NIWA
Taihoro Nukurangi

Climate-Energy Matters

a quarterly newsletter from the National Centre for Climate-Energy Solutions

'Housepower'

New Zealand is set to double its CO_2 emissions from the electricity sector by 2012. Yet the Kyoto Protocol requires us to reduce overall emissions to 1990 levels.

Energy efficiency and renewable energy are the most promising ways to reduce CO_2 emissions and improve the reliability of electricity supply by controlling energy growth and peak demands. But they are so neglected today that the Parliamentary Commissioner for the Environment has given them top priority in his annual assessment of the environmental sustainability of the electricity sector.

So far, most public funding of energy efficiency and new renewable energy has been for large-scale projects. Most of the funding from the Energy Efficiency and Conservation Authority goes to industrial and large-scale commercial efficiency projects, and the 'demand-side' initiatives advocated by companies like Meridian Energy occur only through contract with medium to large-scale customers.

Household energy receives much less attention even though a significant amount of heat is lost through ceilings, windows, walls, and floors. Most householders do not have access to unbiased advice on improving the efficiency of their energy use to save money and make their houses warmer and healthier. Even highly cost-effective hot water cylinder wraps are found in only 4% of houses.

Householders are buying portable LPG heaters, dehumidifiers, and wood burners to try to fix their cold damp houses. Some of these investments are good value, but others are unsuitable (e.g., portable LPG heaters emit exhaust gases into the living area and may cause severe condensation). Sometimes the cheapest options can make the biggest difference, such as cutting trees to let the sun in or hanging curtains to keep in the warmth.

Home insulation, reducing draughts, and damp-proofing are the best investments, but many draughty houses with high ceilings require big space heaters to reach acceptable indoor temperatures in winter. Each household has different needs, depending on its occupants and their hot water needs, the efficiency of appliances, the climate, and the construction of the house itself.

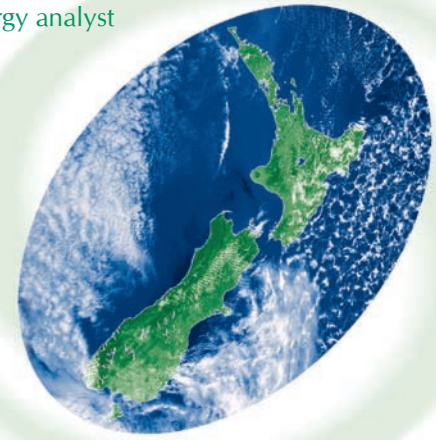
'Housepower' is a vision of householders willing and able to adapt to the increasing cost of electricity supply. 'Home energy use' advisors would recommend mechanisms such as insulation, automatic load management, and active energy management (e.g., the use of efficient wood burners, and switching off appliances when not needed). Participating householders would enjoy more comfort and lower energy bills.

The housepower concept combines community energy action groups, research on household energy end-use and the relationship between indoor living conditions and health, and the market-driven growth of renewable energy for houses. Orion and Eastland Networks already have pricing policies that encourage use of alternative fuels to reduce their network peak demands.

But these benefits will remain sporadic unless energy retailers cooperate. They need to offer a wider choice of tariffs, enabling consumers to adapt their power use to avoid the seemingly inevitable price hikes, and reduce the need to expand generating and network capacity. High fixed charges send the wrong message to consumers – especially small consumers. Commercial motives simply do not drive household energy efficiency.

The Electricity Commission has a golden opportunity to restore balance to New Zealand's electricity planning by giving small consumers – and the world's climate – the attention they deserve.

Molly Melhuish
Independent energy analyst



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Forget the politics and the science: what's climate change going to do to your insurance policy?

Insurance companies see global warming as a serious issue. They accept evidence that it is increasing the frequency and severity of storms and other weather events – and the size of their payouts! The global insurance industry settled an average of 37 major climate related claims a year between 1970 and 1985, but from 1985 to 2002 the annual rate trebled to 110.

