



BIO-BASED

WORLD QUARTERLY

RIDING THE GREEN WAVE! THE INSIDE STORY ON PATAGONIA'S DRIVE FOR A GREENER INDUSTRY... AND BETTER SURF.

"MAKING THE RIGHT CHOICE FOR THE ENVIRONMENT HAS ALWAYS PROVED TO BE THE RIGHT CHOICE FOR THE BUSINESS"

PHOTOGRAPHER AL MACKINNON

THE 'MODEL-T FORD OF THE BIO-REFINING INDUSTRY' THAT IS OFFERING HUGE NEW REWARDS FROM WASTE STREAMS.

WE NEED TO GO MUCH FURTHER, MUCH FASTER, IN CHANGES TO PACKAGING URGES UNILEVER CHIEF.

HOW TechnipFMC IS USING 60+ YEARS OF EXPERIENCE TO DEVELOP A GROWING RANGE OF BIO-BASED POLYMERS.

MOVING EUROPE'S MOUNTAIN OF NAPPIES FROM LANDFILL TO HELPING CREATE USEFUL BIO-BASED PRODUCTS.

AND MUCH, MUCH MORE...

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Our Zimmer® team in Germany provides technology, engineering, project management and procurement services for polymer (polyester and polyamide) production plants.

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Yes, that's us, down there. Yes, you know us as a prime tourist destination and a business service hub. But did you know that in the port of Amsterdam we have one of Europe's largest biorefinery clusters? The port also has reliable infrastructure, logistics providers and terminals, utilities, feedstock and markets literally at spitting distance. Schiphol Airport is, as you know, just around the corner. We reserved space for your business to grow: Biopark Amsterdam. So consider Amsterdam, you are more than welcome to join us! Discover our success stories on portofamsterdam.com



WELCOME



“ON PLASTICS, CUSTOMERS CURRENTLY DON'T HAVE A CHOICE AND WE WANT TO GIVE THEM ONE. ALL OF THEM. WE'RE A MASS MARKET VALUE RETAILER, BUT WE DON'T THINK THAT CONCERN FOR THE ENVIRONMENT IS CONFINED TO THOSE WHO CAN AFFORD TO SHOP AT WHOLE FOODS OR WAITROSE.”

Welcome to the ninth issue of the Bio-Based World Quarterly, your dedicated guide to the latest news and essential business developments for bio-based chemicals, products and fuels and the brands that purchase, use and sell them.

A little bit of context to the quote. It comes from Richard Walker, the Managing Director of Iceland – a supermarket chain in the UK, which has an emphasis on the sale of frozen foods and ready-meals. They announced in January a very commendable programme to remove plastic packaging from all their own label products by 2023. For some this came as a surprise, as with all due respect to Iceland, it's had a reputation for low-pricing, rather than high-quality. The American Whole Foods and British Waitrose, Richard mentions are known for having far higher prices, but emphasis for quality. In the UK Waitrose is considered 'Posh' whilst Whole Foods has the nickname of 'Whole Paycheck' on account of its high prices.

Why have I lead with this?

Well, I think it's about change and who wants change. Or who deserves change?

Iceland's customers have typically been thought of as all about price and convenience. But when they were also asked they responded overwhelmingly with concerns about packaging and waste.

There's often been a perception that only certain consumers truly cared about environment. And even then only on selected products. But with the evidence increasingly visible (and hard to dispute) of the damage we are doing to our planet, there is a huge new opportunity to change the way all kinds of products are made and sold. One that I know you grasp. But one that a wider audience is being to understand and appreciate too.

This is our biggest ever issue of the Quarterly, and delighted that many of you will also be reading a special printed version at our first World Bio Markets event (having brought it into our portfolio last year through acquisition).

Many thanks to all the contributors and advertisers to this issue; Port of Amsterdam, Attis Innovations, TechnipFMC, VTT, the Bio-Based Industries Joint Undertaking (BBI JU) and Patagonia, your support is always appreciated.

Thanks for reading, and please let me know if you'd like to contribute to our future issues – we are always looking for fresh voices and new stories!

Luke Upton

Luke Upton

Editor & Co-Founder, Bio-Based World News

Luke@BioBasedWorldNews.com

Shareholders organised to apply pressure on McDonald's use of polystyrene cups and trays.

“The McDonald's brand is put at risk with branded cups found on beaches and waterways...”

Shareholder advocacy group As You Sow has re-filed for 2018 a resolution with McDonald's Corp., urging the fast-food giant to assess the environmental impact of its use of harmful polystyrene in beverage cups and food trays. The same proposal was voted on by shareholders earlier this year and received the support of nearly one-third of shares voted. Founded in 1992, As You Sow promotes environmental and social corporate responsibility through shareholder advocacy, coalition building, and innovative legal strategies. Among their successes in 2017 were ensuring Unilever agreed to make all consumer product packaging recyclable and making sure that Target agreed to phase out polystyrene foam packaging in e-commerce.



New partnership using Artificial Intelligence to quicken the pace of bio-economy development.

LanzaTech the New Zealand based industry leaders who promote a “carbon smart” circular economy are teaming up with DNA pioneers, TeselaGen, to extend its state-of-the-art biological design platform to include artificial intelligence capabilities that speed up the design process. Developing biological solutions for transformative products like carbon-negative biofuels requires innovative use of molecular design technology. And now LanzaTech will collaborate closely with and license TeselaGen's proprietary cloud-based informatics solution extending its state-of-the-art biological design platform to include artificial intelligence capabilities that speed up the design process.

“Automated biological design is an essential foundation for our carbon recycling technology and TeselaGen has a reliable platform for modern industrial DNA design and cloning,” said Michael Koepke PhD, Director of Synthetic Biology, LanzaTech.

Refugees in Kenya to benefit from sustainable stoves powered by bio-ethanol.

A scheme has been set up in Kenya to provide refugees in Kenya with 10,000 affordable stoves that have a near-negative impact on the environment, using bio-ethanol instead of charcoal that is six-times more efficient than the solid fuel. Called the Safi Stove and developed by Rural Development Solutions, Samsung is helping distribute the cooking stations in the Kakuma refugee camp, situated in the north west of the African country. The durable and cheap-to-produce units run entirely on sugar-based ethanol and replace the need for the charcoal that is scarce, polluting and largely unaffordable for refugees. Bio-ethanol sells for 100 Kenyan Shillings, around 70p or \$1, a litre, and lasts for up to six days for the average household, whereas six days of charcoal costs in the region of 240 Kenyan Shillings – nearly two and a half times more. Getting hold of the charcoal is no easy task, either, with women and children often having to endure a five-hour walk or long queues to get hold of supplies of the fuel.

Stora Enso bring bio-based lignin to market as a replacement for oil-based phenolic materials.

