Rewiring Aotearoa submission on the Draft National Infrastructure Plan

About Rewiring Aotearoa

Rewiring Aotearoa is an independent non-partisan non-profit, funded by New Zealand philanthropy. It is a registered charity working on energy, climate, and electrification research, advocacy, and supporting communities through the energy transition. The team consists of New Zealand energy, policy, and community outreach experts who have demonstrated experience both locally and internationally. We're always fighting for the New Zealanders who use the energy system, and our goal is to help build a low cost, low emissions, high resilience electrified economy for Aotearoa NZ.

Key messages

Investment in electricity infrastructure is needed as we electrify our economy. This has traditionally been provided via centralised sector investment in generation, distribution and transmission networks. There is an increasing role for distributed electricity infrastructure in our energy future such as rooftop solar, battery systems and the potential for vehicle to grid technology. This distributed technology in homes and businesses is commonly referred to as consumer energy resources (CER).[1]

CER can reduce the need for investment in centralised energy infrastructure to provide for demand growth by supporting:

- better utilisation of existing infrastructure, and
- lower cost solutions that offset the need for centralised investment.

The National Infrastructure Plan should recognise the significant potential of CER to deliver a more affordable, resilient and sustainable electricity system for New Zealanders and include direction that proactively enables CER uptake and efficient use.

Investment by customers in CER will benefit New Zealand

Investment by customers in CER can also help to lower consumer bills, support increased resilience and when combined with electrification improve productivity and provide greater fuel security for New Zealand.

[1] CER also includes smart devices such as smart EV chargers that can schedule demand away from peak periods or to when there is excess renewable electricity helping to better utilise renewable generation and provide supply at lowest cost.

New Zealand households and businesses spend around $20 billion on fossil fuels every year, most of which are imported. Electrifying New Zealand households by replacing fossil fuel appliances and vehicles with electric alternatives, along with adding rooftop solar and batteries, presents an opportunity to save thousands on cost of living, and could save New Zealand around $10.7 billion per year by 2040.[2]

Increasingly severe storms, heavy rainfall, and cyclones will disrupt transport networks, power grids, water systems, and communications. Rural and remote regions are also vulnerable to these impacts, with vulnerable agricultural infrastructure and potential flow on supply chain issues.

Distributed CER in homes, businesses, farms and community organisations such as solar panels, batteries, rural EV charging networks and the potential for electric vehicles to store energy in batteries and power homes, can all provide valuable backup services to local communities when centralised electricity supply is out.

Investment in customer CER must be factored into energy infrastructure planning

A significant increase in customer investment in their own energy resources is expected as electricity bills increase and distributed energy technology and installation costs continue to fall.

[2] https://www.rewiring.nz/tomorrow

The figure below shows delivered energy costs from rooftop solar are a fraction of the cost of purchasing electricity from the grid for households.[3]

