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SOIL

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plus

Bioplastics • Gasification update • Materials brokerages • Ocean plastic products



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“If Trump tries to go backwards on climate change, he’ll run headlong into an organised mass of people who will fight him in the courts, in Congress and on the streets”

On the cover:



Soil can play a vital role in protecting the earth's climate, but we've got to muck in and treat it right

Reasons to be outraged

The only bumper sticker I've ever owned, back when I was a headstrong youth working in my first summer job at an environmental charity, said (well, shouted really): 'If you're not OUTRAGED, you're not paying ATTENTION!' And, while I've since lost whatever limited desire I ever had to festoon vehicles with any sort of unnecessary decoration, I find the sentiment from that bumper sticker becoming ever more apt. Indeed, working in this job and researching environmental issues (and governmental approaches to them), I discover new things to be outraged about on a near-daily basis.

Following the shock of the Brexit vote, and the even more traumatic shock of Donald Trump's election as US President, I feel like plenty more people are joining me in outrage – for various reasons, to be sure, but for the purposes of this very short editorial, I'll stick to the environmental implications of the latter victory (for our columnists' thoughts on Brexit, turn to p.6 and 58).

Trump's worry-inducing statements on the environment are too numerous to list here, but some of the more noteworthy proposals include: removing America from the Paris Agreement, while withdrawing support for those already suffering the effects of climate change; eliminating the Clean Power Plan, and lifting the current limited restrictions on 'job-producing American energy reserves, including shale, oil, natural gas and clean coal'; fast-tracking the highly controversial Keystone Pipeline (and similar projects); and eliminating entirely the Environmental Protection Agency.

These proclamations haven't gone unopposed, though, and it was heartening to see so many other countries immediately defy the president-elect at the UN's COP22 meeting in Morocco, where 197 parties asserted in the Marrakech Action Proclamation that global warming is real, and that every country has

an 'urgent duty to respond'. At the same time, nearly 400 major American companies and investors issued a plea to Trump emphasising their 'deep commitment to addressing climate change', and leading climate economist Lord Stern pointed out that, whether or not climate change is important to Trump, he could create many of his promised manufacturing jobs by tackling it (though where that would leave his proposed 'clean coal' and fracking jobs I don't know!).

Even more significant, in my mind, though, is that Trump's statements have been such a spur to action for grassroots movements. One of the immediate effects of his victory was the galvanisation of groups including the American Civil Liberties Union (ACLU), the Anti-Defamation League and Planned Parenthood, all of which saw massive spikes in financial contributions. Environmental groups also benefitted from people's outrage at the result, with 125-year-old environmental group the Sierra Club quadrupling its monthly donation record in the few short days after the election. Echoing the ACLU's viral tweet (the one that read 'Should President-elect Donald Trump attempt to implement his unconstitutional campaign promises, we'll see him in court' and temporarily crashed the organisation's website with an inundation of traffic), the Sierra Club's Executive Director Michael Brune warned: "Trump must choose wisely or we guarantee him the hardest fight of his political life. We won't be in a defensive crouch for the next four years, licking our wounds. If he tries to go backwards on climate change, he'll run headlong into an organised mass of people who will fight him in the courts, in Congress and on the streets."

It seems more and more people are paying attention and channelling their outrage, and that, at least, has to be a good thing. 🇬🇧

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Charles Newman
Resource's Editor in Chief looks into the merits of setting up a materials brokerage



Ray Georgeson
contemplates a full English Brexit and loses his appetite



Leonie Butler
Resource's Associate Editor learns how Bristol is getting its collections ship shape



Peter Jones
and fellow Eunomia consultant Andy Grant investigate why England's reject rate has increased

EDITOR'S LETTER

‘Coffey cup charge’ not on the cards

GOVERNMENT Despite calls from industry and other parties, the government will not bring in a coffee cup charge, preferring an industry-led approach. Edward Perchard reports

Waste Minister Therese Coffey has ruled out imposing a charge on takeaway coffee cups, after the Liberal Democrats called for the government to extend the principles of the successful 5p carrier bag charge to disposable cups, around 2.5 billion of which are thrown away in the UK every year.

The call followed months of back and forth on the subject after celebrity chef Hugh Fearnley-Whittingstall brought it to the attention of the public and the national media. Paper coffee cups are assembled with a moulded plastic layer inside to waterproof the cup, meaning they can only be recycled at two specialist facilities in the country. Less than 0.25 per cent of all disposable cups are recycled in the UK.

However, as has been the case so often before, Coffey wrote in a letter to Lib Dem MEP Catherine Bearder that there was no need for governmental action as the coffee industry is itself taking steps to reduce the waste, pointing to producer responsibility obligations (which have so far failed to yield any improvement for this particular waste stream), as well as individual schemes to incentivise sustainable behaviour, such as Starbucks’s 25p discount for customers with reusable cups.

In October, behaviour change charity Hubbub, with several high street retailers, launched a trial of coffee cup-only street bins in Manchester to see if they could improve capture rates enough to enable single-stream recycling, but Fearnley-Whittingstall called trials such as these ‘greenwashing’ on the part of the coffee chains.


Coffey also highlighted the ‘Paper Cup Manifesto’, an initiative led by the Foodservice Packaging Associations and Paper Cup Recovery and Recycling Group, which has seen over 40 retailers and suppliers, including Starbucks, Caffè Nero



and Costa, pledge to increase recycling rates ‘significantly’ by 2020. This takes the form of a voluntary commitment to make improvements, with no binding targets, in line with government preferences evident across a number of resource-related issues, including food waste reduction and, until recently, microbeads in cosmetic products.

In the case of coffee cups, the industry response to preferred action is split. Martin Kersh, Executive Director of the Foodservice Packaging Association, said: “This shows [the Minister] is listening to the industry... The industry is working on improving recovery and recycling along the supply chain but it’s a complex scenario, not least because the UK waste management infrastructure has... not moved with the needs of society. We live in a 24/7 culture that is time poor and by necessity driven by convenience. We are working hard to find solutions but safe, economically viable and sustainable answers won’t be found overnight.” Potential solutions being developed include a cup created by FrugalPac that can be recycled with paper (although paper recyclers have expressed concern about such a product contaminating material with residues) and a resin that can be made from the current complex cup structures and used to make new plastic products.

However, Chris Sherrington, Principal Consultant at Eunomia Research & Consulting, responded: “Increasing single-use cup recycling rates is a positive step, but the focus on this deflects from the real solution to this problem – we should be incentivising consumers enjoying coffees ‘on the go’ to take reusable cups.”

Sherrington said that attitudes change most when a value is attached to a single-use item, as shown by the bag charge, adding that such an approach would save small businesses “money, prevent waste, reduce the amount of litter in the neighbourhood, and raise funds for good causes”. 

NELSON’S COLUMN

As an industry, what stage of grief have we reached about Brexit? Possibly still denial or anger? Maybe bargaining or depression? Or, as this column is now finally ready for, acceptance?

It really seems like we are going to leave and – if we opt for the ‘harder’ variety of separation – we’ll be saying goodbye to the light that has guided this industry more than any other for 20 years since the advent of the Landfill Directive.

Of course, for many Britons, leaving the EC is no bad thing, but I suspect most environmentalists will not agree. One of Brussels’s strongest suits has been legislating to improve environmental standards in all member states.

So, in accepting that Brexit means Brexit (whatever that means), I’m starting to think that the Circular Economy Package (CEP) will not be a guiding light here. Which leads me to my main question: do we as an industry still care about the circular economy? And, if so, how much?

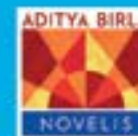
In recent years, most players in this industry have talked up the circular economy with enthusiasm. We may be about to find out who meant it and who was just paying lip service because it looked good for business development with the CEP on the runway.

With the ongoing hands-off approach from Defra, it’s up to the rest of us to step up to the plate if we mean it. Let’s face facts: we are only going to improve recycling rates if businesses, local authorities, consultants and all other players in the sector genuinely commit to matching the level of innovation shown in the past. That has to start with leadership at the biggest firms in the industry, showing the appetite to deliver results that matches that of our neighbours signed up to deliver the ambitious EC package.

I’m ready to move on. Anyone else?

Nelson

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For more information on sustainability efforts, visit www.novelisrecycling.co.uk/sustainability



Novelis

Microplastics' health impacts investigated

GOVERNMENT The government is to review the impact of marine plastic pollution on human health

The Department of Health is to investigate the impact of microplastics on human health, following an inquiry by the Environmental Audit Committee (EAC).

The EAC published a report, 'Environmental Impact of Microplastics', this summer, prompting the government to announce it would be consulting with the intention of banning plastic microbeads, tiny pieces of plastic less than five millimetres wide that are used as exfoliants in a variety of cosmetic products such as body scrubs or toothpaste.

Microbeads, however, are only one source of microplastic marine pollution, which also enter the marine environment through the washing of polyester clothing and when larger pieces of marine plastic pollution break down into tiny pieces through exposure to sunlight and waves. Increasing scientific research is indicating that these particles enter the food web and wind up on our dinner plates, though little is known about their impact on human health.

In its report, the EAC stated that microplastics cause significant damage to the marine ecosystem and called for



Image: Fred Dott for Greenpeace

219 thousand tonnes of microplastics could be entering the oceans from Europe each year

more research into the impact on human health. The damage comes about as fish and other creatures ingest the material, with an estimated 80,000 to 219,000 tonnes of microplastics entering the oceans every year from Europe. The Ellen MacArthur Foundation, moreover, claimed in January that by 2050 there could be more plastic in the ocean than fish.

As well as the chemical additives in the plastic itself, other pollutants from seawater can attach to the particles and may present a health risk. The Chief Medical Officer is therefore to look into the impact of such materials on humans. The Department for Environment, Food & Rural Affairs will also shortly be publishing a report on the potential harm that microplastics can cause in the marine environment.

