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LEADING EDGE

Leading Edge, supported by the Society for Engineering in Agriculture and the Australian Centre for Precision Agriculture, provides a local and worldwide window on engineering and PA research.

Future energy could start down on the farm

By Gary Alcorn

As fossil fuel energy supplies peak, then become scarce and ruinously expensive, the role of the agricultural engineer will change from refining complex technologies to applying long-established principles suited to simpler needs.

Farms will become the mini-energy centres of the future as growers embrace tried and tested processes to produce biogas and electricity for home, shed and regional consumption.

Biogas convert Paul Harris from the School of Agriculture Food and Wine at The University of Adelaide is enthusiastic about promoting farm 'waste' as raw material for biodigesters producing methane for cooking and heating.

Other digesters will produce biofuels for stationary and mobile engines. Cane, cotton and cereal growers will be able to convert fibrous 'waste' or by-products to useful energy products.

The role of farm animals from broilers to horses will change as their waste becomes the raw material for on-farm energy production.

"I have been researching simpler energy production systems for some years and I have seen how the KISS (keep it simple Simon) principle works well in developing countries where new or western technologies are totally inappropriate," he said.

During a recent trip to Cameroon in Africa he built a simple anaerobic digester to produce methane gas for home cooking fires. This cheap apparatus uses vegetable and animal waste to produce small amounts of methane for cooking.

The current alternative is using chain saws burning expensive fossil fuels to fell introduced Australian eucalypts for firewood. The resulting dense smoke haze also produces eye and lung irritations, Paul said.

Still in Cameroon, hiring a contractor with a dozer (the traditional western approach to dam construction and repair) was deemed inappropriate and expensive so 100 local workers would be recruited to perform the same task manually. This was a typical 'horses for courses' approach to match needs to resources, he said.

In Tibet, growers were being 'educated' to use fossil fuels hauled from China to power small tractors to replace traditional low-maintenance bullocks as plough pullers. Is this 'progress'?

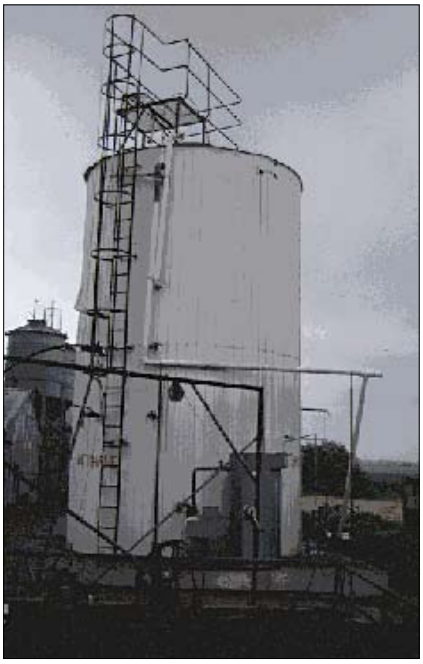
"I always refer my students to a favourite quote by Albert Einstein — 'things should be as simple as possible but no simpler'.It reminds me of a question posed to University of Melbourne tractor tester, Bill Brown.

"He was asked if there was a motor which could be left lying around for ages, it didn't matter if it got wet or anything and would start easily as soon as you picked it up.

"Well that's already been invented, he said, it's called a mule, it goes as soon as you catch it, they'll look after themselves, it doesn't matter if they get wet and may just need a kick to get going."

Paul is a great believer in energy equations for defining real efficiency — how much energy goes into a process to deliver a certain quantum out the other side.

He is adamant biogas can be a very efficient fuel if it is consumed close to its production site and in its natural form. But



This six metre high, 65 cubic metre continuous flow digester processes piggery effluent to produce biogas at the University of SA campus at Roseworthy.

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Biogas course participants instal a small demonstration poly plug-flow digester at the National Polytechnic in Bamenda, capital of North-West Province in Cameroon.

compression (as methane will not liquefy at ambient temperatures) and transport can quickly negate the low production cost, he said.

Numerous examples of the role of biogas made by a plug flow digester using anaerobic processes and links to other energy options can be found on his website: http://www.ees.adelaide.edu.au/people/soil/pharri01.html

"You will see on my website I recommend you get electricity directly from wind, solar or hydro. For mobile uses you need liquid fuel, so biodiesel or ethanol can be considered.

"The way we do ethanol at the moment is hopeless. Maybe it can be done better, I don't see it as renewable and it's competing with food as well.

"Biogas or producer gas is better used for stationary stuff so it can be used efficiently," he said.

Individual responsibility for energy generation, consumption and waste disposal would encourage high levels of efficiency and more ownership of the generation management, he suggests.

What would an individual household total energy generation and management system require besides commitment to make it work reliably?

Paul sees household units harnessing human and kitchen waste as inputs to the slurry based-digester for methane to service cooking and some water heating supported by solar boosters.

In small households a bucket-sized digester powered by kitchen scraps is feasible and on the drawing boards.

"At home we have solar water heating for showers which is fine for six months in Adelaide but we need an electric booster for the winter months.

"You could use a hot water system piped through the back of a slow-combustion stove, that's well established technology where firewood is plentiful.

"You can tap photo-voltaic cells for electrical appliances and use a push bike for transport in some areas. It's amazing how you can reduce total energy consumption with very little effort," he said.

Paul believes ag engineers can show the way because they understand the innovation primary producers show in using every resource efficiently.

MIGHTY DUCKS LEAD THE LIST

In biogas production ranking one pig equals 12.5 ducks.

Paul Harris's web site contains some fascinating links.

Animal manure is a very handy source of raw material for anaerobic digester units to produce methane gas. Cotton and sugarcane growers could consider diversifying into animal production and use waste products for energy generation. It's handy to know ducks, which manufacture approximately 0.33 kg manure per day, are very efficient producing about 8.91litres biogas per kg of animal per day compared with 3.13 litres biogas per kg from beef cattle.

Ducks top the power per kg animal weigh in, with 2.41 W per kg per day compared with 0.67 W per kg animal per day for cattle and pigs at 1.29 W per kg animal per day. This assumes ducks weigh three kg, pigs are 70 kg and beef cattle 500 kg.