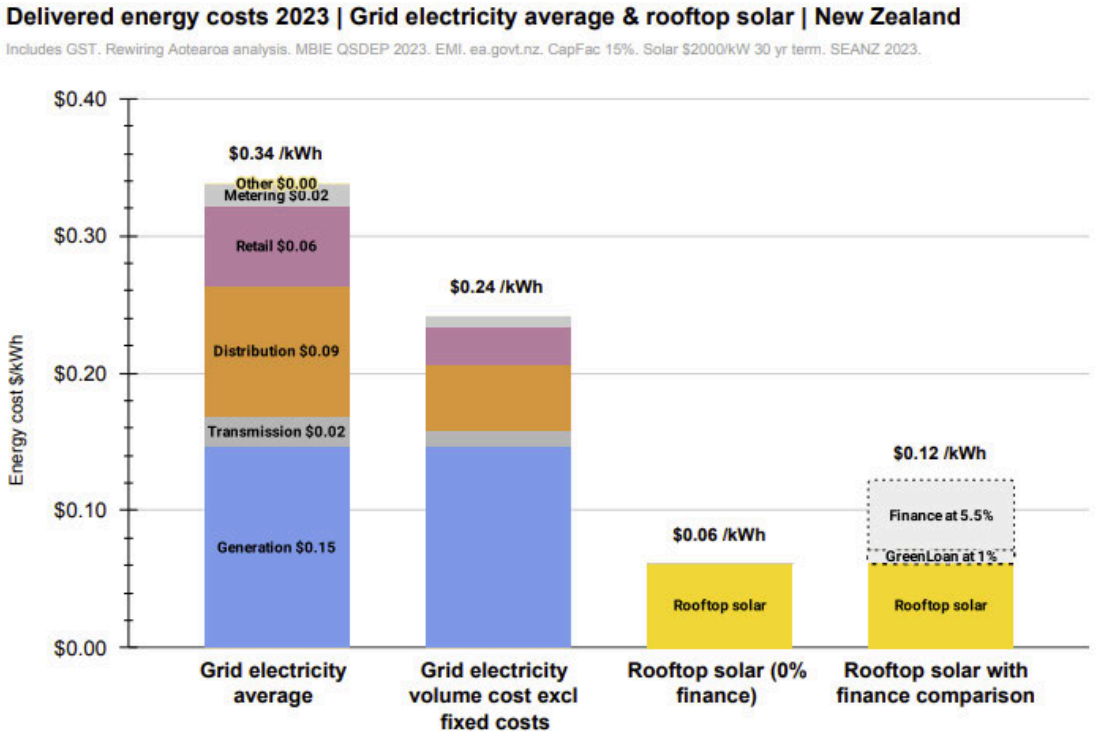
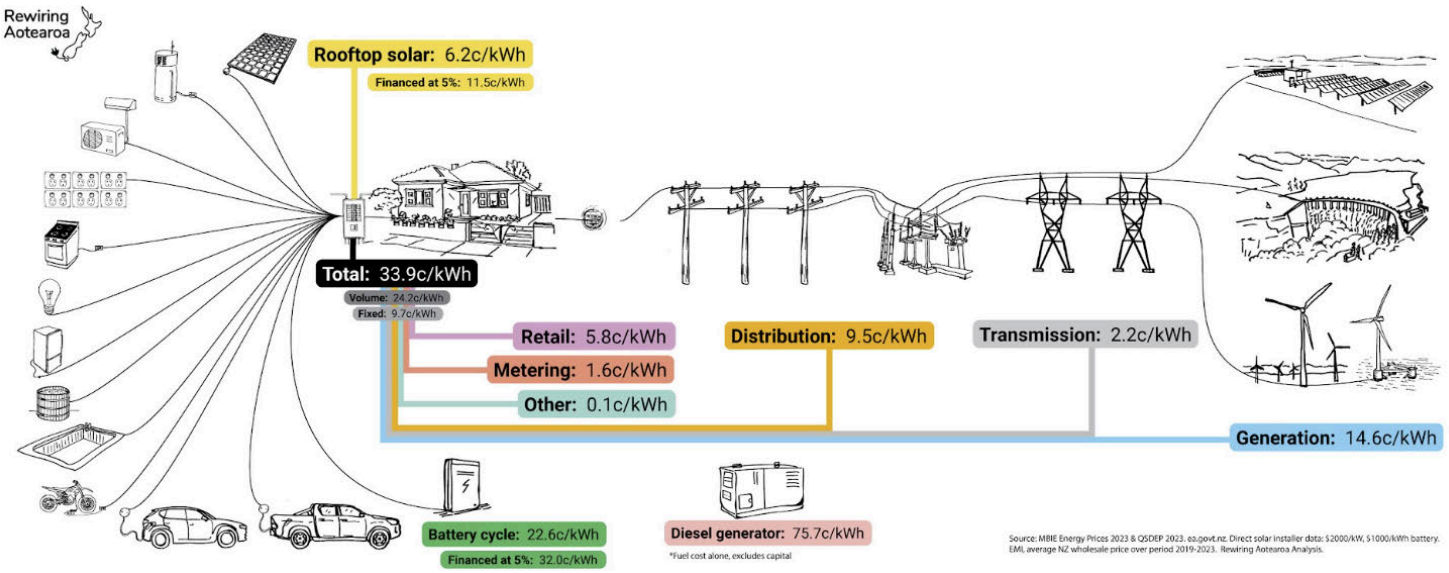


