

ENERGY MAD



The name says it all. This young Christchurch-based company *is* energy mad – and determined to save electricity, consumer dollars, and defer expensive investment in electricity infrastructure. Their first initiative is a runaway success and has been touted as the largest single energy-saving project of any sort ever staged in New Zealand. LETTICIA DODSON gets the low-down on Energy Mad's bright idea.

THE THEORY IS SIMPLE: compact fluorescent light bulbs (CFLs) use less electricity. If New Zealand householders could all be persuaded to install a few we'd lower our peak electricity demand and reduce pressure on transmission lines; our overall demand would fall, allowing us to defer investment in new generation options; and we'd all save some money.

Until recently, however, New Zealand householders *haven't* been convinced. And it's little wonder. Compared to standard incandescent bulbs, CFLs were expensive; they'd break or "blow" often; were annoyingly slow to light up; weren't as bright as "normal" bulbs once they did – and they were ugly!

But with a whole lot of entrepreneurial energy and a good dose of innovation, engineers Tom Mackenzie and Chris Mardon GIPENZ have come up with a solution – a bright and aesthetically-pleasing CFL, and a novel way of introducing it at a competitive price.

A bright idea

Energy Mad evolved from a heated debate between the university friends. Mr Mackenzie had been reading a book about energy efficiency which said that if all New Zealanders installed energy-efficient light bulbs there'd be no need for the now shelved Project Aqua. Amazed, Mr Mackenzie put the concept to Dr Mardon who vehemently disagreed – until he did a couple of calculations: "I discovered that Tom was right on the money," says Dr Mardon, "energy-efficient light bulbs are actually a very effective way of reducing peak network load and saving electricity. It certainly got us thinking."

Eighteen months, screeds of calculations and a business plan later, the friends became business partners. In 2004 Mr Mackenzie and Dr Mardon established Energy Mad with a vision of lessening the effects of climate change by increasing the nation's energy efficiency. Their first objective was "to get five energy-saving bulbs into 55 per cent of homes in New Zealand". By doing so they hoped to save enough electricity to power a city as large as Dunedin, save domestic consumers money, and buy time for electricity transmission companies and suppliers.

But besides conviction, Energy Mad needed a good product. And so began a worldwide search for a suitable prototype; over 100 energy-saving bulbs were tested and the best, sourced from China, was selected for further development. "It was imperative that we undertook advanced development to meet New Zealand's specific consumer requirements," says Mr Mackenzie. "The demise of previous energy-efficient lighting campaigns had shown us that a non-customised bulb didn't cut it." To sell the product in New Zealand they had to ensure a good light output, compact size, attractive shape, long life, and switchability (tolerance of on/off switching). "Many of these features can only be achieved by customising a bulb to New Zealand's unique transmission conditions."

To maximise the benefits to the nation's electricity networks, Energy Mad added a high power factor and low harmonic emissions to the bulb's development criteria. Low-power-factor devices use more current, and therefore require more lines capacity. For example, in very simple terms, a typical 20W CFL has



The Energy Mad team worked through an extensive modification and testing regime. The development process was overwhelmingly successful, resulting in the high-performance 20W "Ecobulb".

a power factor of 0.5 and requires 40W of transmission capacity (20W/0.5), while a 20W CFL with a power factor of 0.9 will only require 22W of transmission capacity (20W/0.9).

Harmonic emissions are best described as electrical noise; like turbulent flow in a pipe, harmonic emissions are disruptive and can interfere with control systems such as ripple control.

Earlier efforts by other manufacturers to raise the power factor of energy-saving bulbs and to lower harmonics had resulted in expensive bulbs with lower light output, a shorter life, and poor switchability. Unwilling to compromise, the Energy Mad team worked through an extensive modification and testing regime with their manufacturers. The development process was overwhelmingly successful, resulting in the high-performance 20W "Ecobulb" which was rated first in an energy-saving light bulb test conducted by the Consumers' Institute in October 2005.

The 20W Ecobulb has a power factor of 0.93, requiring only 22W of transmission capacity and giving a peak load saving of up to 18W

It's been a roller-coaster ride for Energy Mad's two young Directors. In less than two years they've taken a simple, and previously failed, concept and made it an astounding success.

over other CFLs. It is also seven times kinder on harmonics.

