

One kilometre to the coconut

News of a simple, low-cost means of extracting oil from coconuts has captured the attention of just about every country you could think of with bunches to spare.

The technology, developed by scientists from the Australian National University (ANU) and CSIRO, has already delighted Pacific Islanders. It relieves their dependence on increasingly expensive diesel oil and enhances the value of one of their most plentiful natural resources.

Since demonstrating the process in October, scientists have had requests for information from places such as Papua New Guinea, Surinam, Brazil, the Caribbean, the Seychelles, Sabah, Singapore, the Philippines, Sri Lanka and the Solomons.

Coconut oil can be used to power trucks, generators and outboard motors. But until now, the extraction process has been too complicated to be done on a household or village basis. The search for alternative methods has been led by an agricultural economist with the Economics Department of the Research School of Pacific Studies at ANU, Dr Dan Etherington.

'The solution came to me at home as I was sealing a caravan roof with a caulking gun,' Etherington says. 'I realised that a modified caulking gun would be an ideal way of squeezing oil out of grated coconut, instead of the 20-tonne bench press I had been using. That would allow ordinary island households to get oil when they needed it. As a vehicle fuel they can get about one kilometre to the coconut.'

Etherington says diesel costs the islands about \$100 million a year, and using coconut oil could save about \$20 million.

The usual method of extracting coconut oil requires expensive motorised screw-presses operating under high pressures. But Etherington noted that if the temperature and moisture content of the grated coconut were right (about 10-12%), the oil could be extracted easily.

Measuring water content

Etherington worked with Dr Ian White and Steve Zegelin of CSIRO's Centre for Environmental Mechanics to measure the water content of the grated coconut. They used the Time Domain Reflectometry (TDR) technique where a fork-like probe attached to a box of electronics is inserted in the material. The TDR provided an instant readout of the water content of the coconut. This is being used to develop a simple recipe for determining when the coconut is sufficiently dry to extract the oil.

Dr David Hagen of AcrossTech is helping with the mechanical engineering aspects of using coconuts for power. He accompanied Etherington to Vanuatu and the Solomon Islands, and adapted three engines to run on coconut and diesel fuel. Hagen showed the islanders how to clean the oil with a simple sand and charcoal filter.

Coconuts are widely grown in the Pacific Islands, the Philippines, Indonesia, India, Malaysia, Vietnam and Papua New Guinea. Coconut oil is a cosmetic and cooking oil, but because expensive presses are needed to extract the oil, most coconut is exported as copra. Copra prices have fallen to a quarter of post-war levels, and as all the processing is carried out off-shore, little employment is created.

Etherington's work is supported by the Australia and Pacific Science Foundation, and collaborators include the Department of Mechanical Engineering at the University of Wollongong, and CSIRO.

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Dr Dan Etherington grates coconut on a modified exercise bicycle. The demonstration sparked a flurry of interest from coconut-rich nations.

Mathematical solutions

How many trees can a forest stand to lose? How does chimney exhaust move through the atmosphere? How many kangaroos are hopping around the outback?

Who can produce the models to help answer these questions? A mathematician can.

Mathematicians from across the country are preparing to tackle environmental questions such as these during a five-day workshop at Newcastle in February.

Every year the Mathematics-in-Industry Study Group gathers about 100 mathematicians to solve problems presented by Australian industries. This year they would particularly like to hear from organisations involved in environmental management.

The techniques used by mathematicians are ideally suited to addressing many challenges in environmental management.

At the last study group meeting an oil company wanted to understand the mixing of two oils when one was introduced via a nozzle to a large tank containing the other. The mathematics involved here — fluid mechanics — can also be used to model the way a sewage outflow pipe might disgorge into the ocean. Similar techniques would give information about the way exhaust from a chimney is dispersed in the atmosphere.

The study group is headed by Dr Kerry Landman from the Mathematics Department at the University of Melbourne. Sixty-three problems from 39 organisations have been studied since the group was founded in 1984 by CSIRO's Division of Mathematics and Statistics.

The division produces a quarterly news sheet for industry called *Competitive Edge*, mailed free to more than 3 000 people in government, transport, mining, construction, finance, services and manufacturing sectors. It details how 'maths and stats' can solve problems facing managers in these and other sectors.

People involved in environmental management may be interested in receiving *Competitive Edge* to see how problems such as interpreting water quality data and designing wetlands are being tackled by CSIRO researchers.

To discuss ideas for the workshop, contact Dr Kerry Landman, Department of Mathematics, University of Melbourne (03) 344 6762, fax (03) 344 4599. To receive *Competitive Edge*, contact Carrie Bengston at the CSIRO Division of Mathematics and Statistics (02) 325 3225, fax (02) 325 3200.