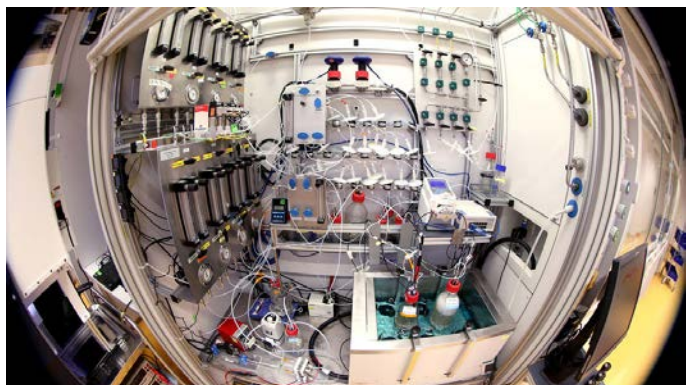
Stora Enso, a Finnish leader in renewable solutions in packaging, biomaterials, wooden constructions and paper globally have officially launched their bio-based lignin product, Lineo™. Lignin is one of the main building blocks of a tree and makes up 20-30% of the composition of wood. Yet it has traditionally

been discarded by the pulp and paper industries. However, Stora Enso is one of those companies that has recognised the potential of this versatile raw material, which can be used in a range of applications where fossil-based materials are currently used. Lineo is now available to companies seeking more sustainable, bio-based alternatives.

Lignin is a renewable replacement for oil-based phenolic materials which are used in resins for plywood, oriented strand board (OSB), laminated veneer lumber (LVL), paper lamination and insulation material.

German giants Evonik and Siemens now partnering to generate high-value specialty chemicals from CO₂.

Global technology powerhouse Siemens and speciality chemicals leaders Evonik have announced exciting and impactful plans to use electricity from renewable sources and bacteria to convert carbon dioxide (CO₂) into specialty chemicals. The two companies are working on electrolysis and fermentation processes in a joint research project called Rheticus. The project was launched on the 18th January and is due to run for two years. The first test plant is scheduled to go on stream by 2021 at the Evonik facility in Marl, Germany which produces chemicals such as butanol and hexanol, both feedstocks for special plastics and food supplements, for example. The next stage could see a plant with a production capacity of up to 20,000 tonnes a year. There is also potential to manufacture other specialty chemicals or fuels. Some 20 scientists from Evonik and Siemens are involved in the project.



Carlsberg strengthens eco credentials with biogas-powered brewery.

Carlsberg has taken a major step in its mission to make its beer as green as the label on its cans and bottles, by fuelling one of its breweries entirely on biogas – action that has enabled the Danish brewer to cut all carbon emissions generated from thermal energy and electricity to zero.

Carlsberg's Falkenberg brewery in Sweden is the company's first to be completely sustainable, though the brewer has set itself the target of eliminating carbon emissions from all breweries within 12 years 74% of the power required to run the plant comes from biogas supplied by Danish energy supplier, Ørsted AB, while the remaining 26% is generated from the waste water from the brewery. Not its first foray into sustainability, Carlsberg last year announced that it had made a change to its production process for beer bottles and will now be made from a bio-based green fibre material.

HEADLINER: GABE DAVIES, EUROPEAN SURF MANAGER, PATAGONIA.

It's fair to say Gabe Davies has already fitted a lot into his life so far. Originally from Newcastle, in the North East of England, he became a professional surfer at the age of just seventeen, embarking on a career that took him around the world and pick up four British surfing titles, numerous English titles and represented his country at World and European Championships. But that's not all. Gabe also has extensive experience working in television, film and printed media and with brands such as Quiksilver, G-Shock, and GoPro amongst others. He is also a Chair for the regional reps of radical marine conservation charity Surfer Against Sewage.

And now in his role at sustainable clothing company Patagonia, he is part of a movement to make surfing and its apparel better for our planet. It should be no surprise that surfers are leading this charge. Whilst most of the public has only recently been made aware of the damage that is being done to our seas by our addiction to plastic, for those regularly in the water, they see its effects every day. Plastic pollution has become an expected part of surfing. Our Editor, **Luke Upton** recently caught up with **Gabe**, for this exclusive interview on how Patagonia are making a change to this sad state of affairs.

Luke Upton (LU): We are talking today in your role as Europe Surf Manager at Patagonia, but you used to be a pro-surfer. What did you learn travelling the world competing that you are using with Patagonia?

Gabe Davies (GD): The surf industry has changed so much over the years. I was always passionate about the environment, and radical ground breaking NGOs like Surfers Against Sewage, but the traditional surf industry was more focussed on contests or just selling product. Competitions come and go every weekend around the world, year after year. It's a bit of a circus. I had an incredible career as a pro surfer and 'big wave rider', but now I have the fantastic opportunity to work and help influence surfing in Europe from the perspective of the most forward thinking companies in the world. It is fair to say that almost everything the traditionally surf industry did, Patagonia does the exact opposite. They continue to throw the rule book out of the window. The focus is on product performing when you need it the most.

Looking in detail at how our clothing and wetsuits are made, how we do business and constantly improving our supply chain. Lastly it is how we can support environmental groups and inspire other companies to improve the way they do business, from an environmental perspective.

LU: It seems that the public are increasingly aware of the damage that plastic is doing in our seas and on our beaches, are the team at Patagonia feeling a similar uptick in interest?

GD: Yes, the world has eyes on this problem right now. Patagonia are supporting many environmental NGOs via '1% For The Planet' funding member. Patagonia has donated over \$89 million in cash and in-kind support to grassroots causes around the world. One of the NGOs we support in the UK Surfer Against Sewage, is pushing the UK govt for a 'deposit return scheme' for plastic bottles. Patagonia's Tin Shed Ventures is a corporate venture Capital fund to support start-ups that offer solutions to the environmental crisis. It has invested over \$20 million so far and is another avenue that Patagonia uses to support environmental solutions. There are two companies we have supported from the Tin Shed Ventures that come to mind. Both specifically have products that will help reduce micro plastics in the water 'Guppy Friend' is a product that you can use to trap micro plastics leaving your synthetic garments via your washing machine. 'Bureo' is a USA company using discarded fishing nets from Chile, as a raw material to upcycle into amazing skateboards and sunglasses.

LU: With surfers seeing the environmental problems every day, tells us more about Patagonia's work in this area?

GD: Back in 1993 Patagonia was the first Outdoor company to divert waste plastic bottles and turn them into product. There are many other products we make that use from natural fibres (Hemp and Organic Cotton), recycled (Down, Nylon or Polyester) or reclaimed (Cotton and Wool). We also look at best in class dying processes, Fair Trade and traceable down feathers. When it comes to wetsuits, a product every surfer needs, it is a product that is traditionally made from petro-chemical or limestone, we knew it was dirty and we could do better. Working



“I HAD AN INCREDIBLE CAREER AS A PRO SURFER AND ‘BIG WAVE RIDER’, BUT NOW I HAVE THE FANTASTIC OPPORTUNITY TO WORK AND HELP INFLUENCE SURFING IN EUROPE FROM THE PERSPECTIVE OF THE MOST FORWARD THINKING COMPANIES IN THE WORLD.”

with Yulex Corporation over many years, we worked on material tests that could help replace traditional ingredients with a natural Rubber alternative. Over 8 years and 4 cycles of product, we have improved our suits which are now the world’s first ‘neoprene-free’ wetsuits on the market. They have reduced our CO2 footprint by ~80% compared to traditional suits. We also invited the rest of the industry to the party. By openly sharing our technology we hope that more brands would come on board with us. We all have a part to play and to educate the end user that the natural rubber alternative was better than the less environmentally older version. The Yulex process started using Guayule based rubber and then moved onto FSC Rainforest Alliance Certified Rubber, sourced in Guatemala and Sri Lanka. The sourcing of the nature rubber turned out to be a critical part of the story. Using non FSC sourcing would have given us a dubious product, as clear cutting of rainforests is a well-known practise by in natural rubber production.

