

The new bio-economy

Not hippy, tree-hugger stuff but serious world politics

By Denise Landow

The new bio-economy is serious world politics, and the 'make, use, then throw away' ways of producing products are no longer options for global companies.

This revealing message is from Dr Florian Graichen, science leader for biopolymers and chemicals at Scion in Rotorua.

Scion is a crown research institute specialising in research, science and technology development for forestry, wood products, wood-derived materials, and other biomaterial sectors.

His mission, in simple terms, is to bring Scion's biopolymer and green chemical disciplines together.

One of his call-outs to the horticultural industry is to, 'tell us what you need – and we'll make a sustainable version'.

"If you want your produce and services to be sold and championed by large international business, more and more, you'll need to help them deliver 'green' products – otherwise you'll find yourself out in the cold," he says.

The Circular Economy, as it's known, targets the transition from a linear towards a circular economic model. It closes the loop of product lifecycles and the bio-economy and aims for sustainable production and use of renewable resources to produce every day products.

It will have massive impacts on New Zealand food producers – whether they agree with it or not.

As Graichen states, "if you're exporting, you will be exporting into nations that understand these contexts, and these contexts are increasingly important to them."

"We can debate about climate change as much as we want. You can believe in it or not – that's totally up to you."

But now international corporates are championing sustainability messages to their customers.

These well-known corporates, such as: Ikea, Lego, Ford, Toyota, Coca Cola, Danone, Starbucks, McDonalds, Apple and Philips have made strong public statements around sustainability and the use of biobased materials as early as 2020.

"They will consider carbon footprints. So if you're in a supply or value chain, delivering to any of these companies, you'll need to help them to deliver these targets – otherwise you're out," he says.

BRAND POWER

Those strong intentions have created enormous brand pull for sustainable and renewable types of products.

"If you look at these companies, they are not little producers of niche products, these are big international



Dr Florian Graichen

companies," he reminds us.

"In New Zealand we have seen bio-economy philosophies gaining momentum. An important part of the bio-economy is the aspect of growing and generating biological resources in a sustainable way.

"So we're not talking about approaches where you cut down rainforests, plant palm oil and say we are driving renewable resources – that's not how this works.

"It has to be sustainable from an ecological and economical perspective. The other part is conversion into food, feed and bio-products, so it's not competing on 'do I use my material for food or feed?'

"You can look at it for the whole spectrum of products. This is not the approach of some lefty-greenie-hippy type people – this is serious world politics."

He states that more than 50 countries world-wide have adopted a national bio-economy strategy.

MAJOR DRIVER

Bio-economics is a now thought of as a major driver for innovation and economic growth.

Brazil is a country that generates a massive amount of biological feedstock, and wants to be world number one in that sector. China wants to substitute

Sustaining, protecting and adapting our natural resources

Growing productivity and profitability with environmental, social and cultural acceptability

fuels with renewable resources. In the European Union (EU), we can look at services and products created in this new science, he states.

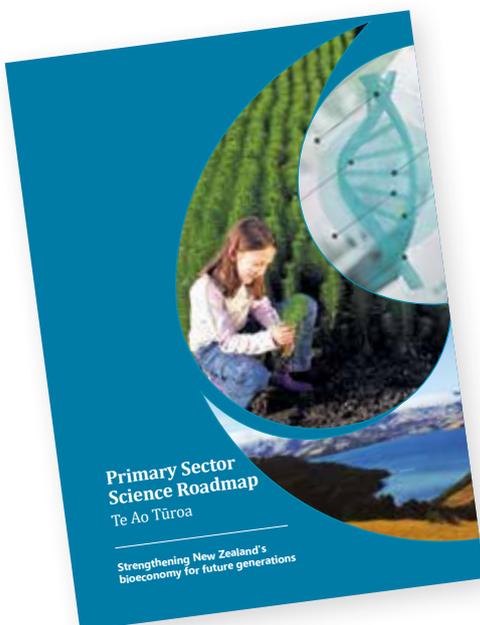
In the EU economy alone, the bio-economy is estimated at 2 trillion Euros (3.5 trillion NZD), that's about a tenth of the whole economy in Europe, and is a growing segment.

Graichen states an interesting thing in our own country is the fact that New Zealand is actually already a bio-economy.

"We have a temperate climate, land, water, strong biological sciences, and a robust primary industry value chain – so we're already set up to feed and fit into this new type of economy."

He strongly recommends people read the MPI's Primary Sector Science Road Map because the information deals with New Zealand's bio-economy.

<https://www.mpi.govt.nz/news-and-resources/science-and-research/primary-sector-science-roadmap-te-ao-turoa>.



High-value products for consumers

Integrating primary production systems, people, communities and values

"This looks across all sectors, and how they can be integrated. It's not group against group. It's not dairy against forestry – it's operating together, co-utilisation, co-usage of resources."

NEW WAYS

One of the biggest challenges in the circular and bio-economy must be single use plastic packaging.

Scion's experts would love to talk to anyone who has problems with single-use plastics, and is keen to explore any opportunities, ideas, or just get together for a chat.

This could cover any aspect of improving packaging, holistic packaging approaches, changing out old ideas for new ways of doing things in more sustainable ways, he says.

Graichen then showed two relevant examples of bio-based polymers his team had recently developed to his captive horticultural audience.

He acknowledges that packaging in the horticulture industry is a highly important variable.

In a global context, packaging is a massive industry worth around \$839 billion (2015) with predicted 3.5% growth rate till 2020. The Packaging Council of New Zealand has highlighted packaging as the value multiplier in our global supply chains. The packaging sector's annual industry sales of \$3.9 Billion contributes to 1.8% of New Zealand's GDP – underpinning a \$60 Billion export sector and a similar quantum for domestic trade.

