Winter Power Demand Outlook 2023
ENA Chief Executive and Chair Forum

TESLA
Forecasting Solutions

Who are **TESLA** Forecasting Solutions?

Experts in **electricity** and **gas demand forecasting** since 1992 – this is our niche

Helping over **200** clients across the globe with offices in the **US, UK, NZ** and **Japan**

Not to be confused with Tesla Motors

Active in **New Zealand** since **2010**

Began forecasting **Uncontrolled Demand** for **Orion**. Established **Asia Pacific** office in **Auckland**

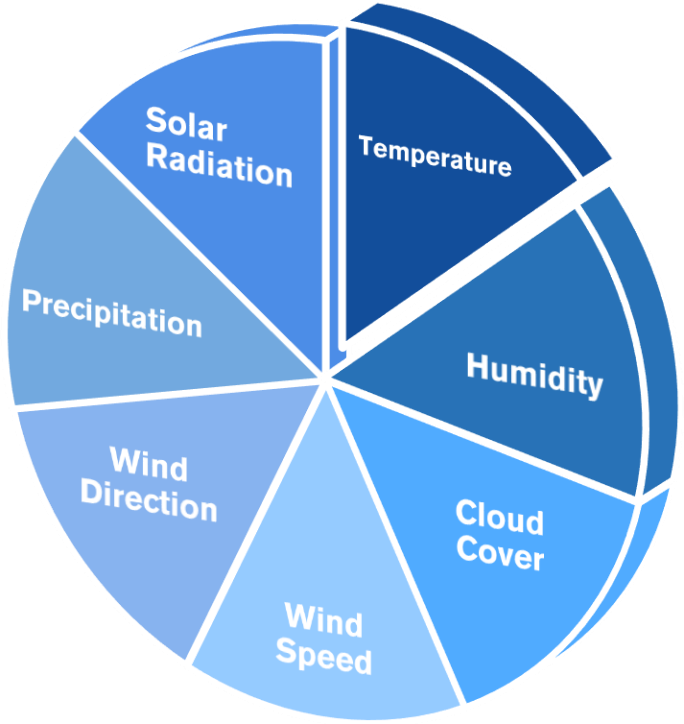
Over **30** clients across NZ, Australia, India, Japan & Philippines. **5** are **EDBs** in **NZ**

Providing **Transpower** with the Medium Term Load Forecast since **March 2022**

Agenda

- Factors that drive power demand
- Weather Adjusted Load
- Historical average and peak load growth trends
- Total demand projection for Winter 2023
- Why peak demand is growing
- Weather view
- Q&A

Weather drives **Power Consumption**



- **MetService** provide **weather forecasts**, updated every hour, for **14 day horizon**
- Typical model contains **several hundred** hourly **weather variables**, not just temperature
- **Weather** must be considered when analysing Year-on-Year power demand **trends**