New recycling guidance

MATERIALS WRAP's National Recycling Guidelines aim to present a clear message and clear up public confusion

A new set of National Recycling Guidelines, published in October, have been developed to clear up what materials can and can't be recycled at the kerbside, and what needs to be done to them, in a move to prevent householder confusion.

The guidelines have been developed by the whole chain of the recycling process - local authorities, waste management companies and recyclers - and aim to provide a consistent and authoritative message on materials and help councils and the wider industry communicate with residents more effectively. A number of surveys carried out in the past year have suggested that a lack of knowledge is a key barrier to better recycling in the UK, where the recycling rate has stalled in the last three years. One of those surveys, WRAP's 2016 Recycling Tracker, found that two-thirds of UK households were unsure of how to correctly dispose of at least one item and just under half (49 per cent) admitted that they regularly put at least one item in their general waste bin that they know is collected for recycling in their area.

The new set of guidelines covers the main materials collected at the kerbside: paper, card, cartons, metal, plastic

49 per cent of UK residents put at least one item they know is recyclable in their residual bin

and glass packaging, and food waste. For each material, residents will be told what items can be included with collections and which can't, how they should be presented (i.e. whether they need to be rinsed and whether lids can be left on or not). The guidelines also explain why certain items can't be taken.

The release of the guidelines, which have been in development for over a year, closely follows September's publication of the 'Framework for Greater Consistency in Household Recycling for England', which, if adopted, would see every home in England able to recycle the same set of core materials by 2025 using a more regular set of council collection systems.



Image: WRAP

Ecodesign extension

SUSTAINABILITY European ecodesign rules are to be extended to cover resource efficiency on consumer products

The European Commission (EC) has promised action to make products more durable, repairable, and recyclable, while a new study shows just how smart design can transform products.

UK environmental think tank Green Alliance published the study, 'Better products by design', to highlight that easily-broken, hard-to-repair products frustrate consumers, cost more money and create unnecessary waste. It urges the EC to extend ecodesign rules to more consumer products as a matter of priority, calling for a regulatory environment that empowers consumers.

The report was published a day after the commission announced it would be bringing forward plans to broaden ecodesign beyond energy saving to cover resource efficiency and apply ecodesign to products 'where there is a clear benefit for European consumers in terms of energy and cost savings, job creation and revenue benefits for European industry, and energy or resource efficiency which contributes to the fight against climate change and the transition to a circular economy'. This will include hand dryers, lifts, solar panels, refrigerated containers, and kettles, but some



Image: Georges Boulougouris

€500 per year per household could be saved on energy bills through ecodesign, says the EU

everyday devices such as smartphones, toasters and hair dryers were left off the list.

EC Vice-President Jyrki Katainen (above) said: "Ecodesign is part of the circular economy. A circular economy is much more productive in creating added value, which is important both for financing society and strengthening the social model within the European market economy."

Speaking about the obstacles that need to be overcome, he said: "We need to empower consumers, and that means that we have to make it possible for consumers to make conscious choices. If they want to save money, energy and nature, it should be possible, and ecodesign and energy labelling are the tools for improving awareness."

English landfill rises

RESOURCES EA data suggests the amount of waste sent to landfill in England increased between 2014 and 2015

The amount of waste being sent to landfill in England increased by over six per cent between 2014 and 2015, according to data published in October by the Environment Agency (EA).

According to the data, 343 landfill sites in England accepted waste in 2015, managing 43.9 million tonnes, an increase of 2.6 million tonnes from 2014's figure (41.3 million tonnes). The data covers all waste types - including hazardous, non-hazardous and inert - from all sources, including both municipal waste and commercial and industrial waste. Although the amount of waste sent to landfill has virtually halved since 2000/2001, when almost 80 million tonnes of waste were deposited, the majority of the drop occurred between then and 2009, since when the figure has fluctuated between 45 and 40 million tonnes.

When the amount of landfilled waste is split by regions, all but three (East Midlands, the North West and London) recorded an increase. The largest amounts of landfilled waste were deposited in the East, where the figure rose from 7.0 million tonnes to 8.9 million tonnes between 2014



Image: WRAP

2.6 million more tonnes of waste went to landfill in 2015 than in 2014

and 2015, and the South East (8.4 million tonnes). As well as an increase in the amount of waste sent to landfill in England, the EA data also reports that incinerators managed 21 per cent more waste in 2015 than 2014, taking 10.4 million tonnes across 78 sites, compared to 2014's 8.6 million at 74 sites.

Overall, the data suggests that 4.1 million more tonnes of waste was managed in 2015 (191.1 million) than the previous year (187.0 million), with 122 more sites (6,427) accepting it across the various treatment and disposal categories.

Canada

Zero-waste supermarket opens

Canada has welcomed its first zero-waste grocery store, with the Montreal-based shop offering more than 700 products to waste-conscious shoppers. Méga Vrac (or 'Mega Bulk' to the Anglophone) opened its doors at the beginning of September and expects customers to bring their own containers to carry home the wide range of food and bathroom products, although they may purchase glass jars and bottles and paper bags if necessary.

With residents of Montreal currently generating, on average, 350 kilogrammes of waste per person every year, of which 70 per cent is food waste, this venture has been welcomed by those that have begun shopping there. One customer told Radio-Canada: "I don't have any waste after using products... it's perfect for me."

USA

Walmart launches ugly fruit range

Walmart is releasing a line of 'ugly' apples in 300 Florida stores.

Under the title 'I'm Perfect', the initiative aims to tackle the perceived dislike of damaged yet edible fruit by consumers in developed countries, which can lead to undesirable fruit ending up in landfill.

Partnering with suppliers from Washington state, Walmart has brought 'I'm Perfect' apples of various varieties into its stores, aiming to reduce food waste and support cultivators who lose out financially from this throwaway culture.

WEEE export ban hopes to protect national security

A new bipartisan bill, the Secure E-waste Export and Recycling Act (SEERA), has been proposed to the US Congress to safeguard national security by preventing the export of waste electrical and electronic equipment (WEEE).

The bill's creators say WEEE is often converted into counterfeit parts in places like China and then sold back into the US supply chain. A Senate study found 1,800 cases



70
per cent of household waste in Montreal is made up of food waste

Sweden

Tax breaks on repair considered

Plans put forward by Sweden's ruling Social Democrat and Green party coalition have proposed the introduction of tax breaks on repairs for transport and household items, like bikes or fridges, to encourage consumers to reuse old items and reduce waste.

The government hopes to encourage consumers to think twice about what they throw out by introducing incentives including

reducing value-added tax (VAT) from 25 to 12 per cent, and also allowing customers to claim back half of the labour costs for repairing white goods, and providing tax credits.

Per Bolund, Sweden's Minister for Financial Markets and Consumer Affairs, told the *Guardian* that a "shift in view in Sweden" had led to "an increased knowledge that we need to make our things last longer in order to reduce materials consumption".

Greece

Fines for waste management

The European Commission has fined austerity-hit Greece €10 million (£8.7 million) for failing to implement EU laws relating to the recovery and disposal of waste, including failing to adopt a plan for the management of hazardous waste and not establishing a network of disposal facilities to treat it safely. It will also be made to pay an extra €30,000 (£26,000) for every day it takes to get up to speed.



€10
million fine for Greece's failure to implement EU waste laws

Japan

Zero-waste town creates building from abandoned materials

A shop and pub created from repurposed abandoned materials, built to symbolise the Japanese town Kamikatsu's commitment to zero waste, has been awarded the World Architecture News Sustainable Buildings Award 2016.

The 'Kamikatz Public House', built by architectural firm Hiroshi Nakamura & NAP, features an eight-metre-tall wall of windows

made from reclaimed materials from nearby abandoned houses that enables cool air ventilation in the summer. The building boasts reclaimed tiles for the flooring, a chandelier made from used bottles, newspapers upcycled into wallpaper, and an exterior made from reclaimed cedarwood boards.

Kamikatsu, a town of 1,700, wants to become the country's first zero-waste community by 2020. It currently recycles 80 per cent of its waste, with residents separating rubbish into 34 categories.

