



# IRANZ Connections.

## Applied research: Value for New Zealand

The smart application of science and technology makes a significant contribution to economic growth. Applied research is based on a need identified in the market or current industry practice, and often involves industry or sector partners from its inception.

Applied research is a strength of many IRANZ organisations and this issue of Connections features a number of stories highlighting recent work. You will see research associated with: finding a new use for lamb skins; providing a tool to manage environmental impact processes related to mining; examining the energy impacts of increasing heat pump use; developing a technology that delivers design and water use efficiencies for the irrigation industry; questioning the potential

for steel innovation to hasten economic recovery after earthquakes; and improving productivity and value of the aquaculture industry.

This outcome focused research is intellectually challenging and creates new technological knowledge, but rarely receives the accolades that basic scientific research receives. The Royal Society of New Zealand recently recognised this with the presentation of a President's Award for 'Research-Based Innovation for Industry' to Dr Henry Kaspar of Cawthron Institute. The award acknowledges his research as a key source of intellectual inspiration for the transformation of aquaculture practice in New Zealand.

The potential leverage from applied research is large. With short times to impact, research driven improvements in

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established industries have the potential to add economic gains within a few years, with a low risk profile. Public investment in applied research and the organisations with strong applied research capability provides an attractive value proposition to benefit all New Zealanders.

**Gillian Wratt** CHAIR, IRANZ

## EARTHQUAKE TESTS NEW ZEALAND'S STEEL CONSTRUCTION STANDARDS

The magnitude of the September Canterbury Earthquake was equivalent to only 75% of the design level earthquake standard, but it provided a real test for New Zealand's steel construction design standards.

The Heavy Engineering Research Association (HERA) has been actively monitoring observed structural failures. With the exception of some damage related to some proprietary bracing systems, there were no apparent deficiencies with respect to current design guidance which require immediate action through new research and development activities.

HERA's seismic research programme ensures steel systems are safe to design level in earthquakes and has developed effective seismic resisting frame systems. Today, New Zealand's structural steel design standards and guidelines are world-leading in respect to design against natural hazards with many countries adopting aspects of them.

HERA's seismic research programme has focused on protecting people from harm but the earthquake and its aftermath demonstrates a need for more emphasis on damage avoidance for quick structural recovery. HERA Director, Dr Wolfgang Scholz, says "with research and strategic planning, steel has the potential to lead the development of damage resilient construction systems due to steel's inherent attributes." These include ease of repair or strengthening; flexibility in design; recyclability; increased productivity through

offsite construction technologies; and the ability to augment other building materials, which do not possess the required strength and ductility. "Ultimately, the goal is to minimise the total cost of an earthquake to individuals, businesses and communities."

[www.hera.org.nz](http://www.hera.org.nz)



**SEISMIC FORCES-RESISTING SLIDING HINGE JOINTS APPLIED AT THE UNIVERSITY OF AUCKLAND BUSINESS SCHOOL**

# CRL Energy provides tools for environmentally sustainable mining

New Zealand is a mineral-rich country, particularly when it comes to gold and coal. In addition, there is growing interest in iron sands and minerals which have recently become important such as rare earth elements. New Zealand's onshore minerals, excluding hydro-carbons, have an estimated value of \$194 billion. Our offshore potential may be in excess of this. Given the size of this potential, the Government regards the environmentally responsible development of New Zealand's mineral resources as a priority.

To support environmentally responsible development of future mines, CRL Energy spear-headed a multidisciplinary team which produced a framework to assist users through consent processes, access negotiation, and assessment of

environmental effects.

The framework focuses on water quality issues associated with coal and gold mining, specifically pH, metals and, to a limited extent, suspended solids. Drawing together research on rock geochemistry, aquatic chemistry, freshwater ecology, aquatic toxicity, as well as management and treatment techniques for mining, the framework provides data collection and decision processes for predicting water quality prior to mining, monitoring discharges from mines, and identifying mining-related impacts. In addition, the framework includes guidance on innovative techniques for prevention of poor water quality in mine drainages and optimal strategies for management of mine waste, overburden and treatment of mine drainages.

The research team, which includes CRL Energy, Landcare Research, University of Canterbury's School of Biological Sciences and the School of Geological Sciences at University of Otago, presented the framework at a workshop held in July in Christchurch.

Supported by the Foundation for Research, Science and Technology, the framework is available from the CRL Energy website.

[www.crl.co.nz](http://www.crl.co.nz)



## Aqualinc determines economic cost of irrigation regulations

Setting a limit on the amount of water a farm can use for irrigation is a simple and powerful method for encouraging more efficient irrigation and reducing nitrate leaching risks. Water-use limits could impose significant economic costs but estimating these costs has been problematic due to the complexity of farm systems.

