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Renewable Energy Technology Options for Parihaka Papakāinga

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Abstract

The Parihaka Papakāinga Trust - the administering body of communally owned Māori land at Parihaka, Aotearoa New Zealand - initiated university research into sustainable energy practices and technologies within a context of community and infrastructure development. As one part of this wider research topic, various renewable energy conversion technologies were compared in terms of cost, effect on increasing the energy independence of the papakāinga (excluding transport, covered elsewhere), and reducing papakāinga greenhouse gas (GHG) emissions.

Consumption of electricity, LPG and firewood was assessed in 14 study buildings over 12 months. Energy demands both now and also for hypothetical scenarios 20 years in the future were proposed, taking into account energy efficiency opportunities, low energy housing design and potential electric vehicle charging loads from parallel research.

The local solar, wind and hydro potentials were assessed over 12 months, and estimations of the long-term resources were made using long-term reference data from the region. An estimation was also made of land area requirements to support a short rotation coppicing (SRC) fuelwood plantation.

The technical and economic performance of a range of electricity and heat generation technologies was modelled, both on an individual building basis and on a community-wide basis.

The technologies with the largest expected economic benefits (after energy efficiency and building design) were a grid-connected community solar PV array with output available for consumption by as much of the papakāinga as possible, and wood-burners for space and water heating in new homes. However further study is required into the design and costs of a feasible metering and billing solution to allocate the benefits of community owned distributed electricity generation.

The technologies with the largest expected effect on energy independence include combining solar water heaters with wood-burners and wetbacks for space and water heating, and producing firewood locally with an SRC plantation.

Based on the household study, transport behaviours or technologies are expected to have a larger effect on GHG emissions than papakāinga infrastructure.

Recommendations include a billing/metering feasibility study potentially followed by a community PV array, an SRC trial, and solar water heaters and wood-burners with water heating for new homes.

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I would also like to acknowledge that the conclusions and recommendations here fall far short of the vision of self-sufficiency at Parihaka, but hope that they inform some initial practical steps as part of a larger journey in that direction.

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