# Future Operation of New Zealand’s Power System

Tēnā koutou

Thank you for the opportunity to comment on the future operation of New Zealand’s power system.

Please see the response from Daikin New Zealand.

## Daikin New Zealand

As one of New Zealand's most trusted names in heat pumps and air conditioning, Daikin can be found in homes, businesses and community projects across New Zealand and around the world. Daikin has been in New Zealand for almost 20 years with the Head Office located in East Tamaki and branches in Wellington and Christchurch.

During this time, we have continued to expand the business and we remain extremely innovative. Heat Pumps and Air conditioning remain Daikin NZ's sole focus and we continue to be a world leader in this field.

Daikin’s leading environmental technologies of heat pumps, inverters and refrigerants provide solutions in the crucial shift towards carbon neutrality, through supporting building electrification and energy decarbonisation. We are constantly developing and improving our products to be part of the climate solution, with a focus on energy efficiency and consumer benefits/end-user comfort and care.

We believe our responsibility in the market exceeds that of solely being a product supplier, our mission value is to support the whole supply chain in a just transition. Utilising our experience in technology and the suite of solutions we have available, we are driven to engage with and support the whole industry and our communities, through collaboration, education and Kaitiakitanga.

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## Submission Questions and Comments

### Q1. Do you consider section 3 to be an accurate summary of the existing arrangements for power system operation in New Zealand? Please give reasons if you disagree.

The summary accurately depicts the current arrangements for power system operation in New Zealand, detailing the responsibilities of the system operator. It outlines tasks such as real-time coordination to maintain frequency and voltage stability, scheduling electricity dispatch, and conducting risk assessments for supply security. The historical context provided highlights the evolution of the system operator role since the establishment of the wholesale electricity spot market in 1996, culminating in consolidated responsibilities under a single service provider in 2004. Moreover, it emphasises the importance of maintaining performance standards and regulatory oversight to ensure efficient and secure power system operation.

However, for a more comprehensive understanding:

- Geographical Overview: The summary lacks a clear overview of the current layout of generation and transmission systems. It would be beneficial to include a description of the geographical distribution of energy infrastructure across the two main islands and the challenges associated with managing the power system operation across diverse landscapes.
- Inter-island Transmission and Funding Mechanisms: The description of the relationship and transmission between the North and South Islands isn't clear. Additionally, clarification on the financial mechanisms, including where funding is generated or supported from and how it operates, would be useful. Understanding if funding comes from national taxes, based on government-specific drivers, can provide insights into potential limitations and priorities in the power system operation.
- Energy Source Breakdown: Providing a high-level percentage breakdown of energy sources, including renewables like solar, wind, and hydroelectric power, would offer a clearer picture of New Zealand's energy mix. This breakdown would help understand the contributions of different energy sources to overall demand and highlight the country's progress towards renewable energy targets.
- Visual Aid: Incorporating a visual summary, such as a diagram illustrating the energy market structure, generation sources, transmission lines, and retail markets, would complement the textual description and aid in conveying the complexities of the power system operation in New Zealand.

Incorporating these points will enrich the response and provide a more holistic understanding of the existing arrangements for power system operation in New Zealand.

By integrating these additional elements, your response will provide a more thorough analysis of the power system operations in New Zealand.

### Q2. Do you agree that we have captured the key drivers of change in New Zealand's power system operation? Please give reasons if you disagree.

Yes, the identified key drivers offer a comprehensive framework for understanding the evolving landscape of New Zealand's power system operation, encompassing technological advancements, consumer behaviours, climate challenges, and energy consumption trends.

However, it's imperative to highlight the pivotal role of behaviour change in reducing overall energy demand. Encouraging energy-efficient practices in households, businesses, and industries, alongside promoting the adoption of renewable energy sources and technologies such as electric vehicles, can significantly alleviate strain on the power grid and contribute to a more sustainable energy landscape. Integrating behaviour change initiatives into broader societal shifts towards sustainability not only reduces energy consumption but also fosters a culture of responsible energy use, reinforcing New Zealand's self-sufficiency in energy production and resilience to climate-related challenges. Additionally, we feel that more information is needed on the role of heat (decarbonisation requirements, demand reduction opportunities etc) in buildings is needed, to better inform the consultation.

We feel that the interconnected nature of the drivers is lacking from the consultation. The feedback loop between climate and energy inaction, the opportunity for behaviour change to impact energy demand, and highlighting that NZ is self-sufficient/reliant, we feel, all need greater appreciation.

## Q3. Do you have any feedback on our description of each key driver?

In the evolution of New Zealand's power system, key drivers are shaping its trajectory. Demonstrating the successful integration of renewables like wind and solar power not only underscores the shift to cleaner energy but also emphasises the cost-effectiveness of this transition. Moreover, initiatives such as innovative demand-side management programs showcase how advancements in technology empower consumers to manage energy consumption, thereby enhancing overall system reliability.

