Can Europe stop the stream of waste?

CIRCULAR ECONOMY For decades now, Europeans have dreamed of creating a low-waste society powered by an economy that copies cycles and principles found in nature. In December, the European Commission laid the foundation stone for establishing a 'circular economy', which aims at protecting the world's finite resources by – among other measures – repairing products instead of throwing them away. At the moment, the strategy is focused on waste prevention. But will that be enough to meet challenges like global warming, marine debris and shortages of raw materials?

Picture: Matic Štojs/fotolia.com

Europe is drowning in a flood of waste. Each and every citizen in the EU produces 481 kilogrammes of household waste annually – around 224 million tonnes a year. 94% say they wished they could do more to stem the flood of garbage. At the same time, critical rare resources are running short. If everyone on earth today had the lifestyle of an average European citizen, we'd need the resources of 1.6 planets to satisfy them. If things continue as they are unchecked until 2050, we're going to need the resources of 2.6 planets. Estimates from the United Nations Environment Programme (UNEP) say 14 resources essential for the production of smartphones and tablets, hard-drives, catalytic converters, hybrid cars and other technical achievements will be depleted by then. The UN organisation also predicts that our oceans will contain more plastic waste by weight than fish by 2050, and that plastics production will swallow 20% of all oil output.

"The world's current economic model is an environmental global suicide pact that will result in disaster if it isn't reformed. We need economic innovation," says UN Secretary General Ban-Ki Moon. A pioneering study published by the Ellen McArthur Foundation with support from McKinsey analysts agrees that it's "time to rethink materials and energy use." The experts recommend solving the waste problem and the finite resources challenge with one blow by creating an economy inspired by nature's principles of circularity.

According to the analysis, recycling and incinerating the more than 2.5 billion tonnes of waste produced yearly in Europe currently captures only about 5% of the original raw material value. In monetary terms, that works out to an economic loss of €80–120bn – without even factoring in costs due to environmental damage like plastic in the oceans. The "exploitation of nature challenges the productivity of economies," the study concludes, which takes into account factors like price volatility of finite resources, climate change, land degradation, ocean pollution and loss of biodiversity. The authors recommend replacing the current linear take-make-dispose model of production and consumption with a circular one that designs waste out of production. In this kind of circular economy, the only materials consumed are renewable and bio-based, while all 'nutrients' are recycled just as they are in nature's biological cycles.

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In the ambitious zero-waste concept, all products made from finite resources would be used in closed loops, but no longer 'consumed', since all technical materials would be recovered.

The study stresses that six pieces have to be put in place before the transition to such a circular economy will be possible: Regenerate [instead of waste], Share [instead of own], Optimise [i.e. production], Loop [instead of dispose], Virtualise [through Internet business models] and Exchange [instead of throw away] – in brief, "RESOLVE". It also predicts that by 2030, a smart link-up of technical and bio-based production cycles could provide over 30% savings in primary material consumption and a 50% drop in CO_2 emissions (see Figure 1, p.52). Circular sustainable product design, cascade production and smart recovery would all be key to implementing a sustainable economy model, the study says.

NATHALIE MOLL
Secretary General, EuropaBio

? What does biotechnology have to offer the Circular Economy?

! *"Industrial biotechnology creates smart, sustainable products and processes based on renewable raw materials, enabling carbon to be recycled at the end of the product's life. This exemplifies the circularity of the bioeconomy."*

