Hello, please find our response to the green paper attached.

We are broadly supportive of the direction outlined in this green paper. We note that a decentralised, renewables based electricity system has potential to accelerate wider electrification of transport and industry, and recommend that this vision is embedded in any strategy, as well as the articulated consumer cost savings and reduced infrastructure build-out.

Kind regards,

Jack Young

Protect Our Winters NZ

https://protectourwinters.nz/

30 APRIL 2025

2025 GREEN PAPER 01-A

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

A Green Paper seeking your views on the opportunities and challenges of a more ‘decentralised’ electricity system.

ELECTRICITY AUTHORITY
TE MANA HIKO

Executive summary

Towards a more decentralised future

Whether New Zealanders (we) are aware of it or not, our electricity system is changing in ways that will increasingly empower and enable consumers and communities.

In the not-too-distant future, our system will have evolved – with collective input – to provide for more of our power needs at the local level, in ways that work for us.

We'll have more choices about when and how we consume and supply power and be rewarded when we contribute to our shared system – one that is more 'decentralised', affordable, clean, secure, and resilient.

The reasons for this change are getting stronger:

- The costs of small-scale renewables, batteries and other energy resources are reducing rapidly.
- Renewable generation, storage and flexible demand are becoming more necessary and valuable.
- Increased focus on solutions that provide resilience to climate change and other disruptive events.
- Concerns about energy affordability.
- Stakeholders are increasingly aware of the potential for local energy to boost economic growth and contribute to other local benefits.

The opportunity is significant. By 2040, decentralisation can unlock more affordable, clean, secure, and resilient energy for Aotearoa New Zealand. This will empower people and communities and contribute to regional and community-led economic growth. This will be enabled by:

- Making full use of our existing electricity system. This includes our:
  - Electricity grid.
  - Existing largely renewable electricity generation assets.
  - Locational electricity market.
  - Highly localised electricity distribution businesses.
- Adopting available and emerging technologies like rooftop solar generation, distributed batteries, electric vehicles and 'smart' energy management systems.
- Developing local energy markets, pricing and services. These will reward consumers and communities for generating and trading energy locally, and for being flexible with their demand for energy.
- Empowering local councils, iwi and communities to play a strong leadership role in energy planning and decision-making. This would enable locally-driven innovation to meet local needs and reflect Aotearoa New Zealand's cultural and regional diversity.
- Unlocking new sources of capital into our energy system through increased local ownership of local energy resources. This includes consumer investment in distributed energy resources (DERs) and community ownership.
- Building trust, engagement and authentic collaboration among industry, local stakeholders, communities, and consumers.
- Creating a network of flexible, locally optimised energy systems, which connect through a strong grid backbone. This approach would support system-wide efficiency, affordability, and supply security.

Decentralisation also presents its challenges. This includes building capability, addressing the complexities of integrating new systems and funding and finance barriers, ensuring equitable access to benefits and creating appropriate governance structures.

More importantly, there are many views on what a more decentralised system could look like in the future. Different parties see different opportunities, benefits and pathways forward. Resolving this needs to be prioritised.

The purpose of this green paper is to start a discussion among all electricity stakeholders. The Electricity Authority (the Authority) wants to hear from everyone who has or could have a stake in our future electricity system. This includes the energy sector, councils, civil defence groups, iwi and hapū leaders, community groups, industrial and commercial organisations, investors and philanthropists.

The Authority will use this discussion to shape its regulatory thinking about what a more decentralised electricity system might look like for Aotearoa New Zealand, how this might benefit consumers, and what might be needed to gain these benefits.

Ko te rākau ka tupu i te wai, ka toro ki ngā pae maunga.

The tree grows with water and reaches towards the mountain peaks.

This whakataukī encapsulates the process of engagement, symbolising how relationships, like trees, start small and require time, care, and trust to grow strong. Over time, these relationships reach greater heights, touching broader areas of the community. This is the essence of the kaupapa—engaging meaningfully with Māori partners and our stakeholders, starting from the top and gradually expanding outwards, ensuring trust and collaboration every step of the way.

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1. Introduction

What this green paper is about

1.1 The electricity system in Aotearoa New Zealand is going through a significant transformation — towards a more decentralised future.

1.2 The reasons for change are getting stronger. The costs of small-scale renewables, batteries, and other energy resources are dropping quickly. Renewable generation, storage and flexible demand are becoming more necessary and valuable. Consumers are more focused on energy resilience to disruptive events and on energy affordability.

1.3 However, there are many views on what this future decentralised system for electricity should look like, and what the pathways are to achieve it. This lack of alignment could lead to inconsistent decision making and an inefficient or delayed transition.

1.4 The Electricity Authority (the Authority), other government organisations, the electricity sector, local government and consumers will make critical decisions over the coming years. These decisions include regulatory settings, major electricity network upgrades, system operation models, local spatial and other council plans, and consumer investment in distributed energy resources (DERs). These decisions could shape or limit future options.

1.5 The Authority is an independent government agency responsible for regulating the electricity market in New Zealand. In setting regulations for the future electricity system, the Authority has an important role in leading this discussion and making sure changes are made in the best interests of consumers.

1.6 The purpose of this green paper is to start the necessary discussion and debate among all electricity stakeholders. This includes the energy sector, councils, civil defence groups, iwi and hapū leaders, community groups, industrial and commercial organisations, investors and philanthropists.

What is a green paper and what will follow?

1.7 A green paper is an initial document used to start discussion and gather feedback on a particular issue. This green paper is the foundation for discussions that the Authority will be convening over the coming months. It will contribute to the Authority's work to determine the regulatory framework required to support consumer benefit in a more decentralised electricity system.

2. What is electricity system decentralisation?

Defining decentralisation

2.1 In the electricity sector, decentralisation means shifting from large scale electricity generation at a small number of sites across the country, to smaller scale renewables and other DERs located closer to consumers.

2.2 These DERs empower consumers and local communities, allowing them to actively participate and potentially shape local energy systems to fit their unique context, needs and aspirations.

2.3 Within these decentralised or local energy systems, supply and demand can be balanced as much as practicable, enabling a wide range of benefits for local consumers (or 'energy communities') and beyond. These local energy systems would be connected across the country by the grid's strong central spine. Appendix A outlines some emerging international visions and models for decentralised energy systems.