Of the largest 20 losses, 18 were natural catastrophes. Of these, 16 were weather related and 14 occurred since 1990. Last year the industry paid out a record US$11.4 billion on natural disaster claims.

Top 10 worldwide insurance losses ($US billion).

Loss	Date	Event	Country
$40.2	2001	World Trade Center	USA
$20.5	1992	Hurricane Andrew	USA
$17.0	1994	Earthquake Northridge LA	USA
$7.5	1991	Typhoon Mireille	Japan
$6.3	1990	Winter storm – Daria	Europe
$6.3	1999	Winter storm – Luther	Europe
$6.1	1989	Hurricane Hugo	USA
$4.7	1987	Autumn storm	Europe
$4.4	1990	Winter storm – Vivian	Europe
$4.4	1999	Typhoon Bart	Japan

In September this year the New Zealand Business Council for Sustainable Development and IAG (Australasia's largest general insurer which trades in New Zealand under the State and NZI brands) held a seminar on 'Climate Change Implications for Small and Medium Sized (SME) Businesses'. The focus was awareness raising, and encouraging SMEs to recognise the implications of climate change.

The bottom line implications for business are:

- **Carbon taxes** – somebody's going to be paying them.
- **Fuel costs** – very likely to increase.
- **Damage insurance** – need more sophisticated cover.
- **Weather and climate** – affects many aspects of business.
- **Global markets** – we are at the mercy of trends beyond our influence.

The seminar delivered information about the effects of climate change on New Zealand business. One of the outcomes was that the biggest challenge facing government, business associations, and the media is to find ways of communicating effectively with the 80% of businesses with fewer than 20 employees.

Even those more sceptical about the issue recognised that small businesses need support to help manage their energy usage and emissions. Climate change is upon us: *'… we can argue about why – but, for whatever reason, the practical side now is how do we deal with it!'*

Weather and climate are core business for insurers. Of New Zealand's top 20 insurance losses, all but two (the Bay of Plenty earthquake in 1987 and the Auckland power failure in 1998) were weather related.

Are these risks and payouts increasing because we are constructing towns and buildings in the wrong places? Not according to the senior actuary at IAG. Although demographics are a factor, the industry still sees a trend that warrants a closer look at how weather-related risks are priced. Premiums are likely to increase in certain circumstances, but may be reduced in lower risk areas.

So how do SMEs respond? They generally won't start to listen until it starts affecting their pocket. The aim is not to penalise businesses, but to reward them. IAG is examining new insurance products that reward lower risk behaviour.

Insurance companies can have a significant influence on consumers. For instance, IAG in Australia is the largest purchaser of white and brown goods (replacing damaged goods). It is trying to change consumer choice by asking 'Will you have an energy efficient version?' The company not only raises awareness of climate change impacts, but also mitigates overall emissions by adopting more energy-efficient practices.

Perhaps government could also do more to reward 'sustainable business' practice.

Gavin Fisher (g.fisher@niwa.co.nz)
Rick Humphries (Ecos Corporation)


Paekakariki floods 2003

A bountiful source of energy

We have a bountiful source of energy in New Zealand that is natural and renewable, has almost no environmental effects, and is highly reliable and predictable. We are talking about power generation from tidal currents.

Let's examine each of those points in turn.

- The tide is caused by the gravitational attraction of the sun and moon on the Earth's waters. The forces involved are huge. Our efforts to use this resource will have an insignificant effect on the moon or sun, so the energy is natural and renewable.
- The environmental effects will be small, with tidal turbines submerged well below the ocean's surface and invisible except for the onshore cables. We're not sure about the effect on marine organisms yet, but we don't think it would be significant (tidal turbines rotate very slowly at 20 revolutions per minute).
- We can predict the tide thousands of years ahead because it is governed by astronomical forces. Therefore, there is no problem with lack of rain or wind, or with the vagaries of El Niño or La Niña. We could also plan in, say, January for the power we would get from our tidal station at 1800 h on the winter solstice.

