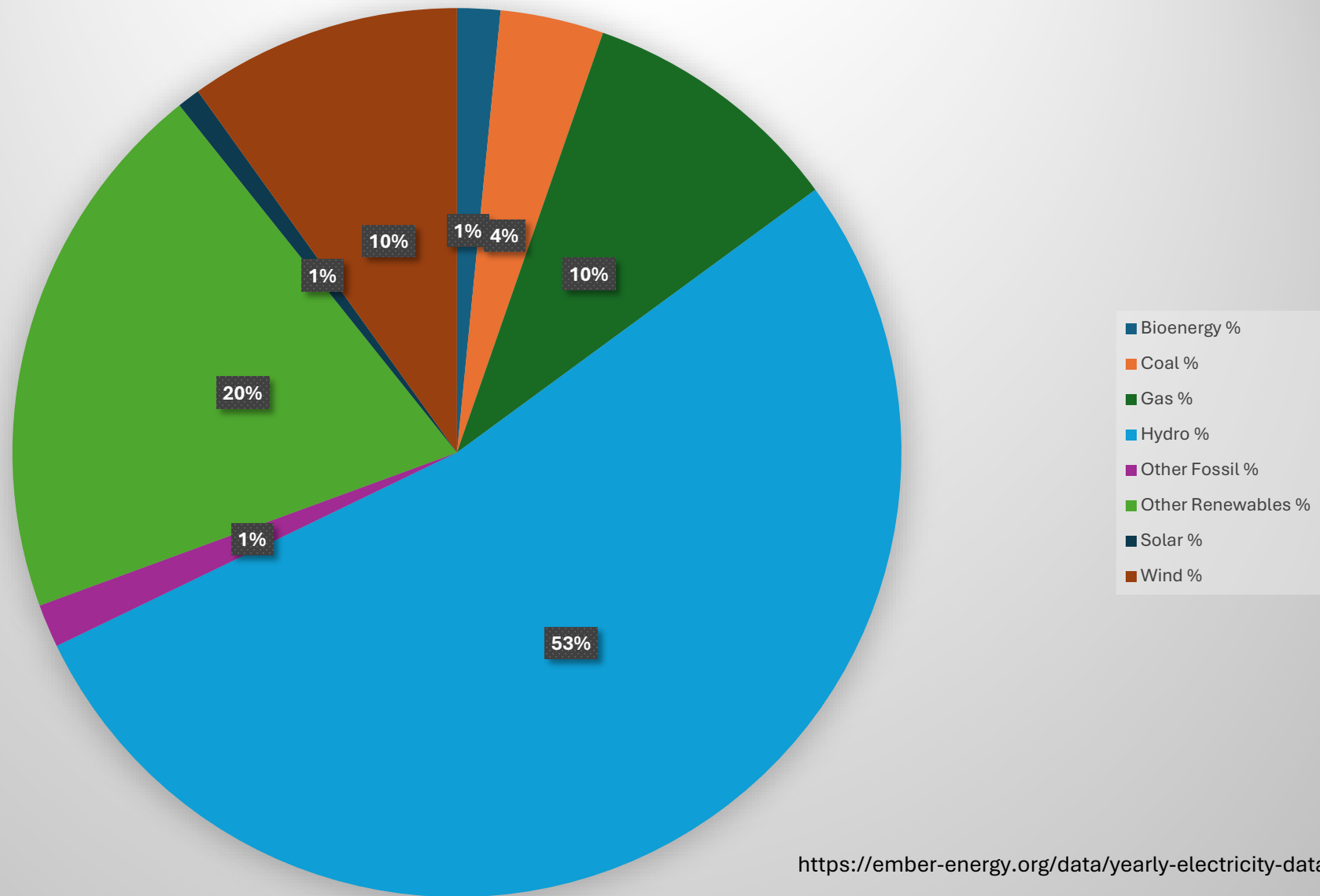
RNZ: May 19, 2025

Some conjectures...

