



TRANSPower



Te Kanapu

Developing a
future grid
blueprint for
Aotearoa

MAY
2025



Te Kanapu Future Grid Blueprint

Delivering a Grid Blueprint to power Aotearoa New Zealand

This paper describes the changed context for Transpower since its landmark *Whakamana i te Mauri Hiko* research and introduces our new initiative to develop and deliver a 'Grid Blueprint'. When complete, this Grid Blueprint will provide a guide for our transmission infrastructure investment to 2050 and beyond. This will give those who plan to generate, move, buy and sell electricity better information, and enable the energy industry to coordinate and optimise their own plans. Our Grid Blueprint development process over 2025 and 2026 will focus on wide engagement and developing a clear evidence base, as well as new scenario modelling. Ultimately, it is about ensuring the transmission network supports Aotearoa New Zealand to thrive and grow as it electrifies.

Harnessing Aotearoa New Zealand's electricity potential

In 2020, Transpower published *Whakamana i te Mauri Hiko*, a paper that examined five possible scenarios for Aotearoa New Zealand's energy future. It set out the opportunity New Zealand had to decarbonise our energy mix through electrification – switching the energy households and businesses use to renewable electricity instead of fossil fuels. We said the Accelerated Electrification scenario charted the most likely course, a 68% increase in electricity demand by 2050 and a doubling of the amount of electricity New Zealand could generate, through additional renewable generation like wind and solar.

Whakamana i te Mauri Hiko was also a call to action for policy makers and the energy sector to rise to the challenge of enabling electrification.

Five years on, as expected, our context has shifted. Overwhelmingly, commentators, policymakers and researchers have arrived at the same conclusion: that a highly electrified future is expected. While electricity growth projections like this for New Zealand were relatively novel in 2020, similar projections have since been published by many other organisations, such as the Climate Change Commission,¹ MBIE,² and the Boston Consulting Group.³ Our monitoring reports have consistently shown that electrification is underway.⁴ There has been a dramatic increase in enquiries to Transpower for connections to the grid from both new generation developers and our load customers – both major uses of electricity and local electricity distribution companies. In addition, the amount of electricity used at the busiest times on the grid – peak demand – has increased substantially over the past several winters. Electrification of most of the energy used in our economy is no longer in doubt: It's happening, and the pace is only going to increase.

¹ Climate Change Commission (2023) Advice on the direction of policy for the Government's second emissions reduction plan

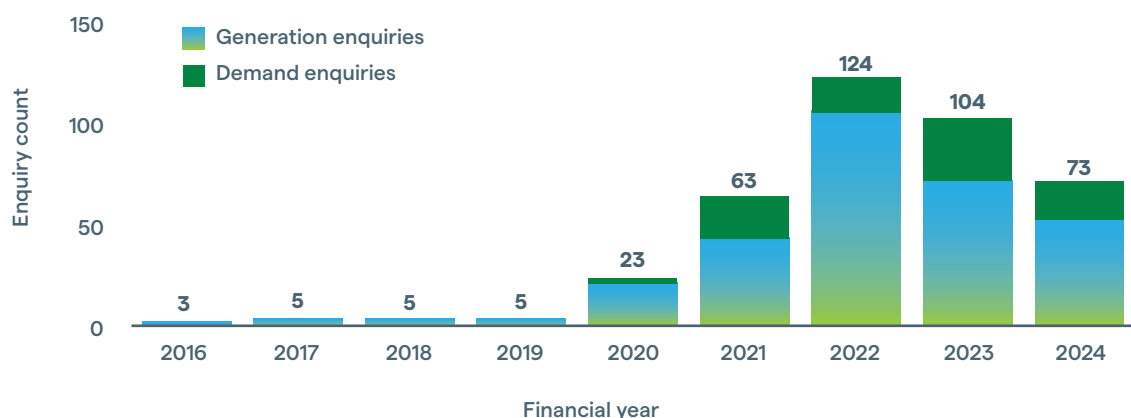
² Ministry for Business, Innovation, & Employment (2024) Electricity Demand and Generation Scenarios (EDGS)

³ Boston Consulting Group (2022) The Future is Electric

⁴ Transpower's *Whakamana i te Mauri Hiko* Monitoring Reports

Generation and demand customer enquiries

Count by financial year, excludes GXP enquiries



Source: Transpower, last updated July 2024

A large proportion of the enquiries on the chart above have now moved forward into our connection pipeline, which in April 2025 had a total of 89 projects (16,089 MW) in either the application, investigation or delivery stages.