So, where in New Zealand would be the best places to put tidal power stations? Cook Strait has obvious possibilities and so do many of our harbour mouths.

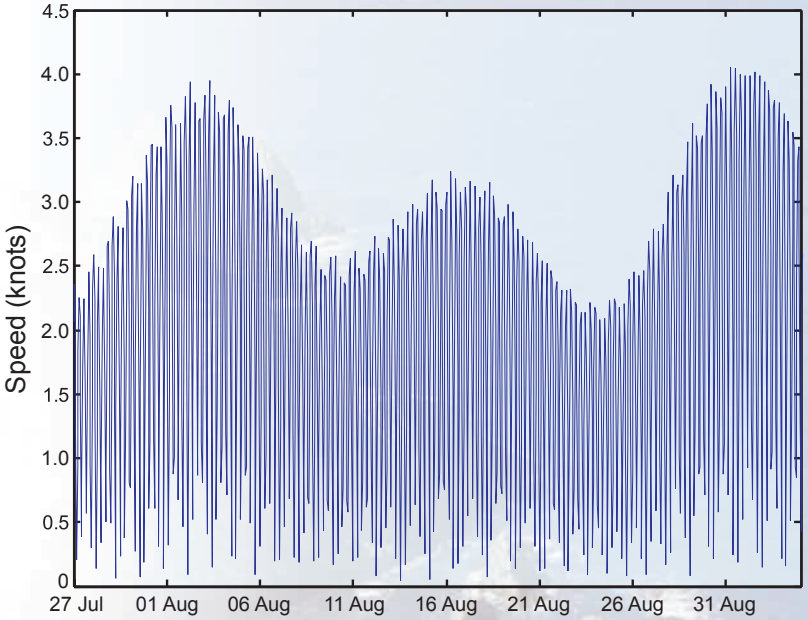
Cook Strait

We have calculated the tidal currents in Tory Channel from 2001 to 2100, and we can predict them with great accuracy. On most days we will be able to generate power for 12 hours a day, but on about 25 August 2019, for example, there will only be a few hours each day when generation will be feasible.

That would be a good time for maintenance, but we should avoid downtime towards the end of the month because that will be a highly productive generation time.

How much power could we produce from a tidal station here? To answer this we would need to know the characteristics of the turbine, including its diameter and efficiency. The table shows the average power and daily energy outputs for a single generator in Tory Channel, assuming 30% of the tidal energy is converted into electricity.

	Turbine diameter (m)	
	6	10
Average power (kW)	6	17
Daily energy (kWh)	145	402
No. of typical houses	5	12



Forecasting tides is precise – this will be the picture in Tory Channel in winter 2019.

Harbour mouths

Harbour mouth tidal flows are huge. They dwarf even the largest flood flows in the largest rivers. The Buller River, for example, has the largest 50-year flood flow of 8000 cumecs. At the mouths of the Manukau, Kaipara, and Hokianga Harbours the tidal flow oscillates ±100 000 cumecs each tidal cycle. This is 12 times larger than the largest flood flow in any New Zealand river – and it happens twice every day! With flows as large as this, huge quantities of sediment are moved across the mouths, presenting a significant engineering challenge to harnessing the power. However, the scale of available energy is so large that it has to be worth investigating.