2.4 The shift towards decentralisation is observed through three inter-related global trends and enabled by one critical success factor (see **Figure 1**):

a) Trend 1: Decentralised or 'distributed' energy resources (DERs)

b) Trend 2: Decentralised or 'democratised' energy planning, decision making and ownership

c) Trend 3: Digitalisation of 'smart' systems

d) Critical success factor: Consumer trust and engagement

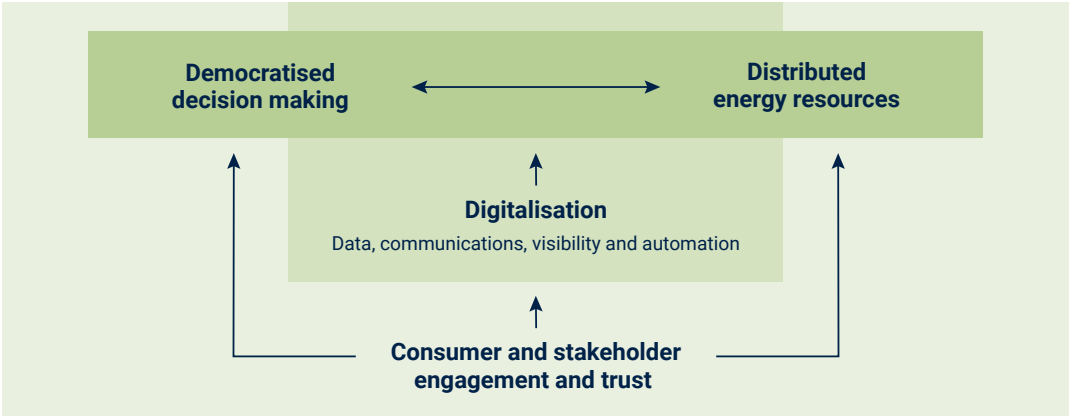

Figure 1: Defining decentralisation

Trend 1: Decentralised or 'distributed' energy resources (DERs)

2.5 The availability of DERs is moving energy generation and storage closer to consumers — where the energy is used. DERs can include rooftop solar photovoltaics, smaller-scale solar and wind farms, micro-hydro generation, batteries and electric vehicles.

2.6 These DERs may be physically co-located where energy is used, for example within a home or building. They can also be integrated within a larger site or 'microgrid' such as a university campus, industrial complex, or housing development. Or they may be connected directly to the local distribution network, or form part of an off-grid or stand-alone power system. They can also be mobile like electric vehicles — this is important with the rise of vehicle-to-load/grid capability, or 'batteries on wheels.'

2.7 The costs of rooftop solar, batteries and other DERs are decreasing rapidly (see for example **Figure 2**) which means the potential cost savings available to those who can access these solutions are increasing. This is part of the explanation for the uptake in DERs, as illustrated by the increase in the installed distributed solar generation (see **Figure 3**).

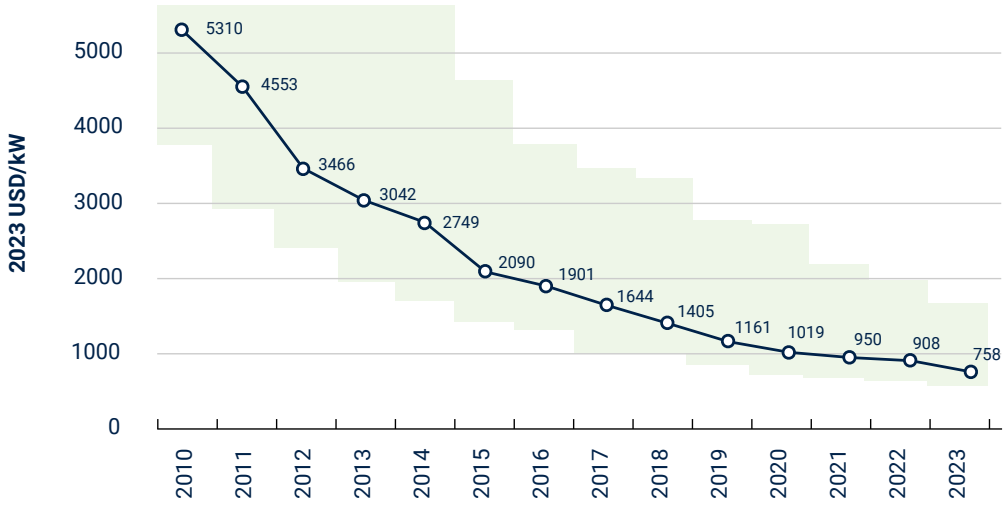

Figure 2: Global weighted average and range of total installed costs for utility-scale solar PV, 2010-2023 [1]

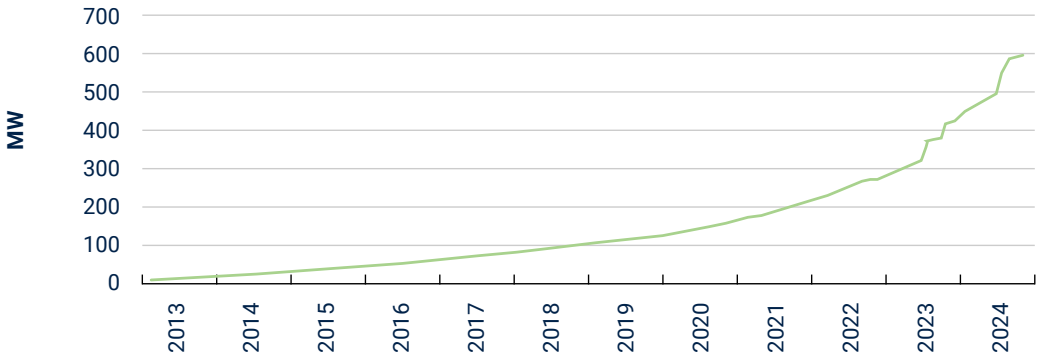

Figure 3: Trend in Installed Solar Distributed Generation in New Zealand.[2]

[1] Reproduced from Renewable Power Generation Costs in 2023 (pp.81), by IRENA, 2024.

[2] Sourced from EMI (market statistics and tools), by Electricity Authority, March 2025.

Trend 2: Decentralised or 'democratised' energy planning, decision making and ownership

2.8 DERs creates new opportunities for consumers, communities, and businesses to take greater ownership and control of their energy systems and align them with their context and values. Organisations such as the Energy Efficiency and Conservation Authority (EECA), Rewiring Aotearoa, Community Energy Network and others continue to play a critical role in educating consumers on the opportunities.

2.9 In addition to the potential cost and carbon savings from DERs, climate change is increasing our (already high) exposure to hazards. Electrification is also increasing our reliance on electricity, making us more vulnerable to outages. This growing risk is likely helping drive increased consumer and stakeholder awareness and appreciation of new solutions for energy resilience.[3]

2.10 More innovative models are also emerging. These new models enable consumers and communities to invest in and share the benefits of local energy generation and storage. For example, peer-to-peer schemes, community 'virtual power plants' (VPPs), and shared ownership models for larger-scale generation.[4, 5]

Trend 3: Digitalisation of 'smart' systems

2.11 Availability of data, information and communication technologies, automation, and artificial intelligence enable Trends 1 and 2. All these factors inform decision-making and should allow DERs to efficiently integrate within the energy system.

2.12 Technologies like building and home energy management systems (HEMS) and VPPs are emerging. These technologies allow DERs to be digitally integrated. This digital connectivity creates value and efficient energy management for consumers, communities, retailers, generators, lines companies, and Transpower — our national grid owner and electricity system operator.

Critical success factor: Consumer trust and engagement

2.13 High levels of trust and engagement between consumers, local and national stakeholders and the energy industry will be critical to enable the full benefits of digitalisation, DERs, and decentralised decision making.

2.14 Consumer-owned DERs can offer great value to the energy industry. They support retailers, generators, distribution companies, and Transpower through demand response and other services. However, consumers will need to trust that industry third parties will manage their DERs in a way that reflects their preferences, before giving those parties access to control their energy resources. The same is true of industry seeking to gain access to consumers' energy data.

2.15 To develop new energy infrastructure quickly and at the scale needed, the industry must actively engage with local communities and highlight the benefits these projects could bring to the area and its people and businesses.