Highlighting the interconnected nature of these drivers is crucial. Changes in operational technology, such as advanced grid management systems, are closely linked to shifts in information technology and digitisation, enabling real-time monitoring and control. Furthermore, the electrification of the energy system, driven by changes in consumer and generation technology, further underscores these interdependencies. Additionally, emphasising the pivotal role of the energy sector in mitigating climate change reinforces the urgency for proactive measures to build resilience and adapt to environmental shifts.

Emphasising decentralisation in energy systems, akin to our water supply systems, signals a move towards bilateral energy transactions and prosumers. Exploring ownership models, including community-run energy networks, opens avenues for broader participation in the energy market. A focus on consumers, driven by new technology and external pricing signals, should consider the need for flexible pricing and the readiness of both smart technology and the grid. Incorporating AI functions into energy use, and linking smart consumer products with intelligent grids, demands robust data collection and secure storage, necessitating increased investment in both data infrastructure and grid upgrades.

## Q4. What do you consider will be most helpful to increase coordination in energy system operation? Please provide reasons for your answer.

Increasing coordination in electrical energy grid system operation is essential for optimising grid performance and meeting climate targets. Advanced grid management technologies and protocols offer valuable tools to achieve this goal, thus providing grid operators with crucial insights into grid conditions and, enabling them to anticipate and respond to fluctuations in supply and demand. Integrated Energy Management Systems (IEMS) consolidate data from various grid components into a unified platform, facilitating comprehensive grid optimisation and informed decision-making. Automation technologies and optimisation algorithms streamline grid operations, minimising operational costs and improving efficiency.

Establishing common standards for data exchange and communication protocols enables seamless communication and coordination among different grid stakeholders. This ensures that critical information is shared in real-time, enhancing grid reliability and stability. Robust contingency planning and disaster recovery strategies help mitigate the impact of grid disturbances, ensuring uninterrupted energy supply even in adverse conditions. By leveraging these strategies, grid operators can better adapt to the evolving energy landscape and maintain reliable grid operation.

Government policy and financial mechanisms are instrumental in fostering coordination in system operation, especially regarding pricing points aimed at consumers using green energy and incentivising prosumers with renewable microgeneration. Clear regulatory frameworks lay the groundwork for effective coordination among industry stakeholders, while establishing interconnection standards and grid modernisation initiatives ensures interoperability and facilitates the integration of diverse energy resources into the grid. Market design, including the implementation of time-of-use tariffs, flexi-tariffs, and other innovative pricing structures, along with investment incentives, incentivises collaboration and innovation. These measures drive improvements in grid performance and reliability by providing financial incentives and fostering innovation, governments can accelerate the deployment of technologies that enhance system coordination and resilience.

In conclusion, a combination of advanced grid management technologies, robust government policies, and strategic financial mechanisms is necessary to increase coordination in electrical energy grid system operation. By leveraging these tools and fostering collaboration among stakeholders, governments can ensure the reliable, resilient, and efficient operation of the energy system. This will not only advance towards climate targets but also meet consumer needs and promote sustainable energy development.

## Q5. Looking at overseas jurisdictions, what developments in future energy system operations are relevant and useful for New Zealand? Please provide reasons for your answer.

Overseas jurisdictions such as Australia, Great Britain, Ireland, the Nordics, PJM, and CAISO offer valuable lessons for New Zealand's future energy system operations, drawing from their significant strides in various aspects of energy transition. Countries like Great Britain and Ireland have successfully integrated renewable energy into their grids, leveraging data-driven smart grid technologies and flexible pricing mechanisms to ensure stability and reliability amidst increasing renewable energy penetration—a strategy that resonates with New Zealand's focus on abundant renewable resources. Additionally, advancements in energy storage solutions observed in regions like Australia and California present valuable examples of optimizing energy storage infrastructure to enhance grid flexibility, a crucial consideration for New Zealand's evolving energy landscape.

Moreover, the Nordics demonstrate effective models for decentralized energy systems, highlighting the benefits of distributed generation and peer-to-peer energy trading, which could empower local communities and promote renewable energy adoption in New Zealand. Studying the experiences of PJM in the United States could offer insights into managing energy systems across multiple states efficiently, while CAISO's pioneering efforts in electric vehicle integration, particularly through vehicle-to-grid (V2G) technology, could inform New Zealand's approach to integrating EVs into its energy system. By learning from these international regions, New Zealand can optimize its energy infrastructure, enhance grid flexibility, and advance towards a low-carbon future while ensuring a 'just' energy transition that prioritizes social equity alongside climate targets.