MetService
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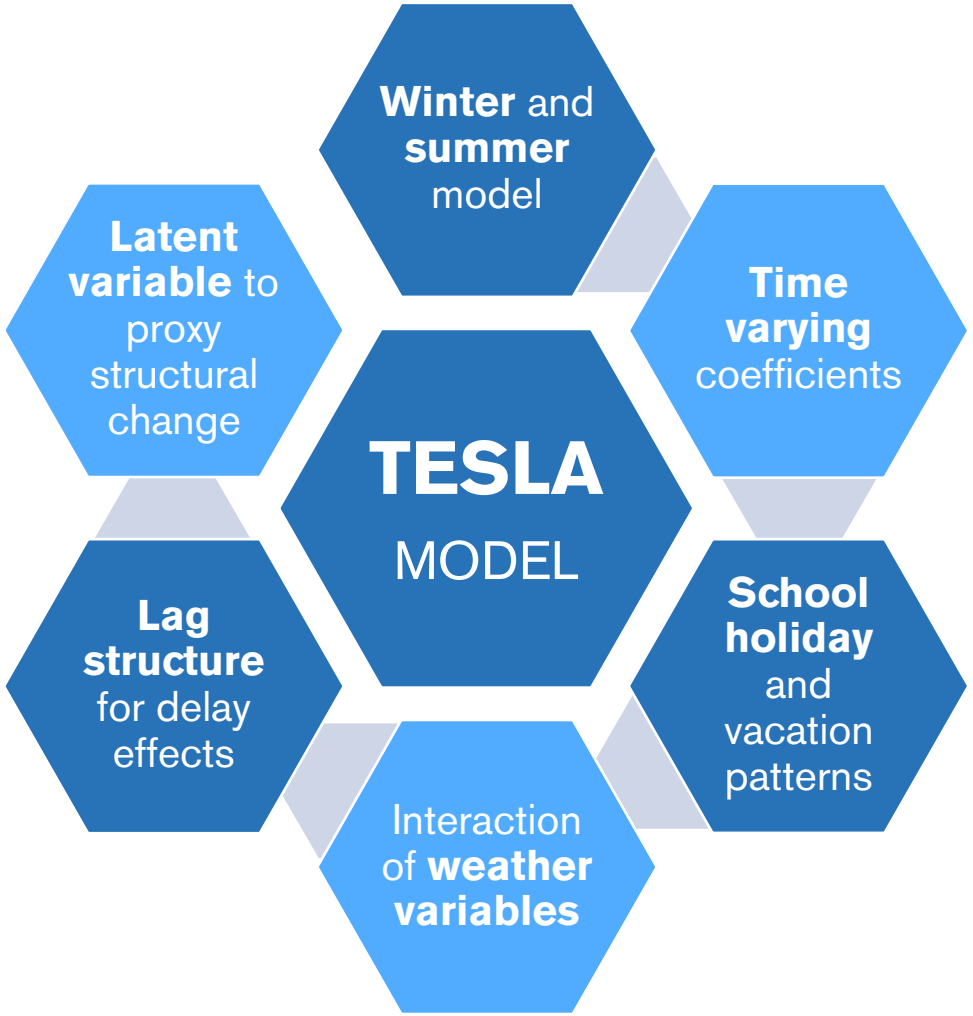
The TESLA Model



Weather Adjusted Load

- **Weather Adjusted Load adjusts** historic demand series to climatic **average "normal" weather conditions**
- **Prevents cold** or **mild winters from** distorting **underlying demand trends**
- Year-on-Year change can indicate **network growth** or **shrinkage**
- Useful for **network** and **financial planning**
- **Great** for **analysing** Year-on-Year **underlying load growth (average demand)**
- **However**, since it shows Year-on-Year demand **growth** during **seasonal average weather,** it naturally **underestimates peak demand growth.**

Year-on-Year Underlying Conforming Load Growth

- YoY average weather adjusted demand growth from 2021 to 2022
- August onward is skewed due to lockdowns. Northland is lower due to Marsden Point Refinery closure.
- Clear growth in the coldest month of July
- Matariki Day excluded

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Northland	11.3%	7.7%	5.1%	-8.7%	-9.1%	-8.2%	-7.9%	-6.0%	-7.5%	-8.9%	-8.5%	-8.4%
Auckland	1.3%	1.5%	0.7%	-0.6%	0.2%	0.3%	0.2%	5.3%	9.3%	4.4%	4.5%	1.3%
Hamilton	0.4%	0.5%	1.7%	0.0%	-1.7%	0.3%	-1.0%	3.6%	-0.4%	2.8%	1.7%	-2.0%
Bay of Plenty	-0.7%	0.3%	3.0%	1.6%	0.2%	-1.2%	0.7%	3.1%	2.3%	2.3%	0.4%	-1.1%
Napier	-0.9%	-1.9%	-2.0%	0.1%	0.9%	1.3%	4.8%	6.6%	1.7%	3.6%	-2.3%	-4.0%
Wellington	-1.2%	-0.7%	-1.8%	-1.7%	-1.0%	-0.1%	0.4%	2.9%	0.8%	2.2%	-0.9%	-1.6%
Christchurch	2.4%	-6.0%	-3.6%	-2.5%	1.5%	1.1%	3.5%	4.6%	3.5%	6.1%	1.2%	3.9%
West Coast	1.0%	-9.6%	2.1%	1.4%	1.9%	0.5%	2.1%	10.8%	3.3%	9.3%	4.8%	9.0%
Invercargill	5.9%	-7.8%	-5.7%	0.7%	-0.8%	3.6%	3.9%	9.2%	5.1%	5.5%	5.7%	7.1%
Palmerston North	0.5%	0.5%	0.3%	2.4%	2.0%	1.4%	3.4%	7.0%	3.3%	0.7%	-4.8%	-4.8%
Total	2.2%	-1.3%	-0.3%	-1.0%	-0.6%	-0.1%	0.7%	4.3%	3.0%	2.9%	0.8%	0.4%