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[3] For example the Consumer Advocacy Council's Electricity Consumer Sentiment Survey, June 2024 signals an increase in the perception that New Zealand's electricity system will not be resilient to extreme weather events resulting in frequent electricity outages.

[4] For more information on Community Virtual Power Plants, see cVPP - Community-based Virtual Power Plant by Interreg North West Europe.

[5] For example this report describes emerging models for shared ownership of large scale renewables: Sharing Power: unlocking shared ownership for a fast and fair net zero transition by Regen (2024).

3. Potential outcomes and benefits of decentralisation[6]

3.1 Decentralisation has the potential to unlock the three energy trilemma outcomes — affordability, security, and decarbonisation. It also has the potential to empower communities and local economies. This is illustrated in **Figure 4** and expanded upon further below.

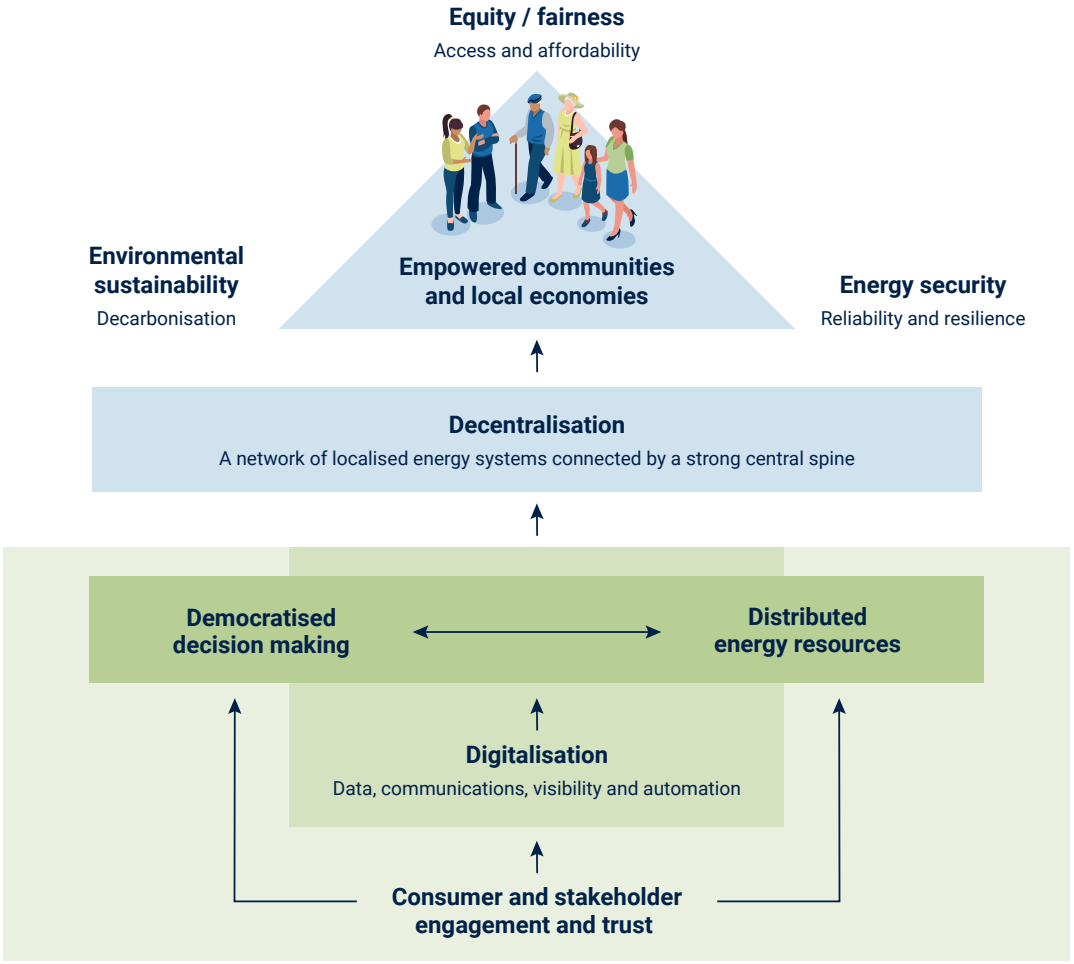

Figure 4: Defining decentralisation and the key outcomes it contributes to

[6] Outcomes are informed by a range of reports including:
- Bray, R., Ford, R., Morris, M., Hardy, J., Gooding, L. (2024). The co-benefits and risks of smart local energy systems: A systematic review. *Energy Research & Social Science, 115*.
- Regen (2024). *Power of Places: a vision for local energy in the UK*.
- Institute for Local Self-Reliance (2023). *Advantage Local: Why local ownership matters*.
- EIS (2025). *Beyond the Grid: The Case for Decentralized Energy Systems*.

Enhanced energy affordability and equity through:

- Local generation, storage, and demand side flexibility, reducing system-wide peak demand and increasing infrastructure utilisation.
- Equitable access to low-cost, locally generated electricity, through peer-to-peer sharing, local markets, community batteries and community virtual power plants.

Enhanced security of electricity supply through:

- Greater diversity in the types and location of energy generation.
- Increased consumer engagement, energy literacy and trust, unlocking demand side flexibility at scale.

Enhanced resilience to climate-change impacts and other hazards through:

- Remote and hazard-exposed communities that have more energy options designed to withstand climate change impacts and other hazards.
- Energy resilience hubs at Civil Defence centres, marae, community centres and schools, providing the community with access to critical energy services during and after disasters.

Accelerated decarbonisation and electrification through:

- Rapid adoption of low-cost renewable generation.
- Accelerated electrification of the transport fleet through decentralised 'batteries on wheels' and unlocking new value streams for vehicle and fleet owners through EVs.

Empowered communities and local economies through:

- Councils and economic development agencies working with the energy sector to integrate energy planning into spatial plans, climate action and adaptation plans, and economic development plans.
- Unlocking new streams of local and international capital in new energy projects, including individuals and communities able to deploy their own capital to meet their needs and attracting new economic activity to a region.
- Increased consumer connection with their energy supply leading to higher engagement, energy literacy, improved energy efficiency and healthier homes and buildings, and increased demand flexibility.

What do you think?

Question 1

Do you agree with the description of decentralisation?

If not, why not?

Yes

Question 2

Do you agree with the articulation of the potential outcomes and benefits from decentralisation for consumers?

If not, why not?

Yes, although it's not clear how energy affordability, for maximum consumer benefit and uptake, will be enabled and prioritised. There is certainly potential that DERs may remain a luxury choice for those that can afford it, and with improper market design or regulatory settings they may not naturally drive consumer prices down more widely.

4 . Potential challenges and risks of decentralisation[7]

Governance design

4.1 The shift toward decentralisation will likely make governance of the sector even more complex.

4.2 The current electricity system does have strong governance and regulatory structures in place. These clearly outline the responsibilities for performance at each level and layer in the electricity system, from the regulator to the grid and system operators, to the lines companies and retailers. This is important for making sure there is accountability in the system, particularly around security of supply and affordability.

4.3 An effective governance framework for the future will likely require more clearly defined decision making between the levels and layers, and ways to empower consumers, businesses and communities, while managing complexity, cost and risk.