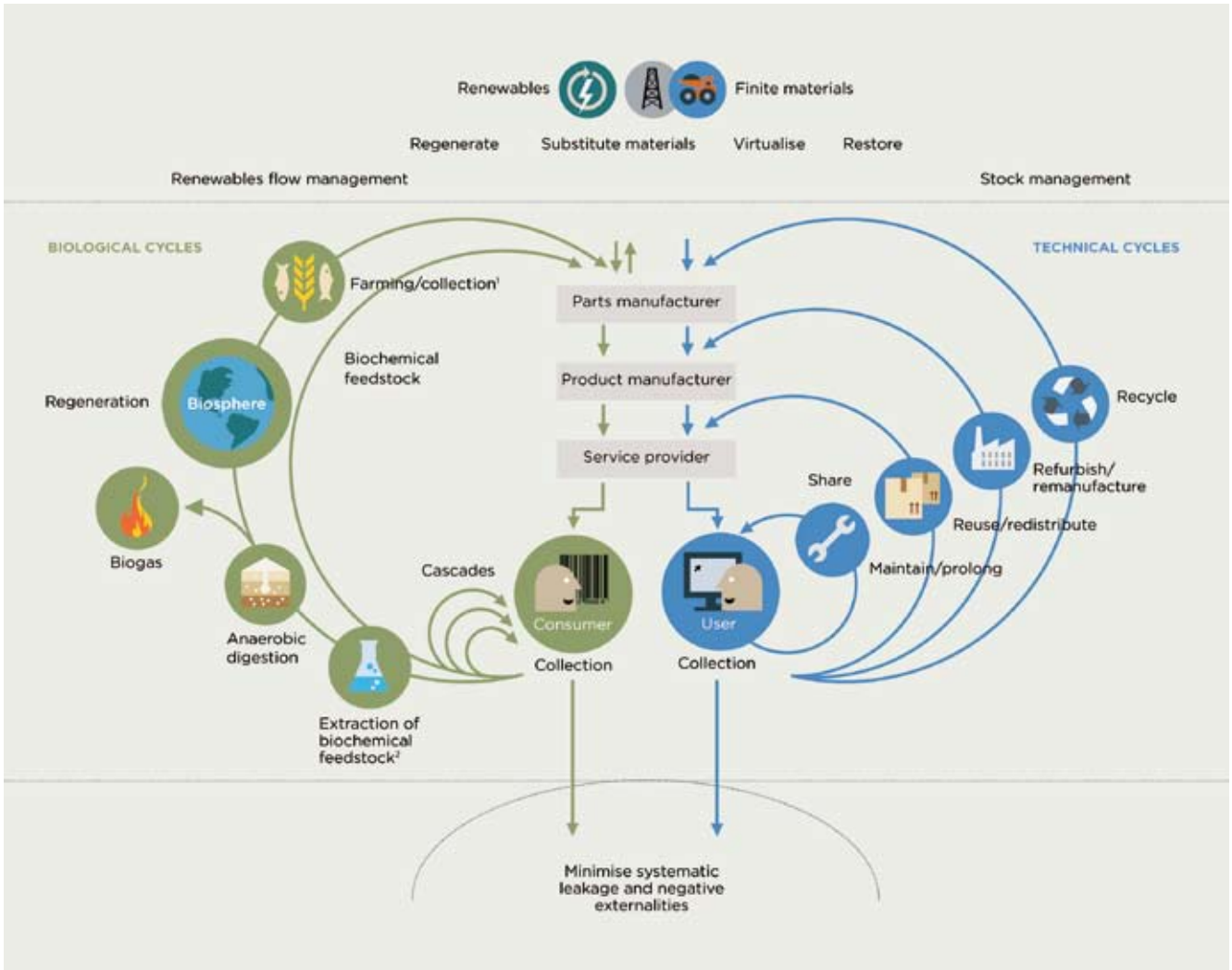
A huge opportunity for biotech

Biotechnologists have been waiting with bated breath ever since the European Commission announced in January 2015 that it would be presenting an ambitious package of measures to make the Circular Economy a reality in Europe. Prior to the COP21 Climate Conference in Paris, DG Internal Market's Chemicals Unit Head Reinhard Büscher stressed that biotech solutions would be crucial to achieving the European CO_2 reduction target by 2030. "A 40% reduction of CO_2 compared to 1999," he said, "can be only achieved by further development of the bioeconomy." Experts from the US, such as green chemistry pioneer John Warner from the Warner Babock Institute, believe however that a sustainable circular economy can't be built only on waste prevention, product repairability and cycling waste streams. He's convinced product innovation will also be essential to achieving the twin goals of sustainability and economic return. "If the basic building blocks [of a product] are not sustainable," Warner says, "no designer can weave it, solder it and glue it together to make a sustainable product."

What's in the latest package

In December, the European Commission took the long-awaited first step towards implementing the new economic model in Europe. EC Vice President Frans Timmermans, who stopped the former Commission's reform of waste laws last winter under heavy protest from MEPs, has now tabled what he calls "a broader package." "Our planet cannot survive if

Picture: EuropaBio



Dame Ellen MacArthur's vision of a circular economy: products, restorative and regenerative by design, are produced by intertwining biological and technical cycles in order to decouple economic development from consumption of finite resources. 1. Preserve and enhance natural capital by controlling finite stocks and balancing renewable bio-based resource flow (regenerate, virtualise, exchange). 2. Optimise resource yields by circulating products, parts and materials in use in both technical and biological cycles (share, optimise, close loops). 3. Foster system effectiveness by revealing and designing for negative externalities.

we continue with the take-make-use-and-throw-away approach. We need to retain precious resources and fully exploit all the economic value within them," he said, adding that although "the circular economy is about reducing waste and protecting the environment … it is also about a profound transformation of the way our entire economy works. By rethinking the way we produce, work and buy we can generate new opportunities and create new jobs." According to the Commission, full implementation of its circular economy package could lead to annual net savings of €600bn through better recycling of waste, better product design and closing the loop. It also expects a total reduction of greenhouse gases by 2-4% per year and a 50% reduction of the 100 million tonnes of food wasted annually in the bloc.