India

Industrial waste gets used again

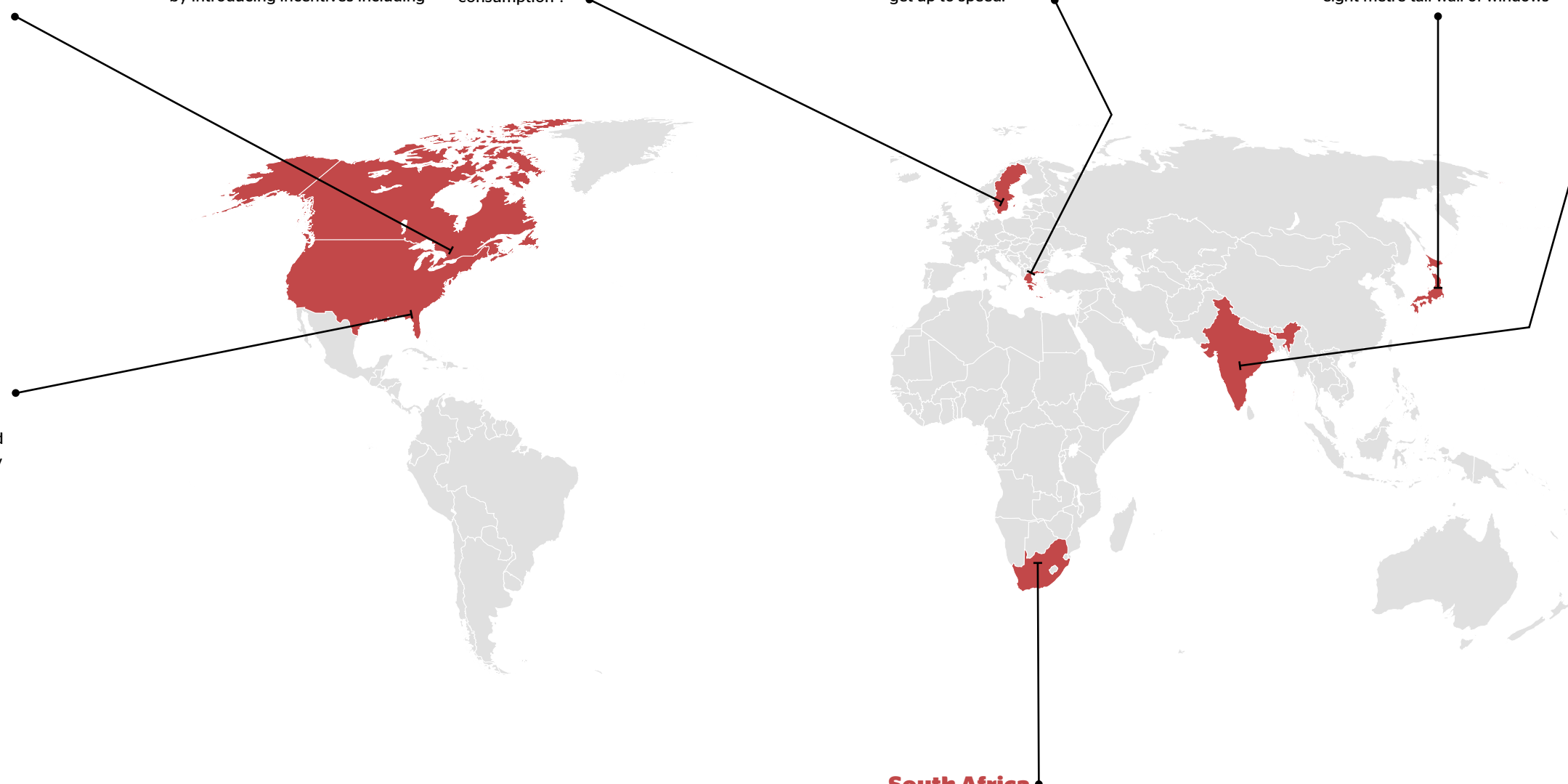
The Punah Project, from the Sanskrit word meaning 'again', is run by Godrej and Boyce, one of India's biggest manufacturing conglomerates (active in sectors as diverse as real estate, consumer products, industrial engineering, appliances, furniture, security and agricultural products), with the aim of upcycling industrial waste into fashion items.

The initiative proposes to reduce the company's annual 18,505 tonnes of waste by using recyclable material to create a range of fashion products, like metal shoes and handbags, some of which were recently displayed at the London Design Festival.

India set for first ELV facility

India's first integrated end-of-life vehicle (ELV) shredding and recycling facility has been earmarked for 2018, with Gujarat and Maharashtra being shortlisted as potential locations. The plant will be the first of its kind in India, with ELVs being recycled in ways that comply with global standards by 'state-of-the-art' shredding and sorting equipment, with the ultimate aim of recycling 100 per cent of all materials.

Sumit Issar, Managing Director of Mahindra Intertrade, which is running the joint venture with MSTC Ltd, said: "Auto recycling, if implemented as per global standards, is not only environment friendly, but also saves energy costs and minimises the reliance on alternate resources."



1.8

thousand cases of counterfeit WEEE have been discovered in military technology



Image: WRAP

South Africa

Teenager makes drought-fighting polymer from food waste

A new super absorbent polymer made from orange peel and avocado skin developed by a 16-year-old girl from Johannesburg could prove a panacea for South African farmers as the country suffers its worst drought in recorded history.

Kiara Nirghin's combination of orange peel and avocado skin

causes a reaction when left in the sun and creates a polymer compound that can be used to create reservoirs to aid the cultivation of crops at minimal cost. The idea recently won the Google Science Fair's Community Impact Award for the Middle East and Africa, and Nirghin has been assigned a Google mentor. She will soon learn if she has made it to the final of the global competition.

16

year old has come up with a new super absorbent polymer to aid drought-stricken country



More than bricks and mortar

A pioneering eco house in Rotterdam has been made using waste-based bricks that even the toughest of wolves couldn't blow down. **Leonie Butler** learns more

When forward-thinking architects Nina Aalbers and her boyfriend Ferry in 't Veld decided to build their own house in the Dutch city of Rotterdam, two years ago, they were clear they wanted to make something with as small an ecological footprint as possible.

First off, they needed to find a plot of land on which to realise their dream. Though Rotterdam, with its mountains of high-rises, feels pretty dense, there are still empty plots in the city centre that lie between old houses and large-scale urban renewal projects. Rotterdam's local government stimulates initiatives for such small-scale projects. After deciding on the neighbourhood they wanted, the pair found a small plot and contacted the local government with an email

Nina Aalbers and Ferry in 't Veld's house, made from WasteBasedBricks, was designed to fit in with the surrounding area.
Image: © Ossip



questioning, simply: "Can we build here?" The reply came back: "Yes, please!" This was in 2014. When they started to design the 4.65 metre (m) wide, 8.8m deep, four-storey house, they wanted it to blend in with the surrounding area, meaning it should be built of bricks. But with an eye on sustainability, the question was: how should it be done? After extensive research, the couple found start-up company StoneCycling, based in Amsterdam, as in 't Veld explains: "From the moment we got in contact with StoneCycling, we saw this chance of designing a brick facade and being more sustainable by using WasteBasedBricks and knew this is what we wanted to achieve."

The bricks themselves are made up of waste from the ceramics, glass and insulation industries, and rejected clay from traditional brick manufacturing – all sourced within a 100 kilometre radius – though the exact recipes are kept secret. The composition of different recipes can lead to unusual aesthetics and different coloured bricks, but they are still essentially bricks, as in 't Veld notes: "The stone does not look like waste. Actually, the small pieces in the brick that you can recognise as pieces of toilet bowls we used in a special brick bond pattern to make ornaments in the facade. In this way, we are showing the beauty of sustainability and the sustainability of beauty."

All StoneCycling bricks are subjected to market tests to ensure they are safe to use according to European standards. They are checked, for example, for frost resistance and the maximum pressure the brick can take. Despite this, the industry is typically risk averse and profit driven, and StoneCycling co-founder Ward Massa is particularly pleased that the architect duo took a gamble on the company: "In general, [architects] love the products because it opens up a whole new range of possibilities in terms of colours and textures. On the other hand, they want to see proof. Realising a number of projects is extremely important to take away any scepticism about building from waste."

"It's quite amazing that [Aalbers and in 't Veld] decided to invest more money and time and take an extra risk to be the first to live in a waste-based house", he says. "But it is inspiring to see a new generation that believes in a different way of designing, living, building, maintaining and demolishing."

in 't Veld says that a visit to the factory and a meeting with Massa and his co-founder Tom van Soest convinced them that the WasteBasedBricks were the way forward: "We found out all the possibilities of the

brick and shared our ideas of what we think a brick should look like. We ended up with a brick with more of a rough surface than the original StoneCycling brick... We then designed a bond pattern to incorporate the sliced version to show the grain of the ingredients of the brick."

Indeed, the architects seem more than happy to try something new: "It is very exciting and challenging to work with a new product which hasn't been applied yet, since you can never be sure how it will work out on the building site and how it will look in a few years."

"Working together as two young companies brings in a lot of positive energy. And the stone is of great quality: when the mason was building a test wall, he was truly impressed by the quality of the brick. He showed us by breaking the brick with his trowel in two. Apparently a lot of bricks nowadays break [into a] thousand pieces."

However, getting uncontaminated waste streams from demolition is a challenge. One idea is to introduce a building material passport (a document describing the materials used in a building), which would make it easier at the end of a building's life to identify materials for reuse. With guaranteed provenance of the building materials, there would then be a way of selling it on and thereby incentivising strategic demolition.

Currently, the bricks are three times as expensive as standard bricks. But, you could argue, as the company



Rotterdam is the second largest city in the Netherlands, after Amsterdam, with a population of just over 600,000. The buildings in its city centre were largely destroyed during the 'Rotterdam Blitz' in World War II, and the reconstruction established a tradition of ambitious new architecture in the city.

does, that because they come in all sorts of colours with mouth-watering names like Blueberry, Nougat, Truffle and Wasabi (the Rotterdam house uses Caramel ones), and can be made in any size you want, it is not a standard brick. However, like anything, it is hoped that the more they are used, the cheaper they will become.

The result of Aalbers and in 't Veld's project is an attractive building they live and work in, comprising of: the ground floor kitchen and eating room; the first-floor office and bathroom; the second-floor living room; a top-floor sleeping room; and a rooftop terrace. StoneCycling estimates that around 15,000 kilos of waste has been upcycled into the new building.

Having moved into the new house just in August, the couple is still overwhelmed with what they have achieved. "We get a lot of nice comments on the house. People take a detour to see the house and when they see us, we get the thumbs up", in 't Veld says proudly. "The local government is happy with the house, it will feature as part of a tour they organised around sustainable homes. Neighbours say it suits the street well and it upgraded the site – we feel very welcome by those comments. We would definitely use the bricks again in a design, when they suit the project."

He concludes: "As an architect, I think we should be more aware of the possibilities to innovate within traditions. For more and more products, the source should be waste!"

StoneCycling images showing the various stages of the brick-making process



Battery business

A conversation with Nick Purser, Communications Manager, and Mario Champagne, Chemical Process Engineer, Technical and Audit Manager at ERP: www.erp-recycling.co.uk



How common are the various types of portable batteries and what are they used for?

Non-rechargeable and rechargeable portable batteries have many different chemistry types.