4.4 Research suggests that decentralisation will be most appropriate if governing tasks are broadly participatory and allocated to the lowest appropriate level of authority. This would require significant changes to the current governance structures.[8]

Understanding future consumer and stakeholder needs and expectations

4.5 A collective understanding of consumers' and stakeholders' likely future needs, aspirations, choices and behaviours need to be developed. Additionally, how these might be both influenced and enabled by a more decentralised electricity system needs to be understood. Building this shared understanding, including surfacing the underlying assumptions and beliefs, will be an important part of the system design.

Local electricity sharing and markets

4.6 Many of the benefits from decentralised electricity systems flow from optimising supply and demand in time and place, for example through peer-to-peer sharing or community VPPs within a network area. These can also enable equitable access to the benefits of DERs across a community. However, current market, distribution pricing and retail services do not fully enable or reward consumers for local sharing of local energy, including the potential benefits of community batteries.

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7 The challenges outlined are informed by sources including:
- Bray, R., Ford, R., Morris, M., Hardy, J., Gooding, L. (2024). The co-benefits and risks of smart local energy systems: A systematic review. *Energy Research & Social Science, 115.*
- MacArthur, J. L., & Berka, A. (2020). (Re)charging communities?: Three energy futures for Aotearoa/New Zealand. *New Zealand Sociology*, 35(2), 47–75.
- *Future of Energy: Embracing Decentralization* by Tara Energy.

8 Brisboire, M. (2020). Decentralised energy, decentralised accountability? Lessons on how to govern decentralised electricity transitions from multi-level natural resource governance. *Global Transitions, 2, 16-25.*

Grid and system operations complexity

4.7 DERs' use creates more dynamic and two-way power flows across the grid, especially when combined with increased variable and intermittent renewable electricity sources (such as wind and solar) and changing consumer use patterns.

4.8 This means sophisticated management tools are needed to maintain grid stability and optimise operations. This includes advanced data management and analytics, real-time grid monitoring, and mechanisms or protocols to flexibly manage demand. New distribution system operation models are emerging around the world to manage this complexity. Irrespective of the model, data and smart technologies must be appropriately available, standardised, and able to exchange information to unlock the full value of decentralisation.

Including an intergenerational perspective in decision-making

4.9 Shaping a future electricity system that delivers long term benefits to consumers requires an intergenerational perspective.[9] This means evaluating the distribution of costs and benefits across generations, and assessing whether they align with the values and aspirations that a wide range of consumers have for Aotearoa New Zealand. Because these issues are complex and emergent, ongoing discussions are essential to develop and maintain understanding of the best ways to evaluate them. Equally important is making the costs and benefits over time transparent, together with the intergenerational consequences of different priorities.

Equitable access to benefits

4.10 Another acknowledged challenge with decentralisation is that lower-income households and renters might miss out on the benefits of DERs. Innovative models are emerging to address these issues here and overseas. For example, social and community housing providers are investing in DERs to unlock the benefits for their tenants. Meanwhile community battery models are emerging overseas which enable the benefits of local generation to be shared with all local consumers.

4.11 There are overseas examples of non-government organisations (NGOs) establishing community energy funds. These NGOs crowd-source investment into local DERs, offer capped dividends to investors, and use the surplus to address energy hardship in their community. Creating innovative models locally will be crucial for achieving the societal benefits of decentralisation.

Barriers to funding and finance

4.12 The initial costs of DERs can be high for many people. Limited or no access to funding or loans can further prevent people from adopting DERs. For instance, homeowners with high mortgages and limited access to additional capital may find it challenging to afford the initial costs of DERs. Similarly, community energy groups might find that banks are reluctant to offer loans, particularly when DERs are located on land under shared ownership or other novel arrangements.

[9] *Bringing an intergenerational perspective into policy* - Speech delivered by Caralee McLiesh - 4 July 2023

Capability development

4.13 Decentralisation will require organisations within and beyond the electricity sector to take on new or different roles — across governance, asset ownership, planning, finance, market facilitation, and system operations. A focused and coordinated approach is crucial for developing the skills needed for these new roles.

4.14 As noted, maximising the benefits of decentralisation relies heavily on increased engagement, understanding, trust and collaboration between the energy sector, consumers, communities and local stakeholders. This will require a significant increase in energy literacy for consumers and local stakeholders, plus enhanced community engagement and innovation capabilities within the energy sector.

What do you think?

Question 3

Do you agree with the articulation of the possible challenges to unlocking the benefits of decentralisation? If not, why not?

Yes

5. We are on the cusp of transformative change in our electricity system

Towards a more decentralised electricity system

5.1 Over 100 years ago, New Zealanders used much less electricity. They relied on local generation and networks to connect them with this decentralised supply. After the First World War, electricity demand increased. The Government built large generation assets and a transmission grid to connect local networks. This shift to a more centralised system moved power generation farther from users, but it lowered costs and improved consumer benefits at the time.

5.2 Following the global shift, Aotearoa New Zealand is now rapidly moving towards more a decentralised electricity system. New utility-scale distributed generation and battery projects are growing across the country. Some industrial sites are developing co-located generation and storage assets to reduce their costs and/or emissions. Uptake of rooftop solar and batteries has been slow compared to other countries, but the pace is picking up — from homes to large commercial buildings.

5.3 In recent years, local government authorities, iwi and hapū, social housing providers and community energy groups have shown more interest in the opportunities offered by local energy. Communities and Māori groups are developing a variety of energy projects to reflect local/community context and values.

5.4 More local councils and economic development agencies are stepping forward to develop local energy stocktakes, strategies and plans with a view to integrating energy into broader local planning activities such as spatial planning, climate action plans and economic development plans.

5.5 While interest and activity are growing, the case studies in Appendix B show that it is not easy for early adopters.

The shift towards decentralisation is accelerating, and much is at stake

5.6 As captured in the following opportunity statement, a more decentralised electricity system offers a great opportunity for New Zealanders:

