Working together to ensure our electricity system meets the future needs of all New Zealanders

Response to the Electricity Authority Green Paper, May 2025

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Summary

Aotearoa New Zealand's shift towards a decentralised electricity system – featuring local generation, consumer empowerment, and resilient grid operations – requires smart, equitable, and behaviourally informed demand-side measures. Our recent, validated agent-based modelling research demonstrates residential demand-side management (DSM), when carefully designed, is a critical enabler of this transition.

The Role of Demand Response in Enabling a Decentralised and Empowered Energy System in Aotearoa New Zealand

The Electricity Authority (EA) is looking to the future of how consumers access electricity and how the system needs to change to enable this. Rightly, it has focussed on shifting from large scale electricity generation at limited sites across the country, to smaller scale renewables and other DERs located closer to consumers. However, we are concerned the Green Paper from the EA [1] largely overlooks demand response (DR), mentioning it only in passing under "unlocking demand side flexibility at scale." This omission is significant, as it ignores the demand side of the electricity consumption equation and thus limits major potential avenues for enhancing grid management and resilience.

Our submission addresses this gap by presenting recent findings form research undertaken by the respondents, highlighting the value of DR in supporting decentralisation and empowering small-scale, consumer-driven energy solutions. Demand response can deliver flexibility, resilience, and cost-effective outcomes – often more efficiently than traditional infrastructure investments – while enabling broad benefits for local consumers and energy communities.

Our work is validated against real electricity consumption data across seasons, geography, and socioeconomic demographics. It also demonstrates the value of agent-based modelling in understanding the future needs, behaviours, and choices of consumers and stakeholders. This modelling approach can strengthen the assumptions underpinning policy design and help shape

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a clearer, evidence-based vision of what a decentralised energy future could look like for Aotearoa New Zealand.

The key findings across our recent studies are summarised under five interconnected themes:

Behavioural dynamics matter

Design of DSM programs must reflect real household behaviours to deliver reliable and equitable outcomes. These behaviours, and their intra- and inter- personal variability, can be very accurately captured with simple dynamic models, such as agent-based models [2,3].

Simple pricing is not always simple

Time-of-use tariffs can reduce household costs and peak demand, but risk backfiring and increasing peak demand without smart device uptake or consumer support [4]. Accordingly, electricity pricing structures should be designed to benefit consumers without increasing network stress.

Benefits of distributed generation and storage are uneven

Distributed solar generation and battery storage can reduce peak demand, emissions, and consumer energy costs. However, high capital costs to install these technologies mean financial benefits skew towards higher-income households unless subsidies are provided [5].

Efficiency is essential

Increasing energy efficiency reduces peak load and offers major public health and equity benefits, especially when targeted to low-income communities. Highest net savings arise from boring but expected solutions. In particular, installation of (added) insulation and replacement of inefficient space heaters with heat pumps [6].

Building trust

Outcome variations across the socioeconomic spectrum highlight the importance of targeting decentralised decision-making and policy interventions to maximise whole-system outcomes. Interventions and subsidies should be designed with explicit consideration of energy equity and socioeconomic variations, to ensure benefits are maximised and as equally distributed as possible.

Policy Implications

- Design programs supporting DSM and decentralisation with validated models reflecting real consumer behaviours and their variations across the socioeconomic spectrum.
- Pair dynamic electricity pricing with technology incentives and consumer education.
- Subsidise access to distributed solar generation and battery storage for low-income households to ensure inclusive decarbonisation and peak demand reduction.
- Prioritise energy efficiency standards and grants, particularly for low-income households, as foundational tools for system resilience and social wellbeing.

Conclusion

Demand-side management is not a side feature – it is key to Aotearoa New Zealand's decentralised energy transition.

Policymakers should treat DSM as a strategic investment bridging emissions reductions, energy equity, and grid resilience. Accurate behavioural models and data should be used to inform program design, considering whole-system outcomes and ensuring an equitable, sustainable future energy system.

We would be pleased to discuss further our work and modelling approach. They are powerful, validated tools for improving network resilience, desired public health and equity outcomes, and the avoidance of unintended consequences.

References

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