Figure 7 - Grid electricity cost stack versus financed rooftop solar. Rooftop solar is the lowest cost delivered energy for many homes. With some green loans being offered at 0% and 1%, rooftop solar is a round 6 to 7 cents per kWh, or about 12 cents per kWh at 5.5% finance (the average home loan rate over the last 10 years). Like any renewable power station, rooftop solar alone cannot provide electricity at every point in time. In reality, the lowest cost delivered electricity for any given home or business will be a mix of grid based electricity, solar, and likely batteries. Maximising the amount of solar usage will lead to lower total energy costs - for example by water heating or car charging during sunlight hours. This chart examines the current costs of solar and the grid. It should be noted that solar purchased today will likely last 30 years, and the costs of the grid are highly likely to go up in that time with inflation, where as the finance repayments for solar will remain comparatively flat as the purchase has already been made.

Delivered energy costs comparison diagram



[3] https://www.rewiring.nz/electric-homes-report, Since this data was published the grid electricity cost excluding fixed cost has increased to an average of $0.27 /kWh.

If we do not realistically explore the role of distributed energy resources and factor in uptake in energy infrastructure planning there is a real risk of building centralised assets that delivers a significantly more expensive electricity system than is optimal, and a risk of stranded centralised assets.

Decision makers including central and local government need to be provided with strong direction to consider the significant role of consumer energy resources in our future electricity system and ensure policy and regulatory settings avoid over investment in centralised infrastructure.

The Draft National Infrastructure Plan does not sufficiently take account of the system wide and direct customer benefits and likely future uptake of CER in the guidance it provides. We have set out feedback below on how it could better provide this direction.

Specific feedback on the draft National Infrastructure Plan

Add additional “Recommendations for change” and expand on how existing Recommendations apply to customer investment in energy infrastructure

The draft National Infrastructure Plan ignores the role of household and business investment in energy infrastructure (eg: CER like solar, batteries and electric vehicles that can provide vehicle-to-grid or vehicle-to-home supply), despite these technologies having the potential to support greater affordability and productivity for New Zealand, providing lower cost solutions to offset centralised infrastructure investment which can lower energy bills for all customers and greatly improve local energy resilience.

This needs to be better reflected in the key recommendations as follows:

The Infrastructure Commission should add a new "Recommendations for change” to page 12 and reflect this throughout the document:

- **Policy makers should consider where possible the role of changing technology uptake to provide lower cost more efficient infrastructure.** It is currently important for decision makers to analyse consumer energy resource uptake rates and how this could most benefit energy consumers and offset centralised energy infrastructure needs. This should be factored into regulation and decisions about energy infrastructure investment to help avoid over investment in and stranding of shared assets.

Better recognise the role of households and businesses as energy infrastructure investors

Throughout the National Infrastructure Plan the role of households and businesses as energy infrastructure investors should be explained. We have selected some examples of places in the document where this could be done, however this should be highlighted throughout the final National Infrastructure Plan.

The draft National Infrastructure Plan states:

- On Page 42: "*We identify two sectors with a rising share of infrastructure investment*.
    - *Electricity: We expect electricity infrastructure investment demand to increase due to technological changes and the need to decarbonise our economy. While this investment can be funded commercially from user charges, government policy will affect how much investment is demanded and how rapidly it can be supplied*."