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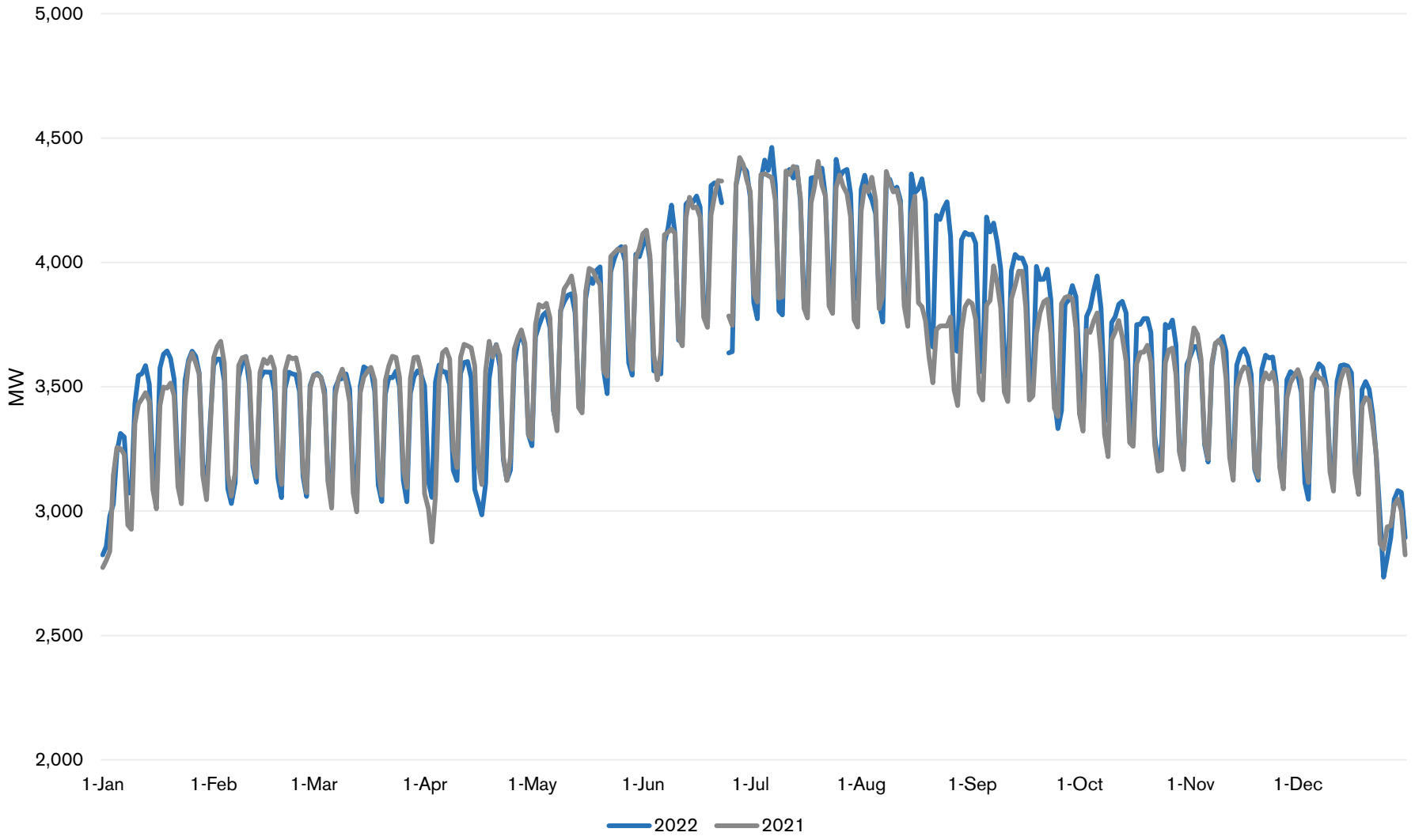
Daily Average Weather Adjusted NZ Total Conforming Demand