Recently Aqualinc developed a robust method for quantifying the cost to farms of proposed water irrigation regulations as part of Lincoln Venture's Foundation for Research, Science and Technology funded groundwater allocation research programme. Aqualinc modified CSIRO's AusFarm model to incorporate New Zealand irrigation systems and water permit conditions. AusFarm analyses different farm management practices and their effects on farm production. Using this modified model, irrigation water limits under consideration for a typical 210 hectare dairy farm in the Canterbury Central Plains region is estimated to result in a \$70,000-\$88,000 reduction of its average annual earnings before interest and tax (EBIT), depending on the irrigator design. Dr John Bright explains "this is an approximate 25% reduction in EBIT so a significant decrease in farm earnings."

Good water allocation decision making process requires analysis of the effects on environmental, economic, cultural and social values. Methods for assessing the effects of allocation policy on environmental and intrinsic values were researched in other components of Lincoln Venture's groundwater allocation research.

[www.aqualinc.co.nz](http://www.aqualinc.co.nz)



**DR JAMES POPE (CENTRE) LEADS A STAKEHOLDER FIELD TRIP TO EXAMINE REHABILITATION TRIALS AT AN ACID MINE DRAINAGE-AFFECTED SITE**

## Sheep Leather Footwear Innovation

*LASRA puts its best foot forward!*

Exports of sheep skins and cattle hides are worth \$500 million annually to the New Zealand economy. Whilst New Zealand fellmongers and tanners have traditionally relied on the leather garment market for lamb skin revenues, revenue is diminishing due to declining sheep numbers, and the garment market faces risks from fashion trends, economic downturns and competition from the emerging industry in China.

In response to these challenges, Leather and Shoe Research Association (LASRA) identified the larger footwear leather market as being more stable and capable of supporting higher prices. However, footwear application places greater processing and wear demands on leather.

Supported by funding from MIRINZ Inc., Beef + Lamb New Zealand and LASRA's industry member companies, LASRA recently completed a three year programme

investigating the suitability of lamb skins for this more physically demanding application.

Initial investigations aimed at identifying the ideal lamb skin found blackface skins performed best, but with milder processing in the fellmongery and the use of an unusual metal salt for tanning, much of the available crossbred lamb skins could be made suitable. Changes aimed at optimising the retanning and fatliquoring (chemical softening with fats) stages produce leather of enhanced intrinsic strength and performance. When compared against 14 footwear relevant performance parameters, the lamb leather matched, and in some cases exceeded the performance criteria of a cattle shoe leather benchmark.

With a projected conversion benefit of \$15.90 per skin, LASRA calculates the added value could be worth \$175 million to the New Zealand economy per year.

[www.lasra.co.nz](http://www.lasra.co.nz)

## Cawthron scientist honoured for research-based innovation for industry

A Cawthron Institute scientist who initiated the world's first mussel selective breeding programme has been honoured for his role in aquaculture research and development in New Zealand.

Dr Henry Kaspar received a special award at the Royal Society of New Zealand's Annual General Meeting for "Research-Based Innovation for Industry". Royal Society President, Dr Garth Carnaby, says it is a 'one-off' award in recognition of the work being delivered by Cawthron's shellfish breeding programme, under Dr Kaspar's leadership, and of its potential value to New Zealand.

"The potential impact of his research for New Zealand can only be regarded as enormous. If the shellfish industry is no longer reliant on wild spat, then selective breeding can begin and rapid genetic gains could give the New Zealand industry an unassailable ten year lead."

Ted Culley, the Aquaculture Manager at Sandford Ltd, which currently harvest around 21 thousand mussels annually, says Dr Kaspar has effectively opened the door for major innovation.

"Henry's work will help industry take a step change in terms of its grow-out characteristics and productivity of water space."

Dr Kaspar continues to collaborate with industry towards industrial mussel hatcheries, and to determine the shellfish most likely to succeed as New Zealand's next aquaculture species.

[www.cawthron.org.nz](http://www.cawthron.org.nz)



**ROYAL SOCIETY OF NEW ZEALAND'S PRESIDENT DR GARTH CARNABY PRESENTS AWARD TO DR HENRY KASPAR**

## IRRICAD:

*Setting the standards in irrigation design software since 1988*

With climate change, growing population demand, and increasing restrictions being placed on water resources, the irrigation industry is under pressure to supply technologies that use water more effectively. IRRICAD is a responsive design tool created and continually adapted by Lincoln Ventures to meet these changing needs.

From its launch in 1988, IRRICAD is now used by over 90% of New Zealand's irrigation industry and is the leading irrigation design programme internationally. Originally Lincoln Ventures identified there was no computer aided design package for irrigation which would deliver significant accuracy and efficiencies for the agricultural and horticultural industries. Using Lincoln Ventures' irrigation engineering and computational

knowledge, the technologies were linked and in doing so, increased the professionalism and precision of the irrigation design industry.

IRRICAD produces in seconds a range of hydraulic reports that would take hours to calculate manually. It can be used to design all kinds of pressurised irrigation systems including: sprinkler systems, turf systems, water reticulation and dust suppression systems, irrigation for golf courses and sports fields, and a wide range of agricultural systems. It can size pipes to meet pressure and velocity specifications and will flag warnings when ranges or ratings for these specifications are exceeded. Lincoln Ventures has invested strongly in continuous programme development and ongoing technical support.