LU: What have been some of the challenge in developing this neoprene-free wetsuit?

GD: Educating the end consumer (and an industry, which is resistant to change) to the benefits. Also, being transparent that no wetsuit is perfect, that they all contain products that we need to try and clean up. The industry is coming around, some brands are faster than others, but we will always face resistance from the lowest end of the market, that is always just pushing for price over quality.

LU: Have you had to market it differently? And what has been the response?

GD: We try to be as honest and transparent as possible, most of the world’s high performance wetsuits come from the same

factories, so it is quite clear at what level brands care about the environment. I loved the ‘we have the best weed in town’ tag line we used to launch the suits when we used Guayule plant for our rubber, it caught the attention and drew people into a much deeper story about where their product comes from.

LU: What future plans do Patagonia have in the bio-based space?

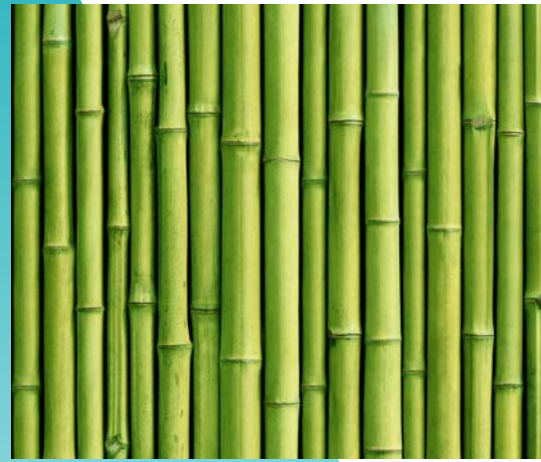
GD: We are looking at improving our rubber performance. it has taken season upon season to fine tune the rubber to get what we need. Next season we have added more flex added to the foam fabrics. We also want to replace other ingredients that go into our wetsuit foam like ‘carbon black’, by using content from recycled tyres. We are also looking at end of life plan to upcycle old wetsuits that are notoriously difficult to recycle, to avoid landfill. We are still sharing our technology with other brands to move the industry into the right direction, as well as internally seeing if the products we have created with Yulex can work in other categories, like our Fly-Fishing gear.

LU: As we’ve discussed, Patagonia are well known for a focus on sustainability, but do you have advice for those readers who want to make a change to how their company produces products, but perhaps don’t have as strong a green ethos?

GD: Whenever Patagonia came to a big cross roads decision, making the right choice for the environment has always proven to be the right choice for the business. People thought moving to 100% Organic cotton back in 1996 would ruin us because the prices would sky rocket. We made a committed decision to support healthy agriculture and ecosystems and people understood why we made that choice and sales went up. Taking time to test products and build trusting relationships with our supply chain has been an important process with long term goals, rather than short term gains. Providing a lifetime Ironclad Guarantee builds a loyal customer base. Building products that are repairable encourages repair rather than replace mentality and makes people value their own products. Within those scenario’s, everyone is a winner in the long term.

LU: Great thanks for the time today Gabe, it is pretty inspirational stuff! Keep up the good work! ■

HOW THE 'MODEL-T FORD OF THE BIOREFINING INDUSTRY' IS OFFERING NEW REWARDS FROM WASTE STREAMS.



Virtually every person, organization, and human activity in the world creates some type of waste. And its generation in most cases represents a hugely inefficient use of materials. Just think for a minute of some of them; black liquor created during industrial pulp & paper manufacturing, the corn stover left after harvest on the field, or the nut shells piling up in food factories. But now, a company based just north of Atlanta, Georgia – Attis Innovations – is changing perceptions of what waste means, and has some major milestones approaching in 2018. Today we speak exclusively to Jeff Cosman their CEO and Helen Petersen about their approach, unique products, and the immense revenue potential their technology brings to the growing bio-economy.

We open up by asking Jeff to give us an introduction into the business; “On Earth, the most concentrated source of carbon in a plant is lignin but it’s considered a low-value byproduct in the production of paper, pulp and cellulosic ethanol and as such is often burned for energy production. For us at Attis, rather than lignin being used as an under-valued source of energy, we believe it has a much higher value when deployed as a renewable substitute for carbon in traditional petroleum-based products.”

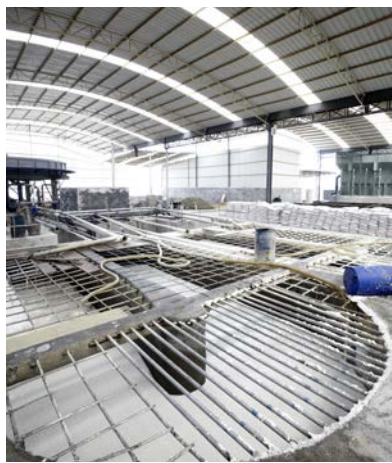
Jeff goes on to say, “Our primary focus is in creating new revenue streams from biomass, where its various constituents can be

elegantly extracted and converted into a multitude of bio-based products for use in plastics, fuels, adhesives and many more. We believe that by capitalizing on these new markets, existing pulp and paper and cellulosic ethanol facilities can generate between 35% to 100% more revenue per ton of biomass processed.”

So that presents the question, why hasn’t lignin been more widely extracted in the past? It has been attempted. However, methods to date have been known to damage the structure of the lignin molecules and thus diminish its usefulness.

This is where Attis’ proprietary technology shines. By employing a process that requires significantly less capital than traditional recovery methods while also delicately extracting and purifying the lignin, Attis can preserve the product’s natural properties at a fraction of the cost. Additionally, during this process, functional additives can be introduced to increase the performance of the lignin in a myriad of applications. Attis capitalizes on lignin’s inherent properties and offers companies and even entire industries a cost-effective strategy for introducing bio-based content into their product portfolios.

Helen Petersen tells us more about the flexibility of their technology; “Unlike pulp and paper manufacturers or cellulosic ethanol producers, we are not solely reliant on cellulose content



“OUR PRIMARY FOCUS IS IN CREATING NEW REVENUE STREAMS FROM BIOMASS.”

Attis’ recent announcement of the exclusive license to American Science and Technology’s (AST) biomass processing facility and associated intellectual property. AST’s processing facility allows for the accelerated evaluation of biomass feedstock opportunities as well as finished product validation. In addition, the AST facility and laboratory can be utilized publicly for contract R&D services related to biomass processing and characterization.

In conjunction with Attis’ vision to commercialize AST’s biomass processing technology, the company has made great strides in the development of bio-based materials from its unique, melt-flowable lignin. February saw them announce the successful completion of performance testing for their lignin-based resins products with the results demonstrating outstanding mechanical and processing characteristics compared to virgin plastics materials. Attis was able to blend its melt-flowable lignin at 15-25% inclusion rates in both polypropylene and polyethylene materials while retaining 100% of the tensile modulus, 100% of the impact strength, and over 90% of the tensile strength. These impressive results come as part of the company’s rapid development curve, and this offering could be used across a host of plastics applications, including automotive components, agricultural products, building and construction and other durable goods.

