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LIV OEIAN/SHUTTERSTOCK

We can only square up to climate change by going circular. So why are we only 9% of the way there?

Angeli Mehta opens our circular economy issue by looking at the corporates, investors and countries that are setting the pace – and what more needs to be done

Striking schoolchildren from over 100 countries and Extinction Rebellion activists have been telling us we have a climate emergency. And climate scientists warn that just 12 years remain to us to start slashing carbon emissions.

Yet from governments we're hearing little. Are there any more hopeful signs that business understands the imperative?

Certainly there are plenty of announcements on transitioning to renewable energy, reducing emissions and cutting water use. The deluge of declarations setting targets on plastics recycling and eliminating waste is welcome. But we have to go much further.

A big dent in global emissions could be made by transitioning to a circular economy. How is that different from business as usual? Across the globe, our consumption follows a straight line: things get made, bought and discarded.

The deluge of declarations setting targets on plastics recycling is welcome. But we have to go much further





Growth is the only aim, and the toll we take on the planet through the consumption of resources and the resulting pollution – be it greenhouse gas emissions, or the particulates that stick in our lungs – aren't factored into prices. Nor is the damage we're doing to ecosystems, as will be highlighted next week by the Intergovernmental Panel for Biodiversity and Ecosystem Services.

In the circular economy the aim is to eliminate waste and keep resources in use for as long as possible, with materials recovered and reused at the end of life.

A few companies, like Renault, discovered some years ago that such a strategy boosts sales and cuts resource use. But most have yet to investigate its potential. Last year, [Circle Economy](#) produced its first analysis of the state of global circularity and concluded that we're just 9% of the way there. The message was simple: we have to "stop extracting, stop wasting, optimise what we already have, and recycle more and better."

The circular economy is said to offer huge economic benefits: in Europe alone some €500bn over 10 years, according to the Ellen MacArthur Foundation.

The Energy Transitions Commission estimates that a more circular economy could reduce CO₂ emissions from the plastics, steel, aluminium and cement industries by 40% globally, and by 56% in developed economies like Europe by 2050. So it should be a no-brainer.

But dig deeper and it's more complex, according to Léon Wijnands, global head of sustainability at Dutch banking and financial services group ING.

"Externalities don't have a price. If we would have a global price on carbon dioxide emissions and water use, that would help." But he adds: "We're talking about systemic changes, not just the nature of one business but of the entire value chain."

Urgently needed are new technologies, business and financial models to keep things in use for longer. There are examples already in the business-to-business sector: Cisco, HP Enterprise and Rolls-Royce, to name a few. More recently, Netherlands-based Floow2 has developed an asset-sharing platform for businesses to share equipment and services. On the consumer side, Berlin-based Grover offers a subscription service for digital devices, while another Dutch company, Mud Jeans, leases and recycles jeans.



BALU/SHUTTERSTOCK

Scientists warn that we have just 12 years to start slashing emissions

'We're talking about systematic changes, not just the nature of one business, but of the entire value chain'



In 2008, Renault created a specialised subsidiary to take control of automotive waste materials and parts, recycling copper, steel, aluminium and plastics from end-of-life vehicles. A plant outside Paris refurbishes tens of thousands of engines and gear-boxes each year, delivering energy, water and chemical savings of 80% and generating more than \$500m in revenues for the company annually, Renault says.

Apple is pioneering new recycling processes to enable valuable materials to go back into the same products. Its goal is eventually to mine none of the earth's resources. Establishing such circular supply chains is key.

ING and public and private sector partners are working to develop a European accelerator programme that will help make the business case for circularity and connect supply chain partners.

Some policy is taking shape: The most recent iteration of the EU's circular economy package includes revised targets on recycling upwards; a binding landfill target; and an EU-wide strategy for plastics, including, most recently, a target to eliminate single-use plastics. An eco-design directive means circularity principles must be embedded in product design. (See [The battle to turn the tide on the e-waste epidemic](#)) But governments could make procurement decisions that would help drive circular solutions.

New recycling technologies that ensure materials keep their inherent value, as well as recycling infrastructure are badly needed everywhere.

"You can't just build a plastics recycling plant overnight," says Jane Bevis, chair of the UK's On-Pack Recycling Label (OPRL) scheme. "However, the whole conversation around extended producer responsibility and the chancellor's consultation [on a tax to encourage a minimum recycled content] are beginning to create the market conditions that make it look a more commercially viable option."

Richard Kirkman, UK chief technology and innovation officer at Veolia, thinks the UK's draft waste and resources strategy "is leading edge. Most countries have a landfill tax, but this is really creating conditions for circular economy." The question, however, is "will they go through with it?" Veolia is writing design guides and working with industry.

Kirkman has recently noticed a big change, with brands employing teams of graduates, all learning how to design for a circular economy. Taxing virgin materials, as proposed in last October's budget, will be enough to tip the



MARIO DO/WIKIMEDIA COMMONS

Renault is recycling materials from end-of-life vehicles

'Most countries have a landfill tax but the UK's draft waste and resources strategy is creating conditions for circular economy'



balance, he suggests. “People are asking us already, and we don’t even have the tax yet.”

There’s no shortage of entrepreneurs with brilliant ideas and promising solutions but they need finance.

“The circular economy is both a challenge and an opportunity for investors: an opportunity to rethink the way value is created in the economy,” suggests Jamie Butterworth, chief executive of Edinburgh-based private equity firm, Circularity Capital. His firm has raised a £60m pot from institutional investors who see the potential of a circular approach, and has identified a “good number of companies at a genuine growth stage [that are] able to outperform their linear counterparts by being more efficient with resources or [have] identified specific challenges in the circular economy and are dealing with those.”

One example is UK-based Winnow, which is helping to close the loop on food waste in the catering industry. Its technology has cut food waste by 50% on average across 100 sites, says Butterworth, and that inevitably has a positive impact on profitability in a sector where margins are tight.

He points to a huge shift in impact investing, from environmental, social and governance criteria to saying: “we want [an] investment return plus a positive impact and climate mitigation. We want our cake and eat it. CE [circular economy] is a good example of where you can get that.”

But there are challenges for the financial sector: the notion of product as a service (See [The cutting edge in circular](#)) will have cash-flow implications and credit risks. Financiers have to get to grips with both new technologies and new business models at the same time.

That’s why ING, ABN Amro, Rabobank and other members of the [FinanCE working group](#) have developed a set of guidelines on what constitutes circularity, which they hope will evolve to be used widely. The wider FinanCE collaboration brings together financial institutions, academia and non-profits from the CE100 programme of the Ellen MacArthur Foundation.

“What we tried to do was develop a common language,” says Wijnands of ING. “If you’re working with multiple parties, there’s a big advantage of all speaking the same language and using the same definitions.”

If investors can learn to speak the same language, can consumers, businesses and governments do the same? Then the circular economy may get the traction it urgently needs. ■



WINNOW

Winnow has cut food waste in half in commercial kitchens



Angeli Mehta is a former BBC current affairs producer, with a research PhD. She now writes about science, and has a particular interest in the environment and sustainability.
@AngeliMehta



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9DREAM STUDIO/SHUTTERSTOCK

From refilling and sharing to recyclable thin film: the cutting edge in circular

Angeli Mehta looks at technology and policy innovations in the push-back against single-use packaging

Once upon a time, people got their milk delivered in glass bottles, which they returned to be washed and refilled; they paid a deposit on soft drinks containers that they got back on return. Those quaint practices were ditched with the coming of cheap and extremely useful plastic.

It made sense – plastic was strong and light, saving on energy for transport, avoiding breakages and cutting food waste. But it became ubiquitous, and carelessly discarded. We now know our disregard for its destination has done profound damage to our environment, and maybe even to ourselves.

Now the pendulum has swung the other way.

A broad swathe of business has signed up to commitments that will see an end to single-use plastics, and in Europe that will be underpinned by legislation from 2021. [A global commitment](#) to eliminate plastics waste by 2025 by ensuring all packaging can be reused, recycled or composted has been signed by 250 organisations.

In February, France became the second nation (after the UK) to launch a plastics pact and has additionally committed to have an average of 30% recycled plastic in packaging by 2025.

In February, France became the second nation after the UK to launch a plastics pact





30 SECOND READ

- Circle Economy's 2018 analysis of the state of global circularity concluded we're just 9% there. In February, France launched a plastics pact committing to an average of 30% recycled plastic in packaging by 2025. The UK government wants to incentivise producers to design better packaging and provide clear labelling on what can and cannot be recycled.
- Next year, a plant in Ohio will start producing recycled polypropylene, found in food packaging, kitchen utensils and medical equipment. The plant's total production is booked for the next 20 years.
- Brands and retailers will be piloting the Loop platform developed by TerraCycle. Hundreds of products will be delivered to customers in reusable and recyclable packaging. Meanwhile, Los Angeles firm Replenish has developed a refillable 'pod' of concentrated cleaning products to which consumers add water.
- Peer sharing and leasing schemes are gaining ground. IKEA is exploring leasing out furniture, while its new London store is offering workshops in upcycling and repairs.

The global commitment is led by the Ellen MacArthur Foundation, which will monitor progress annually. It says that efforts so far “do not truly match the scale of the problem, particularly when it comes to elimination of unnecessary items and innovation towards re-use models.” Moving from commitment to action is crucial, the foundation says.

Jim Brisby, commercial director at food producer [Cranswick](#), says his company's view is that the number of polymers should be simplified, and is urging the rest of the food industry to help. Our job should be making it easier for the next person in the chain. Look at the plastic polymers that are most simple for recyclers to recycle ... and for consumers to recycle.” Consumers, adds Brisby, also need clear instructions on what packaging they can recycle.