  We suggest adding to this:
  "*Consumer investment in their own energy resources (eg: rooftop solar and batteries) and policies to support this can help offset the need for centralised energy infrastructure investment*."

- On Page 55: "*New Zealand's infrastructure is delivered by a mix of central government, local government and commercial entities, each with different funding, governance and regulatory settings*."
  We suggest adding to this:
  "*Consumer investment in their own energy infrastructure (eg: rooftop solar and batteries) can provide direct cost savings to households and businesses and uptake is expected to increase.*"

- On Page 55: "*Financing tools, such as public-private partnerships, special purpose vehicles and asset recycling help spread the upfront costs of investment and should be matched to project needs to support timely and cost-effective delivery across sectors.*"
  We suggest adding to this:
  "Ensuring access to finance for all customers to invest in their own energy infrastructure is important to ensure equitable access to benefits from these investments."

- On Page 55 "*Policy settings that influence demand, such as emissions targets, pricing frameworks and service standards, must be consistent and predictable to give infrastructure providers the confidence to invest at the*

right time and scale, particularly in sectors like electricity where stable policy is critical to support decarbonisation and energy security."
We suggest adding to this:
"This also applies for homes and businesses investing in energy infrastructure, who need efficient price signals from electricity retailers and networks to support investment that can lower overall electricity infrastructure costs, benefiting all energy users."

Regulatory settings need to rationalise where there is a genuine case to invest in centralised electricity infrastructure to avoid stranded network assets

There has been a strong narrative from the electricity transmission and distribution sector about the need to invest ahead of demand to support electrification of the economy. In many cases this is important to support electrification as it can take several years to plan and build large transmission assets once the decision to invest has been made. This means there is a timing mismatch because the development and commissioning of new generation or large industrial electricity demand can take one to three years from the time the decision to invest is made. To avoid a lack of transmission infrastructure delaying electrification, transmission investment decisions will be needed ahead of demand.

However the National Infrastructure Plan should advise caution for regulators and policy makers to rationalise when and where there is a genuine case for investment in electricity networks.

To enable better infrastructure outcomes, regulatory frameworks and incentives must be reevaluated to support more efficient, flexible, and cost-effective solutions. And as such, recognise CER as a key part of the solution and as essential components of Aotearoa NZ's energy future.

There are significant opportunities for networks providers to utilise and incentivise the supply of distributed flexibility solutions to offset the need for transmission and distribution network investment. Distributed flexibility can provide a lower cost solution than investment in centralised electricity infrastructure. For example, exports from many household batteries could be utilised to meet network peak demand and delay the need to upgrade or build new electricity network infrastructure to meet growing peak demand.

In some cases distributed flexibility could reduce the size of the network investment needed to provide for demand growth, for example if a large energy customer is willing to reduce demand during peak periods or have a lower security specification on a new or expanded connection. Similarly investment in

energy generation that is co-located or located near growing demand can also reduce the need for both distribution and transmission investment.

This messaging should be reflected in the final National Infrastructure Plan including in Section 3.2.

CER provides an alternative if centralised electricity costs get too high
Updates to Info Box 5 could be made to reflect that CER provides the opportunity to disconnect from the electricity system if prices get too high.

Info Box 5 on page 44 describes how in 1931 people were willing to pay more for distribution network investment to access significant economic or quality-of-life benefits. In the present day this willingness to pay for shared electricity infrastructure may be limited by the cost of off-grid solutions to meet individual homes or businesses electricity needs. Whilst it currently makes financial sense for almost all residential customers to remain connected to the network, if electricity infrastructure costs reflected through electricity bills get too high, customers who can, may increasingly begin to go off-grid by investing in large household batteries and rooftop solar.