The global context, markets, and opportunities

Importantly, electrification is not just about New Zealand's climate change policy; rather, it is being driven by major global shifts in technology and investment. In 2024, the worldwide capacity for renewable electricity generation surged by an estimated 25% to around 700 GW – the 22nd consecutive year that renewables have set new records for expansion. The drivers are not only policy-driven renewables targets, but increasingly renewable energy is favoured because overall it is the most affordable choice that comes with economic and energy security benefits.

In Europe, for example, electrification has been recognised as a critical pillar of energy security, replacing dependency on foreign imports of gas and oil with domestic energy produced with wind and sunshine.

Here in New Zealand, we are just as exposed to international oil shocks and we are also facing mounting evidence that our own supply of natural gas will not last forever. The falling costs of renewable generation and electric alternatives, such as electric

vehicles and heat pumps, mean that we have now passed the tipping point where an electrified household is now cheaper to run than an equivalent household using fossil fuels for transport and heating.

Electrification is not only about transitioning existing energy use. It also presents an opportunity to develop new industries on our shores. Data centres are a clear example: New Zealand has a strategic advantage due to its existing high proportion of renewable electricity and cool ambient temperatures and abundant natural resources to add further renewable generation capacity. With the rise in the use of artificial intelligence, the Internet of Things, and digitalisation, data centres are poised as an area for significant global growth.⁷ Green fuel production, such as sustainable aviation fuel or green methanol, is another growth opportunity New Zealand could seize.

⁵ IEA (2025) Global Energy Review

⁶ Rewiring Aotearoa (2024) Electric Homes

⁷ Boston Consulting Group (2025) Future of NZ Inc: What will New Zealand be known for in 2050



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Enabling electrification

Underpinning this opportunity for Aotearoa's new energy future is an electricity grid that enables electrons to flow from wherever they are most efficiently generated to where they are consumed.

That's what we do: Transpower works – often in the background – to ensure the electricity system is in perfect balance in real time, 24/7. And to make that happen, we also need to have the right grid infrastructure in the right places at the right time.

With the ramp-up in electrification, we are already experiencing impacts and stepping up our activities to help enable the increasing pace of change in the wider energy system. New connections and the need for additional capacity are putting pressure on the existing transmission network. We're seeing a vastly increased number of projects to connect new generation and load to the grid and this is happening at the same time as much of the existing grid, built 50-70 years ago, is coming to the end of its economic life and needs replacement. On top of this, electrification is also leading to the need to increase the capacity of the grid so it can move larger amounts of electricity around New Zealand to meet increasing demand. The result is a new intensity in Transpower's work that is also mirrored in many electricity distribution businesses around New Zealand.

In the immediate term, our focus is on improving the efficiency of connections and delivering a five-year programme of maintenance and reliability upgrades approved in our current Regulatory Control Period (2025-2030).⁸ In addition, we are planning and delivering a suite of upgrades to increase the capacity of the existing transmission grid where this is possible. These actions will both maintain the existing service and allow us to connect new generation faster to serve growing demand.

This will ensure there is sufficient grid capacity out to 2030.

Longer term, however, more will be needed.



⁸ Transpower's core expenditure to continue to provide a reliable and safe national electricity transmission service is set out in its current five-year Regulatory Control Period 4 (RCP4) work programme.

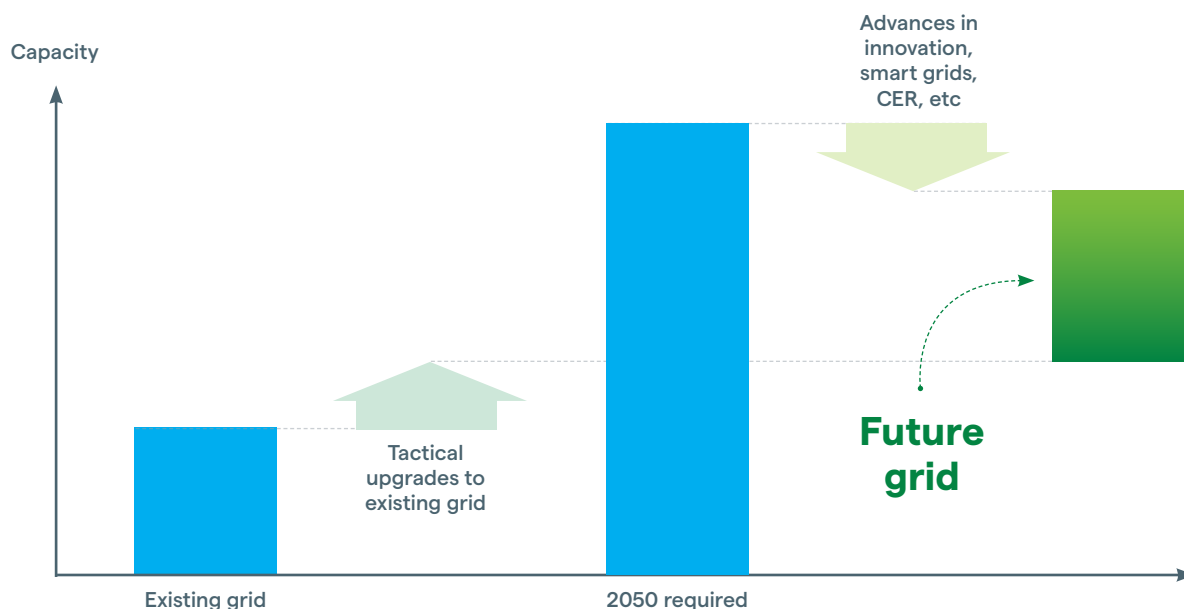
Te Kanapu will deliver a Grid Blueprint to power Aotearoa