Focus on waste collection

In addition to reforms in waste legislation, the Commission tabled a non-binding action plan that reflects its roadmap for pushing the circular economy between now and 2020.

However, critics from the Green Alliance say that the economic projections, which were taken over from the former Commission's draft, have been overstated, because the current EC has diluted the waste targets proposed by the Barroso Commission. Brussels insiders have also told EUROBIOTECH that they believe the Commission isn't properly considering the role that bioeconomy plays in the process. "Bioeconomy is a broader concept than the circular economy. It's renewable, carbon-neutral, and offers reusability in cascades and products with completely new properties. Take Avantium's biobased CO_2-sealed PEF lightweight bottles – they could cut the amount of CO_2 outgassing from billions of

Picture: Ellen MacArthur Foundation, McKinsey Center for Business & Environment, Scheme: Braungart & McDonald, CradletoCradle

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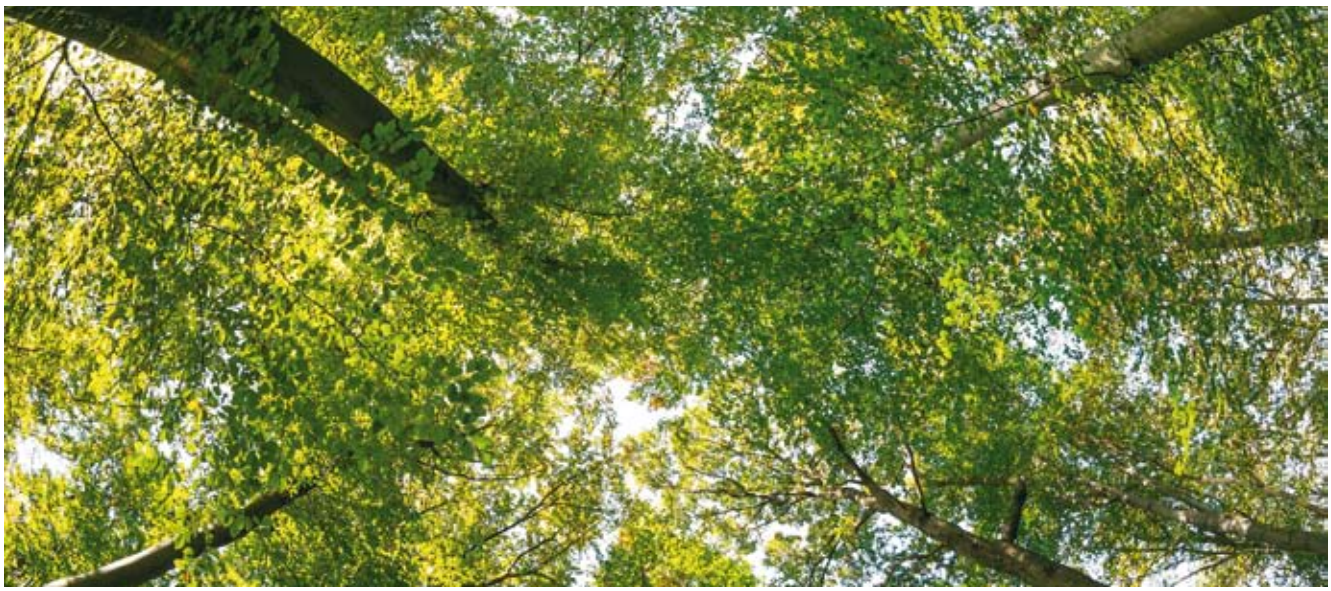

A major recent deal reflected the economic potential of bio-based production. By 2019, Chinese firm Sunshine Kaidi New Energy Group will have invested €1bn in a new wood-based biodiesel plant in Finland, creating 4,000 new jobs along the way.

Coca Cola bottles by 75%," one whistleblower who wished to remain anonymous told us. "That's much more than waste prevention, which is the current focus of the Commission's package." And it's true that the EC's legal proposals don't mention the bioeconomy a single time. Neither does its 2016/17 working plan, which lays the foundation for future funding calls. Instead, the legal package aims to:

- Improve the recycling rate for municipal waste (currently 244 million tonnes per year, 10% of the EU's total waste) from 40% to 65% in weight input by 2030 (Barroso Commission: 70%)
- Lift the amount of (plastics) packaging waste that is delivered to recycling plants from currently 26% to 75% by 2030 (Barroso Comm.: 80%)
- Limit landfilling to less than 10% of total waste by 2030 (Barroso Comm.: Landfilling ban by 2030)
- Implement a ban on landfilling separately collected waste
- Harmonise calculation methods for recycling rates
- Fix the 2030 recycling targets of municipal waste to a 75% rate for wooden waste, 85% for ferrous metals, 85% for aluminium, 85% for glass and 85% for paper and cardboard

Seven EU Member States with less-developed recycling infrastructures can be granted five-year extensions in all cases. The legal drafts are complemented by an action plan aimed at designing reusable and repairable products, as well as resource-efficient production processes, boosting consumption by trustworthy green labels, and establishing voluntary rules for green public procurement. Specifically, the Commission is seeking to:

> "The bioeconomy is the biological heart of the circular economy."

