

As Judged by your Piers

Forestry's engineering friends

Forestry and engineering are kindred disciplines, attracting the same sort of people. They use scientific knowledge to achieve a practical purpose, and their long-lasting achievements are judged by the harshest of tests: including accountants' arithmetic, cataclysmic cyclones, and foibles in fashion. But even within those constraints, some imaginations soar in search for technical solutions to difficult problems.

Dr. Chris Bathurst believes New Zealand should be "on a war footing" over Peak Oil and Global Warming. The Energy Efficiency and Conservation Strategy was to electrify or convert to part-biofuel some 80% of New Zealand's vehicles by 2015, but Chris realised this would put an impossible strain on electricity and biofuel supplies. Some potential power sources are too unreliable or expensive, others too minor. At the same time, David Beach, a retired physicist with a background in energy, had identified tidal power as the most promising option, using the vast currents that flow through Cook Strait four times a day and had written to the Christchurch Press. Unlike most other forms of energy, the ultimate origin of this power is not the sun - it is the gravitational attraction between the earth and the moon - and it is entirely predictable. Chris contacted David, and together these two have formed Neptune Power Ltd to develop this huge resource.

The project appears to have the full support of the Planning Authorities, Lines Companies and other stakeholders. It involves suspending large, buoyant turbines - made of carbon fibre in New Zealand - from the ocean floor at some 90 metres below sea level. At this depth there is little light and low biological activity, except perhaps for migrating whales or dolphins. It is unlikely that marine life would be affected, given that the proposed turbines have no central axle and are slow-moving, but prototype 1 MW camera-equipped turbines are soon to be installed and will record any unexpected biological or mechanical behaviour. If all goes according to plan in this pilot scheme, it should be possible to quickly install sufficient turbines to meet all our foreseeable needs. In fact, according to Chris, 180 turbines of 5 MW size in Cook Strait tidal currents could generate nearly a GW by the year 2021 - and eventually could be expanded to provide more than one-and-a-half times New Zealand's present generation capacity if the demand arose. But electricity can't totally replace fossil fuels by itself - think of diesel for trucks or avgas for aeroplanes.

Not content with running his normal business ("Solvent Rescue" - the name speaks for itself) and with Neptune Power, Chris has pioneered the cracking and conversion of algae grown in the fertile and CO₂-rich Christchurch sewage ponds. The major product is oil which appears indistinguishable from mineral crude oil. This technology is almost operational, makes use of a wasted (and hazardous!) resource, and is an obvious first step towards biofuel production. It could potentially provide 15% of New Zealand fuel requirements.

Chris recognised that wood could also be a feedstock for liquid fuel production. This process would take advantage of an existing standing resource, a favourable climate and an ability of New Zealanders to excel at converting land, especially marginal land, to a productive purpose without impacting on food production.

A fellow entrepreneur, Dr Jim Watson - who is behind the planting of willows near Lake Taupo - does not believe it is wise or optimal to rely totally on a single product. Jim says "what makes Pure Power's technology different is that most, if not all, other technologies are aimed primarily at isolating the celluloses and hemicelluloses and fermenting them into ethanol to produce a single product - bioethanol - destroying or degrading the lignin in the process."

The Pure Power process would make three saleable products from wood: lignin; xylose and pulp. Unsulphonated lignin is immensely valuable as a feedstock for paints, glues, resins, composites, even carbon fibre and many chemicals currently derived from fossil fuels. Xylose is a natural food sweetener - sweeter than sugar - used as a precursor for insulin-free xylitol production making it safe for diabetics.

The cellulose component can be converted to bioethanol or used by Chris to produce bio-oil. So how does Chris plan to achieve this conversion? By dissolving it in super-critical water (ie with extreme temperatures and pressures). He has already produced a sample of this wood-based oil at laboratory-scale and now wrestles with technical issues involving blockages and yield enhancement. You won't find this information on any website, because Chris does not want to overhype his activities. He is a quiet and unassuming guy, whose work speaks for itself. He doesn't want rubberneckers - indeed his concern is to restrict the shareholding to those with a close stake in the process, to encourage their commitment. This approach is quite a contrast to our traditional self-promoting research organisations.

And no column on engineers would be complete without acknowledging Prof Andy Buchanan and his team at the University of Canterbury. Andy has been a long-time supporter of forestry - even owning his own superannuation woodlot - and a researcher who has investigated the superior fire-resistant properties of wooden beams. He is responsible for the recent announcement that all new government buildings should explore a timber option. He is currently pioneering structural multi-storey engineering with wood.

So the moral is: don't despair, foresters, we have more friends than our tight-knit profession would freely acknowledge.

** Piers Maclaren is a Registered Forestry Consultant and a former Forest Research scientist. His column appears regularly in the Journal.*