In speaking to Jeff and Helen, their knowledge is clear but so too is their passion, both firmly believe that Attis can prosper where others have failed, and convert under-valued byproduct streams into higher value, bio-based commercial products. While still early, Attis’ focus is squarely on rapid growth in 2018 with plans to start construction of their first commercial scale facility while continuing to diversify their bio-based product portfolio.

Jeff finishes up his time with us by reiterating their core beliefs; “I consider us to be the Model-T Ford of the biorefining industry. Innovation is at our core and every day we are advancing towards the creation of a truly sustainable bio-economy. We believe that this is just the tip of the iceberg and our innate ability to identify and effectively derive value from biomass will lead to unparalleled growth across multiple industries.”

Attis is seeking partners that have similar aspirations to create more value from biomass while furthering the growth of a truly sustainable bio-economy. If you would like to learn more, please contact Attis Innovations at info@attisinnovations.com or on their website www.attisinnovations.com. ■

in our feedstock, and thus we can focus on various types of non-traditional biomass, opening the door for many agricultural by-products such as crop residuals, bark, sawdust, nut shells and many more.”

This is another point of differentiation with Attis’ technology, not only can it process nearly any form of biomass, but it is also simple enough to be economically scaled-down to a size that fits unique feedstock opportunities. Most biomass processing facilities require massive economies of scale and feedstock inventory to justify their investment. Companies can often struggle to process at a small scale, thus blocking out potential partners and limiting their geographic scope. Not so with Attis, as their technology is uniquely scalable to allow cost-effective processing at flow rates ranging from 200 up to 2,000 ton per day.

Helen further explains, “By converting 100% of the biomass’s constituents, it becomes economically feasible to process at scales previously thought impossible. This creates the potential to boost economic growth and jobs in rural areas and propagate an inclusive bio-economy.”

Since its founding in May 2017 Attis Innovations has made rapid progress in commercializing its lignin extraction process and developing a portfolio of bio-based materials. This started with

Attis Innovations' biorefinery platform processes biomass as effectively as petroleum refineries process oil. Attis plans to recover and convert essentially any form of biomass into far more valuable biobased materials and products. This allows new and existing agricultural businesses to recover more value from their crops while creating a sustainable and secure platform for food, materials, energy and newfound wealth.



GENERATION ONE



GENERATION TWO



GENERATION **ATTIS**

A truly integrated biorefinery



WHICH GENERATION ARE YOU?

WE NEED TO GO MUCH FURTHER, MUCH FASTER,' IN CHANGES TO PACKAGING URGES UNILEVER CHIEF.



Consumer goods giant, Unilever have issues a call to their industry to step-up its efforts to tackle the mounting challenge of ocean plastic waste and create a circular economy for plastics. For the bio-based industry there are major opportunities to be found here in developing new materials to companies looking to change their packaging.

One year after Unilever made its commitment to ensure 100% of its plastic packaging was fully reusable, recyclable or compostable by 2025, CEO Paul Polman welcomed news that 10 other companies (Amcor, Danone/Evian, Ecover, L'Oréal, Mars, Marks & Spencer, the Coca-Cola Company, Unilever, Walmart, Werner & Mertz) have made similar pledges. Polman, a veteran of Procter & Gamble and Nestlé, urged more to step forward to accelerate the industry's progress towards the circular economy and address plastic leakage into the world's natural systems including waterways and oceans.

Research by the Ellen MacArthur Foundation (EMF) has found that the equivalent of one dumper truck's worth of plastic enters the oceans every minute, and by 2050 it forecasts there could be more plastic (by weight) in the ocean than fish. Today, only 14% of plastic packaging gets collected for recycling.

Polman said: "It is welcome news that many other major companies are making their own commitments to address ocean plastic waste. Yet as a consumer goods industry, we need to go much further, much faster, in addressing the challenge of single use plastics by leading a transition away from the linear take-make-dispose model of consumption, to one which is truly circular by design."

Unilever believes there are four key actions the consumer goods industry should take to create the systemic change required and accelerate the transition to a circular economy:

1. For companies to invest in innovation towards new delivery models that promote reuse.
2. For more companies to commit to 100% reusable, recyclable or compostable packaging by 2025 and set stretching targets for using post-consumer recycled content.
3. For a Global Plastics Protocol setting common agreed definitions and industry standards on what materials are



put into the marketplace, to ensure our packaging is compatible with existing and cost-effective recycling infrastructures.

4. For companies to engage positively in policy discussions with governments on the need for improvements to waste management infrastructure, including the implementation of Extended Producer Responsibility schemes.

Polman added: "Addressing the issue of ocean plastic is a shared responsibility – all stakeholders in the value chain must work together in partnership to find effective solutions. However, there is no doubt that the response from the consumer goods industry will be amongst the most critical in determining the speed at which positive change takes place. We are at a critical juncture." Unilever has made good progress on reducing its waste footprint.

Since 2010, the waste associated with the disposal of its products has decreased by 28% and the weight of its packaging has reduced by 15%. The company also stopped sending non-hazardous waste to landfill from its manufacturing sites in 2015. Alongside its commitment to 100% reusable, recyclable or compostable plastic packaging by 2025, Unilever pledged to source 25% of its resin from post-consumer recycled content by 2025, and to publish its full plastics palette before 2020.

In 2017, the company announced it was making good progress on identifying a technical solution to recycling multi-layered sachets through its Creasolv technology, for which a pilot plant in Indonesia is currently being built to assess its commercial viability. We intend to make this technology open source and would hope to scale it with industry partners, so others – including our competitors – can use it. ■

HOW TechnipFMC IS USING 60+ YEARS OF EXPERIENCE TO DEVELOP A GROWING RANGE OF BIO-BASED POLYMERS.



When you're finished changing, you're finished."

Benjamin Franklin may not have been working in the bio-economy, but he was a scientist, so he knew a little about correct processes and the right ingredients, and he certainly had an

entrepreneurial spirit. And change is at the heart of the work of TechnipFMC, the focus of this exclusive feature – change as a company, and change in the way they develop their polymers as they move away from traditional methods into a more bio-based and sustainable way of delivering technologies to their clients. Let's begin with the change at company level.

In January 2017 TechnipFMC began operations as a combined company, following the merger of FMC Technologies of the United States and Technip of France.

Bringing together more than 37,000 employees and decades of experience, this new company is able, through their innovative technologies and improved efficiencies, to deliver fantastic results for their clients through an integrated approach across project lifecycles from concept to delivery and beyond.

This merger comes as a response to the changing nature of the energy industry. With proprietary technologies and production systems, integrated expertise, and comprehensive solutions, the newly minted TechnipFMC has the ability to bring significant and sustainable improvement to the economics behind major projects.