Our Te Kanapu work is Transpower's response to our new context. It will define what we will do to help New Zealand experience an energy transition that is affordable for our country and delivers the reliability and resilience in the transmission grid that our communities and businesses expect.

We are working hard to extract the maximum capacity out of our existing grid. Through tactical investments, we've improved



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the capacity of our lines and substations to help meet the present level of electricity demand. Now, the scale of electrification means we're reaching the limits of these upgrades. We expect that in the longer term, more transmission infrastructure will be needed. It is likely that some new transmission lines and substations will be part of the pathway to lower overall energy costs for consumers of the future – especially when we consider the grid's role in coordination and optimisation across the power system as a whole.

This is where Te Kanapu comes in. Through a programme of research and wide engagement, we will map out possible strategic investments for our transmission network that will deliver an optimal future grid for New Zealanders.

Clear and transparent evidence will underpin our work, including new scenario modelling. The Grid Blueprint we develop will make the case for what investments are needed to meet demand and unlock growth, and help us all plan across a longer time frame.

Given the scale of investment needed across all parties involved in generating and delivering the power New Zealand will need, a long-term picture of the future grid is essential for system-wide coordination and efficiency, keeping costs down for consumers.

Along with robust engagement with communities, iwi, businesses, our partners in the electricity system and others, the blueprint will also support Transpower to sustain the trust and confidence of New Zealanders as we plan the grid needed for the future.

In developing a Grid Blueprint, we will also analyse impacts and opportunities from broader changes in the power system, such as the role that consumer energy resources (CER) like decentralised solar panel systems and batteries may play. CER will become increasingly common and affordable in the future, and they will play a critical role in enabling smarter and more efficient use of the grid. We will also explore other grid technologies, such as further use of HVDC (high voltage direct current) transmission.



Recent experience with outages, such as Cyclone Gabrielle and the Auckland Anniversary weekend floods, both in 2023, has also reiterated the importance of grid resilience. The need for resilience will only increase as electricity becomes a more dominant energy source across our economy and we must mitigate the impacts of climate change such as more frequent and severe weather events. For this reason, the Grid Blueprint will also explore the 'least regrets' investments that will provide reliable and resilient grid infrastructure to last for generations.

Through this work we will do our part to make sure the right transmission grid is in the right place at the right time in a dynamic and changing system.



Updating our 2050 scenarios for a thriving, sustainable economy



To deliver a Grid Blueprint, we are developing refreshed scenarios for Aotearoa's new energy future in 2050. These will explore plausible futures in which New Zealand has a thriving economy and has also reached the target of net zero carbon emissions. The way in which we grow our economy and achieve net zero will differ across each scenario, but the goal of a thriving, sustainable future will remain the same.

Transpower's Te Kanapu scenarios will explore a range of critical drivers, including:

- the role electric vehicles can play in providing short-duration storage (vehicle-to-grid);

- the opportunities for biomass and electricity to decarbonise process heat; and
- the opportunities to enhance our productive industries (e.g. Agriculture 4.0, space, healthcare, creative industries), transform existing ones (e.g. chemicals production), and develop new ones (e.g. data centres, green fuels).

As the fundamental dynamics of the power system are changing, our scenarios will also reflect much greater roles for demand-side flexibility and consumer energy resources – electricity consumers' resources that generate or store electricity, or items that can use electricity flexibly and increase or reduce electricity demand as needed.