The most common batteries are alkaline/zinc-carbon batteries, which can be found in most handheld electronics. Rechargeable batteries, such as nickel cadmium, nickel-metal hydride or lithium-ion/polymer batteries, are also used to power handheld electronics, as well as mobile phones, laptops, and power tools.

Lead-acid batteries are most commonly found in big electric toys, motorised wheelchairs, portable tools or on boats. Non-rechargeable lithium batteries are less common but can be used, for example, in remote locking systems for cars. Button cell batteries (mercury, silver-oxide and zinc-air batteries) are most commonly used in very small devices.

The 2015 data below comes from one of the collection/sorting companies used by ERP in the UK. It clearly shows that alkaline (single-use) batteries are the most commonly collected (almost 80 per cent), followed by nickel-cadmium (rechargeable) batteries:

Alkaline/Zinc-Carbon	77.9%
Nickel-Cadmium	11.4%
Nickel-Metal Hydride	2.9%
Lithium-Ion Rechargeable	3.4%
Lead-Acid	1.4%
Lithium Primary Mixed	0.8%
Mixed Small Button	0.3%
Waste (Paper/Packaging)	1.4%
Industrial Batteries	0.7%
Mixed Batteries	100%

What happens to the different battery streams following collection and sortation?

After collection, batteries are sorted manually and automatically by chemistry type. With efficiency levels of 98 per cent, automatic sorting has become very sophisticated in the last few years.

The sorted batteries are stored and carefully identified to avoid further mixing. Lithium batteries need to be handled with care as arcing can occur if the batteries have any residual energy. That is why those batteries are layered in dry sand or vermiculite.

Where and how are they reprocessed?

Lead-acid batteries are treated in the UK by the same smelters that process end-of-life car batteries. The batteries are crushed to recover the sulphuric acid, plastic and metal; lead is recovered in lingots to make new car batteries.

All the other types of batteries are exported to Europe because there are no treatment facilities in the UK. Each battery type goes to a facility where they can recover the valuable materials and capture any pollutants and heavy metals. The shipped loads are sorted again to reduce contamination.

Here are some examples of how the chemistry types are treated:

- Alkaline/zinc-carbon batteries are shredded to separate the paper, plastics and metal from the black mass core.
- Mercury batteries are heated at high temperature to evaporate and condense the mercury further.
- Nickel-cadmium, nickel-metal hydride and lithium batteries are processed at high temperatures in thermal vacuum vapourisation units, where the precious metals are evaporated and then condensed.



80
per cent of batteries collected by ERP are of the single-use alkaline variety

98
per cent efficiency can be achieved by automatic sorting

What secondary materials are recovered from the different types of batteries and what applications can they be used for?

Again, here are some examples of which materials are recovered and how they are used:

- The iron in all battery types is recovered to make new goods.
- The manganese oxide inside alkaline batteries is processed in a rotary kiln to recover the zinc oxide, which can be used as an additive in numerous products including plastics and ceramics.
- The cadmium recovered from nickel-cadmium batteries is used to make new batteries.
- The nickel in nickel-metal hydride batteries is recovered to make steel.
- Cobalt, nickel and copper can be recovered from lithium batteries.
- Mercury is recovered from mercury cell batteries and the decontaminated steel fraction is used to make steel.

Have there been any important recent developments in battery recycling?

Given the importance of critical raw materials (CRMs), research and development teams are developing processes to extract CRMs from batteries. Some recycling companies in Europe are looking to develop ways of separating manganese and zinc metals from black mass by electrolysis, but this procedure is still costly.

Others have developed ways to avoid shredding and separate the anode and cathode parts of batteries quickly and easily. Finally, studies have shown that it may be possible to transform the black mass from alkaline batteries into fertilisers, but doubts remain about the presence of heavy metals in the final product. [🔗](#)

Show your metal

A conversation with Rick Hindley
Executive Director of the Aluminium Packaging Recycling Organisation (Alupro): www.alupro.org.uk



What is the general state of the market for recycled metal in the UK at the moment?

Figures published on the National Packaging Waste Database by the Environment Agency show we are on track to meet or exceed recycling targets for aluminium packaging for the year. Aluminium packaging is the most valuable waste stream and the market remains strong.

Over 75,000 tonnes of aluminium packaging was collected for recycling

risks to collection crews, disrupt the recycling process and reduce the quality of the recycled product. At every stage, contamination has a cost and efficiency implication. But markets exist for the material, regardless of the source and the collection system – and the intrinsic value of aluminium means there is value in all material, with prices paid to collectors reflecting this.

We need to help consumers understand the 'how and why' of recycling and to instil confidence

“At every stage, contamination has a cost and efficiency implication”

in the UK last year, and over 60 per cent was recycled in the UK with the remainder exported. Demand for aluminium packaging scrap is strong, and growing, across Europe – driven by new recycling facilities, most recently Hydro Aluminium's dedicated packaging remelt plant near Dusseldorf, which came on-stream last summer.

Use of recycled metal is particularly strong in the automotive industry, where demand for aluminium has increased dramatically, because it offers opportunities to reduce the weight of vehicles and thereby cut emissions. In the UK, Jaguar Land Rover and Novelis are working closely together to develop a closed-loop production model for automotive aluminium.

Given recent concerns over contamination in recycling, what steps can the metal recycling industry take to reduce contamination?

Compared to other materials, aluminium packaging is relatively easy to recycle, but contamination can arise at any point and can cause

that industry can effectively recover materials, and that it is viable to do so. That way, consumers are motivated to recycle more. The metal packaging industry is already working with local authorities and the waste management sector to improve understanding. It's going to take time, but campaigns like MetalMatters are having an impact and breaking down the barriers to recycling. More investment in developing consistent campaigns across all sectors and a collaborative approach would enable consumers to receive consistent information and avoid unnecessary contamination of household materials.

Recent research findings suggest confusion remains about what can be recycled and how. Everyday items made from aluminium such as aerosols, coffee pods, foil trays, and bottle screw caps are sometimes overlooked but are easy to recycle. The new recycling guidelines from WRAP will help improve consistency in communications, and Alupro will be supporting local authorities by expanding our range of free resources for local marketing campaigns and the Recycle Now metals focus.

75
thousand tonnes of aluminium packaging was collected for recycling last year

60
per cent was recycled in the UK

How do collection methodologies affect market value?

Despite the success of industry's programme to recover valuable aluminium packaging before it enters the waste stream, significant volumes will always end up as mixed domestic and, in particular, commercial waste. But it is not all lost. One of the areas of growth for recycled metal is aluminium recovered from incinerator bottom ash (IBA).

Whilst focusing on recovering materials through a closed-loop recycling system is always going to be industry's preference, newer treatment technologies are making a valuable contribution to recycling performance across Europe, by enabling the extraction of even the smallest aluminium particles from waste. Treatment of IBAs and techniques like pyrolysis make it possible to recover the aluminium used in composite and laminate packs, e.g. blister packs and food and drink pouches, for which no viable recycling process currently exists. With the growth of energy from waste, these technologies will play an increasingly important role in reaching the challenging targets the metal packaging industry has set itself – and to achieving a more circular economy.

In the UK, the impact of the new protocol for packaging recovered from IBA is evident in the WasteDataFlow figures for 2016. The majority of IBA reprocessors are accredited to issue packaging recovery notes (PRNs) on the aluminium recovered. We estimate that just over 20,000 tonnes is recoverable annually from incinerator bottom ash and we expect this figure to double by 2025. [🔗](#)



Wall of (no) sound

Most of us (there must be a pocket of enthusiasts) wince at the sight of a historic building covered in scaffolding, but Arup has come together with Grosvenor, the London property developer, to unveil a new 'living wall' in Mayfair that could reduce air pollution by up to 20 per cent while covering up the obtrusive metal structures.

The 80 metre squared 'Living Wall Lite' structure is being trialled at the Grade I listed St Mark's building under conversion by Grosvenor. The structure comprises of a mix of grasses, flowers and strawberries that will not only give optical relief while construction is being completed, but will also improve air quality and reduce noise pollution by around 10 decibels, taking green construction work to a whole new level.

Open ide

Everyone enjoys having a project to get their teeth into - some quite literally. Lucie Majerus, a graduate of the Design Academy Eindhoven in the Netherlands, has taken it upon herself to take a bite out of the illegal poaching trade by making jewellery out of her own teeth.

Majerus aims to change the perception of ivory, poached from rhinos and elephants, as an object of desire, instead demonstrating the value of 'Human Ivory' as a metaphor for our own self-worth and to turn the tables on humanity's exploitation of animals. Starting with discarded and extracted teeth, Majerus polishes them to give them the appearance of beautiful pearls that are then used to create earrings, cufflinks and tie pins.



Image: Matan Bellemakers



Polythene rap

Eco-friendly hip-hop. That's a thing now. Ahead of America's trip to the polls in November, the Northern California Recycling Association released a rap video urging Californians to vote YES to Proposition 67 to keep California's 2014 ban on single-use carrier bags in place.

Grocery stores across the state are now required to charge 10 cents per carry-out bag to encourage the use of reusable bags to reduce landfill and the impact of plastic bags on the environment.

Reminding people of the benefits of the policy, the rap, which is introduced with a voiceover from Captain Charles Moore, who discovered The Great Pacific Garbage Patch, includes lyrics like:

You carry your goods on a five-minute path
Plastic bag disappears in the trash
Landfill lands in a Pacific Ocean bath
You're trying to relax, but did you do the math?
Fish eat the particles and end up on your dinner plate
Swim into your blood stream and don't disintegrate.

While the track is unlikely to give Kanye West sleepless nights as the Grammys approach, it did light-heartedly summarise what was at stake and promote this novel opportunity for citizens to vote on environmental policy, which they did, passing Prop 67 by 52 to 48 per cent. Now that's music to our ears.