The company has three main segments – Subsea (technology, situated or occurring beneath the surface of the sea, typically related to oil and gas), Onshore/Offshore (again related to oil and gas, but also gas monetization, petrochemicals, polymers, refining and hydrogen – can include floating and fixed facilities at sea and facilities on land) and Surface (which gives their clients access to leading solutions in measurement and production systems and integrated services).

And it's the onshore segment where we find our bio-based change. Within it, a global business unit named 'Process

Technology' is where the segment's process technologies reside and are managed and developed. Already experts in this area, the group strengthened their position further by acquiring the Frankfurt-based Zimmer polymer technologies in December 2014. By bringing this business into the company, they gained technologies for the processing of polyesters and polyamides, research and development facilities, and around 40 skilled engineers, researchers and project teams. One member of this skilled team is Dr. Andreas Bormann, Managing Director of Technip Zimmer Process Technology (pictured right), in Frankfurt and he spoke to our Editor, Luke Upton, exclusively about their growing work in the bio-based sector.

Luke Upton (LU): Please give us a little introduction into your work:

Dr. Andreas Bormann (AB): Here in Frankfurt, first as Zimmer and now as part of TechnipFMC, we have built a market-leading position with our proprietary polymer processes. The company has always had a strong focus on research and development and over time we have developed our own technical processes. We have two major polymer product groups: polyester plants – used for production of a wide variety of products such as bottles (as PET), shirts, wraps, carpet and more, and polyamide plants – used for the production of packaging, textiles and engineering plastics.

LU: In recent years, you've changed your processes to give a bigger focus on creating bio-polymers. What has driven this change?

AB: For over 60 years, we've used traditional methods of polymer production. But in the last few years, we've expanded significantly into bio-based and bio-degradable polymer processes. Why has this happened? Well for our clients, legislative pressure in Europe and China has had a big impact. There's been a major effort to raise awareness of the environmental footprint of all products, including those made from polymers. We work in a market where our clients are looking more and more not only for high-quality, but also for more sustainable polymers and we made it our goal



to provide them with the right solutions. And we are already seeing success with this for our large, international clients around the world.

LU: So for a company reading this, and looking to re-examine their own polymer production, how does your process work?

AB: There are several ways that we partner with clients. We can work in our labs, with the client, developing a novel polymer together and then move to upscaling. Or we can develop the polymer ourselves, and then take it to the client. Either way, our in-depth knowledge of the technology and polymer design enables us to work with a host of clients. We can manage the whole project, from the master planning and process design stage through front-end engineering, lump sum turnkey execution and commissioning. And the project timeline can be between eight months and 18 months, depending on the scope.

LU: Thanks, and what has the shift meant for your total polymer plant sales?

AB: In 2014, 100% of our plants sales were based on traditional polymer technologies. This year around 50-60% will be from technologies for bio-based or biodegradable polymers. So it's a major change and a big commitment from the company.

LU: On that note, many of our readers work for companies that aren't yet fully embracing a more bio-based way of doing things but are considering making changes. Could you give some words of advice for them?

AB: Yes of course. In making our change we've had the full support of our company's board and senior management. But if you don't have that, I'd urge colleagues to not forget that there is always change going on in any industry and sometimes you have to embrace it if you do not want to get left behind. To go on the kind of journey we are on requires open-mindedness, curiosity and the will to leave beaten paths!

"THERE'S BEEN A MAJOR EFFORT TO RAISE AWARENESS OF THE ENVIRONMENTAL FOOTPRINT OF ALL PRODUCTS, INCLUDING THOSE MADE FROM POLYMERS."

LU: And one last question, if we have companies that want to make a change, why should they contact you?

AB: We are always happy to talk! We bring decades of experience, proprietary technologies and integrated expertise to the table. Beyond this TechnipFMC also has engineering, procurement and construction (EPC) capabilities and the flexibility that our own laboratories, pilot plants and partner facilities offer to clients. The team here consistently has a focus on bringing ideas through our innovation process into commercialisation, often by challenging conventions. We call it 'purposeful innovation'. And we are all excited about the developments that are happening in our industry and proud to be a big part of them!

It's fantastic to speak to Dr. Bormann and learn about the change that TechnipFMC has made in how they develop their polymers. Launching a more sustainable product is one thing. But making a sustainable change within a company that is already successful is often rare, and always commendable. I think that Benjamin Franklin would approve. ■

To learn more about TechnipFMC, contact andreas.bormann@technipfmc.com

FIVE VERY DIFFERENT WAYS THAT CAN HELP TACKLE THE GLOBAL PLASTIC CRISIS.

Dave Songer, *Bio-Based World News*

Reducing the world's dependency on plastic and the development of 100% sustainable alternatives are issues that are very close to Bio-Based World News' heart. We've covered it a lot recently – from the astonishing rise of publicity following the BBC's Blue Planet II series, which showed how plastic had reached even the dark depths of the world's oceans, and Evian and Suntory's development of 100% sustainable plastic bottles, to Unilever's news that it is to overhaul its packaging as part of a plan to replace it with compostable alternatives by 2025.

It's clear the will is there to fight the spread of waste plastic, but what of the practical considerations that will develop the best-laid plans into a reality? Today we explore five of the technologies, campaigns and the approaches taken by countries already making big inroads, clearly illustrating that where there's a will, there most certainly is a way.

1

INCENTIVISING RESPONSIBLE USE

Before 100% sustainable plastic which breaks down naturally and leaves no trace is here there is a growing feeling there should be an attitude change towards single-use plastic – one where taking your own reusable plastic bottle or cup every time you leave the home becomes the norm.

Taking inspiration from Denmark, which in 2003 introduced a retailer tax on single-use plastic bags, and Mexico which from 2010 fined retailers from giving out bags at all, the UK government announced late last year of its intention to hardwire such a situation into consumers' minds, with a proposed tax on all single-use plastics including packaging, takeaway boxes and plastic bottles. How that policy would be applied is unclear, but the government will no doubt hope that it echoes the success of the 5p charge on plastic bags that was enshrined into UK law in October 2015. The Department for Environment, Food and Rural Affairs, reported a year since the plastic bag levy plastic bag was adopted that the use of plastic bags had dropped by a massive 85%.

2

FOLLOWING NORWAY'S EXAMPLE

As with so many things in industry, collaboration is a proven way of achieving good results; sharing knowledge and learning from each other's mistakes can really improve the chances of success. That's certainly the case in the bio-based industry, exemplified recently by Genomatica and Aquafil's partnership to create 100% sustainable nylon.

Collaborative approaches such as those don't just extend to companies, there are countries taking a progressive approach to the green agenda which could help inform future policies in other parts of the world. Take Norway for instance, which recycles a staggering 97% of its plastic bottles thanks to an incentive-based scheme that pays the recycler at specially-adapted machines which read barcodes on bottles to produce a coupon that can be later redeemed for cash. So good is the scheme that it appears likely it will also be adopted in Hong Kong to put a stop to the existing practice of shipping unwanted recyclables to landfills on the Chinese mainland.