The UK government's draft [waste and resources strategy](#), now out for consultation, wants to incentivise producers to make better packaging design choices. An approved list of packaging would “provide the basis for clear unambiguous labelling of what packaging can and cannot be recycled.”

Jane Bevis, chair of the On-Pack Recycling Label scheme (OPRL), also wants to see packaging labelled either as recyclable or not, “But it's easier said than done,” she admits. “For some materials the jury is still out.”

OPRL hasn't done a full mapping exercise yet, and wants to see the outputs from members of the UK's Plastics Pact (of which Cranswick is one), that will help drive the market. Already, says Bevis, some supermarkets are using the labelling matrix, which sets out the recyclability of hundreds of combinations of packaging elements – as a guide to which materials to opt for if they could. OPRL is also looking at providing information on what happens to packaging after it's recycled, or whether it ends up being used to produce energy.

‘Our job should be making it easier for the next person in the chain. Look at the plastic polymers that are most simple to recycle’





A lot of Cranswick's packaging is PET (the stuff drinks bottles are made from): easy for recyclers to identify and sort, and so more valuable. Vacuum packs and shrink-wraps, on the other hand, are made from different layers of polymer. These are key to their functionality, but difficult to recycle. "We're pushing our suppliers ... but we don't want food waste," says Brisby.

Cranswick has also committed to halving the weight of its packaging and reusing all its own internal materials: one challenge is to find an alternative to the flimsy plastic aprons, gloves and sleeves used on the production line. Different sites are trialling different solutions, and they'll share the outcomes with other companies: "Normally we're trying to create competitive advantage, but we need to work together to influence supply chains," says Brisby. The company is working "at pace" and Brisby is confident that it will get 70% towards its 2025 goal of having all packaging recyclable within a year.



CRANSWICK

Cranswick is aiming to simplify packaging to make recycling easier

Since China's ban on the import of waste, the UK has found other takers: Malaysia is one of the biggest, but [the country's infrastructure is overwhelmed](#) and dumping and burning are on the increase. Creating a circular economy must surely mean taking responsibility for our waste at home – something the environment secretary, Michael Gove, has acknowledged. The Energy Transitions Commission recommends that carbon taxes at least as high as landfill taxes should be imposed on plastics incineration to drive recycling.

Recycling innovation

Polypropylene is found in everything from food packaging and kitchen utensils to medical equipment and cars, but little is recycled – and even then only into low-value items. Next year, a recycling plant in Ohio will start producing recycled polypropylene with colour, odour and contaminants removed. It has claimed near-identical performance to the virgin material, thanks to an innovation by one of Procter & Gamble's scientists, John Layman. Such is demand that the plant, being built by PureCycle Technologies, already has its total production booked for the next 20 years.

An Ohio company that will start producing recycled polypropylene next year has its production booked for the next 20 years



1000 WORDS/SHUTTERSTOCK

The pendulum is swinging back to the days of refillable bottles

Earlier this year, Dutch company Ioniqa Technologies announced it had raised the capital to build its first 10,000-tonne plant, which will recycle PET waste into the raw materials needed to make food-grade PET. Its technology means the PET can be recycled infinitely. Takers for the output are again guaranteed.

What about re-use?

Earlier this year, some of the world's biggest brands and retailers – including P&G and Unilever – announced that they will be piloting a new waste-free platform, [Loop](#), developed by New Jersey recycling company TerraCycle. Hundreds of products, from deodorants to ice cream, will be delivered to customers in reusable and recyclable packaging, for which they'll pay a small deposit. Interestingly, many products won't be wrapped in plastic, but glass, stainless steel and aluminium. In some cases, the refilling revolution has led to new product innovations that will cut water use.

Virginie Helias, vice president, global sustainability at Procter & Gamble, told Ethical Corporation that early studies suggest the Loop system is more sustainable than single use after five cycles of refilling. “We hope there will be more, but that's what we need to reach.” Consumers also need to order a minimum of three items to make the service viable.

“We need to make sure we have a functional business model – I mean this is totally new. In terms of [the] supply chain, it's moving from linear to circular; cleaning and filling, we have never done before. We have a lot to learn.”

Unilever is putting several deodorants into the scheme, in a stainless steel container with an expected lifespan of eight years, and the potential to avoid up to 100 packs being thrown away.

‘This is totally new. It's moving from linear to circular; cleaning and filling. We have a lot to learn’





All the brands will be able to test out their usage assumptions when online pilots get under way later this year in New York and Paris. They will then be trialled at supermarkets in the UK, the US and France.

Other companies are innovating with refill systems: Los Angeles firm Replenish, for example, has developed a reusable bottle for cleaning products. On the premise that about 90% of the products we buy are made of water, consumers can add this at home and all that's needed is a refillable "pod" of concentrate, so packaging volumes and transport emissions are cut.

Will consumers adopt the Loop approach fast enough to scale it? Helias says P&G has had more registrations in both Paris and New York than it expected. The company is playing to consumer desires: "One of the strategies at P&G is to make responsible consumption irresistible, so even the people who are not green just want the beautiful stainless steel bottle."

'Stuff as a service'

Loop users won't ever own the container – and that concept is getting traction across a range of industries, from furniture and cars to jeans and music.

The concept of "power by the hour" was pioneered by Rolls-Royce in 1962, offering its corporate customers "a complete engine and accessory replacement service on a fixed-cost-per-flying-hour basis", a model that continues today; Dutch lighting manufacturer Philips offers "light as a service": its customers don't own the light bulbs, and they're promised efficiency savings.

HP says its Instant Ink service – whereby customers automatically get a refill sent when supplies are running low – has decreased the carbon footprint of ink purchase and disposal by 84%. Though that assumes customers would have driven to collect the replacement cartridge.

HP recycles the plastic from its cartridges, as well as recycled bottles and hangers so that 80% of its ink cartridges now contain 45-70%



LOOP

Loop is working in partnership with brands to produce packaging that customers return to be refilled

HP says its instant ink service has decreased the carbon footprint of ink purchase and disposal by 84%



ZEVECA KIRKEZ/SHUTTERSTOCK

The average power drill will be used for just 13 minutes of its life

post-consumer content. Indeed, using recycled PET plastic rather than virgin plastic has cut water use by 38%, total energy use by 63%, and carbon footprint by an average of 42%. However, it's not clear why HP doesn't refill the cartridges, which would presumably allow it to tread far more lightly. But it does mean the company is using less materials and has taken on the costs of recycling its products.

Through HP's "device as a service" offering for business customers, analytics monitor device health, so potential problems are detected in advance and "HP manages all hardware and software migration and decommissioning, which includes refurbishing, parts re-use, and responsible recycling, ultimately driving circularity," according to UK managing director George Brasher.

Sharing items amongst peers maximises the useful life of a product. According to the Edinburgh Tool Library, the average power drill gets used for 13 minutes during its life, while the RAC estimates that the average car is in use just 4% of the time.

So it makes sense for car-makers like Renault and Volkswagen to launch electric-car sharing schemes in densely populated cities like Berlin, Paris and Madrid. Renault already leases its electric vehicle batteries to its customers: these can be reused in renewable energy distribution networks as well as in offices and industry, and eventually Renault says all the material components are recycled.

With the average car in use just 4% of the time it makes sense for Renault and Volkswagen to launch electric car sharing schemes





IKEA has pledged its business will be circular by 2030, with all products made from renewable and recycled materials; using renewable energy across its operations. It believes it can decouple growth from materials use. To get to circular, the company has developed a set of design principles to make sure products will be reused, repaired and recycled.

Its designers will have to think about durability, how materials are combined so as to enable recycling, and in order to minimise waste of materials, water, energy and chemicals.

“The concept of circularity is quite complex and distant to people. But there are common things around ownership and desire ... and a common concern about not being wasteful,” suggests Lisa Henriksson, business designer, Circular IKEA, at the Ingka Group, which owns most IKEA stores.

At its new London store in Greenwich, IKEA is trying to engage its customers by offering workshops in upcycling and repairing products, cutting waste and even growing food.

However, in terms of designing a service for customers, “It’s early days and very complex to design for circularity,” says Henriksson. In February, IKEA said it was exploring leasing out office furniture. Further testing on product lines will take place this year in the Netherlands, Sweden, Poland and Switzerland before trials in all its markets next year. “We need a solution that is desirable, feasible and viable. We’ll work iteratively and start small. We won’t know [the] conditions we will get things back in, it’s new territory,” says Henriksson. The tests will provide valuable feedback to IKEA’s designers.

IKEA might also be able to learn from New York-based Rent Pronto, which has been leasing out IKEA furniture for the past four years.

It was IKEA’s former sustainability director Steve Howard who in 2016 suggested the industrialised world had hit “peak stuff”.

We may have tired of owning stuff that has no value, but what we don’t know is whether the “stuff-as-a-service” model will mean we consume less energy. How soon can we start to close the circularity gap? ■



IKEA

IKEA is offering workshops in upcycling and repair at its new London store

The concept of circularity is quite complex. But there is a common concern about not being wasteful



BIOCELLATION

The high school friends who unlocked a process to recycle thin plastics

A lot of plastic that could be recycled isn't because it is lightweight and difficult to sort. The flexible plastics that go into food wrap, bubble wrap, and grocery bags are often contaminated with food, and of such low value they can't find a market. Cue landfill or energy recovery, both of which produce greenhouse gas emissions, or ocean and river pollution.