Hope floats

We are all familiar with the desperate scenes of refugees that have braved the crossing of violent seas out of pure fear, jobless and seemingly devoid of hope. But where there are ideas, there is hope.

Dutch designers Didi Aaslund and Floor Nagler of No Mad Makers, after volunteering to help refugees on the Greek island of Lesbos, launched Bag2Work, which employs refugees to make rucksacks from the materials salvaged from the boats and lifejackets used to cross the Mediterranean Sea. The project diverts these recycled materials from landfill and gives refugees a chance to work for a decent wage before moving on and to restore some form of hope and autonomy that was previously lost.



Angus Macpherson

Age: 57
Job title: : Managing Director, The Environment Exchange
Location: Edinburgh

Education: Eton; Christ Church, Oxford University, MA (Engineering); Advanced Management Course, Manchester University; MBA, Edinburgh University

Route to present job: City of London: Kleinwort Benson, Hoare Govett; Army: Officer, Scots Guards; Commerce: John Menzies, Midlothian Enterprise Trust, OM

Daily routine: It starts, it finishes. Beyond that unpredictable.

Best thing about the job: Its variety.

Main disadvantage: Insufficient hours in the day.

Top waste prevention tip: Never throw anything away! My desk is a living example of that mantra.

Way in which you'd change the UK' current packaging recovery note (PRN) system: The PRN system was set up to encourage the optimisation of packaging use by imposing a cost on its use and encouraging its recycling by conducting

the funds raised directly to those that are carrying out that task - reprocessors via exporters if they are overseas. In this, it has been extremely successful combining with other economic instruments to deliver significant growth in packaging recycling in the UK.

Concerns are raised that funds do not filter down to collectors and councils. Experience shows that this is not the case, solely that for many, income from PRNs represents such a small proportion of the income that is being achieved for the secondary raw materials that it is difficult to identify. Hence requiring PRN issuers to make a public declaration annually on their website identifying how their funds are spent would allay fears that it is being abused. Similarly, a specific statement in the annual accounts of businesses with an obligation that they have complied with their producer responsibilities would be beneficial.

Vision for the future of the industry: A vibrant global secondary raw material market and marketplace.

Advice to others: Never give up.

Control solutions for AD

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Legislative update

Angus Evers considers the consequences of a recent Upper Tribunal ruling on whether local authority VAT exemption distorts competition in the commercial waste market and asks: How level is the playing field?

Any business producing waste needs to have its waste collected and disposed of. To arrange that, it has a choice – it can either request the local waste collection authority (WCA) to collect its waste, or it can contract with a private waste collection contractor. It is likely that price will be a significant factor in its decision. Private waste collection contractors are required to charge VAT on their supplies of services to their customers. WCAs are not (as a general rule). Does this give WCAs a competitive advantage over private contractors where they both offer commercial waste collection services in a particular area? This issue was the subject of a recent judgment by the Upper Tribunal, which provides a useful insight into the commercial waste collection market in England and Wales, and the legal basis on which that market operates.

Background
The case started as an application for judicial review by The Durham Company Limited (trading as Max Recycle) against HMRC and HM Treasury, with the Local Government Association (LGA) joining as an interested party in support of HMRC and HM Treasury. It was subsequently transferred to the Upper Tribunal. Max Recycle challenged the lawfulness of the VAT treatment afforded to WCAs carrying out commercial waste collection services, claiming that WCAs should not be exempt from charging VAT on supplies of those services, on the basis that WCAs actively competed with it (and with other private contractors) and the VAT exemption enjoyed by WCAs amounted to a distortion of competition.

The position under EU and domestic law
The tribunal began by analysing the relevant EU legislation contained in Article 13 of the Principal VAT Directive, which states that local authorities are not regarded as taxable persons in respect of activities or transactions in which they engage as public authorities, even when they collect fees, et cetera, in connection with those activities or transactions. However, they are to be regarded as taxable persons in respect of such activities or transactions where their treatment as non-taxable persons would lead to significant distortions of competition. The tribunal then considered the relevant EU case law, which indicated that it was a question of national law whether an activity was to be classified as constituting



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the exercise of public administrative law, or as private law that applied equally to all economic operators. The case law also indicated that to be acting as a public authority, an authority had to be acting under a 'special legal regime'. In the domestic context, the tribunal concluded that Section 45 of the Environmental Protection Act 1990 (EPA 1990) was at least capable of being a 'special legal regime', principally because of the duty on WCAs to arrange for commercial waste collections if requested to do so by occupiers of premises and the constraint of making only a reasonable charge resulting only in cost recovery and no surplus.

The tribunal's conclusions
In their evidence, both Max Recycle and the LGA provided examples of different approaches by different WCAs to providing commercial waste collection services, ranging from not operating a service at all, to outsourcing to private contractors, to providing services outside their areas. The tribunal concluded that WCAs supplying commercial waste collection services in their areas in performance of their duties under Section 45 EPA 1990 were engaged in activities as a public authority, but the question of whether a WCA was in fact providing its commercial waste collection services under Section 45 was to be determined on the facts of each case.

Comment
The tribunal's judgment leaves private contractors facing competition from WCAs in a difficult position. Although it would, in theory, still be possible to challenge the VAT status of a WCA's commercial waste collection services on the basis that it was resulting in a significant distortion of competition, or on the basis that the WCA was acting beyond its powers in Section 45 EPA 1990, that would have to be done on a case-by-case basis. It is likely that such challenges would be prohibitively expensive for a contractor operating across multiple WCA areas. The judgment arguably perpetuates a situation in which there is not a level playing field between private contractors and WCAs on the basis of cost. However, the legislation and case law on which the judgment is based need to be considered against the backdrop of Brexit. The position could change in the future as the EU's VAT rules and public procurement rules are scrutinised by UK policy-makers and legislators.

Brewing sustainability

In choosing a drink, your main criteria might not be a beverage's resource footprint, but brewers are increasingly adding a dash of sustainability to their blends. Edward Perchard finds out how one, Adnams, is calling time on underutilised resources

Beer is big business, and a lot of resources go into quenching your thirst on a Friday night. The past year has seen some breweries focusing in on the issue of waste, with the launch of Toast Ale, a beer made from surplus bread, and Wasted, an ale created using waste pears and croissants. But while craft beers may have room to experiment, more traditional brewers face more of a struggle to mix resource efficiency into their brew. Adnams brews 30 million pints a year at its Southwold base, where it's been since 1872. Ben Orchard, Environmental Sustainability Manager, says that the dominant waste material created there is spent grain – what's left over when all the sugars, proteins and starches have been extracted from the barley or cereal used to make the beer. The grain absorbs water during the process, meaning that five tonnes of input malted barley becomes the same amount of waste. When all waste is calculated, therefore, across all Adnams's operations, including its hotels, restaurants and shops, two-thirds is made up of this grain. Luckily, there are plenty of local farmers on hand to take the spent grain as animal feed, ensuring none goes to waste. Another large swig of organic waste is the dregs left at the bottom of the vessel, which is used as the slurry in the company's anaerobic digestion (AD) plant. As well as this 'waste beer' (containing settled yeast and other protein particles), the plant takes in food waste from Adnams's restaurants and hotels, as well as local councils and businesses. This comes together to produce clean biomethane for the grid and a rich digestate supplied to farmers. Work is currently afoot to create a closed-loop system, providing the digestate to the company's local barley suppliers.



30
million pints brewed every year

38
per cent reduction in bottle weight in the past decade

1
thousand tonnes of glass packaging saved per year



The opening of the AD plant was just one of the projects aimed at driving a step change in the company's sustainability. A refresh of the company's values at the turn of the millennium led to plans for a new distribution centre and completely refitted brewhouse, all built on core ideas of resource efficiency. The distribution centre was opened in 2006, using walls made from hemp and lime bricks to provide natural insulation (saving over 600 tonnes of CO2 equivalent) and a sedum roof to harvest rainwater. Two years later, Adnams's Victorian brewhouse was completely renovated and kitted out with efficiency in mind. The resource-efficient mindset extends to water as well, with Adnams using around three litres of water per litre of product, compared to an industry average of four or five. "We reuse some of our cooling water, which takes on heat and is then used as hot liquor water", says Orchard. "We've got a hood on our kettle, which captures all the steam. A lot of breweries will just vent the steam from their boil into the atmosphere. We capture it and pass it back through heat exchange to heat the next brew. So we get 90 per cent of the heat requirements for the brew from the previous one." Systems like this have enabled Adnams to reduce its annual gas use by 25 per cent.

In the past 10 years, the company has also worked on the end of the manufacturing process, following a lifecycle assessment that found that the largest carbon impact throughout the whole beer production chain was making the bottle. In the past decade, Adnams has made the packaging of bottled beer (25 per cent of its output) more efficient, with lightweighting processes (a concept explored on page 32) reducing bottle weight by more than 38 per cent since 2007, saving more than 1,000 tonnes of glass packaging a year in the process. Orchard says packaging improvements will continue to be developed, adding that Adnams is also working to improve processes elsewhere within the supply chain, and with customers, to create a greener ale and raise the bar within the industry. Cheers to that.



Above: Adnams's Southwold distribution centre
Below: The company's lightweight 500ml bottles weigh just 280 grammes

Ship-shape collections



In setting up the Bristol Waste Company, Bristol City Council is getting its recycling into ship-shape conditions, Bristol fashion.

Leonie Butler navigates the changes



Last June, Bristol City Council announced it had ‘mutually agreed’ with Kier (formerly May Gurney) to end its waste collection and street cleansing contract half way through. Its intention (in what appears to be a growing trend for council recycling) was to bring the services under a council-owned company, in this case the Bristol Waste Company (BWC), to improve recycling rates and reach the targets the council had anticipated for the city.

