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Put a tree in your tank

By Chris Barton Email Chris
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Could New Zealand's forests be our oilfields? Business and researchers say it's a serious prospect, but biofuels face major obstacles, finds Chris Barton.


Could wood be the fuel of our future? Photo / Amos Chapple

Amid a spate of manufacturing layoffs, paper-maker Norske Skog last month announced it was permanently halving production at its Tasman mill in Kawerau. Newsprint, it seemed, was a dying industry. There were arguments about subsidies, the impact of the Emissions Trading Scheme, and whether biofuels had a future in New Zealand. Could our forests be oilfields? It was hard to see the wood for the trees, not to mention the carbon and the ethanol.

It still is. Contradictions abound in a sector where a potentially enormous economic benefit is being left to languish. On one hand, the government is supporting Norske Skog to move into biofuel production. On the other hand, the government cut the existing $36 million bio-diesel development grants scheme, and dropped the Labour Government's plan to require a small percentage of biofuel in all petrol and diesel.

Further dousing of sputtering biofuel efforts came in August, with news that state-owned coal company Solid Energy was quitting the biofuels business, selling its Biodiesel NZ subsidiary - the country's only large-scale commercial biodiesel supplier.

At the same time, there was dismay over an influx of cheap, dubious quality carbon credits, making the massive carbon sinks of our own forests worth next to nothing. Late last month an open letter from eight major forestry companies implored PM John Key to "go back to the drawing board" and align the Emissions Trading Scheme with international best practice by including a 50 per cent cap on the use of international carbon units. The letter arrived just as Foreign Affairs Minister Murray McCully was telling the UN General Assembly: "One of the

most striking features of our region has been the complete lack of progress in putting lofty climate change rhetoric into any form of renewable energy practice." Indeed.

Norske Skog added its own views, saying closure of one of its two paper machines was necessary "to create a better balance between demand and supply for newsprint in the region".

But at the same time as it was slashing at least 100 jobs from its 290-strong New Zealand workforce, the Norwegian giant was trumpeting an A$84 million investment in Tasmania - the conversion of a machine at its Boyer mill to produce coated paper, assisted by a A$28 million Australian Federal Government grant and a A$13 million Tasmanian State Government loan.

"Government subsidies beat free market; Tasmania beats New Zealand; Boyer beats Kawerau," was how industry newsletter *Woodweek* summed up the situation. Forest Industry Contractors Association chief executive John Stulen told the online publication that government subsidies had bought the deal for Australia. "Norske Skog management would be well aware that the current administration in New Zealand is not open to discussing subsidies," said Stulen. Which isn't entirely true. Just look at the deals Key seems prepared to do to entice Hollywood movie and television productions.

Economic Development Minister Steven Joyce also indicated that while he wasn't interested in Australian-style subsidies, a significant subsidy for Norske Skog was on the cards. "New Zealand Trade and Enterprise has been working with them [Norske Skog] for some time," Joyce told Rachel Smalley on *The Nation*, indicating that $250,000 had been spent so far on a plan to move the company into the biofuels industry. "We're also looking at a Primary Growth Partnership (PGP)." The joint investment scheme, which aims to boost the growth and sustainability of the primary, forestry and food sectors, has a $70 million budget for the 2012-13 financial year.

But while Joyce's office confirmed Norske Skog had applied for a PGP and is developing a business plan, the company didn't want to talk, citing sensitivity about the job losses. "We are trying to keep ourselves out of the media spotlight because that doesn't help the consultation or the news that unfortunately we have got to execute - probably a poor choice of words - but we've got to follow through in a proper way and we want to stay focused on that," says Norske Skog Australasia vice president of strategy and business development, John Laugher.

Across the Tasman, Norske Skog's regional president, Andrew Leighton was singing a different tune - how the Boyer investment had saved jobs and would increase employment.

Joyce didn't have a real answer on how to stem the wave of redundancies, not just at Norske Skog, but also at Solid Energy's mines, the Tiwai Point aluminium smelter, Newmont's Waihi gold mine, Nuplex Industries' factory closures and at KiwiRail. But he did point to other investments at the Tasman site - by Carter Holt Harvey and SCA Hygiene Australasia - to show there is light in the gloom.