A trip to the municipal waste dump in the city of San Jose in California inspired (then) high school students Miranda Wang and Jeanny Yao to tackle this seemingly intractable problem. Their original idea was to break down flexible plastics with bacteria. But they found this to be expensive, and difficult to scale.

Now graduates and fully fledged entrepreneurs, the pair have garnered numerous awards and recognition by the UN Environment Agency for developing a novel chemical system to recycle two types of polyethylene flexible plastics. The strength and durability of plastic comes from its long chains of carbon atoms bonded together. BioCellection's process breaks down these chains – not into just any old chunks of atoms, but into valuable chemical intermediaries used to make medicines, electrical components, lubricants and cosmetics. These are molecules that themselves would usually be derived from fossil fuels.

By last year, BioCellection was able to treat 1-2kg of plastic film every three hours, using no more energy than a tv screen, they say. This year, they're beginning a pilot programme to convert 100 tonnes of waste into the valuable molecules. Together with Green Waste and the City of San José, they want to develop the technology so it can be easily integrated into existing solid waste management systems.

By 2021, BioCellection wants to be at scale, processing over 36,000 tonnes of waste in partnership with city governments.

Angeli Mehta

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Virginie Helias: P&G's ocean plastic shampoo bottles 'only the beginning' of its war on plastic

The chief sustainability officer of Procter & Gamble tells Terry Slavin how the world's biggest consumer goods firm plans to end packaging waste by 2030

Procter & Gamble has come a long way since Greenpeace activists unfurled giant banners down the side of its Cincinnati headquarters in 2014 accusing the Head & Shoulders shampoo maker of “wiping out dandruff and rainforests”, and demanding that it “stop putting tiger survival on the line”.

P&G's head of sustainability, Virginie Helias, says just how far was illustrated at the World Economic Forum in Davos, when Greenpeace joined the press conference launching the Loop platform, a partnership to radically cut packaging waste, led by P&G and New Jersey waste company TerraCycle.

In pilots that will begin later this year in France and the US, hundreds of products, from deodorants to ice cream, will be delivered to customers in refillable and recyclable packaging. Consumers will be incentivised to return the packaging, which will remain the property of the consumer goods companies, by paying a small deposit, in a breathtakingly ambitious attempt to eradicate single-use packaging.

‘If you told me a few years ago Greenpeace would be on the same side of the table with us at a press conference I wouldn't have believed it’





“If you’d told me a few years ago that Greenpeace would be on the same side of the table with us at the Loop press conference, I wouldn’t have believed it,” Helias says. “In 2014 they were scaling our headquarters in tiger suits, and now we see them supporting one of our projects.”

The support was not unconditional: “They were saying they support the ambition of Loop and in the same breath that it isn’t enough, and we need to scale,” but that is par for the course, Helias said.

As a target for NGO action, they don’t come much larger than P&G, the world’s biggest consumer goods company, whose products, from Fairy Liquid, to Tide and Pampers, reach 5 billion people every day.

In 2017, P&G was one of the brands targeted by Greenpeace when it did an audit of plastic packaging washing up on Asian beaches.

“The role of Greenpeace is critical,” Helias says. “It’s to keep us on our toes and to say it’s a journey and that we will never be done.”

But she points out that Loop is only the latest effort to take responsibility for its packaging. In June 2017, the company in Europe partnered with TerraCycle and French waste company Suez to launch its Head & Shoulders “beach plastics” bottle, high-density polyethylene (HDPE) made of 25% recycled beach plastics, which the company said produces 60% less CO₂ emissions compared with using virgin HDPE. A couple of months later it followed with a beach plastic Fairy Liquid bottle, made of 10% beach plastics and 90% recycled post-consumer waste.

Helias said the two bottles were aimed at raising consumer awareness of both ocean plastics and the need to recycle packaging in the bathroom.

Asked whether there was a danger of being accused of greenwash with such efforts, she said the company at the same time announced that 90% of all shampoo bottles sold in Europe will contain 25% beach plastics by the end of 2019. “That’s the ‘scale’ piece,” she said. “It’s important that we do the scale piece and consumer awareness piece at the same time.”

Helias says P&G is no johnny-come-lately to the plastics issue. “We’ve been working on this for decades without talking about it.”

Ambition 2030

In April last year, P&G unveiled its Ambition 2030 sustainability plan, promising that 100% of P&G’s packaging will be recyclable or reusable by 2030, and none of its plastic packaging will find its way to the sea.



P&G

The Fairy Liquid bottle is made of 10% beach plastics and 90% recycled waste

‘It’s important that we do the scale piece and the consumer awareness piece at the same time’



In January this year, the company's CEO, David Taylor, was named as chairman of the newly launched [Alliance to End Plastic Waste](#), led by the World Business Council for Sustainable Development, a partnership of nearly 30 companies in the plastics value chain, including Shell, Total, Suez, Veolia, Dow, Covestro and DSM. Together they have committed to invest \$1bn-\$1.5bn over the next five years to help unlock solutions to plastic waste in the environment.

Given the big names involved, \$1.5bn seems a drop in the plastic-clogged ocean, but Helias said it would act as "catalytic capital", de-risking projects to allow big institutional investors to jump in with the big dollars needed.

There is no shortage of money, or innovative solutions, Helias says. "What's lacking is a pipeline of investable projects that have qualified to scale. That's the purpose of the alliance."

P&G is the only consumer goods company so far represented, and Helias says she was "thrilled" when Taylor agreed to chair the alliance. "And the impact it had internally was amazing," she says.

Helias, who opted to live in Geneva with her husband and three children rather than move to Cincinnati when she became vice president of global sustainability at P&G in 2016, speaks in a strong French accent and brings a European sensibility to her job, despite more than 30 years working for the US company.

Asked why P&G is not a signatory to [Ellen MacArthur Foundation's New Plastics Economy global commitment](#), which counts 250 companies, including Colgate Palmolive, Mars Inc, Nestlé, SC Johnson, The Coca-Cola Company, and Unilever, she says: "We are totally aligned with the Ellen MacArthur Foundation. The only issue is timing, and this is where P&G makes it hard for itself."

Under the commitment, companies undertake to ensure 100% of their plastic packaging can be reused, recycled, or composted by 2025. P&G has set 2030 for the same target. "We believe we will be 95% recyclable by 2025, but not 100%. This is a small thing, but for us it is very important. We don't put things out there that we know we won't be able to deliver."



In 2014 Greenpeace scaled P&G's Cincinnati HQ – at Davos last year the organisations shared a platform

'We are totally aligned with the Ellen MacArthur Foundation. The only issue is timing'



Helias puts it down to a cultural difference between American and European companies; the former regard commitments as legally binding, while the latter are prepared to set ambitious future goals even if they don't yet have a cast-iron plan to deliver them.

Still, the more cavalier European approach may have its downsides: P&G's research on consumer attitudes towards Loop points to striking differences in attitudes to big brands.

"In the US, people are expecting big brands to be part of Loop," Helias says. "They want their Pampers, Tide, Cascade, Gillette [to participate in the Loop]. In Europe they are super-critical of the big brands. They want to know there is no greenwash."

Helias had her Damascene conversion to sustainability in 2005, when she saw Al Gore's film *An Inconvenient Truth*. At the time she headed up P&G's Ariel detergent brand in Europe.

"The gravity of climate change really struck me," she told another interviewer.

"And more importantly, I discovered that ... Ariel could become the single-most important driver of P&G's carbon footprint reduction," since 80% of its carbon footprint came from the wash temperature.

She came up with the Ariel "Turn to 30" campaign, urging consumers to wash their clothes at lower temperatures. "Thanks to the success of this project, I found my vocation. I then asked the CEO to create a position to bridge the science of sustainability with the business, which ultimately led me to my role today."

Packaging, though important, is only one stream of Helias's work. In her interview with Ethical Corporation, she explains that water security is also a critical issue for the consumer goods giant, with 70% of P&G products requiring water in their use.

The Ambition 2030 document promises a 35% increase in water efficiency (compared with 2010) and to source at least 5 billion litres of water, 10% of its water consumption, from circular sources.

In pursuit of this, P&G has been working with The Nature Conservancy, WWF and the World Resources Institute to identify 18 priority water basins and develop a water risk assessment mapping process.

'In the US, people are expecting big brands to be part of Loop. In Europe they are super-critical of the big brands. They want to know there is no greenwash'



BIEL CAALDERON/GREENPEACE

P&G was one of the brands targeted in the Greenpeace audit of Asian beaches



“What we need to do now is develop a strategy for partnership and funding, just as we do with [plastic] waste,” Helias says, promising a big announcement on water next year. “We want to show the same kind of leadership [as with plastics] and be the catalyst on water stewardship.”

This sits a bit uneasily with the latest report from CDP on the preparedness of consumer goods companies for the low-carbon transition (see ‘[Companies aren’t moving fast enough on the circular economy](#)’), which ranked P&G second last among household goods firms. Asked in an email about the CDP report, Helias said: “Climate change is a key priority for P&G and we have significant efforts under way. This includes driving progress against our science-based goal to cut our greenhouse gas emissions in half, achieving 100% renewable electricity, and helping consumers reduce their own emissions by providing detergents that deliver outstanding performance in cold water. We have significant and comprehensive efforts underway to address Scope 1, 2 and 3 emissions.

But what is P&G doing to address [deforestation](#), the issue highlighted by Greenpeace in its 2014 stunt at P&G’s headquarters?

While P&G reports to CDP on its energy and water risk, earning B and B-, respectively last year, it does not report on its efforts to address deforestation risk in its supply chain. But it is notable that in its Moment of Truth report last year Greenpeace praised P&G as one of eight big brands to [publicly list](#) its palm oil suppliers, all of them RSPO-certified.