3

SUPPLIER BACKING

No matter how big the appetite among the public for recycling, without a commitment from the companies producing and supplying the products progress is likely to be challenging. Back in the UK, the Iceland chain of supermarkets announced in January that it would be completely remove the use of plastic in all of its own-brand products by 2023, an initiative that would help reverse the worrying statistic revealed by Greenpeace that UK supermarkets generate one million tonnes of plastic every year. Despite having more than 800 stores, Iceland has just a 2.2% share of the UK food market but it's hoped that the drive from the supermarket chain will kick-start its much larger competitors, such as Sainsbury's and Tesco, to also make similar pledges.

"The onus is on retailers to take a stand and deliver meaningful change. Other supermarkets, and the retail industry as a whole, should follow suit and offer similar commitments during 2018," said Iceland managing director, Richard Walker.

**Large shops in
England must
charge 5p for
single use plastic
carrier bags from
5th October 2015**

**4**

HARNESSING BIOLOGY

Even if a solution for a fully biodegradable plastic was in place today, there is still the huge matter of recycling all the plastic already in existence. Around 480bn plastic bottles were sold around the world in 2016, reported The BBC last year. That's one million bottles a minute. There is hope, though, as there is an emerging technology currently being developed that chemically breaks down any plastic into basic chemicals that can then be used as a feedstock to make more bottles or even used as biofuel. Should it be successful it would remove the need for expensive and time-consuming sorting regimes: one of the main contributing factors towards low recycling rates.

"New materials enter the market slowly, and thus the biggest impact is in developing more efficient methods to recycle the plastics that are produced in large quantities today," said Megan L. Robertson, associate professor of chemical and biomolecular engineering at University of Houston, in Science Daily.

5

COMMITTED CAMPAIGNING

Today, the challenge of gaining worldwide recognition and pushing an issue up the agenda can be achieved with relatively little effort through the use of social media and focused digital campaigns. If it's timed right, pitched in the correct way and is about an issue that enough people care about a message can gain worldwide attention in days and even hours. A tactic (sometimes) used to great effect is the online petition, which can accrue thousands of signatories in seconds – an achievement made all the more easy owing to the ease with which people can make their voice heard.

The power of the internet has been leveraged to raise the issue of plastic waste, with eco-warriors Greenpeace – an organisation not averse to using the tactic – launched a campaign to encourage Coca-Cola to spearhead change. According to Greenpeace, Coca-Cola produces more than 110 billion single-use bottles and is in a great position to enact industry-wide action. In the campaign's first week it received around 150,000 online signatures, a figure that in around three months grew to 500,000. Coca-Cola has said it is committed to reducing single-use waste and in October 2017 introduced a trial system at England's Reading University using refillable bottles.



BBI JU 2017 STAKEHOLDER FORUM - BRINGING TOGETHER THE BIO-BASED COMMUNITY.

The inaugural Stakeholder Forum took place in Brussels dedicated to engaging directly in dialogue with BBI JU's projects and stakeholders. It brought together all of BBI JU ongoing projects who were given an opportunity to present the details of their project in a dedicated exhibition and in thematic workshops. More than 600 participants took part in the event and the day programme provided many opportunities for networking and exchange of thoughts and ideas.

Bringing together the right people at the right time was important, as we move with conviction towards the creation of a European bio-based economy. The event managed to do exactly what it promised: bring together all actors of the bio-based community! Participants represented a wide range of industries and sectors, SMEs, academic and research organisations, local and national government, EU Institutions, primary producers, political figures, projects and the bio-based industries community as a whole. The day was the true proof of the catalyst effect BBI JU has in building the bio-based sector: connecting the links of the currently somehow fragmented the bio-based chain.

Throughout the day the high level speakers, from the Commissioner of Agriculture and Rural Development to project coordinators and from recognised entrepreneurs to academics all agreed upon the key importance of the development of a competitive and sustainable bio-based sector in Europe that will have in the heart of its operation the citizens of Europe, the environment.

A number of strategic messages were developed by the speakers, while the audience whose questions stimulated animated discussions and debates echoed the workshop' conclusions some of which are described below.

"THE DAY WAS THE TRUE PROOF OF THE CATALYST EFFECT BBI JU HAS IN BUILDING THE BIO-BASED SECTOR: CONNECTING THE LINKS OF THE CURRENTLY SOMEHOW FRAGMENTED THE BIO-BASED CHAIN."

Innovative value chains within the bio-based sectors can provide new outlets for agricultural products and by-products. In this way, sources of income for farmers and rural populations can be increased and diversified which is totally aligned with the vision of thriving and resilient rural communities in Europe. At the same time, the development of a bio-based sector has the potential to create much-needed jobs in rural areas, and to contribute to more circular, climate-friendly and resource-efficient agriculture and forestry practices.

Improved policy coordination and standards at European level must prevail national regulations so that the challenge of creating a European sector will be tackled efficiently avoiding the creation of an uneven playing field. BBI JU is already dealing with the complexity of connecting until recently disconnected actors. Its centralised management of the program provides a "one stop shop" point for interested parties and facilities information flow.

Looking further to 2020, participants reflected and elaborated on the need for the continuation of the initiative, not only because the initial reasons of its creation, such as de-risking of investments, building critical mass etc. continue to remain valid, but also because its extension will solidify the momentum already established during the first years of its operation. BBI JU has and will continue to show an increased focus on structuring the sector and will further concentrate its efforts on actions that can make a difference and produce a clear impact. ■

For more information visit www.bbi-europe.eu



ON-SITE ENZYME PRODUCTION TO CUT COSTS IN BIOREFINING

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PROJECT FOCUS: MOVING EUROPE'S MOUNTAIN OF NAPPIES FROM LANDFILL TO HELPING CREATE USEFUL BIO-BASED PRODUCTS.

Luke Upton, *Bio-Based World News*

As any parent will tell you, babies use a lot of nappies (diapers) and as the father of a 16 week old, I am now learning directly about the large amount of waste that even a very small baby produces! It is estimated that a child will use between 4,000 and 6,000 nappies and in the UK alone about eight million are thrown away each day, accounting for about three percent of total household waste. Disposable nappies in landfills take hundreds of years to degrade, but also have a significant environmental impact through their manufacturing, transport and the chemicals they require. When you include all absorbent hygiene products (AHP) waste, not just nappies but also adult incontinence products, feminine hygiene items and wipes, etc., across Europe, this non-recyclable waste totals 8,500,000 tons being incinerated or landfilled. But now, a fantastic new project, EMBRACED, supported by the, Bio-based Industries Joint Undertaking (BBI JU), a public-private partnership between the EU and the Bio-based Industries Consortium, is working to improve this process.

And to learn more, we speak exclusively to Marcello Somma Head of R&D and Business Development at FATER, a joint venture between Procter & Gamble and Angelini Group that manufactures and distributes a wide portfolio of products including Pampers in Italy who are co-ordinating the consortium behind the project, and Philippe Mengal, BBI JU's Executive Director who are supporting the project.

Launched in June of last year, the EMBRACED project is focussed on establishing a multi-purpose bio-refinery for the recycling of the organic content contained within used nappies and other AHP waste.

I ask Marcello to introduce the project; "The origins lie in a focus on unlocking the potential that remains in nappies and other AHP beyond their use. Many of us are parents ourselves and have seen the huge amounts of waste first hand. At FATER, we strongly believe in the potential of the circular economy. We started with a nappy recycling demonstration plant in Northern Italy in 2015 and it's exciting that the EMBRACED project will be taking this to the next level."