Drivers	New energy future		Transpower's enabling role
<div></div> <div>Economic Growth Maximising our strategic advantage so New Zealand thrives</div>	Increasing demand for electricity	Electrification of transport	Developing, maintaining, and delivering the transmission grid
Sustainable prosperity		Electrification of heat	Operating the electricity system in real time
		New Industries	Connecting new generation and load
	<div></div> <div>Decarbonisation Policy, technology, and consumer behaviours</div>	Increasing supply of electricity	New power plants
		More distributed	
		Secure and affordable	Advocating for appropriate regulatory & market settings



A Grid Blueprint will guide our delivery

While our new Te Kanapu scenarios will inform our view of the energy future in 2050 and beyond, the ultimate end goal is a Grid Blueprint that will guide our infrastructure delivery. This means the energy scenarios must lead to the identification of least-regrets transmission investments that best unlock a thriving, electrified New Zealand.

While our work will outline the strategic high-level investments required to optimise the transition to electrification, more work and engagement by Transpower will follow to develop these into detailed investment proposals. We intend the Grid Blueprint to be a strategic outline that identifies and informs our investments. Those investments would proceed through our existing regulatory process.

This is the first time we have undertaken long-term transmission planning of this nature, at this scale. The time is right to shift our sights to the longer term as electrification gathers pace and our work delivery intensifies.

This first grid blueprint will set the direction to 2050 and identify the low-regrets, major projects we need to get on with. Once it's published, we would expect to re-evaluate it in a few years' time with a longer horizon, as the context and our power system continue to evolve, and adjust our direction accordingly. It will provide a guide for us to keep checking our course in the years ahead.

Working with our stakeholders is key

As well as outlining the journey we've begun with Te Kanapu this paper also signals the need for wide input into our thinking and analysis as we develop a Grid Blueprint.

Transpower is one part of a wider energy system that exists to serve New Zealanders. If there's one thing our regional electricity development planning work over the past few years has taught us, it's that partnership and collaboration are core to the success of long-term planning. We look forward to further strengthening those connections and continuing to work closely with all involved in New Zealand's energy system through this process.

We know that this work will impact people in different ways. Over the coming months we'll be talking with several groups and stakeholders who are also considering and planning for what Aotearoa might look like in 20-30 years' time. We'll be working alongside other future-focused industry initiatives to learn from and support them. And we'll be publishing papers exploring how transmission can enable affordable, sustainable growth for New Zealand.

Seeking stakeholder perspectives and carefully considering these is essential as we develop a Grid Blueprint. Our approach will include engagement, consultations, and focus groups. It will also include seeking technical assurance that our approach and assumptions are robust.



Te Kanapu is the next step on from Te Mauri Hiko, which set out the opportunity for Aotearoa to make renewable electricity the cornerstone of our energy supply. A grid blueprint will identify what we at Transpower need to do enable our country to electrify and grow.

In 2025, we will undertake formal consultations on our assumptions, future scenarios, the potential investment options we identify, and the methodology to develop a Grid Blueprint that will map out a set of optimal investments.

We know we must engage with business, government and community representatives right across New Zealand to ensure that the views of those who use electricity, rely on our service, and host our infrastructure are reflected in this work.

We also appreciate that any proposed new infrastructure will be of particular interest to local communities where those investments are signalled. As we progress, there will be strong, ongoing community engagement.

A Grid Blueprint will provide a pathway for Transpower's transmission grid to play its role to enable New Zealand's electrification and economic growth into the future.

It will ensure transmission investment is backed by carefully considered analysis and draws on all the information available to identify the optimal investment that put New Zealand's interests first.

We will think about the power system as a whole, understand how it could evolve, and keep seeking and clarifying that understanding over time as the context continues to change.

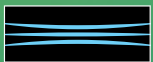
While our earlier work in *Whakamana i te Mauri Hiko* highlighted the opportunity for electrification, our Te Kanapu initiative will identify what work Transpower must do on our national grid to bring that opportunity to life.

Through this work, we believe we can deliver a transmission grid that enables Aotearoa to thrive in a changing world. We look forward to working alongside you and our many peers and stakeholders to enable the transformation to a more secure, affordable, and sustainable energy future. We invite you to join with us along the way. Sign up for updates at transpower.co.nz/te-kanapu or email feedback@transpower.co.nz.

An aerial photograph of a coastal city, likely Auckland, New Zealand, viewed from a high vantage point. The city is nestled between the sea and a range of hills. The image is overlaid with a semi-transparent green filter. A large white circle is centered on the page, framing the title and the main text block.

Te Kanapu Future Grid

'Kanapu' means both **'lightning'** and **'bright'**. Lightning as the raw form of electricity is a key symbol on the pou whakairo (carving) in the entrance hall at Waikoukou, Transpower's head office. 'Te Kanapu' speaks about the electrification and illumination of our country and Transpower's goals for a bright, energised future.



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