Helias points out that no consumer goods company is going to meet commitments to end deforestation in supply chains by 2020, “but we [P&G] have steps to get there, and we are working with suppliers to make sure they have zero deforestation.”

She talks enthusiastically about a P&G programme teaching 2,000 small-holder palm oil farmers in Malaysia more sustainable agriculture techniques, which has resulted in a 30%-50% increase in yields with far less fertiliser use. The project will be expanded to reach up to 10,000 farmers over the next five years.

It’s the kind of thing Helias clearly relishes: using P&G’s relationship with thousands of suppliers and billions of consumers to try to do some good in the world, or at least less harm. As she said in a recent TED Talk after the launch of the Head & Shoulders beach plastic bottle: “These products have been part of the problem; we want them to be part of the solution.” ■



Virginie Helias with Tom Szaky of TerraCycle – P&G is part of the Loop circular packaging scheme

TWITTER



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Australian university pioneers urban mining microfactories

Last year, Veena Sahajwalla's vision of a microfactory that can transform e-waste into its valuable components became a reality. Now, Sahajwalla, director of the Centre for Sustainable Materials Research and Technology (SMaRT) at the University of New South Wales in Australia, is out to prove that it can be run as a commercial operation.

"Whether it's electronics or packaging materials, what we haven't thought about is an equally sophisticated way of dealing with the end of life. There is no question: we have to be re-designing with recycling in mind, but the reality is that some products – for example circuit boards – are just so complex ... we can't necessarily unmake them."

The microfactory consists of a series of small machines and devices: these could be robots handling broken glass from mobile phones; a small furnace for separating metal components; or a device for reforming plastics into high-quality filaments for 3D printing. And it will need to be agile, depending on the type of product it is receiving. One of the key differences to traditional recycling is the fact that there isn't just one type of material in electronics. Isolating them may not be as important as transforming them into valuable new materials – what Sahajwalla describes as "the fourth R", alongside reduce, reuse, recycle.

There's a lot of clever chemistry at work to create new materials from e-waste. One example is silicon carbide, whose properties make it ideal for water filtration. It can be made, in a carefully controlled reaction, from the glass and plastics of a computer monitor. As Sahajwalla points out, it's not a new application, but the specialised material could be produced in small quantities and used locally.

Glass is another example. In conventional glass recycling waste glass has to be separated into different types, and the melting process is extremely sensitive to any contamination. "We





UNIVERSITY OF NEW SOUTH WALES

Veena Sahajwalla with colleagues at the microfactory she created, which transforms e-waste into valuable components

demonstrated that mixed broken glass can be used as primary input in the production of polymeric glass composites, with the mechanical properties, utility, aesthetic appeal and expected market value that are comparable to natural and engineered stone products.” The microfactory on the university’s campus has been producing plastic filaments for 3D printing extracted from e-waste such as printers and computers. A local spectacle-frame company is a potential first customer if it can show the filaments are robust. Her team is also prototyping a microfactory that will turn waste textiles, glass and even mattresses into flat construction panels that could be used for heat and sound insulation, and has already attracted commercial interest.

Sahajwalla wants to license the technologies, and expects that “the research will leave the university this year.” She adds: “Companies can look at the products and see how we do it. So we’re not just handing over the baby, but saying ‘look the baby can walk’.”

The components of the microfactory could fit on a site as small as 50m², so could be located wherever waste is accumulating, especially in remote locations. Different microfactories might concentrate on different types of product or material streams, such as computers or textiles.

She sees an opportunity to grow this micro-industry in different parts of the world, and it could do social good. “People are collecting and sorting waste in many disadvantaged communities globally. This can empower communities, so they have more than just a sifting role – becoming a manufacturer of valuable materials ... and [having] an opportunity to be part of the supply chain.”

It’s especially suited to the systems that are already in place in India, where more than 1 million poor people are involved in manual recycling operations.

Angeli Mehta

[View online](#)

BELISH/SHUTTERSTOCK

Beyond recycling: Putting the brakes on fast fashion

With the jury still out on the most sustainable textiles, efforts to make the garment industry more sustainable are focusing on reducing consumption, reports **Angeli Mehta**

UK consumers buy more clothing per person than any other country in Europe – more than one million tonnes every year. Around 300,000 tonnes goes to landfill or is burnt, and less than 1% of fibres used to make garments are recycled into new clothing.

More of us may salve our consciences by taking used clothing to charity shops or recycling bins: according to WRAP, around 200,000 tonnes were sold for re-use in 2014, and 350,000 tonnes were exported. The poor quality of many garments means much of the clothing ends up in landfill in the developing world, suggests Tim Cooper, who leads research groups on sustainable consumption and sustainable clothing at Nottingham Trent University. There's a particularly telling video online of women shredding clothes for recycling in India: they assume that water is so expensive in the industrial world that people can't afford to wash their clothes, so discard them instead.

Worldwide, the number of times clothes get used before being discarded has fallen 36% since 2012; in China the figure is 70%, according to a report for the [Ellen MacArthur Foundation](#).

Textiles production accounts for more carbon emissions than maritime shipping and international flights combined





30 SECOND READ

- UK consumers buy more than 1m tonnes of clothing yearly. The poor quality of many garments means around 300,000 tonnes goes to landfill or is burnt. Less than 1% of fibres used to make garments are recycled into new clothing.
- WRAP estimates that clothing companies could cut carbon, water and waste impact by 3% if they made clothes that last three months longer. However, pressure remains from retailers and consumers for rapid turnover.
- The used clothes market is growing, thanks to platforms like eBay. Renting clothes and take-back schemes are increasingly popular; buyers of Netherlands-based Mud Jeans contract to return them at the end of use, or lease them.
- Recycling technologies are promising: H&M Foundation is funding a €5.8 million partnership with HKRITA, which has developed a process to turn three tonnes of unwanted textiles into yarn each day.
- The UK's Environmental Audit Committee has suggested brands and retailers pay 1p per garment they create, which would raise £35m to invest in clothing collection.

It has estimated that textiles production accounts for more carbon emissions than maritime shipping and international flights combined. Just the simple act of wearing garments for longer would cut emissions.

The garment sector has become a “monstrous disposable industry” thanks to the rapidity with which new designs are churned out in the world of fast fashion, according to British designer Phoebe English. She told a recent inquiry by the House of Commons [Environmental Audit Committee](#) that rather than make only what's been ordered, the industry puts prospective sales into production, leading to countless wasted garments, not to mention the hundreds of thousands of tonnes of fabric left over in design and production.

It's clear the fashion industry couldn't be further from circularity.

“Slowing the cycles is as important as closing the loop. We need to build up markets for recycled material. But it only takes you so far,” says Cooper. “My problem is [that] ... recycling perpetuates the throwaway culture, and it uses energy. The latest figures from the IPCC make clear we need to reduce consumption. We've got to go beyond efficiency and recycling to something more fundamental.”

Extending life

WRAP [estimates](#) that companies across the garment supply chain could cut their carbon, water and waste impact by 3% if they made clothes that last just three months longer; nine months could improve that by up to 10%. Cooper and his team at Nottingham Trent University designed a protocol for WRAP to help designers and manufacturers create longer-lasting garments.

Some brands have trialled the impact of machine washing on different hemming techniques to extend garment life, or developed new technical specifications to improve colour fastness or reduce pilling on knitwear – all potential means to encourage customers to wear garments for longer.

Customers don't want things to last because they want change. Young people may wear something just once





But Cooper concludes that “it’s quite hard to test garments properly for durability because there’s no time ... There’s pressure from retailers to have a turnover of garments on display, plus customers don’t want things to last because they want change. Young people may wear something just once or twice.”

Swedish fashion group H&M has launched an online initiative to help consumers repair and look after their clothes, although it won’t comment on traffic to the site.

Slower fashion

Peer-to-peer sales of used clothes are growing rapidly, thanks to online platforms like eBay, Vinted and Poshmark. US platform ThredUp received 21 million items from across North America last year, compared with 4 million in 2014. [Research](#) it commissioned suggests that if everyone in North America bought one used item instead of a new item, that would save over 200,000 tonnes of waste, and 2.6 million tonnes of carbon dioxide – the equivalent of taking half a million cars off the road for a year.

But why buy when you could rent? That’s the logic behind increasingly popular platforms like New York company Rent the Runway, UK-based Girl Meets Dress, or China’s Y Closet.

Netherlands-based Mud Jeans is trying to slow down the fashion cycle. Its jeans are made with reuse, repair, and recycling in mind, using techniques that recycle water and cut harmful chemicals. Consumers contract to return them at the end of use, or can even lease them.

If still wearable, jeans will be upcycled and sold again – indeed they sometimes come back in almost perfect condition, according to Eva Engelen, an engineer responsible for corporate social responsibility at the company.

To make the jeans recyclable, they’re as simple and “mono-material” as possible, says Engelen: there are no leather labels, and stainless steel buttons can be reused or recycled back into buttons.

Mud Jeans got its first batch of jeans back for recycling nearly four years ago, so garments now being sold consist of 23-40% recycled denim, blended



KORYENYEVA TETYANA/SHUTTERSTOCK

In the EU, around 300,000 tonnes of discarded clothes go to landfill or are burnt

Netherlands-based Mud Jeans makes its jeans with reuse, repair and recycling in mind. Customers contract to return them at the end of use, or can lease them



with organic cotton. The search is on for chemical recycling techniques that will help cut that quantity of virgin cotton.