EMBRACED is taking place in Amsterdam and has a number of objectives, but principally to demonstrate a replicable logistical scheme and service which will enable the collection of 10,000 tons/year of separated AHP waste and from this recover three separate high purity fractions suitable for subsequent added value valorisation. It will validate the obtained bio-based products - fermentable sugars and syngas and demonstrate the involvement of the local community in order to increase the separate collection and recycling of AHP waste in paving the way towards a wider uptake of this process.

EMBRACED is a truly Europe wide partnership with organisations from Italy - Legambiente Onlus, Novamont, Contarina, Edizioni



Ambiente, Germany – Fraunhofer, Spain - Fundación CIRCE, Fertinagro, the Netherlands – AEB Expolitatie and BV Ruberfabriek Wittenburg), Switzerland – Procter & Gamble, Croatia – Saponia and the United Kingdom – Terracycle. This impressive line-up includes experts in logistics, conversion into new materials, enabling legislative framework, and the scaling of the recycling technology.

The consortium has received support and funding worth €10.6m from BBI JU and Philippe tells us more; “Our role is to help develop a sustainable and competitive bio-based industry in Europe. We firmly believe in the capacity of our European industries to play a leading role in this sector. And this is a particularly impressive project, demonstrating an innovative and beneficial solution to a significant environmental challenge.”

Marcello tells us more about BBI JU’s involvement; “They have been hugely important. It’s a major challenge bringing the bio-based world to brand owners. And only partnerships, like those brought together for EMBRACED can help us achieve the goals that we all have for the bio-economy. In addition to their financial support, BBI JU have been able to bring their experience in developing an international consortium and leveraging the sometimes complex processes within it to make it a success.”

I conclude by asking Marcello what the final goals for the project were; “It’s a hugely exciting project and by 2022 will have demonstrated the feasibility of taking nappies and other AHP waste and through valorization developing sustainable and commercialised bio-based materials such as bio-plastics, fertilizers and high-end chemicals. In addition to the environmental benefits there’s also clear economic advantages through the product development and job creation. A real win-win!” ■

“IT IS ESTIMATED THAT A CHILD WILL USE BETWEEN 4,000 AND 6,000 NAPPIES AND IN THE UK ALONE ABOUT EIGHT MILLION ARE THROWN AWAY EACH DAY, ACCOUNTING FOR ABOUT THREE PERCENT OF TOTAL HOUSEHOLD WASTE.”



European
Commission

Innovative bio-based products: Investment, Environmental Impacts and Future Perspectives

6 June 2018 · Brussels



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Innovative bio-based products: Investment, Environmental Impacts and Future Perspectives

ANY QUESTION?

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The project consortium conducted a study on research and innovation policy in the area of bio-based products and services on behalf of the European Commission.



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CUTTING THE COST OF BIOREFINING WITH ON-SITE ENZYME PRODUCTION.

Travis Larson, TenFour

The first wave of biorefineries has demonstrated that the technology works and the business model is viable. Combined with the oil-price volatility that makes ethanol production an increasingly attractive investment, this will likely lead to more players entering the market. But what can be done to speed up the wider adoption of biorefining and make it more economically viable on smaller scales?

Biorefining is the process in which residual biomass – for example the waste from farming sugarcane – is converted into useful fuels and chemicals. Biochemical biorefineries rely on powerful cellulase enzymes to speed up the process of breaking down biomass into sugars, which can then be processed further to create the desired end product, such as ethanol for use in vehicle fuel.

If biorefiners could produce their own enzymes on-site, tailored to their specific raw materials and processes, they could both improve enzyme efficiency and make substantial cost savings by eliminating the need for purchase and transport. The good news is that not only is on-site enzyme production already possible – it is likely to become the norm in the future.

Solving the enzyme bottleneck

One of the major challenges for biorefiners is enzyme supply. Currently, cellulase enzymes are only produced at a limited number of facilities in North America and Europe. Although these enzymes are high quality, they are also expensive – especially in the quantities needed by a biorefinery. A typical ethanol biorefinery measures enzyme use in tonnes per day, which is why they make up on average 30–40% of the cost of biorefining. After production, the enzymes need to be concentrated and formulated to stabilize them before they are shipped to biorefineries around the world. These transport costs lead to higher operational costs, which is a significant factor holding back the wider adoption of biorefining technologies. Commercial enzymes are also “one size fits all”, even though raw

materials and pre-treatment processes vary widely. This cookie-cutter approach means biorefiners are unable to squeeze more efficiency out of their enzymes, for example if their biomass feed or processes change. Some producers are discussing a new model of near-site production, where enzyme production facilities are located closer to the refinery. However, while this can reduce transport costs, it does not solve the problem of a lack of flexibility when it comes to tailoring the enzymes.

How on-site production can help

Producing enzymes on-site solves many of the challenges related to the current centralized production model. On-site production ensures a consistent supply while also cutting out the need for costly concentration, formulation, and transport; instead, biorefiners are able to simply pump the liquid enzymes directly into the process as needed.

On-site production also allows enzymes to be tailored to better suit a biorefinery’s specific raw material and production processes – and over time it is this enzyme fine tuning that will ultimately allow the creation of a local enzyme product that delivers better results for less money.

Carlos Calmanovici, Process Development & Innovation Executive at Brazilian ethanol and sugar producer Atvos, agrees. “From an economic point of view, it’s obviously much better to have competitive on-site production, while from a technical point of view, the possibility to really tailor the enzymes for each application is a unique advantage.”

Biorefiners also benefit from greater flexibility as they are not tied to a specific supplier or a long-term contract. By lowering costs, on-site production can also enable new biorefining business models for lower-volume waste materials where centralized enzyme supply does not make economic sense. According to Simo Ellilä, Research Scientist at VTT, “In a recent case, our modeled enzyme cost was lower than one would expect for an enzyme preparation purchased from a separate, non-adjacent

production facility. Just removing the need to transport the enzyme to the ethanol plant accounted for savings of \$0.09–0.18 per kilogram of product.”

Brazilian biotech company GranBio operates the southern hemisphere’s first commercial-scale 2G ethanol plant. Process Coordinator Osmar Carvalho Netto also sees clear advantages in on-site production: “Enzymes produced on-site will be much cheaper than commercially produced alternatives,” he believes, “and although it will take a few more years for them to become the norm, simply having two different options to choose from will offer much-needed flexibility.”

A partnership that delivers valuable expertise

It is important to stress that on-site enzyme production is not a “plug-and-play” solution; it requires careful planning and specific scientific expertise, which many biorefiners may feel they lack. This is where VTT’s expertise and practical support can be invaluable.

“VTT has worked with the primary cellulase-producing organism – *Trichoderma reesei* – for more than three decades, and no one can match our track record,” says Nina Aro, Principal Scientist at VTT. “We also have the necessary skills to optimize the enzyme cocktail and production processes to fit the exact needs of a particular biorefinery’s raw material.”

VTT aims to offer a complete package to help biorefiners get started, including the enzymes, host production strains, and biomass. Through screening and development, VTT can create a starting-enzyme cocktail for biorefineries to enable efficient cellulose hydrolysis. External partners are brought in as needed, for example to design the enzyme production plant.