Year-on-Year Average Peak Conforming Demand Growth

- YoY average weather adjusted peak demand growth from 2021 to 2022
- August onward is skewed due to lockdowns. Northland is lower due to Marsden Point Refinery closure.
- Clear growth in the coldest month of July
- Matariki Day excluded

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Northland	10.7%	7.7%	4.3%	-6.4%	-6.6%	-5.1%	-4.7%	-6.5%	-8.3%	-7.4%	-7.3%	-7.9%
Auckland	0.7%	1.4%	0.6%	-1.3%	0.1%	1.3%	1.7%	3.1%	5.0%	4.8%	4.3%	0.8%
Hamilton	0.5%	0.1%	0.5%	-0.3%	0.6%	3.5%	2.5%	3.3%	0.2%	4.8%	1.9%	-2.1%
Bay of Plenty	0.2%	0.0%	2.2%	1.2%	-0.6%	-0.6%	0.9%	1.4%	0.7%	1.6%	-0.7%	-2.1%
Napier	-0.9%	-1.7%	-2.2%	-0.7%	2.1%	2.0%	4.8%	3.7%	0.4%	3.4%	-2.7%	-4.8%
Wellington	-1.4%	-1.3%	-2.8%	-2.3%	-1.0%	-1.0%	-0.3%	0.5%	-1.3%	0.8%	-2.5%	-2.0%
Christchurch	2.4%	-4.7%	-3.3%	-2.7%	0.7%	1.1%	2.5%	2.8%	2.2%	5.4%	-0.4%	2.3%
West Coast	1.1%	-8.0%	2.1%	1.0%	0.0%	0.2%	1.1%	7.8%	2.0%	6.9%	2.9%	7.0%
Invercargill	5.2%	-6.3%	-5.1%	0.7%	-1.8%	2.2%	2.2%	8.9%	4.7%	5.5%	4.3%	6.4%
Palmerston North	1.1%	1.4%	-0.4%	1.7%	1.7%	1.6%	2.7%	4.4%	2.1%	1.2%	-4.3%	-4.3%
Total	5.0%	-1.1%	-0.9%	-1.2%	-0.4%	0.5%	1.4%	2.3%	1.5%	3.6%	0.6%	0.1%