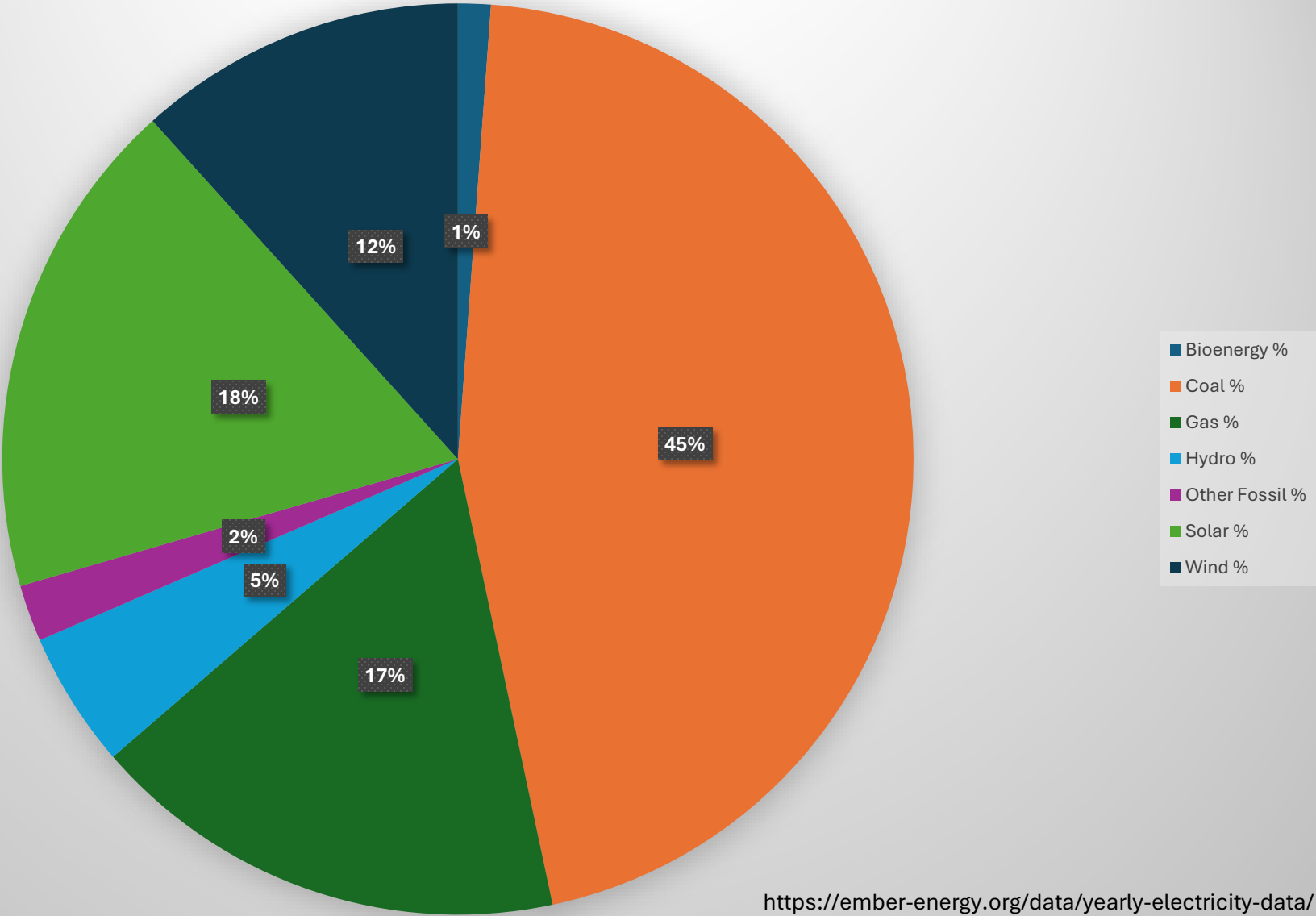
Decarbonization
is leading to a
convergence of
energy systems.

This will result in
a convergence of
market
arrangements.

New Zealand Electricity Generation 2024



Australia Electricity Generation 2024



Are electricity markets converging?

- Markets are facing the same problems to different degrees.
[“Ten challenges for mathematical modeling of the energy transition”, www.epoc.org.nz]
- Are electricity systems becoming more convex?
- Are electricity systems are becoming more unpredictable?
- Debate on central planning versus market investment.
- Shortages not acceptable imply capacity mechanism needed.
- Will decarbonization be too late? Or should countries goldplate capacity now at some extra cost in order to save the planet?