- Improve product design at the start of a product's life to make it more durable, easier to repair, upgrade or remanufacture. A 2016 update of the Ecodesign Directive will especially affect dismanting of electronic devices, which usually contain rare earth elements.
- Encourage better product design through financial contributions from producers to end-of-life costs (Extended Producer Responsibility schemes)
- Optimise resource use and recyclability in production processes. For industrial waste not covered by municipal waste legislation, the Commission wants to establish sector-specific best-waste management and resource efficiency practices (BREFs) in granting permission for new installations. To solve the problem of marine garbage and establish innovative plastics that are degradable on command, the Commission is drafting a "Strategy on Plastics in the Circular Economy" by 2017.
- Increase consumption through green labeling and green public procurement schemes, which will be used by public authorities on a voluntary basis
- Boost waste prevention and management locally through a €5.5bn Cohesive Funding budget. The Commission is aiming to define quality parameters for recyclable waste in order to generate markets for secondary raw materials, such as plastics, which can be reinjected back into the economy. It also announced a revision of the EU regulation on fertilisers. "Creating markets for secondary raw materials is at the heart of the new circular economy package," explains Büscher.

Bioindustry associations and MEPs welcomed the Commission's new commitment to the circular economy, but they

Picture: John Smith/fotolia.com

also emphasised the imminent circularity of the bioeconomy.

A wake-up call for industry

According to Dirk Carrez, the Director of the Bio-based Industries Consortium – the private partner in a €3.7bn public-private partnership – the "projected socio-economic and environmental benefits [of the Circular Economy] are impressive. But these benefits will only be truly felt if the bioeconomy – the renewable part of the circular economy concept – is made to play its important and growing role."

EuropaBio called for the prioritisation of biotech solutions for a circular economy in Horizon 2020. According to the industry organisation, coordinating the production of biobased products with waste management is a necessary first step in adopting appropriate political measures to ensure a sustainable transition from a linear towards a circular economic model. "Industrial biotechnology creates smart, sustainable products and processes based on renewable raw materials, enabling carbon to be recycled at the end of the product's life," said the association's Secretary General Natalie Moll. "EuropaBio is convinced that the Commission's move towards a circular economy can only materialise if the growing roles of the bioeconomy and biobased products are fully recognised and supported through concrete policy actions to help create markets for more sustainable goods and services."

In its action plan, the Commission says that bio-based industry success will depend on investment in integrated biorefineries. However, Moll emphasises that according to the IMF, "fossil industries are still being subsidised to the tune of US$5.3 trillion … so without real support, how can renewable alternatives compete?"

Stephan Tanda, a board member at enzyme world market leader DSM, points to the impact that green public procurement programmes have already had across the pond. "The US has led the way with their top-down Biopreferred programme, which tracks and labels biobased products to help procurers identify and purchase them. In 2013, biobased industries added US$369bn to the US economy and accounted for four million jobs. These kinds of measures are crucial to replicate such successes for the EU, and a strong EU bioeconomy will be crucial for a successful EU circular economy."

EU parliamentarians have already made it clear, however, that they would like to see both stricter recycling targets and a more comprehensive role for biobased production in the circular economy package. "We need to give the bioeconomy more space in the existing economic models so that its market share and societal impact can increase even further," says MEP Lambert van Nistelrooij (EPP). He believes a bioeconomy is fundamental to achieving a more sustainable society.

Biotech's role still up in the air

Several impact assessments appear to bear his belief out. While waste only contributes about 3.3% to global CO_2 emissions, fossil-fuel dependent transport and energy are responsible for 80%. Focusing too strongly on recycling or resource efficiency could therefore cause shortfalls in significantly reducing the EU's CO_2 footprint. And even if the Commission's waste prevention measures were fully successful, the EU would still generate around a billion tonnes of unreusable waste per year. So innovation is crucial, particularly when it comes to plastics packaging. Currently a mere 5% of it is returned to the market in recycled, lower-value products. According to Warner, "the real thing is inventing a next generation of plastics; what we need is to have things that trigger their degradation."

Director of Bioeconomy at DG Research and Innovation John Bell says that a review of the 2012 Bioeconomy Strategy will be finished by the end of this year (see interview p. 56). Only then will we know whether the bioeconomy is to become "the biological heart" of Europe's circular economy. ■

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