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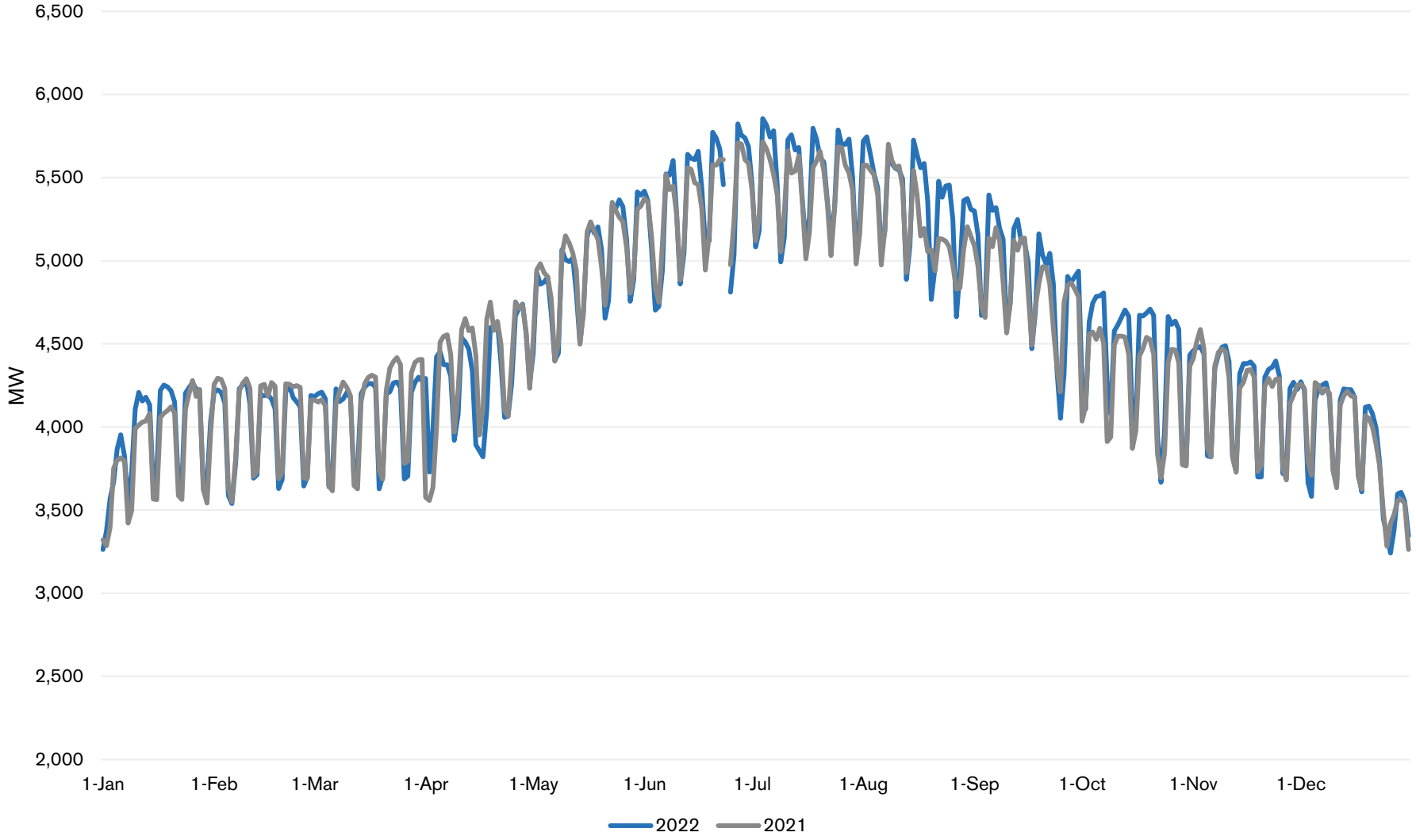