Better modelling of the uptake and role of consumer energy resources in long term energy infrastructure planning is needed

As noted above it is important to be clear about the role of CER in our future energy system. Any analysis of Aotearoa NZ's energy infrastructure future must recognise the inevitability of widespread solar and battery adoption behind the meter. As the technology costs continue to decrease, homes, farms, and businesses will increasingly invest in rooftop solar and battery systems because they offer the lowest electricity costs. This shift will happen regardless of what the industry considers the most capital-efficient pathway for large-scale infrastructure. Solar energy will collectively contribute to large-scale generation, while batteries provide highly distributed, firm energy during peak demand.[4] As noted above battery exports can also play a valuable role to offset investment in distribution and transmission networks. As a result, homes, farms, and businesses are becoming key components of the nation's energy infrastructure even as industry stakeholders and regulators work to adapt to this shift.

Embedding foresight into relevant decision-making is critical to ensuring that our energy system is shaped in a way that supports this transformation. Anticipating the increase in local energy production and integrating this into long-term

[4] As noted elsewhere by Rewiring Aotearoa, if 5% of households installed batteries, their combined output at peak times would rival NZ's largest power station (Manapouri).

planning will help support a successful transition through avoiding missed opportunities and efficiencies.

This will be an important part of right sizing investment in centralised energy infrastructure and avoiding stranded centralised energy assets. Proactively updating regulatory frameworks, network infrastructure, and market models to accommodate CER is essential for creating the type of energy future that New Zealanders want and deserve.

Small decisions can have a large impact

The current focus on macroeconomic indicators like GDP and inflation to guide investments often overlooks the cost-effective potential of micro-level ('dinner table') decisions – such as household, farm, and business investment in CER and electrification – to address infrastructure challenges. Prioritising these decisions, with targeted government support, can drive a broader shift in infrastructure. As electrification uptake increases, the overall system will become more efficient and sustainable.

The occurrence of positive tipping points is empirically observable, especially in renewable energy and electrification technology.[5] This is driven by the "learning curve" effect, where widespread adoption of technologies like CER reduces costs through economies of scale and innovation. For instance, electricity from solar PV was 710% more expensive than the cheapest fossil fuel-fired option, but by 2022 it was 29% less expensive against the same benchmark.[6] In Aotearoa NZ, policies supporting electrification can further reduce costs and improve infrastructure competitiveness.[7] By focusing on these micro-level actions, we can create a self-reinforcing cycle that addresses infrastructure challenges and delivers macroeconomic benefits.

The National Infrastructure Plan should reflect these points in Section 3.5 and elsewhere in the Plan. For example Section 3.5 could include points such as:

- "Understanding how consumers can directly play a role in financing energy infrastructure in their homes and businesses can help to rationalise future needs for centralised investment."
- "Anticipating the increase in local energy production and integrating this into long-term planning will help support a successful transition through avoiding missed opportunities and inefficiencies."

[5] Sharpe, S., & Lenton, T. M. (2021). Upward-scaling tipping cascades to meet climate goals: plausible grounds for hope. Climate Policy, 21(4), 421-433.
[6] IRENA (2023). Renewable Power Generation Costs in 2022. International Renewable Energy Agency (IRENA).
[7] Making existing systems more cost-effective, adaptable, and resilient, thus providing greater value for money and better long-term outcomes.

Rewiring Aotearoa's 2025 Policy Manifesto sets out a comprehensive package of actions to support electrification and unlock benefits from CER.[8]

Opportunity for household investment in electrification and distributed energy to address affordability constraints

We know that electrification is key to improving affordability, efficiency, resilience and sustainability across Aotearoa NZ's infrastructure. By transitioning to electric-powered systems in transport, industry, and energy generation, we can lower operational costs, strengthen resilience, reduce emissions, and enhance the performance of existing assets.

A key part of unlocking this potential is to recognise the role that homes, farms and businesses can play in being a valuable (and valued) part of our energy infrastructure. Existing and future CER assets are an untapped resource within our energy system. Recognising homes, farms and businesses as potential energy infrastructure not only avoids unnecessary capital expenditure but also accelerates progress toward meeting climate commitments. Instead of building new infrastructure, we should prioritise optimising and electrifying what we already have, ensuring long-term value and greater efficiency for a sustainable future. As we note above CER must be explicitly recognised in the final National Infrastructure Plan to support this rethinking of energy infrastructure as something much wider than our traditional understanding of energy assets.