Which was partially true. SCA, a subsidiary of a Swedish company, makes tissue paper at Kawerau and is investing $57.7 million to expand the site's converting facility for finished consumer products. But growth at Kawerau will be at the expense of up to 140 Waikato workers who will lose their jobs when the company's Te Rapa plant closes in early 2014.

Asked what investment Joyce was referring to, CHH chief executive John Ryder had no comment. Joyce's office told the *Herald* it was a reference to CHH upgrading its recovery boiler in a multi-million dollar project last year.

Joyce also pointed to Norske Skog investing in a new geothermal plant in Kawerau. So did Norske Skog regional president Andrew Leighton, indicating "future growth opportunities for the mill" would involve renewable energy.

Not mentioned was that by cutting paper production from 300,000 tonnes to 150,000 tonnes, Norske Skog will also dramatically reduce electricity demand. "We are a 130 megawatt plant with two machines. With one machine we are 65-70 megawatt," says the company's Laugher.

On top of that cutback, demand from Mighty River Power - which the government plans to partially sell under its mixed ownership model - will drop by a further 22 megawatts when Norske Skog's own geothermal plant comes online at the end of the year. One analyst estimated it would take until 2016 for electricity demand and supply to return to balance.

But the big news at Kawerau could be a proposed multi-million dollar biofuels investment with Australian company Licella. A likely first stage would involve Norske Skog, with government help, building a test plant, estimated to cost A$50 million. Employing Licella's patented technology, the plant would transform radiata pine sawdust into 125,000 barrels of "bio-crude" per year.

Norske Skog showed such a proposal at a Bioenergy Association presentation in June, describing how the company, which last year formed a joint venture with Licella, plans to commercialise the technology.

The presentation promoted a grand, 15-20 year plan in which Licella's "catalytic hydro thermal reactor" technology would be scaled up to eight commercial plants across New Zealand. Together they would process 1.6 million dry tonnes of woody biomass and produce 4 million barrels of bio-crude a year - around 10 per cent of New Zealand's crude oil needs. The scenario had Kawerau processing 400,000 tonnes and making a million barrels annually. Such a plant would probably cost about $400 million.

"We are involved with them [Norske Skog] as the technology of choice should they move forward with the government on that programme," says Licella chairman Dr Len Humphreys. "We have been working with them on a bigger scenario for the past year or so."

Over the past year Licella has been processing 10,000 oven dry tonnes of woody biomass at its Somersby commercial demonstration facility in New South Wales, which has received more than A$4 million in federal government assistance.

Licella's process begins with ground up woody biomass - sawdust - mixed with water and heated under pressure. A catalyst is then injected, starting a chemical reaction, says Humphreys. "In less than 24 minutes the biomass is chemically transformed into a bio-crude oil with an average energy content of 34-36 megajoules per kilogram." In comparison, diesel fuel has an energy content of 42-43 megajoules per kilogram.

The bio-crude can then be separated at a conventional refinery into diesel and petrol, indistinguishable from the stuff distilled from crude oil. Licella has signed memoranda of

understanding with Virgin Australia and Air New Zealand to develop aviation fuels from its bio-oil.

Its reactors are built in modules capable of processing 10,000 tonnes, costing about A$10 million per module. "We make in the region of 2.7 barrels of bio-crude from one oven dry tonne of woody biomass," says Humphreys. "At scale we can produce it for around US$50-55 a barrel. Crude today sells around US$90 a barrel so our production cost is very competitive with fossil crude."

On the face of it, Licella appears to have found the holy grail of biofuels - an efficient, relatively low-cost way to make oil with a high energy content from a sustainable, plentiful biomass that isn't a food crop.

Dr Ian Suckling has been chasing this wood-to-fuel holy grail for decades and knows just how difficult such a transformation can be.

At the Scion crown research institute's sprawling Rotorua campus, surrounded by forest, it's a step back in time to 1970s architecture where, naturally, everything is made of wood - laminated beams, wooden floors, wooden panelling, spiral timber staircase, even wooden name tags on the office doors. In this setting it's no surprise to find a scientist who has spent some 30 years working with wood, seeking ever more efficient ways to disintegrate it. Or, as he prefers, to make wood "digestible".