In the UK, M&S has been running a take-back scheme in conjunction with Oxfam since 2008. Mike Barry, director of sustainable business at M&S, told the Environmental Audit Committee that the challenge is not about take-back per se: “It is what you do with 1.2 million tonnes of fibre that the British industry uses collectively each year, and we need to work harder, all of us, in terms of developing new industries that can use the fibres. It is quite possible to prevent anything going to landfill or to incineration. It is much harder at the moment to do something with the fibres you recover”.

M&S does have an ambitious voluntary target for 25% recycled fibre content across 25% of its clothing by 2025. The committee heard that M&S had made a men’s suit line with 50% of the wool recovered from the take-back scheme. “We have taken suits back and reused them, but it is more to raise awareness of the issue rather than to claim that it is hundreds of thousands of garments. It is not,” Barry said.

Both H&M and its charitable foundation have invested in a range of promising recycling technologies, but these need to get to scale. In 2018, H&M used just 1.4% of recycled materials, including cotton, polyester from plastic bottles, nylon, wools, silver and down. A swimwear range, for example, uses Econyl’s regenerated nylon, made from fishing nets and other nylon waste.

There are multiple challenges in recycling, including separating fibre blends in textiles, and ensuring fibres maintain their properties.

H&M Foundation is funding a four-year €5.8m partnership with the Hong Kong Research Institute of Textiles and Apparel (HKRITA), which has developed three recycling techniques. One of these – a mechanical approach – is now processing three tonnes of unwanted textiles into yarn each day at Hong Kong yarn producer Novetex. It plans to scale to 10 tonnes per day. Textiles woven with the recycled yarn will have about 30% virgin fibre added, but the fibres can be recycled again. H&M is one of the first customers. Novetex’s yarns



GABRIEL12/SHUTTERSTOCK

Buying used clothing creates significant emission and waste savings

H&M and its charitable foundation have invested in a range of promising recycling technologies, but these need to get to scale



MUD JEANS

Netherlands-based Mud Jeans makes its garments with re-use in mind

will be made into textiles in China. China's ban on waste imports – including textiles – means solutions, like those of HKRITA, are urgently required in the markets where waste originates. Hong Kong government figures show that Hong Kong consumers alone send 247 tonnes of textiles to landfill every day.

The institute's other recycling processes are just as promising, says business development director Yan Chan: a hydrothermal method to separate polyester and cotton mixtures has been shown to work at pilot scale, and is expected to start commercialisation later this year.

Chan is optimistic about the prospect of a circular economy: thousands of visitors from across the textile supply chain have already beaten a path to HKRITA's door. "When we design the materials we use, we can think about recycling at the end – and not just once."

The partners have also set up a garment-to-garment recycling demonstrator where customers can bring their unwanted clothes and watch the miniaturised system create new garments, to be sold. At its launch last year, Eric Bang, innovation lead at H&M Foundation, said "seeing is believing, and when customers see with their own eyes what a valuable resource garments at end of life can be, they can also believe in recycling and recognise the difference their actions can make."

In the UK, Worn Again Technologies has raised the £5m it needs to take its dual polyester and cotton recycling technology out of the lab. The aim is

'Seeing is believing, and when customers see with their own eyes what a valuable resource garments at end of life can be, they believe in recycling'





to displace oil derivatives as the raw materials for polyester, and to cut the amount of virgin cotton going into clothing. The cellulose fibres produced in the process have many similar properties to cotton, and the industry is used to working with cellulose fibres to make viscose and Lyocell, for example. As chief executive Cyndi Rhoades, has pointed out: “There are enough textiles and plastic bottles ‘above ground’ and in circulation today to meet our annual demand for raw materials to make new clothing and textiles.”

IKEA, GAP, Adidas and H&M are among the signatories to the Textile Exchange’s recycled polyester commitment to grow their use of the recycled plastic by 25% by 2020: a target they’ve already exceeded. In just a year, their combined use of recycled polyester – or rPET – was up 36%. But with fibre-recycling technologies only beginning to emerge, plastic bottles are the main source material.

So, could synthetic fibres be one answer to a more circular textiles industry? Cooper says more research

is needed. “We’re still utterly lost about best practice. All [fibres] have problems,” he says, warning that switching from synthetic to natural fibres may have unintended consequences. The shedding of microfibres joins a long list of issues that need to be tackled: water consumption; pesticides use; chemicals used in processing and finishes and how these are preserved in recycled fibres; and the difficulties of separating fibre mixes.

Producer responsibility

The UK has a voluntary Sustainable Clothing Action Plan (SCAP) co-ordinated by WRAP. So far, there are 80 signatories, accounting for about 60% of retailers by volume. While they have made progress on water consumption (down 10%) and cutting carbon emissions (down 13.5%), waste reduction across the supply chain has been cut by less than 1% since 2012, which suggests voluntary measures are not enough.

The Environmental Audit Committee concluded that brands and retailers should pay 1p per garment they create, which would raise £35m to invest in clothing collection. It also wants the government to investigate whether textile products containing less than 50% recycled PET should be taxed, and for



M&S

M&S has a men’s suit line with 50% recovered wool

‘We’re still utterly lost about best practice. All fibres have problems’



it to consult on an extended producer responsibility (EPR) scheme for textiles by the end of the current parliament. The EU's Circular Economy Package requires member states to extend separate collection requirements to textiles by 2025: Defra says it's considering what can be done in the UK.

France has an EPR scheme for 19 different waste streams, including textiles: anyone putting textiles on the market has to contribute to recycling and treatment of the resulting textile waste. Since the law was introduced in 2007, the proportion of used textiles and clothing diverted from landfill has doubled – but significant quantities still end up there. Further measures were proposed last year: including banning brands and retailers from burning or landfilling unsold stock, and offering tax breaks to companies that sort textiles for re-use and recycling. A recent Swedish research programme concluded that an EPR scheme would have a big impact on both textile recycling and fibre-to-fibre recycling of used textiles.

The aim of the EU's Ecodesign Directive was to increase the energy efficiency of products, and get rid of the least efficient. Now efforts are under way to improve material efficiency by considering durability, and recyclability. Could the approach work for textiles? Clothing labels don't usually even give information on re-use or recycling. However, a report for the Nordic Council of Ministers details potential requirements for an eco-design label for textiles and furniture.

These could include minimum recycled content; durability of fasteners, availability of spare parts (like buttons), design for disassembly or re-use – for example, the easy removal of logos. Cooper points out that creating a lifetime label for textiles is much harder than for electrical goods, but a voluntary code could signal durability – a gold or silver rating to indicate a garment has had a wash test or performance check might start to signal to consumers that longevity is something to consider.

In the UK, Defra says it intends to introduce ecolabelling for white goods, after EU exit, and that this could be extended to textiles.

As anyone in the fashion industry knows, trends quickly change. Consider the impact The Blue Planet had on consumer attitudes to plastics. What's needed is a similar wake-up call to the dangers of fashion's throwaway culture. ■



H&M

H&M is working with HKRITA to develop recycled textiles

In the UK, Defra says it intends to introduce ecolabelling for white goods and this could be extended to textiles

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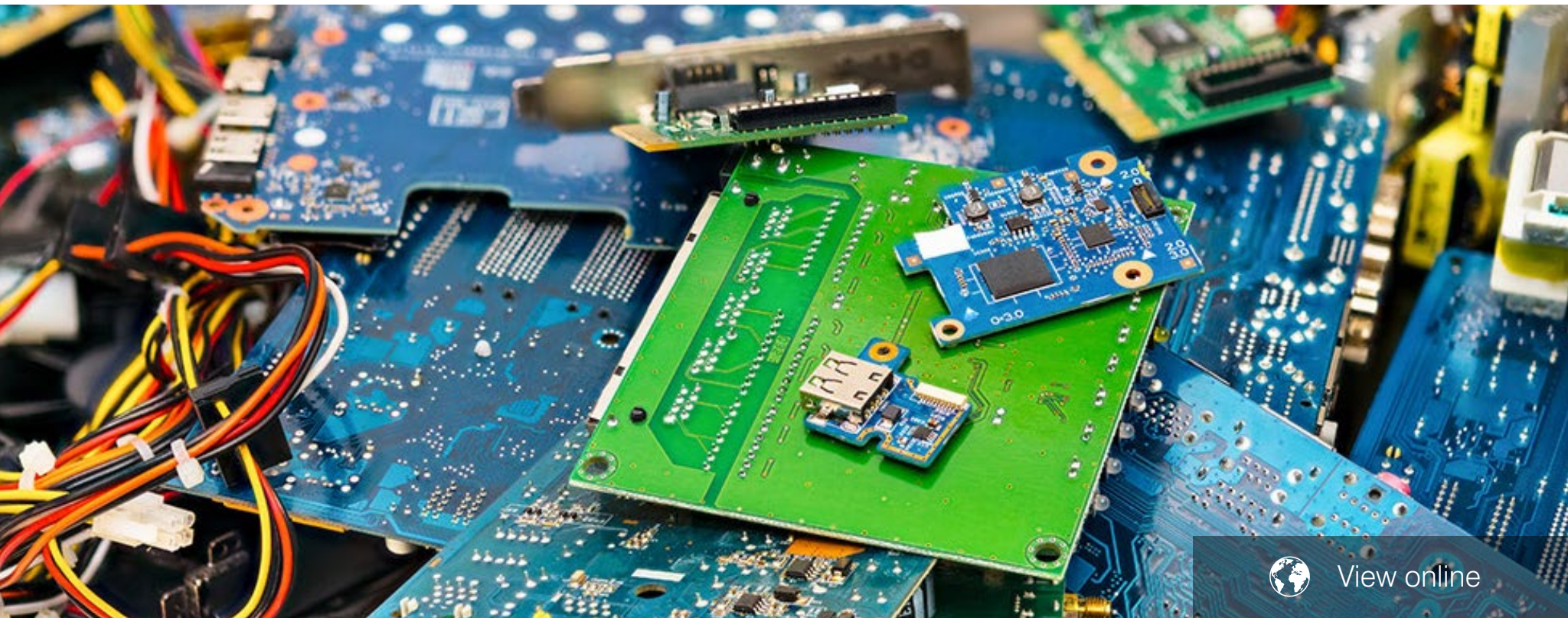
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The battle to turn the tide on the e-waste epidemic

With electronics detritus growing 4% every year, Angeli Mehta looks at how the EU and leading companies are trying to ameliorate the impact of our global addiction to smartphones

Consider the washing machine: one of life's essentials. Yet it's usually cheaper to buy a new one than to repair the old. That's often simply because it's impossible to get access to replace the inexpensive bearings that enable the drum to rotate smoothly. For French industrial designer Christopher Santerre, it's as if you had to buy a new car because the brake pads are worn.