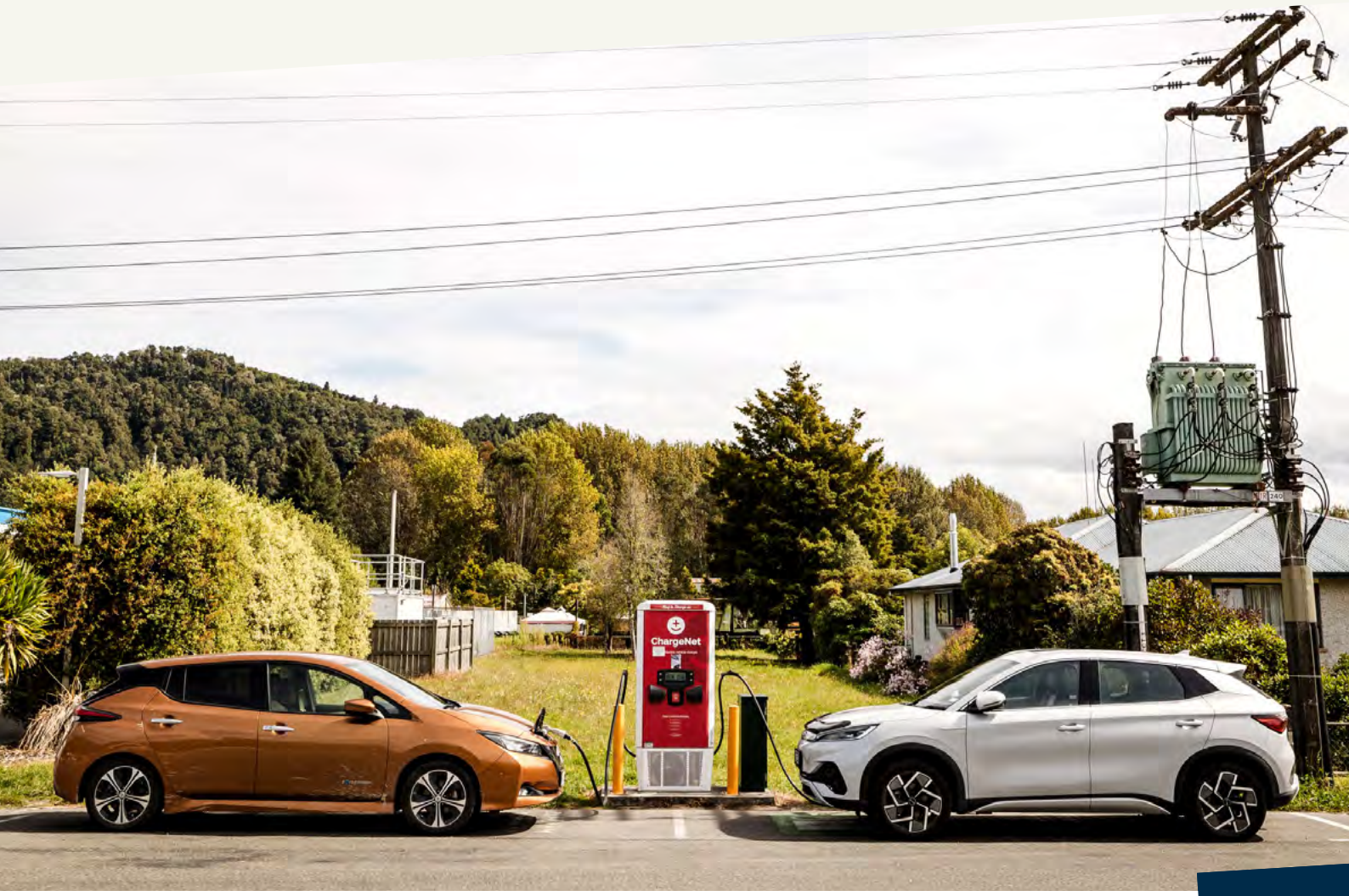
By 2040, Aotearoa New Zealand's electricity system has unlocked the affordability, decarbonisation, and security and resilience benefits of distributed energy solutions for regions and communities. This more decentralised system empowers people and communities, ensures fair and secure access to energy, and drives regional and community-led economic growth. This will be enabled by:

- Making full use of our existing electricity system. This includes our:
  - Electricity grid.
  - Existing largely renewable electricity generation assets.
  - Locational electricity market.
  - Highly localised electricity distribution businesses.

- Adopting available and emerging technologies like rooftop solar generation, distributed batteries, electric vehicles and 'smart' energy management systems.
- Developing local energy markets, pricing and services. These will reward consumers and communities for generating and trading energy locally, and for being flexible with their demand for energy.
- Empowering local councils, iwi and communities to play a strong leadership role in energy planning and decision-making. This would enable locally-driven innovation to meet local needs and reflect Aotearoa New Zealand's cultural and regional diversity.
- Unlocking new sources of capital into our energy system through increased local ownership of local energy resources. This includes consumer investment in DERs and community ownership.
- Building trust, engagement and authentic collaboration among industry, local stakeholders, communities, and consumers.
- Creating a network of flexible, locally optimised energy systems, which connect through a strong grid backbone. This approach could support system-wide efficiency, affordability, and supply security.

5.7 This aligns with the Government Policy Statement on Electricity (the Policy),[10] which stresses the need for a secure, resilient, and efficient electricity system. The Policy also supports decarbonisation and economic growth, while ensuring consumer benefits.

[10] New Zealand Government (2024). *Government Policy Statement on Electricity*.



What do you think?

Question 4

Do you agree with the articulated opportunity statement for a more decentralised electricity system?

If not, why not?

Yes - absolutely.

However, missing is the role for DERs to help reduce carbon emissions from electrification of the transport and energy sectors, more rapidly and more completely than possible otherwise. The fact that DERs could and should be a major contributor to wider and more affordable electrification should be a key part of the vision statement.

Question 5

What other feedback would you like to provide to input into the discussion on, for example:

a) what a more decentralised electricity system might look like,

b) how this might benefit consumers, and

c) what might be needed to unlock these benefits.

There needs to be acknowledgement about how DERs can help meet the rapid growth needed in electricity systems and infrastructure, to keep up with and enable faster decarbonisation of the transport and industrial energy sectors - both currently driven by fossil fuels.

Electrification has wider societal, environmental and economic benefits, and DERs could and should play a pivotal role in making this transition faster, more affordable and more equitable.

6. The Authority's work programme and strategic alignment

Context and strategic alignment

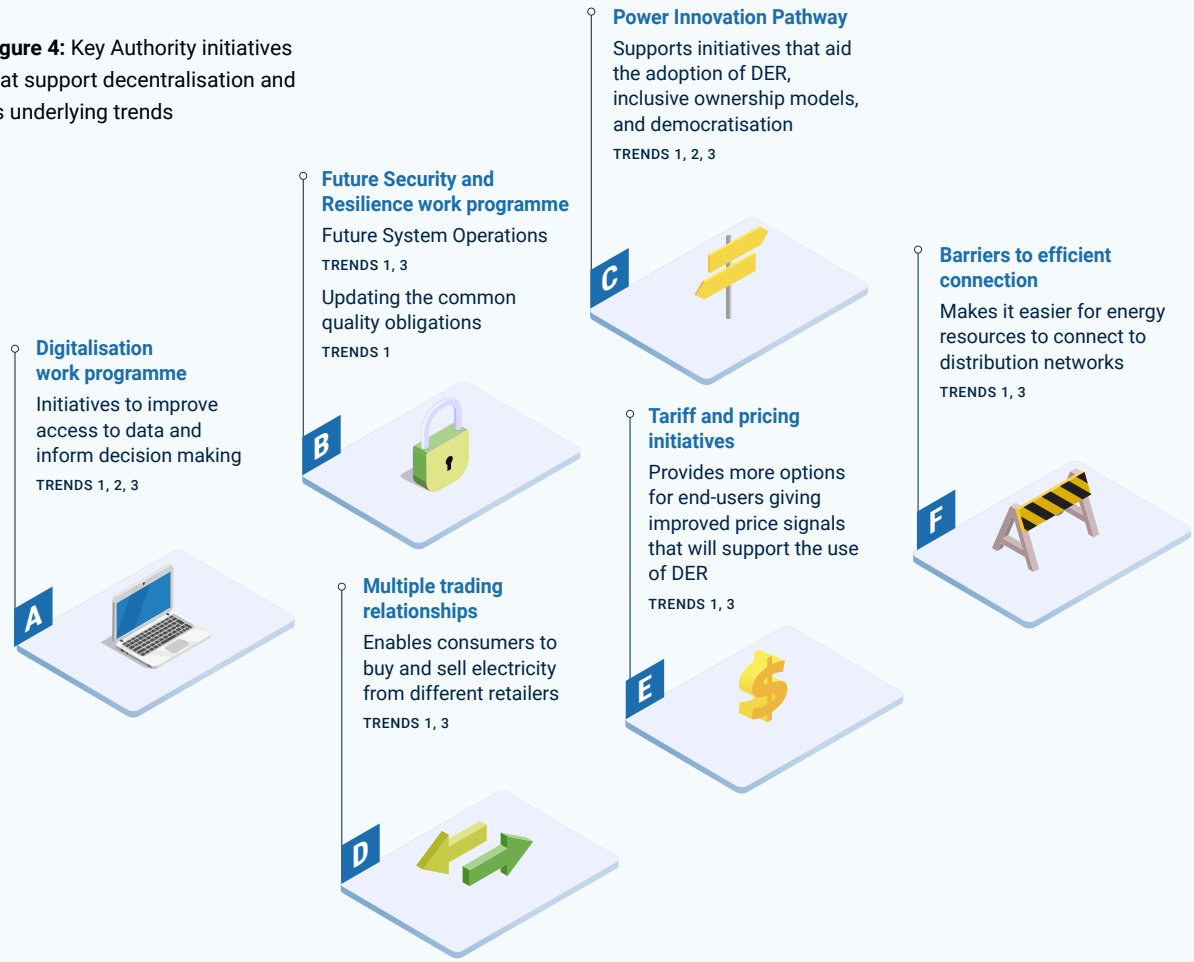
6.1 While decentralisation cannot address the immediate security and affordability challenges facing the system, decentralisation will play a key role in improving supply of security and affordability over time.