Suckling, who heads Scion's bioenergy and biofuels research, focuses on a more complex bio-chemical pathway, quite different from Licella's, with the potential to produce a much wider range of bio-products.

Scion's process begins by pre-treating ground wood fibres with heat and steam, then partially separating them into their components: cellulose, hemicellulose and lignin. Enzymes then break down the celluloses into simple sugars that are fermented to produce ethanol and other biofuels. The remaining lignin can also be further treated to produce bio-chemicals used to make plastics.

At Scion's research pulping facility, built in the early 90s to make mechanical pulps for newsprint and packaging, Suckling shows how the equipment has been adapted to pre-treat wood fibres for biofuel. "In the past we were always focused on making the best fibre for the best paper," he says. "That is a hugely valuable knowledge for working out how to make the best fibre for delivering a high sugar yield."

When the facility's huge electric motor is turned on, driving steel grinding discs, it draws 10 per cent of Rotorua's power supply.

As well as developing its own biofuel process, Suckling confirms Scion is also working with Norske Skog to assist the Licella PGP proposal. "We have a lot of value outside of the core process that we can add around analysing waste treatment," he says.

Much of Scion's work has focused on just how realistic it is to see our forests as potential oilfields - and whether there is enough "feedstock" in those forests to make sufficient quantities of biofuel.

New Zealand's forestry industry, employing around 20,000 people, is based on managed plantation forests covering 1.75 million ha, which contribute an annual gross income of some $5 billion, 3 per cent of GDP. Export earnings for the year ended June 2011 were $4.5 billion, with export logs accounting for 47 per cent of the total harvest and earning $1.7 billion.

Scion studies have shown those forests could be a huge, sustainable source of feedstock, especially if waste from trimmings, cutting and processing was used. However all the currently available biomass residues combined would meet only 10 per cent or so of New Zealand's liquid fuel demand. To meet 60 per cent of demand, Scion research shows another 1.8 million ha would have to be planted - feasible if planting was on marginal hill country.

Such a resource, says Scion, could produce 6 billion litres of transport fuel a year by 2035 and would also store carbon dioxide, reduce erosion, improve water quality and cut emissions.

But there is a reality check: as well as new forests, the scheme would require 24 large-scale production plants, each equivalent to New Zealand's largest pulp mill.

A different scenario developed by the Bioenergy Association proposes that by 2040, 30 per cent of transport fuel could be provided by biomass sources, mostly forests and forest residues. But the strategy, which was reviewed by BERL Economics, also has a significant capital cost hurdle - the construction of six "bio-refineries", each costing about $1 billion and similar in size to the Kinleith Mill near Tokoroa.

Having had its research independently reviewed, Scion is ready to move to the next stage - finding a commercial partner and making its process more cost effective. "We have built up a hypothetical process model of a whole plant - a process flow diagram that would go from wood through to sugars," says Suckling. "We believe we have something unique to make this feedstock work."

A key element is using the central plateau's geothermal fields. "Normally a mill needs to burn its residues to create heat to run their processes," says Suckling. "With geothermal you have cheaper heat coming out the ground which allows you to use your residues for other things."

But if economics is so far preventing Scion reaching biofuel nirvana, a more fundamental problem threatens to stop biofuels getting off the ground - literally. The government's changes to the Emissions Trading Scheme, largely at the urging of coalition partner Act, have had an unintended consequence - stopping forest replanting in its tracks. The drying up of investment has been bad enough for forestry, but for a proposed biofuels industry, requiring not just replanting, but significant new planting, it's disastrous.

Forestry criticism has focused on the lack of any restrictions on importing cheap international carbon credits to offset emissions. The resulting influx of cheap credits has led to the collapse of the market for local carbon credits (New Zealand Units or NZUs) generated by tree planting. Spot NZUs fell from more than $20 a tonne last year to an all-time low of $3 last month.