And although the Ecobulb only uses 20W of energy, the Consumers' Institute measured it to be 29 per cent brighter than a 100W incandescent bulb – giving an energy saving of over 80 per cent for an equivalent light output.

While Energy Mad prefers to keep the details of the customisation private (a patent is pending), part of the solution lies in the shape of the bulb: while many CFL manufacturers have opted for the 3U shape, which disperses the light horizontally (making them appear less bright than a conventional 100W bulb), the 20W Ecobulb is shaped in a spiral, which directs light downward.

As for the “annoyance factor”, a spinoff benefit from designing the Ecobulb specifically for New Zealand's 230V/50Hz electricity supply has been a reduction in the time the bulb takes to reach full light output – about 60 seconds compared to two or three minutes for other CFLs.

Switchability and length-of-life testing also rate the Ecobulb highly. Outstripping most of its competitors, the Ecobulb's on/off switching performance exceeds 10,000 cycles. Its 10,000-hour bulb life – or nine years of average use (three hours a day) – is more than twice that of most other energy-saving bulbs. Compared with a standard incandescent bulb, the Ecobulb is light years ahead, lasting up to ten times longer.

In consumer surveys, aesthetics and price dominated CFL purchase decisions, so they rated highly on Energy Mad's list of desirable features. Shorter and squatter than other CFLs, the Ecobulb is designed to be a similar shape to, and only about 11mm longer than, incandescent bulbs. Not only are Ecobulbs more attractive than other CFLs but they can be inconspicuously integrated into most conventional fittings.

Pilot

With the technical problems addressed, the matter of pricing remained. One of the biggest challenges facing energy-efficient lighting campaigns is cost. “Energy-efficient bulbs are more expensive to manufacture than standard incandescent bulbs. Other failed campaigns had tried to pass this increased cost on to the consumer but our market research indicated that consumers aren't willing to pay \$7–\$8 for a CFL – which is what other good CFL brands retail at. Although they may recognise the benefits, consumers will stick with \$1 energy-hungry incandescent bulbs,” says Mr Mackenzie.

Energy Mad's solution was an innovative partnership plan enlisting the funding and promotional support of local energy trusts (major shareholders in lines companies), distribution or

electricity retail companies, and the Electricity Commission. The project – dubbed the New Zealand Household Efficient Lighting Project (HELP) – was piloted in South Canterbury in November 2004.

With funding partners in place, Energy Mad was able to put together a very attractive promotional deal offering consumers five Ecobulbs for \$10. “Even so, our Ecobulbs were still marginally more expensive than incandescent bulbs, but we made sure our marketing material emphasised the 80 per cent power savings and translated it into consumer-friendly terms,” says Mr Mackenzie. For example, an average household could save up to \$136* in power savings per bulb. If a household installs five Ecobulbs they can save up to \$680 over the life of the bulbs, or around \$75 a year.

Consumers were quick to work out that their potential savings would more than offset the slightly higher cost. Consequently Energy Mad sold out of Ecobulbs during the first promotion, shifting a total of 62,000 bulbs. Participation was high, with 65 per cent of homes purchasing the Ecobulbs.

The success of the pilot project meant that Energy Mad's subsequent Ecobulb projects – Network Tasman, Christchurch, West Coast, North Otago, North Canterbury and Wellington – commenced with full endorsement by the Energy Trusts of New Zealand.

A measurable difference

Besides developing a customised energy-saving bulb and a creative partnering process, the Energy Mad team came up with a low-cost method of measuring their contribution to peak network load reduction and electricity savings.

Using Canterbury as their test area, they measured lighting usage in 50 South Canterbury and 50 North Canterbury homes, using data loggers installed on five Ecobulbs in each home. This novel use of data loggers overcame the expense involved in the more traditional method of wiring directly into lighting circuits.

A complex analysis was then undertaken, from which the electricity savings could be calculated. The same data was also used to calculate carbon dioxide emission reductions. These measured results can then be extrapolated for other HELP initiatives to calculate energy savings and peak load reductions in other centres.

Saving the world

It's been a roller-coaster ride for Energy Mad's two young Directors. In less than two years they've taken a simple, and previously failed, concept and made it an astounding success. But instead of taking a

* Assuming a 100W incandescent bulb is replaced with a 20W Ecobulb used on average 3 hours/day at a cost of 17c/kWh. The life expectancy of an Ecobulb is 10,000 hours (or 9.1 years of average use).