With battery prices continuing to decrease and electricity rates expected to keep rising - as they have historically with inflation - solar energy is poised to become even more cost-effective over time (more detail is available in our Investing in Tomorrow report[9]). Demand-side generation and storage therefore represents the quickest and most affordable methods for increasing renewable energy and reducing emissions. In most cases, the cost of financing a solar and battery system has already fallen below the average price of grid electricity for homes. However, existing energy pathways and industry scenarios[10] have significantly underestimated the potential advantages of this kind of widespread distributed electrification. We recently discussed this in the Delivered Cost of Energy 2024 paper.[11]

This creates strategic opportunities (to be actioned in the final National Infrastructure Plan) to manage energy assets in a more distributed way, where Aotearoa NZ's homes, businesses, and farms are recognised to play a central role

[8] https://www.rewiring.nz/manifesto
[9] https://www.rewiring.nz/tomorrow
[10] For example, ERP2, BCG, BusinessNZ, and the Climate Change Commission.
[11] https://www.rewiring.nz/delivered-cost-of-energy

in the solution. The current focus on large-scale infrastructure limits our ability to effectively manage energy assets and fully realise the potential of a more flexible, community-driven energy system.

If we get this right there is a clear opportunity to reduce energy bills for households. This messaging should be reflected throughout the National Infrastructure Plan including on Pg 25 and Section 3.3 page 45.

Demonstrating the opportunity to address affordability constraints
To demonstrate the opportunity to address affordability constraints through electrification and CER we have considered Figure 15 in the draft Plan. This shows a significant increase in the per household cost of infrastructure in the period 2035 - 2040.

Much of the increased electricity infrastructure cost will come from renewals of electricity distribution network assets, but some of this will come from investment in network assets to meet demand growth, which can at least in part be offset at a lower cost through investment in CERs. This means through better considering and utilising CER we can reduce the increase in infrastructure cost ("Electricity" purple bar) for all consumers.

The most significant affordability wins for customers however come from direct savings on their energy bill due to electrification and uptake of CER. Homes currently using gas or LPG appliances and petrol vehicles could save over $1,000 per year if they electrify their appliances and vehicles, and get their power from a combination of rooftop solar, home battery, and the existing electricity grid.[12] This could more than offset the total change in household costs associated with infrastructure investment (black bar in Figure 15 from the draft National Infrastructure Plan below), before we have even considered the wider system cost savings.

[12] Investing in financed rooftop solar alone can save most homes $500 - $1,500 per year.

Infrastructure investment has an impact on household budgets

Figure 15: What our forward guidance would mean for the average household budget, 2035–2040

Note: Changes in cost are relative to expenditure on infrastructure services in 2019. Source: New Zealand Infrastructure Commission analysis and modelling.

It would be missing a huge opportunity if the final National Infrastructure Plan does not acknowledge the opportunity from CER and electrification and include direction for decision makers to provide for and facilitate these consumer benefits. The Infrastructure Commission needs to do a much better job for New Zealander by recognising and providing for the significant role of CER and electrification in our energy infrastructure future.