6.2 Therefore, decentralisation will play an important role in helping us achieve the Authority's strategic outcomes of an affordable, efficient, and secure and resilient energy system, and its vision of ensuring consumers have choices in accessing the energy they need now, and in the future.

Work programme alignment

6.3 The Authority are working on initiatives to support the key trends discussed in this paper and therefore enable the positive outcomes from more decentralisation. **Figure 4** displays the key initiatives underway that will support decentralisation and the specific trends that decentralisation is observed through as discussed in section 3.

Figure 4: Key Authority initiatives that support decentralisation and its underlying trends



7. Next steps: convening the conversation

7.1 From May to July 2025, the Authority will hold discussions and gather feedback on this paper. The discussions and feedback will contribute to the Authority's work to determine the regulatory framework required to support consumer benefit in a more decentralised electricity system.

7.2 The Authority welcomes people and organisations with an interest in the energy system to join us in these initial discussions. This includes iwi and hapū leaders, local government and civil defence groups, community groups, consumer representatives, housing developers, education facilities, industrial and commercial organisations, and, of course, the energy sector.

How to arrange a discussion

7.3 If you would like to arrange a discussion on the contents of this paper, please email decentralisation@ea.govt.nz.

How to submit feedback

7.4 Please send feedback on the below questions to decentralisation@ea.govt.nz by 25 June 2025 with "Decentralisation green paper" in the subject line. You can send through a PDF of this document that includes your embedded responses, or you can send your responses to the questions separately.

7.5 If you cannot send your submission electronically, please contact the Authority at decentralisation@ea.govt.nz or by phoning **04 460 8860** to discuss alternative arrangements.

7.6 Please note the Authority intends to publish all submissions it receives. If you consider that the Authority should not publish any part of your submission, please:

(i) indicate which part should not be published,

(ii) explain why you consider we should not publish that part, and

(iii) provide a version of your submission that the Authority can publish (if we agree not to publish your full submission).

7.7 If you indicate part of your submission should not be published, the Authority will discuss this with you before deciding whether to not publish that part of your submission.

7.8 However, please note that all submissions received by the Authority, including any parts that the Authority does not publish, can be requested under the Official Information Act 1982. This means the Authority would be required to release material not published unless good reason existed under the Official Information Act to withhold it. The Authority would normally consult with you before releasing any material that you said should not be published.

Appendix A

Emerging visions for decentralised energy systems — international perspectives

United States

a) In the United States a 'Community Choice Aggregator' (CCAs) model is gaining traction. This model lets communities pool their electricity demand to buy clean energy and develop local projects for residents and businesses. CCAs are set up by local councils, and work in partnership with the local lines company (which continues to deliver power and maintain the network). CCAs also become the default retailer.[11, 12]

b) One far-reaching vision is for a future energy system broken down into layers, from smart homes and buildings, to microgrids, to local communities (defined by network areas), to cities and regions. These 'integrated-decentralised energy models' are proposed to be designed and operated bottom-up. They reflect the context, values and choices of consumers and communities while addressing system-wide grid challenges. Energy supply and demand are balanced within each layer, before importing or exporting energy to or from the next layer up.[13]

United Kingdom

c) In the UK, one form of decentralised energy model is referred to as 'Smart Local Energy Systems'. It aims to maximise the benefits of DERs by joining things up locally: "With local integration, solar panels on houses and factories can help power the community's heating and transport. Battery systems can store renewably generated electricity for later use. Electric cars can return stored power to the local grid when they don't need it…. All this can be coordinated by smart digital systems – intelligently using all the data available, maintaining the link between the national grid and the local system, and balancing energy supply and demand across the whole community." [14]

d) The Smart Local Energy Systems Framework (**Figure 5** overleaf) shows three trends:

(i) Distributed Energy ('Energy System Elements')

(ii) Democratisation ('Local Elements') and

(iii) Digitalisation ('Smart Elements')

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[11] See US Environmental Protection Agency. *Community Choice Aggregation*.

[12] See California Pacific Utilities Commission. *Consumer Information on CCAs-Frequently Asked Questions*.

[13] Kristov, L. (2019). The Bottom-Up (R)Evolution of the Electric Power System: The Pathway to the Integrated-Decentralized System. *IEEE Power and Energy Magazine*. 17(2).

[14] UKRI (2022) *Smart Local Energy Systems: the Energy Revolution Takes Shape*.

These three trends can be combined into decentralised or localised energy systems to meet specific goals and values. They also contribute to local benefits and unintended consequences. The local energy system does not work alone. It interacts with wider systems and brings wider benefits and unintended consequences beyond the local area.[15]

e. Research shows that the UK could save £8bn pa by 2040 if 50% of energy goes through smart local energy systems.[16]