Today and in the near future, packaging has to do more, and it's not just about protecting products anymore, he explains. Packaging has to tell a story, have anti-counterfeiting and traceability features. It has to connect digitally with the internet and cloud-based data storage, while at the same time, work within new requirements to be functional in the circular and bio-economy framework.

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FINDING THE SWEET SPOT

One of packaging’s biggest issues is finding that sweet spot between under-packaging, which places products at risk in terms of performance, cost and design, and over-design. Over-packaging sees orchardists paying too much for over-engineered systems.

“This is an area where Scion has a lot of experience in the assessment and development of packaging solutions,” he states.

“That’s important because New Zealand is isolated and our produce travels long distances. We’re not sending things like cars – we’re talking about exporting extremely fragile and sensitive products, and the packaging has to be thought through.”

With fragile products, the risks and impact of failure are costly because squashed products are pretty much useless. Scion experts are looking at several approaches.

One current area of investigation is packaging with gas-barriers, but the main effort is along bio-based lines with degradable materials which achieve better performance but can either composted or recycled.

TRUSTED AND TRUE

New Zealand produces amazing primary products such as fruit, wine and meats and once they leave our shores – how can the end consumer really know if the food they’ve purchased is actually from where the label says?

This is where new technologies to beat counterfeiting are required.

“New Zealand growers deserve a premium but you can only demand a premium if you can ensure your produce really comes from New Zealand.

“One of the latest research topics is to make packaging labels that can be traced and tracked to avoid or deal with counterfeiting. We’re working on printed electronics on packaging and labels, and other items to allow companies to collect data through the internet and the cloud. We do this with several technologies and inks. If this is of interest, we would love to hear from you.”

The failure rate of boxes is also a massive profit destroyer in the industry. If you look at the entire supply chain, a lot of boxes actually fail, he says.

In a world-wide context, the costs of these boxes failing are tens of billions of dollars.

It’s no surprise that boxes at the bottom of a stack will eventually break down because of creep, and destroy the products within.

Scion is operating the WHITE room (an acronym for weight, humidity intervals, temperature and experiments), a unique purpose-built cool room, designed to test box failure under controlled conditions. The WHITE room enables Scion to study the causes of box failure, and to develop solutions that both protect and add value by reducing the amount lost through this factor.

Boxes and packaging that better withstand export supply chains will be a great enhancement for many industries.

BEYOND THE BIOSPIFE

Scion was commissioned by Zespri to create the bio-spife, which was launched at this year’s New Zealand Agricultural Fieldays, and Graichen says it’s a fantastic example a product that goes beyond the device itself.

The biospife is a novel tool and is made from bio-plastic material that incorporates kiwifruit residues. It’s designed to be composted along with the skins when finished with.

“We’ve been showing this in Europe. It’s seen as an example of food waste or food side-streams used in a bio-based product. Zespri had been using a spife for a long time. But when you offer customers organically grown kiwifruit in a compostable punnet but a have spife made from polystyrene – it doesn’t really work, so they wanted a compostable spife.

BIOPLASTICS FROM KIWIFRUIT WASTE

Novel uses for plant components provide a wealth of opportunities for the primary sector, particularly when they use residue or waste and can replace more traditional plastic or other oil-based products.

The Biospife is a spoon made from kiwifruit waste that is under development by Zespri supported by expertise at Scion. The technology used by Scion transforms the kiwifruit residue into a material which can then be formulated with other plastics, but allows the material to be renewable and compostable.

While not yet commercially available, the Biospife has the potential to reduce Zespri's carbon footprint by 3 percent. It also reduces costs by using the thousands of tons of kiwifruit waste that are dumped each year. This demonstrates the potential for what could be many more applications of biomaterials. Photo: Zespri.



The biospife is a novel tool made from bio-plastic incorporating kiwifruit residues.

“That in itself is relatively easy but they also wanted it made with circular and bio-economy thinking in mind, and have one of their feed stocks incorporated, the kiwifruit skins.

“We sourced kiwifruit skin and the bio-based polymer – and this is where Scion technology comes in. We had to answer the question of how do you make that work, because a polymer compound has never used kiwifruit skins before.”

The scientists had to ensure the material was functional and operational. Other factors such as compounding, moulding technologies, biodegradability, food content approvals and market acceptance were also important.

DUST TO DUST

Working with the wine industry, Scion has developed biodegradable clips. Bird netting clips traditionally used petroleum-based non-degradable plastics.

Around New Zealand there are many organic vineyards which look picture

perfect, but non-biodegradable clips are currently in use.

The only purpose of these clips is to hold netting on for a few months.

“When the nets are ripped off, they have to break into the pieces are so small, that no one would bother to pick them up. They lie there on the ground forever, and eventually they will break down into micro-plastics but they would never degrade,” he says.

“What we suggested is a better way to make these clips. There’s no need for the items to last beyond their intended purpose, so we designed bio-clips from rigid films containing red grape pomace and biodegradable polymers. The fibre from the skins both stiffens the clips and makes them easier to break.”

It now can be part of the viticulture industry’s exciting story about being renewable and sustainable.

In this case the wine pomace accelerates the degradation. The clip

is now a superior product with a purpose.

“Now these clips can lie on the ground and eventually degrade,” explains Graichen.

“These are two examples, I believe that in horticulture, there are any number of single use plastics that we could look at in the same way.

“Don’t be tied down by the fact that this is a clip. Items can be made into different shapes and forms, they can be hard or soft, look like ropes, or whatever.

“I can’t tell what items you use in your operations, but what I can do is ask - can you think of similar scenarios in your work area?”

The main driver is to combine performance with sustainability, but you can play with a lot of variables, Graichen says.

“We’re talking about customised design. These examples were an appetiser to show you that Scion is much more than wood and forestry.”