“We’ve been impressed by VTT’s vast experience in enzyme production and their understanding of how these particular microorganisms work,” says Osmar Carvalho Netto. “Their wide network in various fields also gives them a unique perspective on future development,” he continues.

“Our goal is to be a long-term partner,” says Simo Ellilä, VTT. “We can act as advisor not only throughout the setup process, but also into the future – for example, assisting with continued development and refinement of the enzymes to improve quality and further bring down prices, or to make adjustments when needed, for example if the biomass changes. The key here is to enable the flexibility that biorefiners need to stay competitive.” In an industry as young as biorefining, companies will continue to experiment in order to find the optimal model to secure cost-efficient, high-quality enzyme supply. However, as the majority of the world’s biomass is located in regions like South America, Sub-Saharan Africa, and Southeast Asia, the significant cost savings enabled by local supply mean that the shift towards on-site production will continue. The greater flexibility it offers should also enable new business models for processing other

waste products or producing non-ethanol products, including those with smaller volumes than a typical first-wave biorefinery producing ethanol.

According to Osmar Carvalho Netto, “Working with VTT showed us that on-site enzyme production is definitely viable from both a cost and technical perspective – which is why we strongly believe that this model, including commercial enzyme producers setting up their own on-site plants, is going to become more and more popular in the future.”

It’s an assessment reinforced by Carlos Calmanovici. “Commercial off-site production of commoditized enzymes might not be efficient enough in the long term. The move has to be toward more regional and, ultimately, on-site production,” he concludes. ■



“IF BIOREFINERS COULD PRODUCE THEIR OWN ENZYMES ON-SITE, TAILORED TO THEIR SPECIFIC RAW MATERIALS AND PROCESSES, THEY COULD BOTH IMPROVE ENZYME EFFICIENCY AND MAKE SUBSTANTIAL COST SAVINGS BY ELIMINATING THE NEED FOR PURCHASE AND TRANSPORT.”



THE LAST WORD WITH... CHRISTOPHE SCHILLING, CEO OF GENOMATICA.



The timeline to realise our business plan was stretching out, placing more stress on the company. My biggest challenge was to keep it all together and navigate a course through stormy weather, and we did.”

In its quest to develop commercial bio-based chemicals used to produce sustainable everyday products better than their fossil-based alternatives, [Genomatica](#) has commercialised processes for plastics and cosmetics and is well underway to engineering bio-based nylon and tyres. The company’s ability to ‘programme biology’ is backed by an intellectual property portfolio that includes around 700 patents and applications – resources that no doubt helped it to pick up the ICIS Best Innovation award last year for its butylene glycol product, GENO BG.

Bio-Based World News’ Dave Songer caught up with the co-founder and CEO of Genomatica, Christophe Schilling, to find out more about the company hopes to change everyday products for the better. In the interview, Christophe explains the importance of understanding the customers’ motives, how the company overcame a two-year blip and what’s so exciting about his favourite bio-based product.

Dave Songer (DS): You have 20 years of experience in the bio-based industry – what do you most enjoy about working in it?

Christophe Schilling (CS): The technologist in me loves how we keep getting better at programming biology. The engineer in me is fulfilled by seeing concepts turn into commercially operating

plants. The entrepreneur in me enjoys seeing the business and the field mature. And the conservationist in me is energised about our increasing ability to positively impact society through more sustainable everyday products.

DS: What would you say is the biggest challenge facing the industry? And the opportunity?

CS: I believe it’s a more exciting time to be involved in the bioeconomy than ever before. But the biggest challenges are of the industry’s own making and both have led to customer and investor disappointment: under-delivery and over-simplification. Many firms have and continue to promote unrealistic timelines to commercialisation and misleading guidance on market size or the time it takes to create new markets; the results are not pretty. Similarly, some firms over-promote the breakthrough potential of a technology that focuses on a piece of the overall problem; the issue is that customers need to deploy whole solutions.

The opportunity is to deliver and show success. To deploy real, whole solutions we need to understand what our customers are looking to do, need to do, and the world they operate in; and become a valuable and trusted partner by challenging them and presenting a distinctive point of view. But this always needs to be done while working with them to connect the dots and deliver a full solution.

DS: What is the biggest professional challenge you’ve faced?

CS: From 2014 to 2016 it was hard going. Our underlying technology worked, we had good commercial partners, and



“I BELIEVE IT’S A MORE EXCITING TIME TO BE INVOLVED IN THE BIOECONOMY THAN EVER BEFORE. BUT THE BIGGEST CHALLENGES ARE OF THE INDUSTRY’S OWN MAKING AND BOTH HAVE LED TO CUSTOMER AND INVESTOR DISAPPOINTMENT: UNDER-DELIVERY AND OVER-SIMPLIFICATION.”

believed our strategies were sound but it was a very tough environment to sell into and you could feel the hesitation on bold partnerships. The timeline to realise our business plan was stretching out, placing more stress on the company. My biggest challenge was to keep it all together and navigate a course through stormy weather, and we did. We found significant new investors and partners that had a similar view of our opportunity and that gave us a great boost. 2017 was a record year, with our highest revenue ever; five new partnerships including the largest R&D agreement in our history; a smooth-running commercial plant for our first product, bio-BDO; a second product in early commercialisation, our Brontide™ bio-butylene glycol, which won the ICIS Innovation Award; and we have been rated #1 in delivering sustainability technology by the mainstream chemical industry, competing against the largest firms.

DS: What advice would you give someone looking to get started in the bio-based industry?

CS: Find a company whose culture and values match yours. That’s the basis for doing great things with your colleagues and loving your work. As I often share with the team, fulfilment comes from doing significant things alongside people that are significant to you, meaning you have shared purpose and work in a high trust environment. Beyond that – look for the companies that seem like they’re solving genuine customer pain or enabling entire new businesses, not just ones that have cool technology.

DS: What is Genomatica’s business focus for 2018 – can you share any details?

CS: Yes, absolutely – more innovation, more partnerships and more market traction. 2018 is already shaping up to be much bigger than our record 2017. We kicked off this year by announcing our collaboration with Aquafil for our polyamide intermediates programme. That’s aimed at bringing more sustainable everyday nylon products to reality, like apparel and carpets. You’ll see more on bio-BDO, more on our new Brontide™ butylene glycol and definitely more partnerships. We hope we’ll be able to talk about them!

DS: Where would you like to see Genomatica in 10 years’ time?

CS: I see Genomatica leading a transition to more sustainable everyday products. More chemical companies, downstream firms and major brands looking to us as the go-to partner for pragmatic, advantaged technology that supports them in their key business and societal initiatives. Visible metrics of our impact, strong financials, energised employees, delighted customers and partners and much more ahead of us.

DS: What is your favourite bio-based product and why?

CS: I’m especially fond of a bio-based athletic shirt made with bio-BDO produced using our GENO BDO process. The very first of these is on display in the lobby of our San Diego Innovation Center. The shirt made our innovation tangible and real and meant that people could see and touch what it meant to be able to get the same great products but which can also be made more sustainably. That shirt opened a lot of good conversations! ■