Integrating lessons from Australia's approach to mandatory demand response (DDR) products and smart grid technologies can further enhance New Zealand's efforts to incentivize consumer behaviour change and drive bottom-up reductions in energy demand, ensuring a more resilient and sustainable energy system for the future.

Additionally, understanding the distinction between a smart home and a smart grid is crucial; integrating consumer-level smart products with grid-level intelligence enables dynamic energy management tailored to both user behaviour and system capacity.

Addressing existing gaps in energy efficiency, particularly within the building sector, is imperative. New Zealand can benefit from reviewing and updating sector standards, such as building codes, to align with international best practices. Improving energy efficiency in buildings not only reduces energy demand and waste but also lays a foundation for integrating future smart technologies effectively. By modernising standards and promoting energy-efficient design and construction practices, New Zealand can better align with global advancements and optimise its energy systems for sustainability and resilience.

## Q6. Do you consider existing power system obligations to be compatible with the uptake of DER and IBR-based generation? Please provide reasons for your answer.

Existing power system obligations in New Zealand may encounter challenges in keeping pace with the increasing uptake of distributed energy resources (DER) and inverter-based resources (IBR)-based generation. Traditional regulatory frameworks may not adequately address the unique integration challenges posed by DER and IBR-based generation, focusing primarily on centralised generation and lacking incentives for seamless integration into the grid. Furthermore, the current grid infrastructure may require upgrades to accommodate the growing penetration of DER and IBR-based generation, potentially leading to reliability issues without sufficient investment in modernisation efforts.

Moreover, existing market structures may undervalue the contributions of DER and IBR-based generation to grid reliability, hindering their full utilisation and integration into the grid. Operational challenges, such as voltage regulation and system stability, become more complex as the penetration of distributed resources increases, necessitating revisions to existing power system obligations to address these issues effectively. Additionally, promoting greater consumer participation in distributed energy markets and incentivising the adoption of innovative technologies will require evolving electricity tariff structures, regulatory frameworks, and consumer engagement strategies. Overall, updating or supplementing existing power system obligations is essential to ensure the seamless integration of DER and IBR-based generation into the electricity system while maintaining grid reliability and efficiency.

Expanding on the need for home energy management systems (BEMS/HEMS), it's imperative to roll out these systems across all building and industry sectors to facilitate better energy management at both the building and system levels. Implementing such systems not only enables more efficient energy usage but also paves the way for the integration of distributed energy resources (DER) and inverter-based resources (IBR) systems. These systems offer a framework for managing energy consumption, production, and storage within individual buildings and industries, ultimately contributing to overall grid stability and reliability.

## Q7. Do you consider we need an increased level of coordination of network planning, investment, and operations across the New Zealand power system? Please provide reasons for your answer.

Increased coordination of network planning, investment, and operations across the New Zealand power system is crucial for optimising resource allocation, enhancing grid resilience and reliability, and integrating renewable energy.

Efficient resource allocation is enabled through coordinated planning, allowing stakeholders to prioritise infrastructure projects and minimise unnecessary costs. Additionally, alignment with system-wide reliability requirements enhances grid resilience by identifying vulnerabilities and implementing mitigation measures against disruptions like extreme weather events.

Coordinated planning facilitates the effective integration of renewable energy sources into the power system by identifying suitable locations for projects and assessing grid capacity constraints. It also enables optimised asset management by prioritising maintenance activities and planning timely upgrades to critical infrastructure. Furthermore, coordination is vital as it supports innovation and technology deployment by aligning investment decisions with development roadmaps and regulatory frameworks, promoting the adoption of advanced grid technologies.

Ensuring an increased level of coordination across network planning, investment, and operations within the New Zealand power system is essential for navigating the challenges and opportunities presented by the energy transition. The emphasis on meeting emissions budgets underscores the critical need for a skilled labour force capable of driving innovation and adaptation within the industry. Retaining highly skilled workers while also reskilling or upskilling them to meet evolving demands is paramount to successfully transitioning towards a sustainable energy future. Additionally, a comprehensive plan is imperative to effectively roll out and support new consumer technologies and decentralised energy solutions. Establishing market mechanisms to drive uptake among homeowners and businesses is crucial, while concurrently implementing safeguards to protect consumers from potential exploitation by private energy firms seeking to profit from new technologies.

## Q8. Do you think there are significant conflicts of interest for industry participants with concurrent roles in network ownership, network operation and network planning? Please provide reasons for your answer.