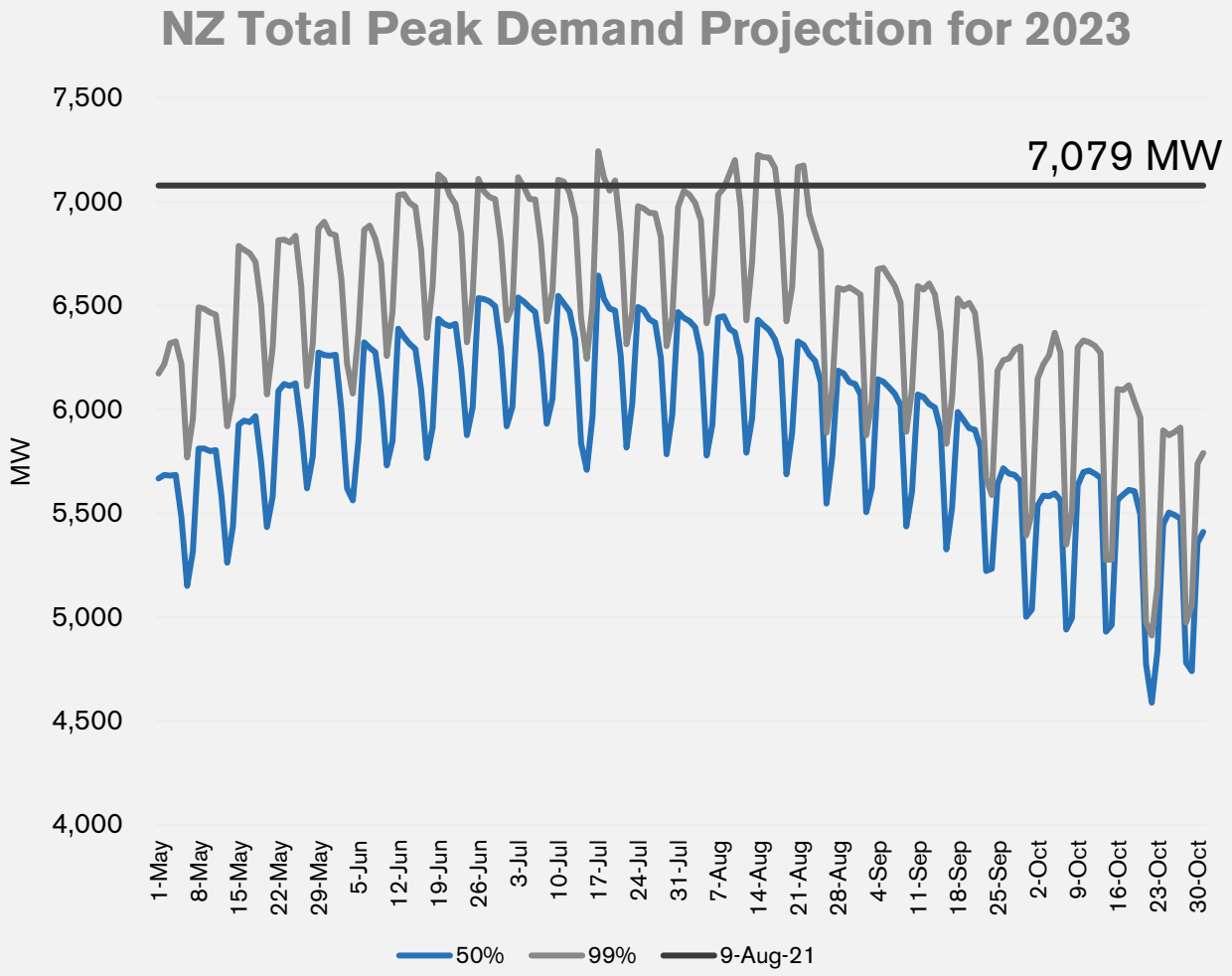
Daily Peak Weather Adjusted NZ Total Conforming Demand