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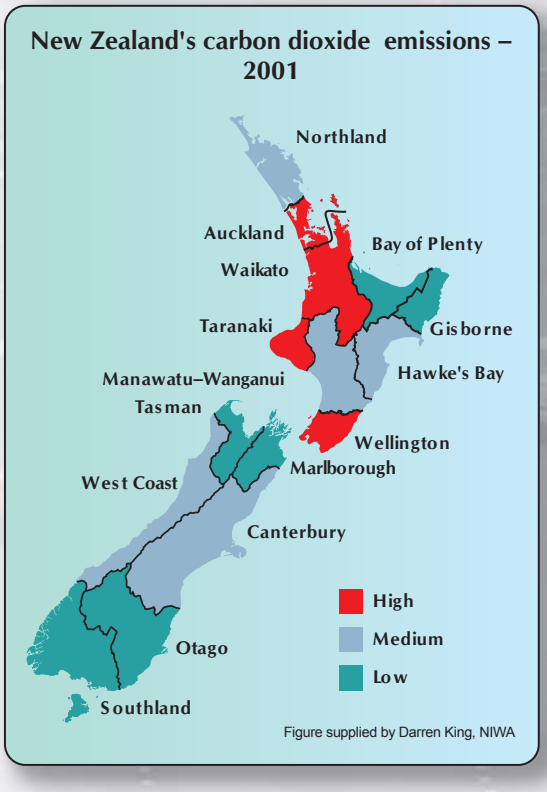
Determining New Zealand's greenhouse gas emissions: who does it and how?

Last December New Zealand ratified the Kyoto Protocol. If it enters into force, this will legally bind us to reduce greenhouse gas (GHG) emissions over the Protocol's first commitment period, 2008–12, to 1990 levels. We will be required to take responsibility for any excess emissions if this is not achieved.

Six GHGs are covered: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF_6). Recent analysis of New Zealand's GHG emissions shows that CO_2 has overtaken CH_4 as our most significant GHG, making up 45% of total emissions in 2001, with CH_4 contributing 38%. Nitrous oxide contributes about 17%, and emissions of HFCs, PFCs, and SF_6 make up less than 1% of the national total.



Work has begun on implementing policies to reduce our GHG emissions. To verify emission reductions we must quantify emissions of the six GHGs for 1990 and for every year since then. Do we have accurate inventories of our emissions for 1990 and for the present? How do we ensure their accuracy? Who is responsible for tabling this information to the United Nations Framework Convention on Climate Change (UNFCCC) to ensure we are complying with our Kyoto Protocol commitments?

Currently the UNFCCC requires an annual inventory report detailing GHG emissions from all anthropogenic sources (energy, transport, agriculture, land-use change, forestry, industry, and waste) by 15 April each year. The New Zealand Climate Change Office collates this information and submits it to the UNFCCC. This national inventory report is used as a benchmark for compliance with the Kyoto Protocol and will be used to establish New Zealand's right to participate in mechanisms such as emissions trading. For New Zealand to participate in international emissions trading, the national inventory report must be internationally reviewed before 2007, and 1990 base year emissions must be fixed. The basic information comes from several government departments, including the Ministry of Economic Development who gather data on energy and fuel use, the Ministry of Agriculture and Forestry, Statistics New Zealand, and various other agencies.

NIWA is involved in research to better quantify New Zealand's GHG emissions. In April this year we measured vehicle emissions in Auckland by remote sensing. One of the aims was to quantify emissions from the New Zealand vehicle fleet rather than rely on data from overseas that are likely to use a different distribution of vehicle types and fuel mix. We are also involved in collaborative research on CH_4 and N_2O emissions from the agricultural sector with AgResearch, Landcare Research, and NzOnet. The research focus for CH_4 includes developing new techniques to verify GHG emissions at the source, and conducting new satellite experiments to quantify emissions at the country scale. This research aims to more precisely estimate the national annual livestock emissions and help develop strategies to reduce them.

In addition to the national inventory report, a national communication is submitted to the UNFCCC every 3–5 years. This details the country's policies for GHG emission reductions, emissions projections, effects of policy measures, climate change impacts and adaptation measures, and research and education programmes being undertaken. New Zealand's next national communication (the fourth) is due early in 2006.

Further information can be found at www.climatechange.govt.nz.

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What are your CO_2 emissions?

Calculate the CO_2 emissions of your household and see how you could reduce them.
Go to: www.niwa.co.nz/ncces