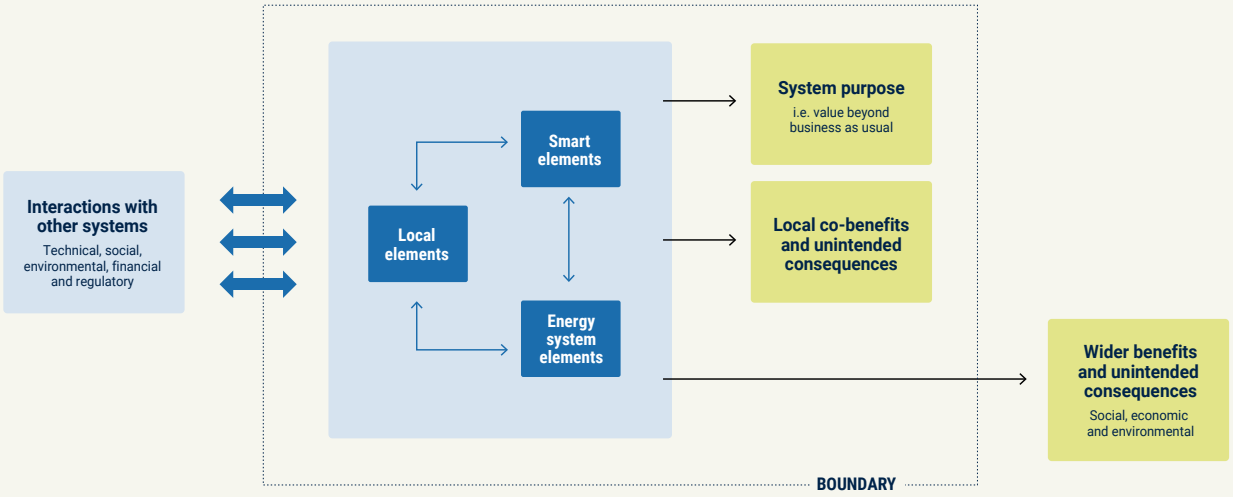


Figure 5: Smart Local Energy Systems Framework.[17]

[15] Ford, R., Maidment, C., Fell, M., Vigurs, C., and Morris, R. (2019). A framework for understanding and conceptualising smart local energy systems. EnergyREV, Strathclyde, UK. University of Strathclyde Publishing, UK. ISBN: 978-1-909522-57-2.

[16] UKRI (2022). *Smart Local Energy Systems: the Energy Revolution Takes Shape*

[17] Reproduced from Ford, R., Maidment, C., Fell, M., Vigurs, C., and Morris, R. (2019). A framework for understanding and conceptualising smart local energy systems. EnergyREV, Strathclyde, UK. University of Strathclyde Publishing, UK. ISBN: 978-1-909522-57-2 (Figure 1, pp.6)

f. Similarly, UK research shows that significantly better outcomes are achieved when cities and regions tailor their net zero carbon emissions transition to local needs and opportunities. Adopting this locally tailored or place-based approach could reduce the cost by £137bn (70%). It could also generate an additional £431bn (85%) in energy savings and wider social benefits by 2050 compared to a place-agnostic or centrally driven transition (**Figure 6**).[18]

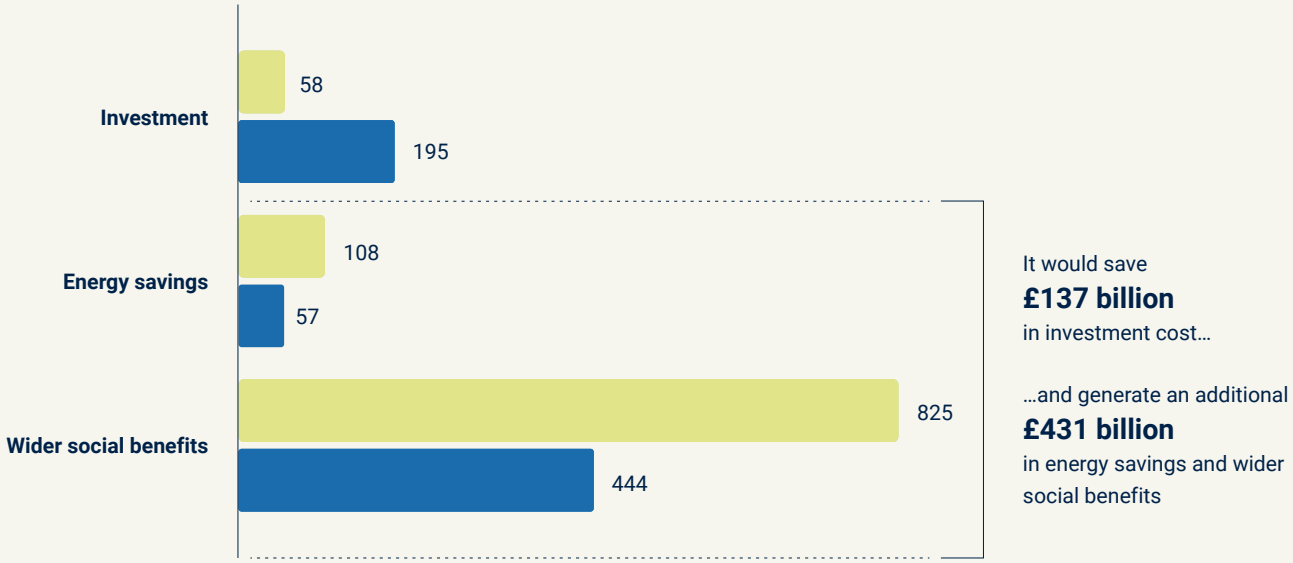


Figure 6: UK research suggests that maximising the benefits of net zero requires a place-specific approach[19]

Australia

g. In Australia, distribution networks are piloting energy hubs or 'Local Renewable Energy Zones' (LREZ). These zones use available roof space, network-connected community batteries and existing electricity infrastructure to help communities access more renewable energy, store it and share it locally.[20] These initiatives give all local consumers access to the benefits of shared solar, including people living in apartments and low-income renters. In one example it is estimated that this could save some participating households up to $800 per annum on electricity bills.[21] In the future, LREZ could combine with network islanding capabilities to offer enhanced resilience to hazards.

[18] UKRI and Innovate UK (2022). *Accelerating Net Zero Delivery- Unlocking Benefits Climate Action UK City Regions*.

[19] Reproduced from *Accelerating Net Zero Delivery*, by UKRI, March 2022 (pp.13).

[20] Queensland Government (2024). *Miles Doing What Matters: Caloundra to be home to local renewable energy zone pilot*.

[21] Australian Government (2024). *Expanded solar and savings for thousands of Queensland households*.

Appendix B

CASE STUDY 1 : Tākaka co-housing community energy

Residents of a semi-rural 100-home community development in Tākaka have been investigating options to reduce their energy costs, improve the resilience of their community, and reduce their carbon footprint.

They forecast their annual energy usage to be ~1650 MWh (350 MWh residential electricity usage and 1,300 MWh vehicle). This equates to a total annual energy spend of ~$500,000 and carbon emissions of 300 tonnes CO2e.

The community used a formal decision-making process and values-based approach to plan this project. Their values included clean, low-cost, and resilient power. In phase 1, they plan to install 100 kW of solar panels and a 200 kWh battery. This will allow power-sharing between homes behind a single meter. The self-generation also unlocks a purchase of 3x EV cars and 2x E-cargo bikes for shared use, to reduce households' travel cost and emissions.

This is expected to result in the following benefits:

(a) **Affordability:** 20–30% cheaper bills from day one (4-year payback period; 60–75% of annual demand met by self-generation).

(b) **Resilience:** Power outage resilience for critical load, such as electric water pumps.

(c) **Decarbonisation:** 38 tonnes of carbon dioxide emissions reduced annually.

Once this model has been proven, the community will consider adding additional renewable generation, storage and electric transport options. A dairy processing plant across the road from the development could potentially benefit from the extra energy generated during spring and summer.

While there is a clear positive business case for this community energy proposal, there are some substantial implementation challenges:

(a) **Financing the upfront capital investment:** Banks are reluctant to provide a loan given the novel nature of the project and the 'shared ownership' model.