CFL bulbs

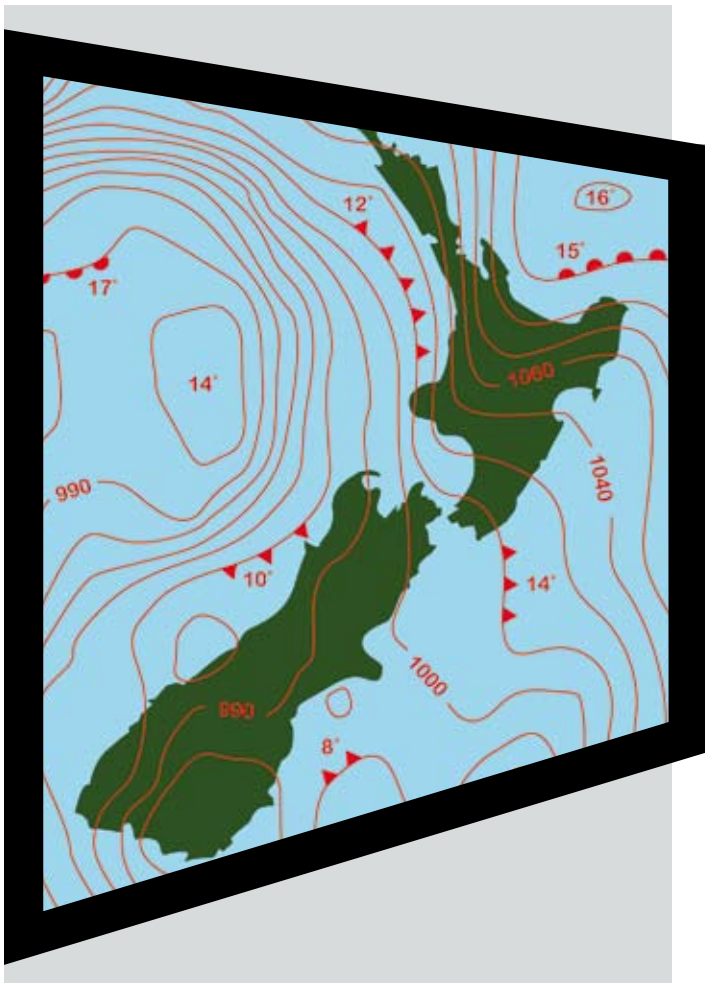
Energy-saving CFL bulbs consist of two parts – a gas-filled tube and a ballast. The gas in the tube glows with ultraviolet light when electricity from the ballast flows through it. This in turn excites a white phosphor coating on the inside of the tube, which emits visible light throughout the surface of the tube. Incandescent bulbs work differently. Most of the electricity they use heats a tungsten filament until it glows white hot. As a result, incandescent lamps use more electricity to produce the same amount of light.



break, Mr Mackenzie and Dr Mardon are brimming with new ideas and are keen to see them implemented: "Light bulbs are only the tip of the iceberg. We have a lot of other energy-saving ideas and now that we have earned a good reputation and industry support, we'll be looking at implementing some of them in the near future," says Mr MacKenzie.

Although mischievously evasive about the specifics, the energy mad pair clearly have plans, big plans, and with their own brand of engineering innovation and entrepreneurial enthusiasm they'll get there – hopefully taking New Zealanders with them towards a more energy-efficient future.

Leticia Dodson is Managing Editor at IPENZ Engineers New Zealand.



The inspiration behind Colt ventilation systems.

It's all about moving air around utilising the powerful thermal currents already present in buildings: smoke or fume-filled air or air that is too warm – to create safer, more comfortable environments.

And with a Colt system, that can be achieved naturally in any space, from a car park or factory to an office block or shopping mall. If it comes from Colt, you know you're getting true innovation, by design.

- Louvre systems
- Smoke and fire control
- Solar shading
- Natural ventilation
- Car park ventilation

For more information, please contact Colt Products and Systems Wellington (04) 913 2072, Auckland (09) 579 8142 or email coltnz@aquaheat.co.nz

Colt is an international award winner for louvre design. It is the only New Zealand produced louvre range performance tested to the NZ Standard AS/NZS 4740:2000.

COLT

Colt is an ISO 9001:2000 accredited company and a member of the Aquaheat group. www.colt.co.nz P.O. Box 51-031 Tawa, Wellington, NZ

COL/601/Enz