Weather Risk for Long Term

- **Same model** - longer term **scenarios consistent** with short term. **Evidence based trends from demand data** incorporated into the future
- Hourly **weather forecast** reverts to seasonal normal weather beyond 2 weeks. Rather than **seasonal normal weather**, we transplant 10+ years of **historical weather data** and solve the model hundreds of times. The **percentile distribution** is graphed.
- Coupled with long range **weather view** to guide decisions



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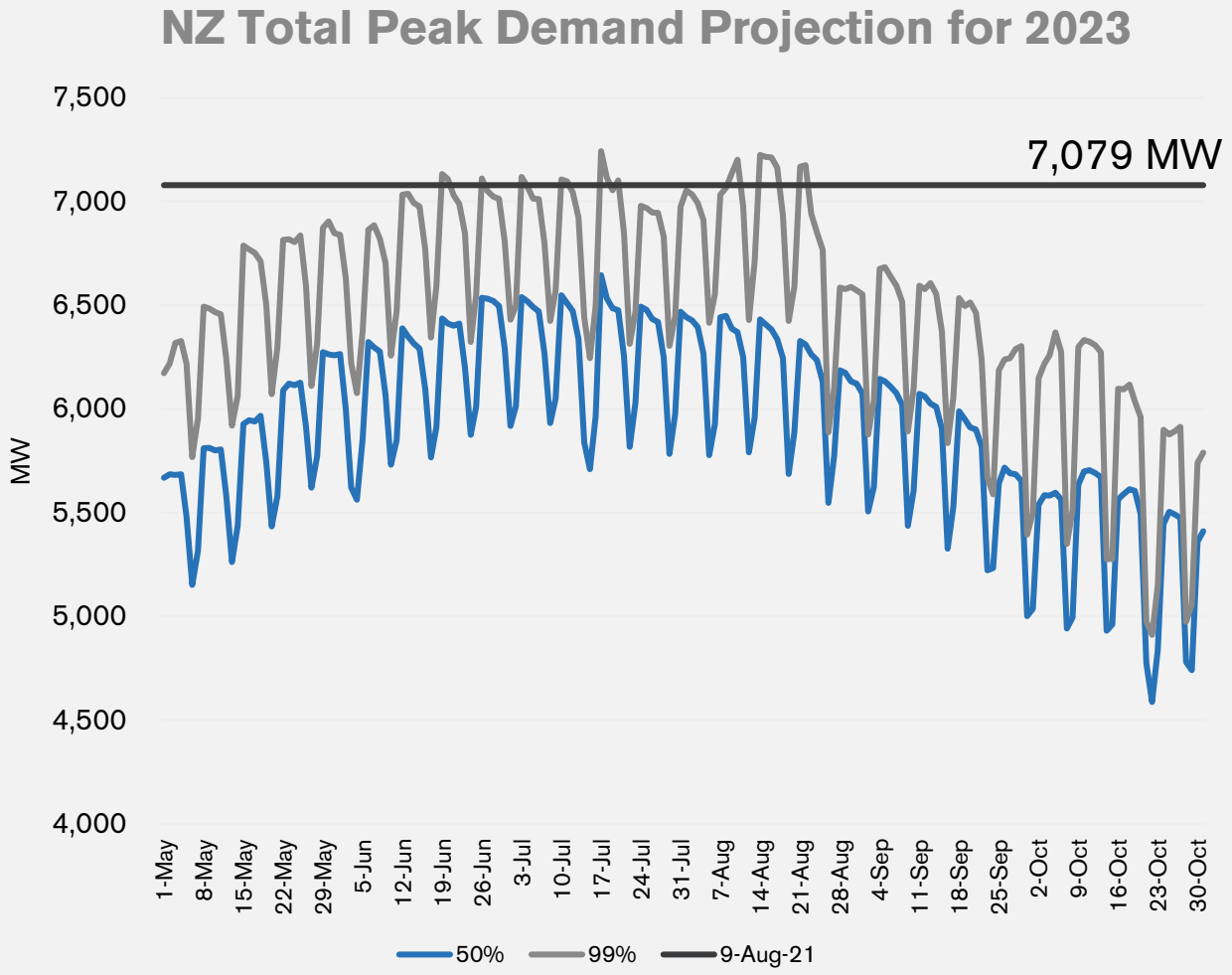
Weather Risk for Long Term

- **TESLA's Conforming Demand Forecast** with **last year's Non-Conforming Demand** layered on top.
- Very possible for demand to exceed 9th August 2021's **7,079 MW** peak if cold snaps occur mid-June to mid-August
- Solution utilizes actual weather data from 2009 through 2022
- Peak 99th percentile forecast of **7,243 MW**