(b) **Right sizing the remaining power bill:** How to get a fair time-of-use plan at small scale, and fair pricing for using the lines network.

(c) **Technical implementation:** Integrating new technologies and solutions with the industry.

Overall, this case study illustrates the potential benefits that DERs can unlock for communities. However, we must also work through some challenges to fully realise the benefits. The group is fortunate to have several residents who have the necessary skills to get a project like this off the ground. Other community groups may not be as fortunate, which is another challenge we need to consider to maximise the benefits of DERs for consumers.

CASE STUDY 2 : **Franklin community energy sharing**

Counties Energy and its partners Ara Ake and Climate Connect Aotearoa (Tātaki Auckland Unlimited) are working with the Franklin community to launch a pilot initiative to locally generate and share affordable renewable energy with its residents.

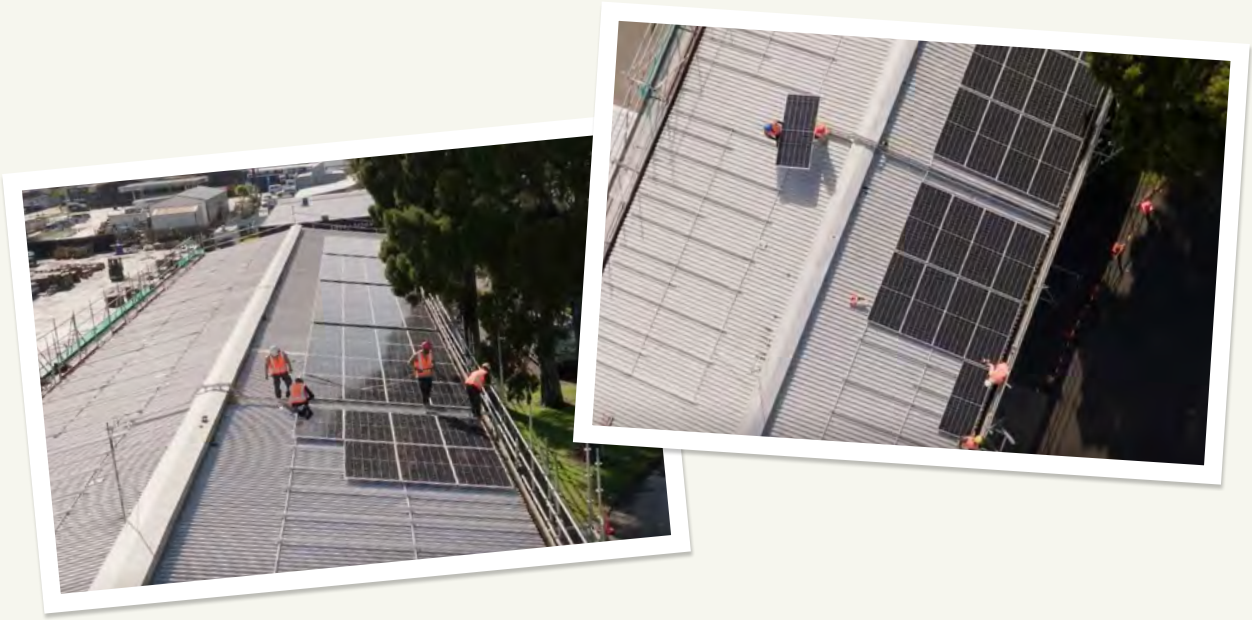
Counties Energy plans to install half a mega-watt (MW) of solar panels on its site, with up to 110kWp made available for energy sharing, alongside a 120kWh battery. This will enable the value of exported solar energy to be shared through local community groups, particularly with those households who are in energy hardship. A key feature of this initiative is an agent acting on behalf of participating customers to optimise their energy usage to maximise the benefits from this initiative.

They expect this pilot to cover around 80–90% of annual energy bills for three family services organisations participating in the pilot, who would share the benefit with the families they support. It will also have resilience and decarbonisation benefits.

Once this model has been proven, they will consider installing additional solar panels at other Counties Energy sites and Auckland Council facilities, and expanding to other local community members and businesses to assist with renewable energy uptake and addressing energy hardship.

While there are clear community benefits for the proposal, there are some substantial implementation challenges. These include enabling consumers to buy and sell electricity from different retailers, and other technical market integration challenges.

This collaborative initiative draws on expertise from Intellihub and other potential reconciliation services and customer-agent services providers. The initiative shows how DERs can help address energy hardship in communities, while also improving sustainability, resilience and affordability outcomes for residents. It also illustrates the importance of collaboration and local expertise (which EDBs are uniquely positioned to have) to get a highly impactful initiative like this off the ground.



CASE STUDY 3 : Castle Hill Community Energy Project

Castle Hill village in the Southern Alps is exposed to numerous natural hazards, from earthquakes to wildfires and extreme weather. In an event such as Alpine Fault 8, Castle Hill would most likely be cut off from the rest of Selwyn and would act as a forward operating base for an emergency response. During an outage, the only alternative electricity source is a 22kva fixed diesel generator, which relies on fuel availability.[22]

In mid-2024, community members began an energy project to improve the Castle Hill township's energy resilience before, during and after an adverse event. The group joined a Community Energy Activator programme through which they received expert advice and mentoring in 2024.[23]

Community members participated in a survey to understand their households' current energy status and their aspirations for renewable energy solutions. Community resilience was the key theme. Ninety per cent of respondents indicated they would be interested in a community energy scheme to address this.[24] The survey identified that the key elements of energy resilience for the community during an emergency are:

- Power to the community hall for either Civil Defence staff or residents, including lighting, fridge, freezers, cooking facilities etc
- Charging of batteries associated with emergency management actions, as well as batteries for communication needs
- Communications not reliant on the main grid (for example, WiFi via Starlink)
- Provision of fresh water via the village reticulation; and ideally
- Provision of wastewater services via the village reticulation.

The group is currently conducting a detailed options analysis. So far, they have identified a combination of rooftop and ground-mounted solar generation as their preferred choice. Other critical components include a community battery and the ability to 'isolate' the village from the main grid during and after an event.

Key challenges the community faces include:

- Access to expert advice without ongoing reliance on voluntary support
- Accessible funding and finance mechanisms
- Mechanisms to enable electricity sharing between sites within the village
- Solutions to safely isolate the village from the main grid during and after an event
- Greater clarity on roles and responsibilities for developing energy resiliency solutions for hazard-exposed communities.

The community is currently engaging with their local council (Selwyn District Council), hapū (Te Taumutu Rūnanga), electricity distribution business (Orion) and EECA to seek support or active involvement in the initiative. Responses to date have been positive. However, at this stage the onus rests with the community to further develop the project, navigating through the above challenges with whatever volunteer support they can muster.

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[22] Selwyn District Council. (2025). *Public Councillor Briefing Agenda Updated*, (pp.48).

[23] For more information and the programme impact report, visit the programme website: *Community Energy Activator: Plugging on our people*.

[24] Castle Hill Community Association (2025). *Castle Hill Community Energy Project*.

What do you think?

Question 6

What are other emerging case studies we could learn from?

V2G demonstrated in Australia
https://www.csiro.au/en/news/all/articles/2025/april/vehicle-to-grid-v2g

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