He and fellow designer Julien Phedyaeff have designed and prototyped a washing machine that can be repaired and upgraded so it lasts for at least 20 years. It's called L'Increvable, which translates as "tireless". "Is there a market: will people pay more for the product that is more durable? We are convinced about this," says Santerre.

So far, the pair have been unable to find a washing machine manufacturer who shares that conviction. "We want someone who wants to do the project. It will start with low volumes [so] they will have to believe in the project and want to push it with us, to disturb the market."

In 2016, we generated nearly **45 million tonnes** of e-waste globally. It's almost impossible to comprehend how much that really is. The term e-waste

'Will people pay more for the product that is more durable? We are convinced about this'





covers everything with a plug or battery; from irons and toasters to mobile phones and washing machines.

The material value of those devices is reckoned to be €55 billion, containing, as they do, precious metals like gold, silver, platinum and palladium; as well as hazardous heavy metals like mercury and cadmium. However, just 20% of e-waste is properly recycled. Much of the rest goes to landfill or is incinerated. Some will be “recycled” by impoverished workers, with serious health and environmental consequences.

We’re generating some 3% to 4% more e-waste every year, partly because we all own more devices and upgrade them regularly to the latest technology or faster speed. Research suggests that people are starting to delay mobile phone upgrades, but smartphone plans usually mean we can get a new one every two years, no matter how durable manufacturers say their products are, or how long they’ll upgrade the software that make the devices work. When discarded, equipment still works perfectly well – it’s just become “out-dated”.

Researchers in Canada [estimate](#) that all those smartphones, laptops, and tablets, together with the infrastructure that enables our virtual activities, will be responsible for 3.5% of global CO₂ emissions by next year, and 14% by 2040. The smartphone is the real killer: emissions are expected to reach 125 megatons (Mt) of CO₂ equivalent (CO₂e) per year in 2020, compared with 17 Mt CO₂e per year in 2010. Up to 95% of those emissions are caused by production. So keeping phones in use as long as possible, and then recycling them, is crucial.

A [report](#) earlier this year, on behalf of UN agencies, states: “It is time to reconsider e-waste, re-evaluate the electronics industry and reboot the system for the benefit of industry, consumer, worker, health of humankind and the environment.”



30 SECOND READ

- Globally, we generated nearly [45m tonnes](#) of electronic waste with a material value of €55bn in 2016. E-waste contains precious metals like gold, silver, and platinum, however, just 20% is properly recycled. We’re also generating 3%-4% more e-waste every year.
- Persuading consumers to recycle the 100 million old devices they still own is key. Some companies are partnering with third parties to recycle used hardware; others will refurbish old devices. In the US, Hyla Mobile predicts the secondary mobile device market will reach \$38.9bn in 2025.
- From 2021, EU policy will require product designers to think about disassembly and repair. Dutch company Fairphone has developed a phone customers can repair themselves. Meanwhile, French designers have invented the l’Increvable washing machine, which can be repaired and upgraded.
- Data is crucial. Researchers have developed an EU-wide urban mine platform that reveals material flows. It estimates there are 450m tonnes of batteries, electrical devices and cars in the EU that contain valuable products for re-use.





Re-use and repair

Ironically, business-to-business is accustomed to a culture of repair. IT services and hardware group Cisco “has basically been doing this forever”, according to Darrell Stickler, the company’s global lead for environmental sustainability. When Cisco sells equipment, it often sells a service contract alongside. Recovering and repairing equipment quickly is vital because that equipment usually forms the backbone of a customer’s business. Usually, equipment can be repaired up to three times; and when it does reach the end of its life, whole components and assemblies can be re-used. Otherwise, materials are recovered through recycling and sold into the global commodities market.

In 2012, HP opened a Technology Renewal Centre in Scotland, for government and business customers. Once reconditioned and tested, equipment is either rebuilt to specific customer requirements or resold. It handles 9,000 laptops, PCs and workstations a week, and the re-use rate is 95%, excluding components that have to be recycled for data security.

But it’s different in the consumer market, where more than 100 million old devices are just sitting at home gathering dust. The first task is persuading consumers to recycle them. Some companies are partnering with third parties to recycle used hardware; others will refurbish old devices and recycle components.

In the UK, Mazuma Mobile will pay for used iPhones and refurbish them to be sold again, while its sister company iMend will repair iPhones at home or at work. In the US, Hyla Mobile says it’s completed over 50 million mobile phone trade-ins since it was set up in 2009, repurposing and reusing them, or recycling components. It predicts the secondary mobile device market will almost double in value from \$19.7bn to \$38.9bn in 2025.

Dutch company Fairphone has developed a modular design so that customers can repair their own phones, and upgrade components. It began with the idea of selling an ethical phone, made without conflict minerals, as well as a more sustainable one. Last month, its model 2 (on the market since



NEMANJA ZOTOVIC/SHUTTERSTOCK

Our addiction to smartphones is fuelling 125 megatons of emissions per year

Cisco’s equipment can be repaired up to three times; and when it does reach the end of its life, whole components and assemblies can be reused



L'INCREVABLE

Christopher Santerre (left) and Julien Phedyaeff, designers of the repairable and upgradable L'Increvable washing machine

2015) sold out, but it has stockpiled three years' worth of spare parts. Google once explored the idea of a modular phone that would have new capabilities added over time – but without users having to replace the whole phone. But that idea was abandoned.

Approaches like l'Increvable and Fairphone need to be replicated to tackle the growing mountain of discarded products. Here EU policy will help, and potentially have ripple effects across the globe. From 2021, product designers will have to think about disassembly and repair, so that key spare parts can be replaced by professionals without causing damage, and with tools that are common and not proprietary. The legislation won't go far enough to help L'Increvable get off the ground, because there are caveats. For example, manufacturers will be allowed to bundle parts such that it may not be cheaper to repair the one small worn item.

Nonetheless, it represents a world-leading ambition, according to Stéphane Arditi, policy manager on circular economy, products and waste for the [European Environmental Bureau](#). “We have been fighting for this for the past 10 years: it is quite a success.”

Moreover, when products are dismantled at the end of life, hazardous components will have to be easier to remove, which will aid recycling. “Instead of discarding, we will be repairing, but we will have to wait a few years to see if the attempt to extend life has worked.”

‘Instead of discarding, we will be repairing, but we will have to wait a few years to see if the attempt to extend life has worked’



Alongside the design requirements will come new energy-efficiency labelling intended to help consumers make more informed choices about the efficiency of products. Together the energy-efficiency labelling and eco-design requirements are expected to save over 130 terawatt hours (TWh) per year, or almost 5% of the EU's entire electricity consumption in 2018.

Europe's Joint Research Centre, which provides scientific advice on policy, is also working on a repair scoring system. This, says Ardit, could be transformed into a labelling system to point the consumer to the most energy-efficient and repairable products. "Energy and extension of life-time go hand in hand, so the [economic] calculation changes for consumers.

Indeed, a forthcoming report from the European Environmental Bureau (EEB), will demonstrate that for many EU appliances, including smartphones, it makes no sense to update them because energy efficiency has improved so much already. So the embodied carbon emissions become so much more significant."

Arditi sees a bolder ambition of industrial transformation, with a new type of service economy that creates valued jobs in extending the life of products, and cutting emissions.

Meanwhile, in the US, 18 states have passed "right to repair" legislation giving independent repairers the access to tools, spare parts and documentation to enable them to carry out repairs. That doesn't necessarily mean manufacturers will make it easy to repair equipment, and some have voiced concerns about threats to intellectual property.

Recovering value

Can we ever get to a completely closed loop system? The laws of physics mean we probably can't get to a 100%, says Richard Kirkman, UK chief technology and innovation officer for waste, water and energy management group Veolia. "But we're so far away, it's a question of how can we improve what we've got."