The handover period saw employees, vehicles, equipment and facilities move across to BWC from Kier, with the new service starting on 1 August 2015. At the time, the council said that it was still looking ‘in full detail at the best long-term service model’, and only expected the new system to be operated for a year.

BWC obviously did something right, though, because on 11 August this year, Bristol City Council’s Cabinet awarded Bristol Waste Company a 10-year agreement to provide an integrated service for the city. Finance Director Steve Ostler, who helped set the company up, says it was welcomed by employees: “Even though it had its own challenges, in inheriting a company the new waste company reassured the council that this was viable and offered a better-than-market price.

“Employees are pleased by the contract, as they know where they stand [and] are more engaged with the company. Moreover, we are local and if you’ve got an issue, you don’t have to go to head office – we’re visible to the workforce.”

BRISTOL
waste

10

year contract
awarded earlier this
year

41.5

per cent recycling
rate in 2013/14

50

per cent (plus) aim
for 2020

70

per cent aspirational
target for 2025

Announcing the 10-year agreement, Bristol Mayor Marvin Rees said: “One of my key promises to the city has been to launch a Clean Streets Campaign. We need a city-wide strategy to tackling problems with littering and fly-tipping, and to increase recycling rates. We must work closely with community organisations and schools to promote behaviour change.

“We have been given a real opportunity to make a difference to Bristol’s streets, and after considering all the facts, we believe that Bristol Waste Company offer us the best chance to achieve our ambitious goals for the city. There is a lot of work to be done, but we hope that a 10-year contract will allow us the stability to make serious progress towards tidying up our streets.”

To give a little context to how Bristol is currently doing, in 2013/14, Bristol City Council recycled or composted 41.5 per cent of waste, a fall of 3.8 per cent on the previous year. After recycling and composting, the council was left with 221.1 kilogrammes of residual waste per person, according to *Resource*’s residual waste league table, meaning it ranked 51 out of 138 disposal authorities in England, Wales and Northern Ireland. Ostler hints that the council is already now recycling 47 per cent and believes it can go beyond this, though 70 per cent recycling, although technically feasible, would be a little too ambitious for a large city like Bristol with a great deal of flatted accommodation. “We have an aspirational waste strategy, but don’t think 70 per cent recycling by 2025 will be translated into contract. We have said, however, that we will achieve



over 50 per cent by 2020. The key for us is to decouple waste growth with population growth.”

For most of the city’s 189,000 households, the council’s recycling service consists of fortnightly collection of residual waste, combined with weekly collection of recyclables in two separate boxes and food waste in a food waste caddy, as well as a charged garden waste service.

Under the terms of the agreement, BWC will be responsible for the vast majority of Bristol’s waste services: waste collection, street cleansing and winter maintenance; communication, education and customer engagement; household waste and recycling centres; waste treatment and disposal; the sale of recyclable material; and waste and recycling collection from council premises.

BWC has also committed to provide revenue funding to manage, once built, a third household waste, reuse and recycling centre in the city. Responsibility for enforcement for waste offences will continue to lie with the council, which will work closely with BWC to enable successful prosecutions.

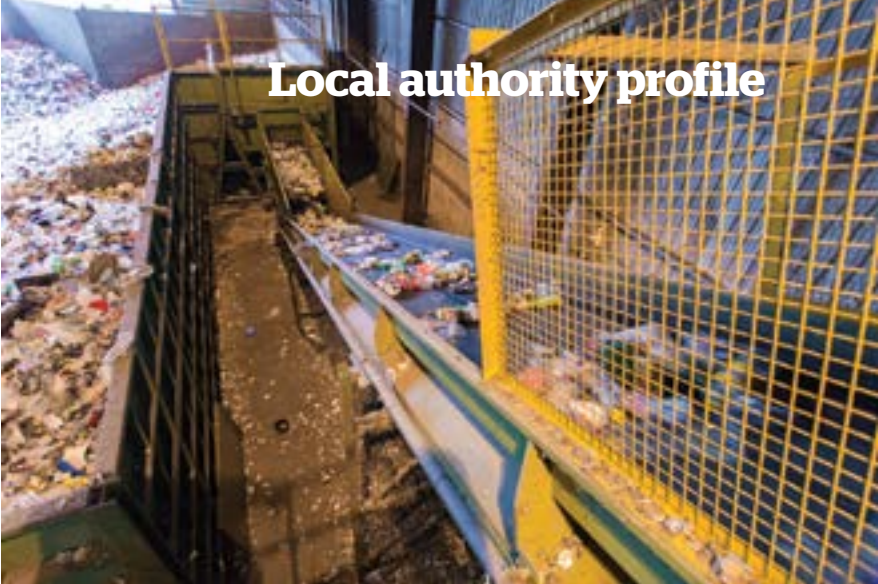
For now, residents will see little change in their collection, though Ostler hopes that they’ll have higher “customer satisfaction”. BWC is working on a number of potential changes that it will take to the council next year to decide upon to see an increase in recycling and revenue. “It will probably contain 10 options or so for the council to consider. One of those will definitely involve reducing the frequency of residual collections – whether that be monthly or three-weekly”, explains Ostler.

“The three main issues are: 1. How acceptable/ convenient is it to the residents? 2. How much is it going to cost? 3. What is it going to do for our recycling performance? It is up to the council to decide its balance between cost and acceptability.”

Ostler definitely believes there’s appetite for a reduced residual collection service in the city, but recognises ‘one size doesn’t fit all’: “If you reduce collection frequency or residual bin size, you are likely to encourage more materials into recycling, that’s fairly well documented.

“However, we recognise what will work for one area of the city, might not work for another. We’ve got about 60,000 properties that are not a wheeled bin collection because of the type of housing stock. I think slightly different collection services for different parts might work, though you have to be careful not to dilute cost benefits.”

The company needs to update its collection vehicles in 2018, so the system could dramatically change, if the council sees benefit in doing so, Ostler adds. “Our current source-separated collection produces good-quality material. It is expensive to collect, but you get better revenue downstream from it. However, we get a lot of messages from people that [source separated] collection and storage has very negative impact on littering the city... But if we went co-mingled, we



haven’t got a MRF, so we’d be relying on a third party and a big injection of investment for new, wheeled-bin containers.”

Meanwhile, with four new community engagement officers, specialising in talking to students, schools and businesses, BWC is hoping that these individuals will go into and rally communities to engage with recycling. The company is also currently running the mayor’s Clean Street campaign, a ‘behaviour nudge’ request for people to take responsibility for their waste, as well as a specific campaign in the Stapleton Road area of the city to address fly-tipping of small and bulky waste and abuse of commercial waste containers. “We’re

“There’s always a temptation to just keep on clearing the street scene up, but that doesn’t encourage the right behaviour”

trying to say to communities: ‘You must be fed up with this – so are we, so let’s try and do something about it.’ That might come back on us to do more, put more bins out or sweep streets more frequently... The bulky waste collections, however, and to charge or not, is the council’s policy, but BWC believes they might have some influence to better understand whether there’s a correlation between charging for bulky waste and fly-tipping and what we do at the household waste recycling centres.”

At the moment, a wide variety of collectors pick up the city’s commercial waste, but BWC is starting a commercial waste arm from next April. “The reason we want to do commercial waste is that hopefully we can make a surplus we can bring back into the council’s funds, and it might allow us to make an offer to smaller businesses in Bristol that aren’t well served by other contractors. It will also allow us to have more control over the street scene generally. There’s always a temptation to just keep on clearing it up, but that doesn’t encourage the right behaviour. But, if we want people to recycle more and have more pride in their area, we need to do that from a position of strength and bite the bullet and make it clean.”

COMPOUND PROBLEMS

Composite materials like fibreglass are strong, durable and light, making them ideal for any number of applications. The only trouble is, they're not very easy to handle at their end of life. **Will Simpson** learns more

It is one of the most commonly-used materials, but one that remains deeply problematic when it reaches the end of its life. Fibreglass is hard, durable and light and can be produced in any number of complex shapes: its applications range from boat hulls to wind turbines, from surfboards to bike helmets. But as it stands, the majority of it still ends up in landfill.

The issues it throws up in terms of recycling have been a frustration to the fibreglass industry for some time, though, as the compound material – that sees glass fibres reinforced with plastic – is particularly tricky to handle at end of life. “It’s difficult to recycle

destroying the chemical structure of the fibreglass resin and recovering some of the original constituents. The problem with this process is that it’s expensive and requires a specialist chemical treatment plant.

The other, which many would hesitate (or refuse) to label ‘recycling’, is to decompose the material at high temperature and capture some of the energy content of the resin, as EuCIA outlined in a brochure it produced in 2013 called ‘Composites Recycling Made Easy’. “This is similar to if you were burning coal or oil”, says Frassine. “In Europe, one of the major processes to recycle composites is the so called ‘cement kiln’ route, where you use composites as a raw material to produce cement.”

But, as Frassine himself admits, this is not ideal. “You are downgrading the material. You also have to pay a fee to the cement kiln owners to dispose of the fibreglass, so this is not very profitable. But at least this is economically viable – the cement kiln owners say that it is a good raw material for producing cement.”

Nevertheless, there are some projects that have tried to find a solution to the fibreglass problem. In Denmark, a project called Dreamwind (Designing REcyclable Advanced Materials for WIND energy) aims to produce a new (and, crucially, entirely recyclable) kind of composite material for wind turbine blades, using a combination of virgin and non-virgin fibreglass. The idea is to eventually produce a blade that can easily be disassembled at the end of its natural life – unlike blades in use today.

