

Final Report

Network, Interactive Wind Generation – Mairaki Downs, Rangiora

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Executive Summary

Report title: "Viability of Grid Connected Micro-wind Turbine Electricity Generation in the Canterbury Plains Region of New Zealand" p.38

This study examines the viability of grid connected distributed electricity generation via a 2 kW micro-wind turbine in the Canterbury Plains region. The project was a joint initiative of Industrial Research Ltd, Mainpower, Richard Alison, Ecovalue and Unitec Institute of Technology. The study involved the installation of a 2 kW grid connected wind turbine at Mairaki Downs, Rangiora, on the Canterbury Plains.

Background

The recently released New Zealand energy strategy has placed a hiatus on investment in fossil fuel electricity generation for the next 10 years reflecting concern over the increasing impact of greenhouse gas emissions on the global environment. Also, the Distributed Generation Regulations have just been released which create a new opportunity for the straight forward interconnection of below-10kW generation devices via residential Network Connection Points. Large scale electricity generation from wind turbines with a generating capacity of over 500 kW is well established in New Zealand however robust technical criteria for small scale electricity generation from grid connected wind turbines with generating capacities of 10kW or less are not well established. Furthermore the economics of these small systems in relation to the New Zealand electricity market and wind conditions are virtually unknown. This study focuses on delivering new knowledge by way of technical criteria and optimised performance data for effectively linking a 2 kW wind turbine generator to the grid; determining socially acceptable turbine installation guidelines; determining the minimum average wind speed for viable operation, and determining the potential for use of this technology on the Canterbury Plains.

Aims and Objectives

The study aimed to assess:

- Minimum average wind speed for a positive economic return.
- Installation guidelines for meeting acceptable sound power levels.
- The total potential for micro wind turbine electricity generation in the Canterbury Plains region.

Methodology

The 2 kW micro turbine installation was undertaken by IRL with assistance from MainPower and Richard Allison who were partners in this project. An extensive list of equipment was required and several equipment failures and the need to relocate the turbine from its original site at the landowners request contributed to delays of 18 months in this project. Once installed measurements were taken of the electrical output, wind speed, and noise levels at selected 1 second intervals. These measurements combined economic data and other long term measurements near the site and at other stations across the Canterbury Plains were used to assess the viability of microwind generation.

Outcomes/findings

The project achieved its outcomes. It was successful in determining critical performance and cost criteria, and while the installation was not viable it highlighted areas that are critical to viability.

Conclusions

The conclusions of this study are:

- i. Electricity production may be economic from similarly priced 2 kW wind turbine installations where the average wind speed exceeds about 8.8 m/s if the temporal wind speed profile is similar to that of the Canterbury Plains.

- ii. For the ZW-2000 turbine the noise limit of 40 dBLA90eq will be met if the turbine is located at least 67 metres from the monitoring point or if turbine speeds are limited by control of the electrical loading conditions which could reduce electrical output.
- iii. Electricity production on the Canterbury Plains using a ZW-2000 2 kW turbine is only viable if feed-in tariffs exceed \$0.68/kWh.

Implications

The research will benefit central government policy makers, local councils and the wider renewable energy community. The research highlighted that microturbine generation may be possible with a different configuration. Further research options are under discussion with the Department of Electrotechnology.

Publications and dissemination

- The report has been sent for cataloguing on the NZ Energy library <http://www.energylibrary.org.nz/documents/EnergyUpdateOct2010.pdf>.
- Journal paper is in preparation to the international journal "Renewable Energy" <http://www.elsevier.com/locate/renene>.
- A précis/summary will be submitted to the EECA News
- Seeking to load the report on the Unitec website and send link to local councils.
- Other options for presentations within NZ are being examined in conjunction with partner IRL.

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