Swapping high energy bills for finance repayments

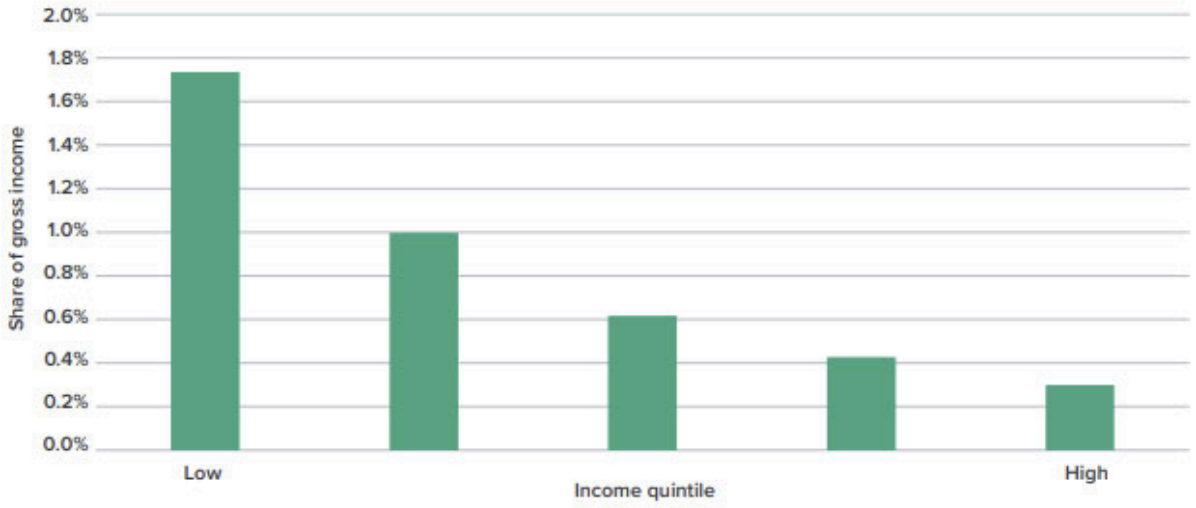
Electrification involves swapping fuels for finance, where a higher upfront cost enables significantly lower and more stable operational costs by avoiding fossil fuel bills. Likewise investment in solar swaps high electricity bills for lower finance repayments. Improving the facilitation of this finance to all New Zealanders could help the nation realise this opportunity

Opportunity to address equity issues

Proactively supporting low income households to access energy infrastructure in their home can help address and counteract the inequity associated with households' contribution to infrastructure costs, demonstrated in Figure 16 in the draft National Infrastructure Plan (see below). Offering affordable finance, and/or targeted subsidies and support for low income homes to access and efficiently utilise CER and electrification will be a key part of delivering equitable outcomes for all energy users.

Similar to today, lower income households will contribute a higher share of their income to meeting future infrastructure needs

Figure 16: Impacts on the average New Zealand household budget of the Commission's forward guidance, by household quintile group, 2035–2040



Note: We have used Stats NZ data for this figure. The income quintiles are formed by dividing the total population into five groups. The bottom quintile (quintile 1) is the lowest 20. Source: New Zealand Infrastructure Commission analysis and modelling % of the population in terms of income, while the top quintile (quintile 5) is the highest 20% of the population.

Workforce development should address systemic constraints that limit uptake of CER

Workforce development should also aim to address skills and investment shortages in training and education for the trades, engineering, and technology sectors. Our research has shown that it would be helpful to better understand the systemic constraints that inhibit uptake of small-scale renewable energy generation and electrification of households, farms and businesses. For example, our work on upstream conditions relating to electrification uptake identified a green skills shortage associated with residential solar installation; a knowledge gap and lack of clear information around household electrification; and the critical role of finance in enabling uptake of solar, battery and vehicle-to-grid technology to build household, farm and business level energy resilience.

Strategic action that provides multiple outcomes through development of the green labour market is needed. In the context of the energy transition it should consider:

- Education for tradespeople, such as electricians and plumbers to act as trusted advisors on electric options and CER for households and businesses. This could include educating trades people to advise customers investing in CER to make decisions to both minimise their own bills and also to reduce strain and cost on the wider electricity system.

- Certification schemes for mechanics to work on EVs to improve safety and support efficient battery upgrades and recycling.
- Development of the green work force to support investment in electrification and CER that improves energy resilience in communities and adaption of energy infrastructure in the context of natural hazards.