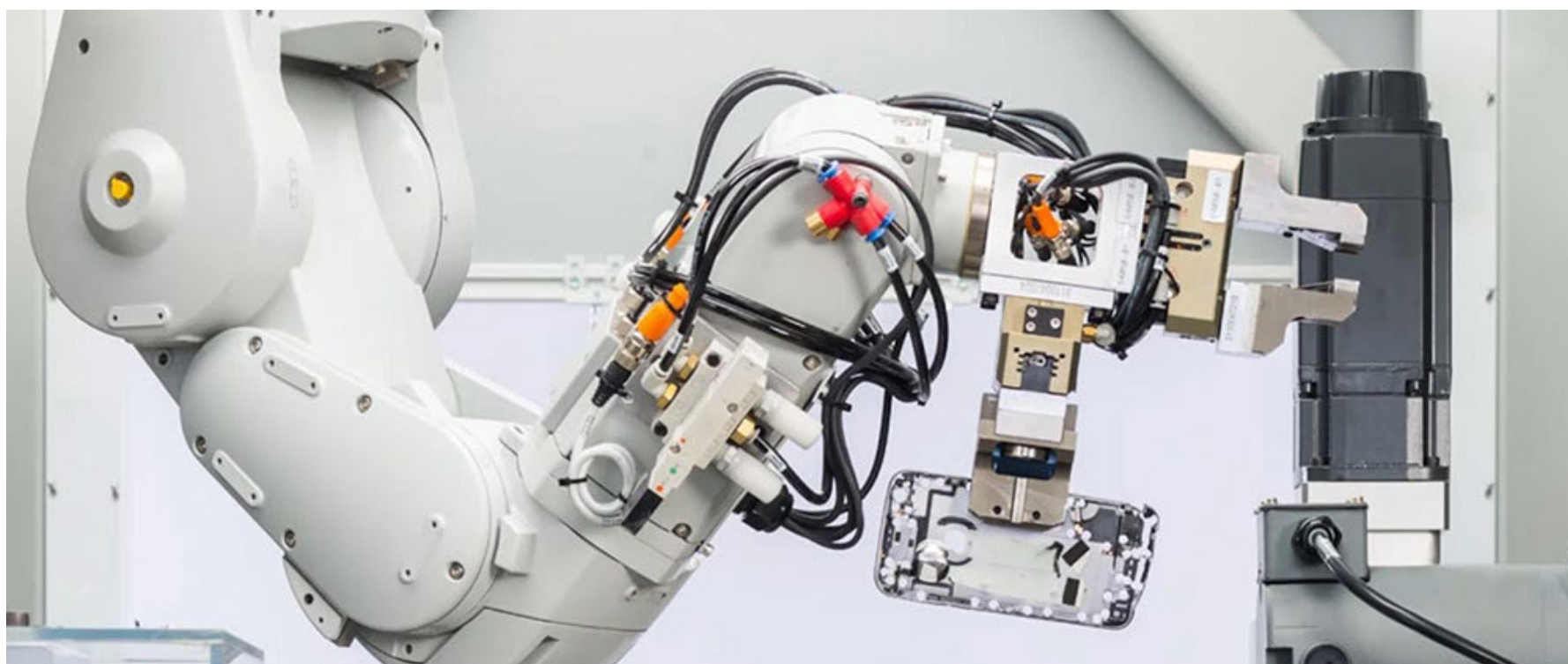
E-waste is a particularly complex problem. "The traditional route was to put it through a shredder and recover as much as you could," he explains. Veolia



FAIRPHONE

Fairphone customers can repair and upgrade their own phones

In the US, 18 states have passed 'right to repair' legislation giving independent repairers access to tools, spare parts and documentation



APPLE

The Apple robot Daisy can disassemble 200 iPhones an hour

has designed its own robotic system for dismantling TVs and monitors, and can now collect and process 300,000 of them every year.

By weight, it's processing four times as much as it did when the plant opened in 2016, but it's not even half of what consumers discard. Veolia's system can recover ferrous metals, plastics, glass, precious metals from circuit boards, copper from cables, and even the fluorescent powders from cathode tubes. Fewer than 7% of components are recovered and used as fuels. "This is the future for electronic equipment," suggests Kirkman.

And, indeed, it is the approach being taken by Apple, as part of its eventual ambition to extract nothing from the earth. The company created material impact profiles for 45 raw materials used in its products, and is focusing initial efforts at closing the loop on aluminium, cobalt, copper, stainless steel, tin, tungsten and rare earth elements. It's working on cutting emissions from aluminium production – a highly energy intensive process, but because aluminium accumulates impurities each time it is recycled, Apple has developed an alloy that enables it to add aluminium scrap without affecting performance.

Together with Mitsubishi, Apple has developed a robot, now in its second iteration as Daisy, to disassemble iPhones at sites in the Netherlands and Texas. The sequence of four robots that comprise Daisy can get through 200 iPhones an hour, and components like the logic board and camera are sent to specialist recyclers who can recover cobalt, tin and tungsten. Apple estimates that the recycled copper it's using avoids 60,000 tonnes of mined ore; and in 2019 using recycled tin will avoid almost 29,000 tonnes of tin ore. After a pilot, Apple is now using recycled cobalt in batteries for its products.

Apple estimates that the recycled copper it's using avoids 60,000 tonnes of mined ore



One of the biggest challenges for Cisco to scale closed-loop recycling, is getting its gear back: its durability means there is a thriving secondary market, says Stickler. “If we don’t have a steady stream of used products coming back, we can’t meet the customer timetable – that’s the manufacturing challenge.” He adds: “We’ve had 100-plus years of developing the forwards supply chain: we have to recreate that on what I call the backside of the moon.” Reverse supply-chain logistics is where the hard work needs to begin.

He foresees companies joining up to explore interlocking relationships where one producer’s “waste” is another’s raw material.

It’s all about data

If we’re going to tackle waste and turn into commercially viable products, we need data. Kirkman explains how Veolia decided to analyse what was collected in its street-sweeping operations. Along with the twigs and pebbles, cans and bottles was dust that contained precious metals like platinum and palladium. The source was the catalytic converters used in car exhausts. It turned out that the palladium was present in the same concentrations as in a palladium mine. “We couldn’t commercially recover it, but what it did was to change the thinking in our company, to analyse and measure [waste]”.

Now a team of researchers has developed an ambitious EU-wide [urban mine platform](#) that reveals material flows to help recyclers, industry and policymakers to make informed choices.

It estimates there are some 450m tonnes of batteries, electrical and electronic devices and cars across homes and businesses in the EU that contain valuable products that could be used now or in the future. They provide a home-grown supply of increasingly limited resources like cobalt and lithium, which are used in batteries; indium used in touch screens, and neodymium, which is vital for making permanent magnets in motors.

Not only are materials in all those dishwashers and smartphones valuable, like gold, and platinum, but they’re polluting to mine. “Mining” gold from discarded electronics produces 80% less emissions than mining it from ore. ■



CREDIT NEEDED KHUNKORN/SHUTTERSTOCK

Dust on city roads contains precious metals from catalytic converters in car exhausts

‘We’ve had 100 years of developing the forwards supply chain: we have to recreate that on what I call the backside of the moon’



NATIONAL STEEL INNOVATION CENTRE

The push to reinforce steel's circular economy credentials

One of the most widely recycled packaging materials is steel, which can be used over and over again without losing its properties. Globally, the recycling rate is 83% but it's up to 90% in some countries. Even so, increasing the recycling rate to 95% in countries (most likely in the industrialised world) where steel stocks aren't growing would cut the need for virgin steel production by two-thirds and carbon emissions by a similar amount, according to an analysis for the Energy Transitions Commission.

Peter Hodgson, manager for product sustainability at Tata Steel Europe, explains that there simply isn't enough scrap globally to meet the demand for new steel, 35% of which is made from scrap, although that gap is expected to close to roughly 50% within a couple of decades. In the UK, Tata is the largest steel manufacturer, with a division dedicated to packaging materials. Its advances mean steel cans are 30% lighter than 20 years ago.

However, scrap steel has to be melted down, requiring hefty energy input to get to the temperatures required, and involving some loss of material.

Steel can also suffer from the same problem as plastics: being down-cycled into less valuable products, such as reinforcing bars used to strengthen concrete. Such down-cycling is partly due to contamination with other materials, such as copper.

According to one estimate, only 8% of the steel originally used in car manufacture gets re-used for the same purpose because of loss of quality. Research efforts are under way to tackle this. Tata Steel is pioneering a new energy-saving steel-making process, through an EU-backed project at its IJmuiden steelworks in the Netherlands. The HIsarna technology will also play a role in recycling, taking up to 50% scrap steel input, and, crucially, steel that is coated with zinc, from car bodies, for example. Potentially the zinc could be recovered and then reused in car making.



When the National Steel Innovation Centre gets off the ground in the UK next year it will look at the means to advance the circular economy in steel making, as well as the new steels that will be needed for more sustainable batteries for electric vehicles, and packaging.

“Some of our construction projects are developing demountable products,” says Hodgson. “Rather than a coarse demolition process that will reduce the value, if you make the structural components demountable, and deconstruct carefully then you have a whole bank of materials. But you need to have designed it that way.”

Analysis by researchers at [Cambridge University](#) suggest re-use is declining in the UK, but there are exceptions: much of the steel for south London’s BedZED eco-village arose from refurbishment work at Brighton railway station; several of the buildings developed for the London 2012 Olympics were designed for deconstruction, while the athletics stadium itself reused 2,500 tonnes of pipeline steel in the roof structure; and BAA leases a warehouse near Heathrow that was designed to be disassembled and reused.