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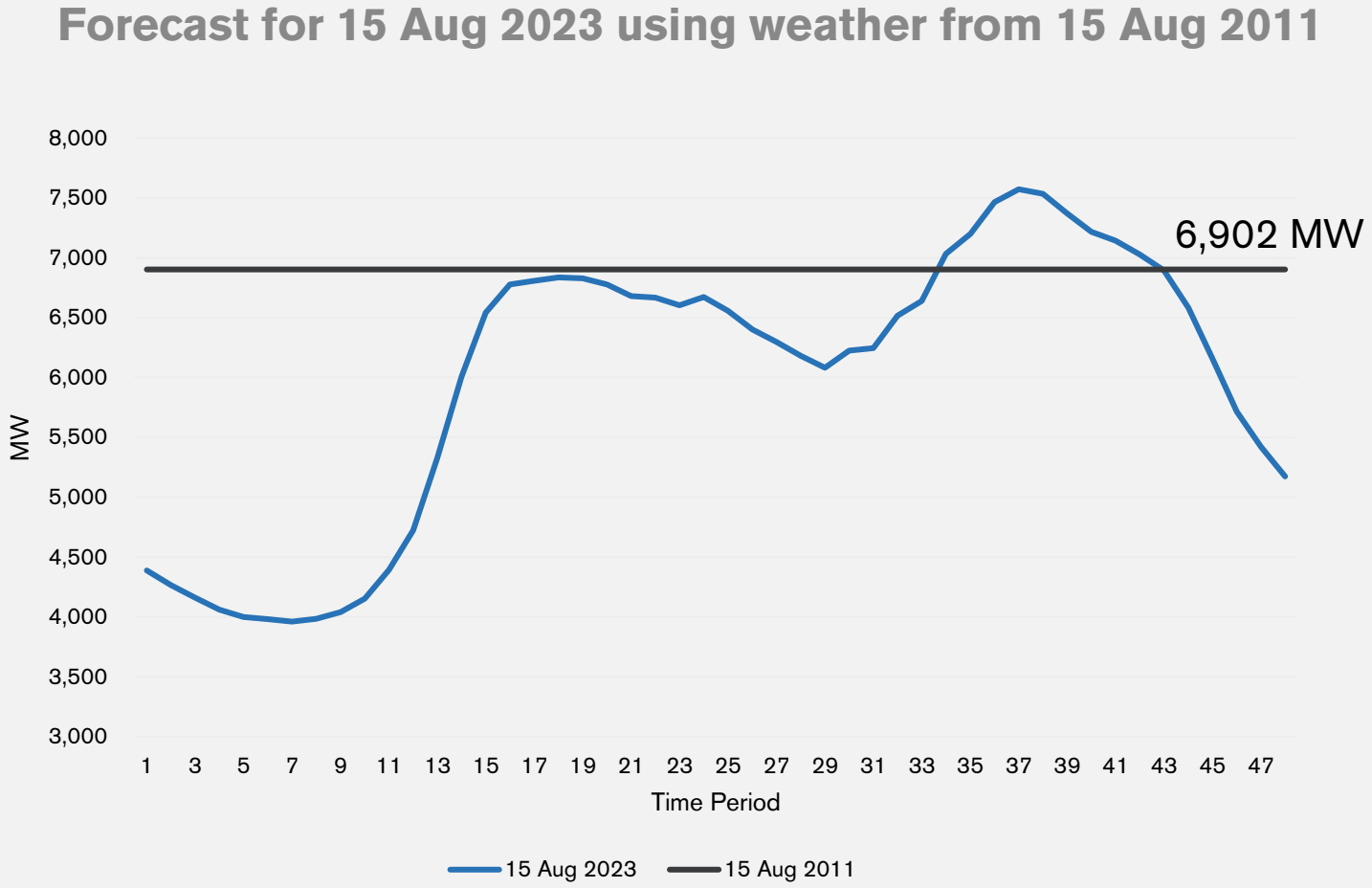
Transplanting cold weather to today

- Before August 2021, NZ Total **peak** demand was **6,902 MW** on 15 August 2011 when it **snowed** in **Wellington**
- If we transplant 15 August 2011's weather to 15 August 2023, NZ's Total peak demand forecast is **7,574 MW, 9.7% higher than in 2011**



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Why is peak winter demand growing?

- Healthy homes = more heating and cooling demand
- Something we're seeing across the globe as economies have hybrid work-from-home environments (heating in homes and offices during the day) and electrification trends (Electric Vehicles, heat pumps, etc.)
- Heating demand moving from gas to electricity – new builds rarely have gas connections
- Unique to New Zealand is last year's removal of RCPD – less incentives for EDBs and large energy users to load control/curtail consumption during peak demands
- During the first cold snap of 2022, it became clear that many EDBs were no longer load controlling like they used to. TESLA adjusted the load forecast models to forecast peakier demand during cold periods. The effect is regional, depending on the actions by each EDB and/or large energy user

Example in Auckland – 7% peakier during very cold weather

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MetService's view

- Last three winters were the **warmest on record** in New Zealand, yet **record power demand peaks** were recorded
- El Nino Southern Oscillation (ENSO) - Neutral conditions are present and should remain through autumn, then models continue to point towards a potential El Nino towards the back end of winter and into spring
- Temperatures should cool slightly towards the **end of April when cold snaps look more likely again**
- Through the remainder of autumn and into winter, the South Island remains the place to pick up slightly warmer than average temperatures due to increased sea surface temperatures, while the North Island could run closer to normal
- This winter is likely to feel colder as the last few winters recorded record warmth

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Q&A

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