Decentralised Electricity

Cover Letter: Submission to the EA Green Paper

25 June 2025

Why: The Green Paper Maps the Direction

The Authority's Green Paper effectively maps the direction of change — identifying the need for more distributed energy resources (DER), localised energy markets, and smarter network coordination. It articulates the challenges, outlines opportunities for reform, and raises important questions about consumer empowerment, equity, and digital enablement. It is a foundational roadmap for transforming Aotearoa's electricity system in response to climate, economic, and technological drivers.

How: A DER Model to Build the Vehicle

This submission complements the Green Paper by providing a coherent implementation pathway — a 'vehicle' for realising the decentralised vision. It addresses the technical, economic, and behavioural mechanisms necessary to enable a fair and effective transition. The following pillars are essential:

Mandated grid-forming standards for all new DER

All new distributed energy resources (DER) - including inverters, EV chargers, and batteries — should be mandated to include grid-forming capabilities. This means they autonomously manage local voltage and frequency deviations without requiring centralised command, relieving the EDB from costly network upgrades. Through standardised interfaces and protocols, DER can receive transparency signals (such as local voltage, frequency, or transformer load data) from the EDB, triggering autonomous, proportional responses.

When all DER contribute, the actual power and control effort required from each device is minimal, as the collective response is distributed across thousands of assets. This enables a self-regulating, resilient grid edge — where households and businesses inherently contribute to system stability simply by being connected. It also transforms DER from passive participants into frontline infrastructure, reducing technical complexity and cost for EDBs while increasing equity in system participation.

Pricing reform (c/kWh/km) to reflect the value of proximity and reduce distribution losses

Distribution pricing reform using a cents-per-kWh-per-kilometre (c/kWh/km) model would fundamentally change the way network services are valued. Current EDB revenue structures are based heavily on capital expenditure (capex), incentivising continual network upgrades to meet occasional peaks. In contrast, a c/kWh/km model introduces a dynamic income stream that rewards EDBs for transferring more energy over existing infrastructure, encouraging them to 'sweat' their assets efficiently.

This model also enables the introduction of congestion pricing where network capacity constraints are reached, ensuring transparent and efficient load shifting. By aligning pricing with physical asset use and proximity of supply to demand, this approach supports more distributed energy resources (DER), reduces unnecessary grid expansion, and enhances the feasibility and value of peer-to-peer trading at the local level.

Peer-to-peer trading using intuitive, standardised interfaces and secure blockchain settlements

Energy trading between neighbours reduces grid costs, congestion, and losses. Implementing secure, blockchain-based settlement frameworks would enable real-time validation of local energy trades, with simplified contracts and plug-and-play functionality for consumers. This requires support for interface standards, consumer protections, and integration with DSO systems.

Open-source Home Energy Management Systems (HEMS) to ensure consumer familiarity

Many households face cognitive and digital barriers. A standardised, open-source HEMS platform (with a consistent UI across devices) would reduce confusion, improve engagement, and simplify the user experience. This would replace fragmented apps with a unified interface that supports basic automation and price response, democratising access to flexibility benefits.

Time-sensitive rebates for V2G-enabled EVs to accelerate uptake and equity

Vehicle-to-grid (V2G) enabled electric vehicles can autonomously support the grid by charging during troughs and discharging during peaks, generating revenue for the owner. This transforms the EV from a transport-only asset into a dual-purpose grid support system with return on investment (ROI) potential, accelerating uptake even among cost-sensitive consumers.

Incentivising the purchase of V2G-capable EVs ensures public funds are directed toward technologies that deliver ongoing value through grid support, enabling owners to benefit from dynamic energy pricing and accelerating market penetration.

The ability to earn from energy transactions contributes to equity, especially for renters or low-income households, by turning an EV into a portable income-generating asset. This also creates systemic national benefits by reducing reliance on imported fossil fuels and supporting the wider integration of DER, where energy is produced, stored, and consumed locally. EVs become a foundational part of the renewable, decentralised energy ecosystem — contributing to grid stability and energy security while displacing internal combustion engine (ICE) vehicles.

Leveraging parked EVs for edge computing and grid stability tasks beyond transport

EVs are not just mobile batteries — they are idle computers most of the time. These edge devices can support local computing, Computing as a Service (CaaS), (e.g., smart contract execution, demand orchestration, cyber-physical system monitoring) and provide responsive voltage/frequency control. This reduces centralised cloud and control infrastructure costs, improves resilience, and turns consumer assets into national infrastructure.

Examples of this multi-purpose function include:
1. Processing the blockchain contracts involved in local peer-to-peer electricity trades. This reduces latency, avoids reliance on centralised cloud infrastructure, and improves resilience through distributed validation.
2. Supporting future road user charging systems by processing geotagged transactions. Vehicles could be charged per kilometre travelled over different road types, factoring in road quality, congestion, and time

of use — all managed locally on the vehicle itself, reducing load on national servers and enhancing real-time feedback for users.

This proposed model reduces reliance on centralised investment and increases system intelligence at the edge, unlocking systemic value. It offers a practical implementation framework that aligns with the Green Paper's vision while addressing current technical and regulatory inertia.

Sincerely,

Graeme Weston

Submission to the Electricity Authority Green Paper:

A Future-Ready, Distributed Energy Model for Aotearoa

This submission responds to the questions posed in the EA Green Paper on a decentralised electricity system (June 2024). It reflects a citizen-initiated model grounded in distributed energy resources (DER), consumer equity, grid-forming standards, and local market enablement.

1. What do you think a decentralised electricity system looks and feels like for households, communities and businesses?

It is transparent, locally responsive, and intuitive. Households use familiar apps to monitor energy in dollars, not kWh. EVs provide transport, grid support, and computing-as-a-service. Communities trade energy peer-to-peer. Businesses and renters can participate via portable V2G and standardised interfaces. Local transformers act as micro-markets governed by locational pricing.

2. What's needed to enable a thriving decentralised electricity system?

- Encourage grid-forming capability for all new DER

- Create c/kWh/km distribution pricing to reward local energy use

- Accelerate V2G uptake via targeted EV rebates

- Support open-source HEMS apps for user familiarity

- Permit P2P trading with simplified market access and blockchain settlement

- Standardise device APIs for orchestration

3. How do we ensure this future system is equitable, resilient, and affordable?

Use EV rebates to allow renters to participate in V2G arbitrage. Translate energy use into financial terms for intuitive participation. Avoid grandfathering: allow old tech to pay others for services they don't provide. Use digital feedback loops (e.g. 'you saved $1 overnight') to incentivise flexible behaviour. Let edge devices perform voltage/frequency support instead of expensive central upgrades.

4. What outcomes or changes do you think are most urgent?

- Immediate mandate of grid-forming inverters for new DER

- Open access to real-time pricing signals for prosumer HEMS

- Introduce c/kWh/km network pricing to make local energy valuable

- Start testing EV-based grid-forming and computing-as-a-service

- Launch a common, user-friendly HEMS platform

5. What should the EA prioritise for its next steps?

- Embed locational and dynamic pricing within distribution network frameworks

- Align with MBIE to fund open-source HEMS development

- Work with OEMs to enforce compliance with grid-forming standards

- Back EV rebates as grid assets, not just transport

- Establish DER testbeds with EDBs to demonstrate decentralised services

- Transition retailers out of market via managed shareholder exit and pivot to platform models