Concurrent roles in network ownership, operation, and planning within the electricity sector present significant conflicts of interest, potentially compromising consumer welfare and the achievement of climate targets. Profit maximisation by companies with overlapping roles may prioritise short-term financial gains over long-term grid reliability and sustainability. The lack of transparency and accountability in decision-making processes hinders effective public scrutiny and regulatory oversight, undermining consumer trust. Market power concentration can lead to anti-competitive behaviour, stifling innovation, and consumer choice. Conflicts in investment priorities may result in suboptimal decisions, while overbuilding infrastructure can lead to excess capacity and unnecessary costs for consumers. Regulatory capture risks exacerbate these challenges, necessitating robust governance mechanisms and regulatory frameworks.

Addressing these conflicts requires aligning industry incentives with broader public interests and promoting transparency, accountability, and stakeholder engagement. By prioritising investments in grid modernisation and renewable energy integration, industry participants can facilitate a transition to a sustainable and resilient energy system while safeguarding consumer welfare and advancing climate goals. Concerns about the role and reach of Transpower underscore the need for a government entity to oversee the end-to-end process and identify areas requiring future investment to meet 2050 goals.

Furthermore, the establishment of new price points to support flexible grids and incentivize renewable energy integration is crucial. Ownership over energy generation and feedback into the grid are important for achieving goals related to bilateral energy transactions (prosumers). However, challenges remain, as demonstrated by the UK, where most homeowners are poorly financially compensated for selling energy generated via solar PV panels back into the grid. Addressing these issues is essential for creating a more equitable and sustainable energy landscape.

## Q9. Do you have any further views on whether this is a good time for the Authority to assess future system operation in New Zealand, and whether there are other challenges or opportunities that we have not covered adequately in this paper? Please provide reasons for your answer.

Assessing future system operations in New Zealand is imperative given the dynamic nature of the energy landscape, characterised by rapid technological advancements, evolving consumer behaviours, and shifting political priorities. As the world moves towards cleaner energy systems to mitigate climate change, New Zealand's renewable energy potential and ambitious emissions targets necessitate a proactive approach to address challenges and capitalize on opportunities arising from this transition. With renewable energy playing a pivotal role in meeting these targets, evaluating future system operations becomes paramount to ensure the integration of renewable sources into the grid effectively while maintaining reliability and stability.

One of the key opportunities lies in harnessing technological innovations in energy storage, smart grids, and demand-side management. These advancements offer the potential to enhance grid flexibility and accommodate the intermittent nature of renewable energy sources. By effectively deploying these technologies, New Zealand can mitigate grid challenges associated with renewable energy integration, optimise asset management, and improve overall system efficiency. However, careful evaluation and planning are essential to ensure seamless integration and maximise the benefits of these innovations. The relevance of the New Zealand

Fast Track Bill and the decision to halt the NZ battery project shouldn't be ignored, as assessing future system operations becomes even more pertinent. The Fast Track Bill could expedite infrastructure development, influence regulatory frameworks, and shape policy priorities, though it could also be at the cost of nature and land conservation, from an overall climate scenario we should be mindful of providing such unchecked power to Governments. All of this comes to necessitating alignment with future system operation strategies to ensure grid stability, market efficiency, and investor confidence.

Furthermore, understanding and adapting to changing consumer behaviours are crucial aspects of future system operations. The rise of prosumers—consumers who both consume and produce energy—poses new challenges and opportunities for grid operators and policymakers. As consumers increasingly adopt distributed energy resources like rooftop solar panels and electric vehicles, grid operators must adapt grid operations and regulations to accommodate these changes. As highlighted in the IEA report (New Zealand 2023), many key points covered in this consultation paper are reinforced, but it also offers additional insights and perspectives, particularly on challenges, policy implications, and cost considerations. Anticipating and addressing these dynamics (while prioritising consumers by offering high-quality, reliable and cost-effective solutions) will be essential to ensuring grid stability, reliability, and affordability while empowering consumers to participate actively in the energy transition.

In addition to technological and behavioural shifts, the impacts of climate change and exacerbated natural disasters pose significant challenges for future system operations. Building resilience in the electricity infrastructure and developing strategies to adapt to climate-related risks is imperative. Assessing future system operations provides an opportunity to evaluate the vulnerabilities of the electricity infrastructure, identify areas for improvement, and implement measures to enhance resilience against climate-related disruptions.

Lastly, policy and regulatory frameworks play a pivotal role in shaping the trajectory of the energy transition. Timely assessment of future system operations allows for a review of existing policies, identification of gaps, and development of new frameworks to support a sustainable, resilient, and efficient energy system. Integrating future technologies alongside societal behaviour change, such as promoting the uptake of electric vehicles and public transport, will be essential in reshaping energy patterns and grid dynamics. By fostering collaboration and coordination among stakeholders and prioritising investments in grid modernisation and renewable energy integration, New Zealand can navigate the complexities of the energy transition and build a more sustainable and resilient energy future.

Ngā mihi maioha,

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