[www.lvl.co.nz](http://www.lvl.co.nz)

## Marsden funding for toxic sea slugs

Last year, Cawthron Institute discovered the deadly tetrodotoxin in sea slugs that were causing dog deaths on Auckland beaches. Cawthron and university collaborators have now pieced together funding from a number of sources to further explore this phenomenon including a successful Marsden proposal led by Professor Craig Cary of Waikato University and Dr Susie Wood of Cawthron. With colleagues from Waikato University, Massey University's Allan Wilson Centre, the University of New South Wales, the Hauraki Maori Trust Board and the Auckland Regional Council (ARC), and funding from ARC, FRST, Nga Pae o te Maramatanga, Cawthron and the universities, a range of research projects are underway to help understand the risks and biology of tetrodotoxin in sea slugs.

[www.cawthron.org.nz](http://www.cawthron.org.nz)

## Bigger trucks

TERNZ has developed six pro-forma over-dimension vehicle designs to assist the transport industry with designing vehicles to utilise the provisions of the May 2010 amendment to the Vehicle Dimensions and Mass Rule 41001. This rule allows heavier and longer vehicles to operate on sections of the highway network.

Commissioned by the New Zealand Transport Agency (NZTA) and the Truck and Trailer Manufacturers Federation, vehicles based on these designs have low speed turning performance that was no worse than the worst-case standard vehicle. These vehicles will have complete access to the network at standard weight limits and access to approved routes at higher weight limits.

The pro-forma vehicle designs can be seen on the NZTA website.

[www.ternz.co.nz](http://www.ternz.co.nz)



# Heat pumps on the rise

In 2004, BRANZ completed research in the Household Energy End-Use Project which found only 4% of households had heat pumps, and further that 50% of the space heating energy was 'invisible' to regulators and energy suppliers as it was delivered via solid-fuel burners. Nationally, that corresponds to half of the annual electricity generated by the Huntly power station.

A 2007 follow-up report highlighted concerns that heating and cooling behaviours were beginning to change. There were increasing winter loads and a 'summer peak' had emerged or a new load on the electricity grid corresponding with people using their heat pumps to stay cool in summer. This was found to be especially true in houses with subsidised heat pump installations



**INSUFFICIENT GROUND CLEARANCE FOR HEAT PUMP OUTDOOR UNITS IS A COMMON INSTALLATION PROBLEM**

where they had replaced a solid-fuel burner to help meet local clean air targets.

What are the national energy implications of such a steep growth in demand and what are the social factors which underpin use of heat pumps? The three year project examining these questions is now entering its second year. The first year's work concentrated on installation quality and its energy impacts, uncovering some areas needing attention. The 'service' that the homeowners are getting from the heat pumps is now being examined. From a national financial perspective, this will have the biggest impact. Kiwis are learning that they can be comfortable in their homes, and the national grid will need to cope.

[www.branz.co.nz](http://www.branz.co.nz)

## Using road design to lower speeds

Transport Engineering Research New Zealand (TERNZ) has been exploring the effectiveness of self-explaining roads (SER) in Point England, Auckland. The aim of SER is that different classes of roads should be distinctive and drivers would perceive the type of road and 'instinctively' know how to behave, reducing the need for traffic signs or traffic regulators.



The study used SER principles to treat an area that included 11 kilometres of roads. Local roads or low capacity roads received landscaping and community islands to limit forward visibility and removal of road

markings. Roads categorised as collectors or moderate-capacity roads received increased delineation, addition of cycle lanes and improved amenities for pedestrians.



Prior to SER treatment, both local roads and collector roads had mean speeds of approximately 50 kilometres per hour (kph) but there was a large variation in speeds on both types of road. Speed data collected 3 months after implementation showed significant reduction in speed to 30 kph on local roads and decreased variation of speeds on both local and collector roads. In addition, residents' perceptions of normal

and safe speeds for each type of road decreased after SER treatment. Interestingly, new data reveals that at four local streets over four non-consecutive days that the mix of the total road users changed after SER treatment. The proportion of vehicles decreased and proportion of pedestrians increased. Senior Researcher Dr Hamish Mackie says "it appears that the low speed environment in the local roads has led to more confident pedestrian behaviour and possibly a re-balancing of users on these roads."

[www.ternz.co.nz](http://www.ternz.co.nz)



### Who we are:

IRANZ is an association of independent research organisations. Its members undertake scientific research, development or technology transfer. Members include Aqualinc Research Ltd, BRANZ, Cawthron Institute, CRL Energy Ltd, Heavy Engineering Research Association (HERA), Leather & Shoe Research Association (LASRA), Lincoln Ventures Ltd, Opus Central Laboratories and Transport Engineering Research NZ Ltd (TERNZ).

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