Dreamwind is backed by the University of Aarhus and Danish Technological Institute, but is still in its early stages. “We have not yet progressed to the stage of making prototypes or scalable products”, admits

Allan Hjarbaek Holm, Dreamwind Specialist Materials Senior. “The work we’ve done so far is in the lab, seeing if we can demonstrate if these things could work. We are also discussing what the business model would look like. If we do this and you suddenly have some sort of value on a scrap turbine, how would we then process this and how would the market change in response? What are the implications of it changing from something that costs to get rid of to something that can be turned into a value of some sort?”

Dreamwind hasn’t yet cracked the conundrum of how to separate the components of this new fibreglass, but is looking at completing a prototype that does so by 2020. Holm is confident that, if successful, Dreamwind’s process could be applied to other industries that use fibreglass products. “But”, he cautions, “there are a lot of technical assessments that have to be done to answer whether it’s acceptable in a future blade design. We will have something that is not a virgin material and may be a little bit inferior to what you get if you buy virgin material. We have to address that before we can really look into what it means from a business perspective.”


Meanwhile, in Italy, another project has been quietly exploring the possibilities of fibreglass recycling since the turn of the century and has a line of recycled composite material, Glebanite, certified by the Construction Specifications Institute. The company, Rivierasca, is the brainchild of engineer Giacomo Bonaiti, who explains one way fibreglass can be recycled – by recasting ground-up fibreglass powder into a mould. “We are using very simple technology”, explains Bonaiti. “Once you have the ground-up powder you can add fresh resins to the mixture and create a liquid mixture, which you can cast into any shape you may have finished. We have already produced fibreglass statues using this process.” Bonaiti adds that the material can be used in furniture production or for facades, for instance, and, as a next step, he plans to create a mobile recycling machine that can be moved to where fibreglass scraps are likely to be found. The idea is to take it to a couple of companies in Italy that have expressed an interest in recycling material from boats, something he wants to develop “sometime in 2017”.

Over in Washington state in the US, there is also Global Fibreglass Solutions, a project whose original idea was to produce a recycled fibreglass railway sleeper. “The technique we used was to shred and grind the material down to a specific length,” explains Company President Don Lilly. “Before using an open mould system. Once the sleeper was actually produced, it would take no more than 90 minutes to set. Three to four hours later, it would be ready to go on a track.”

The problem, as with much fibreglass recycling, was finding the right source material. After trying disused aircraft and boat hulls, Lilly alighted on wind turbine

blades as the most cost-efficient and easily-available source. Since its original railway sleeper prototype, Global Fibreglass Solutions has also produced prototypes of a recycled fibreglass manhole cover and ‘moisture proof, fire-resistant’ construction panel. Lilly claims that the company will be able to start mass producing these items in 2017: “We’re on the verge of making it competitive. The process has to be something that people can see that they will receive a return on their investment, but we now have major architectural firms as well as builders that are now looking to utilise the materials we’re looking to produce.”

However, despite Lilly’s optimism, fibreglass recycling remains some way from the mainstream. Frassine suggests that for any serious progress to be made in this area, regulations would need to be put in place: “It’s not like something that is spontaneously going to occur in the industry, which is always tending to maximise profit. But if the change of public opinion, some regulations at a European level or probably a combination of both were to happen, that could force companies to develop recycling strategies. But it’s not a process that is likely to be self-developed by industry.”

Certainly, for all the exciting developments in labs and R&D departments around the globe, it looks like landfill will continue to be the final destination for fibreglass for some time to come. 

“It’s not like a metal that you can melt and reshape. You cannot reshape a fibreglass product”

because it is difficult to go back to the original components”, explains Roberto Frassine, researcher and ex-Chairman of the European Composites Industry Association (EuCIA). “Usually, the product’s shape cannot be modified in any way, because you cannot melt the resin. The only way to reshape fibreglass is to recover the original components – the resin and the fibre – and impregnate the fibre with a liquid resin and start the process all over again. It’s not like a metal that you can melt and reshape it. You cannot reshape a fibreglass product.”

There are two main ways fibreglass can be recycled at present. One is to treat the material with high pressure and heat it to a high temperature, thereby

“If we create an entirely recyclable wind turbine and you suddenly have some sort of value on a scrap turbine, how would we then process this and how would the market change in response?”





Plastics that sub in plants for petrol are booming, with the market set to quadruple in the next five years. **Edward Perchard** takes a look at the industry's plant-based growth

Swapping out the oil-based plastics we all know and love (or hate, as the case may be) for ones derived from things like seeds may seem like a new-fangled idea, but the concept has been around as long as man-made plastics themselves. In 1862, Alexander Parkes patented Parkesine, made from cellulose treated with nitric acid. The venture went out of business after two years, but the idea of utilising surplus crops or other biobased sources to make solid industrial materials has never gone away.

Henry Ford himself was an advocate, and in the 1930s used a soy plastic for steering wheels, panels and trim, even unveiling an entirely 'Soybean Car' (barring the steel frame) at a festival in 1941 – an experiment curtailed by World War II. Petrol-based plastics, first seen in 1907, boomed following the war, a growth that has yet to be slowed. But the desire for a greener alternative has remained, and today bioplastics represent a rapidly growing industry.

The term bioplastics covers a variety of materials made in part, or totally, by polymerising things like natural sugars, oils and fibres from renewable resources. The term 'bioplastic', then, is a broad church, including plant-based materials that biodegrade (polylactic acid (PLA), and polyhydroxyalkanoates (PHA)), or are simply biobased (using 'drop-in' chemicals to make materials like polypropylene (PP) or polyethylene terephthalate (PET)).

The materials are further categorised by generations, and by identifying their renewable content. As processes develop, producers are increasingly able to replace more petrol-based feedstocks, and so the industry has gone

from materials with around 10-15 per cent renewable content to (in at least one case – Novamont's fourth-generation Mater-Bi) ones with over 60 per cent.

Are they actually better?

The advantages of bioplastics vary with their nature. As David Newman, Managing Director of the Bio-based and Biodegradable Industries Association (BBIA), says: "It's a big family, and bioplastics are therefore to be looked at as materials for specific use rather than just a plastic substitute."

However, he offers up three general advantages to bioplastics. The first is the sourcing of the material. Using renewable feedstocks over waning sources of fossil fuels carries obvious advantages for resource supply (so long as those feedstocks are themselves sustainable and gathering them doesn't displace food crops, for example), and it can also enable a more local operation. Italian biochemical giant Novamont, for example, operates a facility in Sardinia where local farmers supply thistles grown on less arable land, from which both the oil and biomass are used to create products.

"The second advantage is that it's cleaner to use", says Newman. "It's less harmful to the environment if it falls into it, and it's less harmful to human health both in the manufacturing process and in the use of the material."

The third potential advantage for some of these products is biodegradability. Biodegradable films (certified as suitable for composting – which in Europe means complying with the EN13432 standard and breaking down in up to 180 days) can be used to

encourage and enable food waste collections, says Newman. With food waste at once a huge environmental problem and a great opportunity for boosting recycling rates, compostable plastics that can be safely included in collections and treatment offer an attractive solution. "Flexible compostable plastics play a potentially huge role in getting that food waste back to soil," says Newman, "and that's where its success has been in countries like France and Italy, using these materials to get food waste back to clean treatment systems, closing the soil-to-soil loop."

In Milan, for example, retailers' carrier bags must be compostable, providing a handy crossover with food waste collection, as they can then be used as bin liners and composted with the food waste. Since the changes were introduced, the quality of organic waste has improved greatly.

Environmental benefits are all well and good, but when biodegradability isn't a focus (or even a desired trait), bioplastics need something else to hang their hat on to crack big business. Sokhna Gueye, Packaging Environmental Sustainability Specialist for Nestlé, says that the consumer giant sees no advantage in biodegradability for its packaging: "If you tell the consumers the packaging is biodegradable they think they can throw it away and it disappears the next morning, which is not the case."

However, other forms of bioplastics are becoming more attractive to companies like Nestlé, which doesn't necessarily want biodegradable packaging, but rather a biobased material that can slot in with current process (and which, in theory, can be recycled with petrol-based plastics), or perhaps even exceed conventional plastics' performance. "The first generation of materials such as PLA are moisture sensitive, and we are a dry food company and need to keep moisture out, but there are products for which it makes sense: PLA is a perfect aroma barrier and can be a good material for yoghurt cups. Generation two are the drop-in materials, so can be exactly what we are using today, with exactly the same properties, but without the fossil-based composition.

"The third generation is really what we are aiming at: material that has enhanced performance, for which we can make sure that we don't have any contributions to food insecurity." Indeed, just because something comes from a renewable resource doesn't mean it's environmentally beneficial, and the impact of producing biobased products must be considered. WWF's Bioplastic Feedstock Alliance includes some of the world's largest consumer goods producers (Coca-Cola, Nestlé and Unilever, to name a few) and works to guide the responsible sourcing. Gueye explains: "When we consider bioplastics compared to fossil-based plastics, we aren't focusing only on greenhouse gas emissions. We also look at the impact on land use, water and biodiversity to make sure that we are not shifting burdens. Whenever we are considering bioplastics also we will go and check locally where the feedstock is coming from."

The growing market

Although Hasso von Pogrell, Managing Director of trade association European Bioplastics, suggests that, in theory, bioplastics could completely replace conventional plastics right now, they currently represent around one per cent of the 300 million tonnes of plastic used annually. However, as generations progress and suitable applications become available, this market is growing exponentially.

European Bioplastics expects the global production capacity for bioplastics to grow from 1.7 million tonnes in 2014 to 7.8 million tonnes by 2019, while a Research and Markets report forecasts the market will grow at a compound annual rate of 29.3 per cent between 2016 and 2020.

