Robert Stuart, IRL

## From desktop to device: wave energy hits the water

This year saw major advances in the WET-NZ (Wave Energy Technology-NZ) project with construction and sea trials of a proof-of-concept wave energy device.

WET-NZ is a collaboration between Industrial Research Ltd (IRL), NIWA, and Power Projects Ltd, funded by the Foundation for Research, Science & Technology.

The proof-of-concept device is a one-quarter scale model of the unique design developed by the WET-NZ team. It is a streamlined device in which power is generated by the device's rotation at a pivot point between the main spar (below water) and the float (on the surface).

This year, four sea trials were successfully completed, all in Lyttelton Harbour. These trials are a staged process, where the team test out how the device responds, then introduce a new element or planned modification.

To date, the device has either been free floating or tethered by a single line. Next, the device will be moved to Wellington so NIWA can trial mooring configurations. In addition, IRL will build a full-scale prototype, required to test the complete electro-mechanical componentry.

www.wavenergy.co.nz

*Top: WET-NZ wave energy device during sea trials at Lyttelton.*

*Bottom: The proof-of-concept device (one-quarter size) hanging upside down in IRL's Christchurch workshop. Power is generated by rotation at the pivot point between the shafts and the float (centre bottom).*

## Home wind turbines: assessing the potential

*"Household wind turbines way of the future", "Would you consider a home wind turbine?", "Home wind turbine cuts power bills"...*

This year, the prospect of micro-scale wind turbines on home roofs sparked the public and media imagination. The consistency and strength of wind at the turbine site is an important factor in whether such technology proves economic. Wind at roof-level tends to be relatively low speed and turbulent, and not all homes are ideally situated, so Vector commissioned NIWA to examine whether some suburbs in a city were better suited for home wind turbines than others.

For such work, we use Gerris – a computational fluid dynamics code which accurately simulates complex wind patterns. We ran Gerris for both predominant wind directions, estimating the mean annual wind speed at grid points 100 metres apart, and mapped the results.

In general, the upper slopes of the hills were best. For a more accurate estimate, we can run Gerris at a finer (e.g., 10 metre) resolution incorporating the effects of the vegetation and the house itself.

Vector

*This Swift Turbine is mounted on the Waitakere City Council building at Henderson, Auckland, for a trial by Vector. The turbine is about 2 metres in diameter and weighs about 50 kilograms. It could provide about a quarter of an average New Zealand household's annual electricity use.*

## Biogas: fuel from wastewater

Imagine thousands of tiny bacteria which thrive on little or no oxygen. In a big city near you, these bacteria are hard at work breaking down sewage sludge. The gas they release is 50–60% methane, and is often collected to generate electricity.

Such 'anaerobic digestion' also occurs in farm effluent ponds and small town wastewater treatment plants, but not very efficiently. The methane-rich gas usually goes to waste.

NIWA is developing and demonstrating pond technologies, especially covered anaerobic ponds, which maximise biogas recovery, achieve better wastewater treatment, and make financial sense.

Highlights this year include:

- Construction of a large-scale demonstration system at a piggery, working with Waratah Farms and the Pork Industry Board. In the coming year, we plan to produce compressed biogas to run the piggery tractor.
- The simple conversion of an 'off-the-shelf' petrol generator to run on biogas from a dairy farm's effluent pond, with the assistance of Entec Services, Auckland.
- Implementation of a full-scale demonstration of biogas collection from anaerobic digestion of algae in the Waihi domestic wastewater treatment plant, in conjunction with Hauraki District Council.

This programme is funded by the Foundation for Research, Science & Technology.

Rupert Craggs, NIWA

*Stephan Heubeck demonstrates a generator converted to run on biogas from a dairy farm effluent pond.*

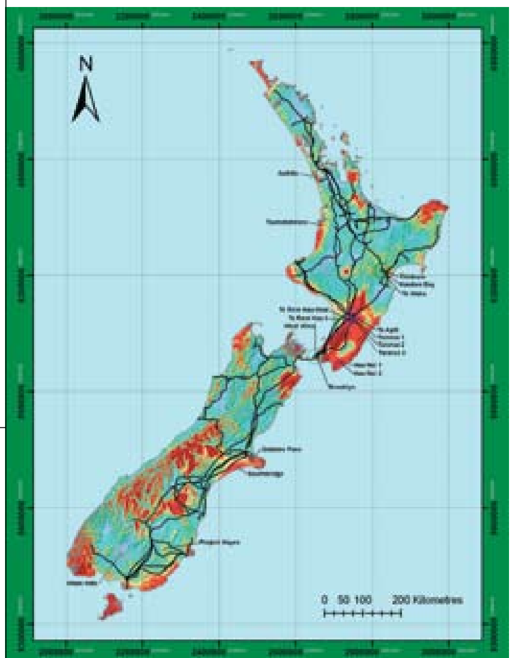
## Framing New Zealand's Energyscape

The debate about New Zealand's energy future is sometimes characterised by vociferous promotion of particular solutions and lip-service to the fact there are no silver bullets. There is little guidance as to how trade-offs between potential outcomes – economic growth, security of supply, environmental sustainability – should be tackled.

The NIWA-led project, The New Zealand Energyscape, will identify the scale of change required to meet a given policy objective, e.g., a greenhouse gas reduction target. What would be the effects, for example, of an energy future dominated by carbon sequestration and biofuels, compared with heavily renewable electricity generation and electric cars?

This year, the Energyscape team developed a series of interlinked maps showing the location and size of energy demand, resources, infrastructure, and constraints on supply. This brings together disparate information, makes it consistent, and displays it clearly for non-specialists. The project runs till mid 2008. By then, the Energyscape framework and database relating all elements of the energy system will be complete.

Energyscape is the first major undertaking of a new alliance of five key energy research providers: NIWA, CRL Energy, Scion, GNS Science, and Industrial Research Ltd. It is funded by the Foundation for Research, Science & Technology.




*Potential wind power density.*

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