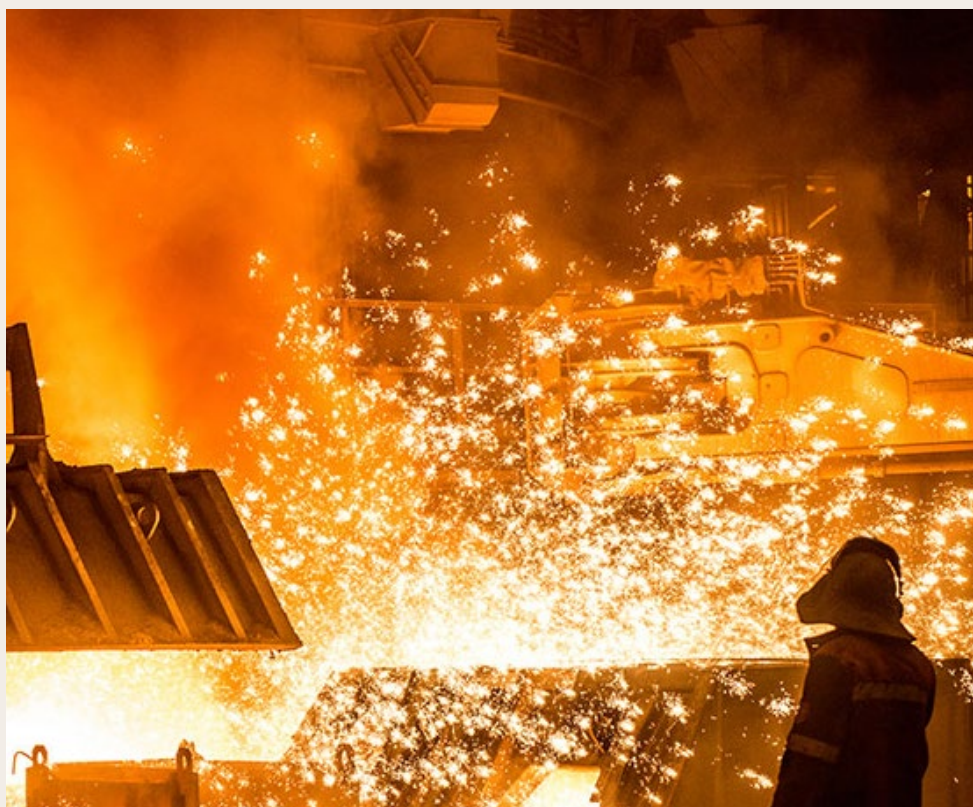
IKEA’s newest UK store in Greenwich – billed as its most sustainable – recycled 99% of the building materials from a Sainsbury’s supermarket it demolished on the same site. The steel was re-used offsite. Ironically the Sainsbury’s building had been lauded as the UK’s most sustainable supermarket.

The [WellMet 2050](#) project at the University of Cambridge concluded that by making the right design choices up to 75% of steel (and 50% of aluminium) in the UK could be reused, with negligible carbon emissions.

Tata Steel produced the materials for a distribution centre at Amsterdam’s Schiphol airport. To facilitate the re-use of the steel, the project partners developed a building material “passport”, containing the specifications of the steel used in the building.

As a building or a car gets to the end of its life, says Hodgson “you also need information on its composition, what it’s been through in its life that might affect its functionality in its second life.”

A recent EU-funded study looking at how to encourage steel re-use found quality, certification and traceability were frequently cited concerns, so efforts are under way to address these.



SHESTAKOV DMYTRO/SHUTTERSTOCK

Scrap steel has to be melted down at huge energy input

Angeli Mehta



[View online](#)

DEYMOSHR/SHUTTERSTOCK

'Companies aren't moving fast enough on the circular economy'

Christie Clarke of CDP says progress by consumer goods firms on plastic waste falls far short of the transformative action required

Increasing transparency around the environmental impacts of plastic pollution has driven rising consumer pressure to reduce plastic waste and move towards greater circularity. Today's plastic value chain is fundamentally linear, with 95% of the material value of plastic packaging (\$80-120bn annually) being lost after a single use.

World production of plastics has increased exponentially – from 2.3m tons in 1950, to 162m in 1993 and to 448m by 2015. Today, however, consumers are moving away from single-use packaging and have the potential to disrupt the linear business models that traditional fast-moving consumer goods (FCMGs) rely upon. This is a trend we looked at in our latest [research on the consumer goods industry](#). Regulators have responded to consumer pressure through a proliferation of packaging and circular economy regulations that will disrupt consumer goods companies that fail to act. These measures have usually taken the form of levies or bans on specific products, like microbeads and plastic bags, but there is a growing appetite for their scope to be extended to other items and to incentivise broader circular economy considerations.

Consumers are moving away from single-use packaging and have the potential to disrupt linear business models





For example, the 2018 EU Circular Economy Package proposed a set of measures and funding solutions, presenting significant opportunities for companies that are able to position themselves ahead of the curve.

FMCGs are beginning to respond to these societal and regulatory pressures through active innovation. Most of this innovation, however, involves incremental tweaks to product design, such as light-weighting or increasing recyclability. They do not address key barriers that exist in transitioning to a circular packaging system and therefore have limited impact. To truly achieve circularity, FMCGs must engage in more transformative, systemic innovation to drive more fundamental shifts in business models.

Some leading consumer goods companies have begun investing in this kind of innovation, but usually at a small scale or through experimental pilots.

Unilever, for example, partnered on the development of a breakthrough chemical process called CreaSolv, which it says will allow high-quality recycling of plastic sachet waste. Sachet waste is notoriously difficult to recycle and is particularly prevalent in emerging economies, which tend to have less sophisticated recycling infrastructure, so this innovation could be highly impactful if it proves successful.

Meanwhile, Henkel has partnered on the development of an innovative solvent-based process called Newcycling, which enables the recovery of high quality, clean grade materials from complex, multi-layer packaging.

The scope and level of development of waste collection and recycling infrastructure varies greatly between regions and countries. While the majority of global plastics waste is generated in Europe and North America, manufacturing of plastic parts (and with it the demand for recycled plastics) has shifted to Asia over the last few decades. The domestic recycling infrastructure in these countries, however, remains underdeveloped.

Danone has conducted a mapping exercise to determine which of the markets into which it sells have the lowest recycling rates. It has then designed local programmes, often working with governments at a municipality level, to improve recycling rates in these areas. One focuses on human waste-pickers,



KANITCHUREM/SHUTTERSTOCK

Consumers are moving away from single-use plastics

Henkel has partnered on the development of an innovative solvent-based process called Newcycling



who are a critical link in supporting the recycling stream in countries that lack formal waste management systems. In Argentina, Brazil, Mexico, Indonesia, and Ghana the Danone Ecosystem Fund is assisting the creation and development of worker co-operatives that can oversee the process of collecting, sorting, and selling plastics directly to recycling plants.

AB InBev is doing similar work to support local recycling systems. In Brazil, it is working on reverse logistics to collect and transport more recycled glass. In the US, the world's biggest brewer co-invested in infrastructure to clean and crush glass, and in Mexico, it has partnered with a local NGO to help collect broken glass and has invested in a new glass processor at one of its plants.

Another solution for overcoming these logistical barriers is establishing take-back schemes, in collaboration with retailers. A number of FMCGs have experimented with take-back schemes for specific brands, however these tend to be small in scale and pilot in nature. Heineken, for example, has piloted a returnable bottle scheme, while its Tiger brand has set up a pop bar in Singapore, which provides consumers with complimentary drinks in exchange for a returned glass bottle.

Although it is developing rapidly, the market for recycled plastics is still small. This is in part due to a lack of demand for recycled plastics, which inhibits investment in material-recovery activities. The economic feasibility of using recycled plastics depends on its cost advantage over virgin alternatives. Generally speaking, manufacturers can achieve lower input costs by applying recycled resins, however low oil prices can remove the cost advantage.

A number of consumer goods companies are actively investing in increasing recycled content in their packaging, driving up demand for recycled materials. In 2017, L'Oréal replaced virgin materials with 7,294 tonnes of recycled materials, and a number of their brands such as Kiehl's, Pureology, Biolage and Redken also rolled out products with 100% recycled packaging. Danone's Evian brand is also working towards a 100% recycled plastic bottle, while collaborating to develop a new technology that allows PET to be recycled again and again without suffering any loss in quality.



DIPAK SHELARE/SHUTTERSTOCK

Waste pickers are a critical link in regions that lack formal recycling

In Mexico, AB InBev has partnered with a local NGO to help collect broken glass and has invested in a new glass processor



Several FMCGs, including Danone, Coca-Cola, Unilever and Procter & Gamble, have also set specific targets to increase the percentage of recycled content in their packaging. These targets provide signals that demand for recycled materials is likely to rise in the future, which may allow for more favourable economics.

Household recycling rates are constrained by a lack of knowledge. According to a survey of UK households conducted by WRAP, less than half the sample (48%) understood “very well” what they are supposed to use their recycling containers for. About a third of households said they would increase recycling if they had better information about local recycling services.

A number of FMCGs are beginning to invest in consumer education and behaviour-change programmes to encourage recycling. Coca-Cola recently launched a new community legacy programme, Zero Waste Cities, which aims to accelerate the behavioural change required to make the circular economy and recycling part of people’s hearts, minds and everyday routines. Through its partnership with Keep America Beautiful, Coca-Cola is also helping to educate Americans on what they can recycle in their local recycling programmes.

Another example is Nestlé Waters China, which launched a PET Bottle Recycling Action, a nationwide campaign to raise consumer awareness about recycling PET bottles and encourage them to play their part. In Italy, Nestlé Waters has also organised local educational tours and campaigns to encourage the recycling of PET plastic.

Our analysis, however, shows that fewer than 20% of packaging innovations were rolled out at group level and over 40% were considered to be incremental innovations or small product-level tweaks.

To really achieve circularity, companies will need to scale up their efforts and collaborate across the value chain. It will also be important for companies to pursue a number of circular packaging solutions rather than focus their efforts in one direction. Ultimately, any transition to a circular packaging system will require a breadth of innovation: from very technical efforts to advance depolymerisation to more social innovations focused around behaviour change in local communities. ■



A number of consumer goods firms, like Biolage, are replacing packaging with recycled materials



Christie Clarke is research analyst at CDP.

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