"[Forestry services company] PF Olsen is observing zero interest in new forest planting from either investors or existing hill country farmers," said chief executive Peter Clark in his

submission on the amendment bill last month. Roger Dickie, head of forestry investment company Roger Dickie NZ, says "I tried to emphasise to [the select committee] there won't be any planting without a reasonable carbon price because it's not sufficient incentive to do any planting.

"The nurseries are in state of total depression ... what this has done is already buggered up next year's planting because they haven't got any seed in the ground.

Dickie said National had broken its 2008 election promise to "get New Zealand planting again". "John Key's National Government must be the most environmentally unfriendly government New Zealand has ever seen," Dickie told Carbon News. "They lied to the New Zealand public about their intentions to sequester carbon by planting forests, and now they expect every New Zealand taxpayer to subsidise our corporate emitters."

Parliamentary Commissioner for the Environment Dr Jan Wright agrees, saying the planned changes will be environmentally damaging and cost taxpayers over $330 million in the next four years. "Right now we're subsidising 95 per cent of big polluters' emissions. That was due to be phased out, albeit too slowly, but the bill will leave those subsidies in place indefinitely."

Clearly in the big polluter camp, Norske Skog Tasman will benefit significantly from the subsidies staying in place. Last year it was given 237,752 NZUs under the Climate Change Response Act.

Despite the subsidies it's getting here, Norske Skog is getting more in Australia. Inevitably there must be questions about its commitment to staying in New Zealand. The latest paper machine shutdown is not the first. That was in July 2006, and with the second machine about to close, Norske Skog is following a familiar pattern of cost reduction, shutdowns and selloffs as it struggles to find a way out from under its 6.9 billion kroner (US$1.14 billion) debt burden.

The Norwegian giant's troubles can be traced back to its expansion phase beginning in 2000 when it sought to become a global player. That was the year it acquired Fletcher Challenge Paper in New Zealand for $5 billion - at the time the largest acquisition ever made by a Norwegian company. "In retrospect, it may seem as [though] Norske Skog paid too much for the companies and mills acquired during the expansion in 2000 and 2001," says the company in its 50th anniversary chronicle.

Nor is it the first time Norske Skog has entertained moving into biofuels. From 2006 to 2010 the company worked to develop wood-based synthetic biofuel in Norway, but the project was cancelled in October 2010.

There must also be questions about the government's commitment to biofuels. The word gets just four vague references in the *New Zealand Energy Strategy 2011 - 2021*. Example: "Extensive farming and forestry options mean biomass could be a source of electricity, heat or biofuels." The word "biomass" fares a little better, getting eight mentions and a target. "By 2025: We will utilise up to 9.5 PJ per year of energy from woody biomass or direct use geothermal additional to that used in 2005." Better than nothing, but the effort is clearly aimed at heating and possibly electricity rather than biofuels.

The *Energy Strategy*'s focus is on fossil fuels and minerals. "We can't just turn off the tap in our journey to a lower carbon economy," said Acting Minister of Energy and Resources Hekia Parata when the strategy was released. "Petroleum was our fourth biggest export earner in 2010." That figure, said the press release, "could increase to $12.7 billion with future discoveries, which would help pay for schools, hospitals, broadband and roads." It noted that New Zealand is set to earn $3 billion in royalties from existing oil and gas fields.

There was no mention of the Wood Council of New Zealand's strategic plan to double the forest industry's export earnings to $12 billion by 2022 - by moving into high-value, fibre-based products, including biochemical and biofuel value streams.

New Zealand's strategy is in direct contrast to Australia, which recently announced a A$200 million programme to help businesses develop and commercialise clean energy technology. "Put simply, Australia has a unique opportunity to lead the world in clean technology that helps reduce greenhouse gas emissions," said Australian Minister for Industry and Innovation Greg Combet, announcing the scheme.

"We have an opportunity here which is as big as the minerals and mining the government is focusing on," says Bioenergy Association of NZ executive officer Brian Cox. "When international investors come here and say to us: 'What is the government attitude to biofuels and bioenergy?' We say: 'They don't care.' And so the investors say: 'We don't want to be in an environment where the government doesn't care'."

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