Much of this growth is down to increased demand for non-biodegradable biobased plastics like polyethylene (PE) and PET (the 'drop-in' second generation Gueye refers to), which made up 60 per cent of global bioplastics capacity in 2014 but by 2019 will likely represent over 80 per cent. Katrin Schwede from European Bioplastics says that the "lion's share" of bioplastics production is focused on PET, which is mainly used in packaging applications such as bottles. "That makes packaging the largest market segment for bioplastics at the moment. But it's not only the PET – a lot of the biodegradable materials are very suitable for food packaging or biodegradable bags or biodegradable tableware." This is, of course, only true if the biodegradable plastics are kept out of the conventional plastic recycling stream, as otherwise they could have a detrimental effect on reprocessors' operations (see below).

Flexible compostable plastics play a potentially huge role in getting that food waste back to soil

Markets are, moreover, hard to predict: we suggested in *Resource* 58 (Spring 2011) that the cost of crude oil would continue to rise, eliminating a major bioplastic barrier. With oil prices falling, that issue of cost, at least in the short term, is still a hurdle restraining growth, and Gueye suggests that demand for greener products is not yet so great that consumers are willing to pay more: "Most of the time, consumers are not ready to pay more just because it's biobased packaging – they are buying our products for the product, not for the packaging."

But as the industry scales up, this cost gap will diminish. Schwede says: "We already see that prices of a lot of biobased plastics have fallen drastically in recent years, with higher volumes being produced and sold on the market as well as innovations. PLA, for example, can already be offered at very competitive prices."

And Gueye adds that companies can themselves help by working together: “We are ready to pay more at the beginning if we see a way forward to get closer to the fossil-based polymer. We’re partnering with other food manufacturers because we cannot be the only ones using a novel material that has the potential to further improve the environmental performance. It has to be widely available to bring the cost down.”

Taking the next step

The market for bioplastics is clearly growing and, as Gueye attests, many of the world’s biggest brands see them playing a large role in their future: “If we have bioplastics in our roadmap, it’s because we believe it’s a potential solution.” Both Newman and European Bioplastics, though, say that the driver for growth must come from outside the industry. “In the waste industry and in many new industries, government regulations are a game-changer”, says Newman. “Look at the laws in Italy. That sort of driver has meant that we’ve gone from zero to 100,000 tonnes of compostable plastics in five years.” In the last year, moreover, France has banned plastic carrier bags and disposable plates, cutlery and cups. Since July, carrier bags there must contain 30 per cent renewable material, increasing to 50 per cent in 2020 and 60 per cent in 2025. The government predicts the moves will also create 6,000 new jobs in the country.

Here in the UK, Newman points out that biobased research centres are making “wonderful discoveries”, but “all the guys are getting up and going to the US to build their factories, because the markets there have given a boost to the sector by preferring to purchase biobased materials”. He adds: “What stimulated

support for the uptake of biobased materials in applications, inclusion of renewable and recyclable feedstock in ecodesign guidelines, a “level playing field” between the different segments of the bioeconomy to ensure secure supply to feedstocks for all, and, “most importantly”, the improvement of the waste management infrastructure in Europe.

The European Union’s Circular Economy Package has already noted that ‘biobased materials present advantages due to their renewability, biodegradability and compostability’. A positive sign, but national policy is key – green public procurement, for example, like the USA’s BioPreferred programme, created in 2002 and expanded in 2014, which requires all federal agencies to purchase biobased products in 97 categories including carpets, disposable tableware and cleaning products. “That’s given rise to an industry of some hundreds of millions of dollars”, says Newman.

But are there barriers to be overcome within industry too? Critics suggest end-of-life complications would cloud the benefit of bioplastics, a claim von Pogrell calls a “big myth”, stating that polymers are already sorted by type and that contamination is more common the other way round, with plastic bags being used to dispose of organic waste.

Edward Kosior, Managing Director of plastic recycling consultancy Nextek, though, says that this is an oversimplification, especially for films. “The truth is that films are rarely sorted by polymer type. As most films are PE they tend to be sorted by physical techniques that identify the 2D nature of the material without splitting into polymer types. This is why it is a big issue at least in principle, even though the relatively small volume of bioplastics means that this is not a statistically big problem.”

While some biobased polymers like bio-sourced PE are identical to the conventional material, Kosior notes that many other biopolymers based on sugar, starch and cellulose are not miscible with PE. Further, he says, biodegradable bioplastics typically require pre-drying before processing (PE does not) and typically degrade at relatively low temperatures “causing visible and physical deterioration of the recycled product”. He adds that the presence of even a little will create problems in a blend or even in 100 per cent bioplastic streams due to the lack of thermal stability compared to petro-plastics.

So, there’s still work to be done, but, as Newman says, the industry is always finding new ways to improve. While several years ago bioplastics were great for simple markets, he says, they’ve become more and more sophisticated. One exciting field is the development of rigid bioplastics, particularly those being used in automobile companies like Jaguar Land Rover, Honda and Ford, which “actually perform better than conventional plastics”, while making cars lighter and more fuel efficient. It seems like Henry Ford was on to something.

We must look at bioplastics’ impact on land use, water and biodiversity to make sure we are not shifting burdens

companies like Novamont to go to Italy was the guaranteed audience they had early on. It was that volume – on its own about 40,000 tonnes a year – that meant companies could actually start investing. They then used those same biopolymers to make lots of other things, from lubricants to textiles for a whole series of construction materials and chemical building blocks for other industrial uses. It was that sort of certainty with the market that allowed you to go from small-scale to large-scale.”

Schwede adds: “There is nothing that bioplastics can’t do; the hurdles are based on a lack of policy to support market penetration.” She has a veritable shopping list of policies to help bioplastics “gain a stronger foothold in the European industry”: more

A few examples of bioplastics taking root at major companies

Coke PlantBottle

Coca-Cola is one of the companies trying to harness plant-based PET, currently using sugarcane from Brazil to create bio-monoethylene glycol for its fully-recyclable (but not compostable) PlantBottle packaging. Primarily used for bottles for Coca-Cola’s water, soft drinks and juices, the PlantBottle technology is also being used in partnership with Ford for car interiors, as well as clothing and carpet.

The choice of sugarcane is somewhat controversial, as campaigners insist it will push Brazilian agriculture into the rainforest while depriving people of food, but Coca-Cola has worked with WWF towards a sugar certification scheme in Brazil and anticipates using other plants as well, if the material takes off as expected.

Although the bottles are currently ‘up to 30 per cent’ plant-based (and in 2013, the company was convicted of ‘greenwashing’ by the Danish consumer ombudsman), work is being done on the rest (at the moment made up of fossil-fuel-based purified terephthalic acid, since you asked). Last year, a pilot 100 per cent PlantBottle was showcased, though it’s not ready for commercial use yet. Over 43 billion PlantBottles have been put on the market worldwide, and by 2020 the company aims for all new PET bottles to be made from the material.

Lavazza



For some a telling sign of the consumer and workaholic culture of the 21st century, coffee pods are here to stay. Though there are cases to be made for their portion control effects, it’s hard to deny that the coffee from the single-serving pods could just as well be loaded into one bag like the good old days.

Last year, however, Lavazza launched a fully compostable and biodegradable coffee capsule using Novamont’s Mater-Bi third-generation bioplastic. So now, instead of the bin, your collection of spent capsules can be chucked in with the food waste. The innovation has kicked off a trend, with Percol and Dualit recently launching compostable pods of their own.

TIPA Corp

Taking on unrecyclable laminated flexible packaging for food products, Israeli start-up TIPA aimed to emulate the multi-layer protection of an orange peel in developing a compostable bioplastic that it says is just as durable and impermeable as conventional materials but decomposes in home composting within 180 days – like an orange peel.



The company produces a range of films and laminates that can be used for pouches, bags or wrappers. In October, it announced that its material would be used as packaging for Snact, a range of fruit jerky made from surplus produce.

Jose Cuervo/Ford

The Soy Car may not have made it, but Ford didn’t completely lose interest in biobased materials, and in 2007 introduced the automotive industry’s first soy-based seat cushions and backs (although soy, again, brings up concerns over deforestation).

This summer, though, Ford teamed up with tequila giant Jose Cuervo to develop new bioplastics using offcuts from the agave plant, the distilled juice of which turns into the spirit.

The partnership is looking into using leftover agave fibres in heating and air conditioning units, wiring harnesses and storage bins. Ford says that the move could reduce the weight of its cars, improving fuel economy, as well as decreasing reliance on petrochemicals.



Loowatt

It’s not just food waste that can be collected by compostable bags. UK company Loowatt uses bioplastics as part of its chemical-free human waste solution for places without plumbing. Using a patented and simple sealing technology to capture toilet waste in a biodegradable film, developed to also inhibit odours, the toilet stores the waste in a cartridge for periodic emptying. The bags and their contents can then be treated through anaerobic digestion to produce biogas and fertiliser.

As well as festivals in the UK, the toilet units have been rolled out in Madagascar to provide urban sanitation, as well as energy and electricity, and the company has received backing from the Bill & Melinda Gates Foundation to scale up its systems. [T](#)



THE CIRCULAR BUILDING

Engineering firm Arup has created the world's first 'Circular Building', an experiment in circular economy thinking. **Elena Holmes** learns more about the project and what it means for the future of sustainable construction

Wouldn't it be great if we lived in sustainable houses? Great for the planet, great for our consciences, great fun. This idea is all very well and good in theory, but in practice, there are numerous challenges faced by the construction sector in creating a truly sustainable home, not least resource use in the building process itself. According to the UK Green Building Council, more than 400 million tonnes of materials are used in the UK each year, of which 60 million tonnes are wasted due to over-ordering. In fact, the construction industry produces three times more waste than all UK households combined.

The government's 'Construction 2025' policy of July 2013 established a target for the sector of reducing greenhouse gas emissions by 50 per cent by 2025 (set against an overarching target in the UK Climate Change Act to reduce emissions by 80 per cent by 2050). The Green Construction Board, a consultative construction forum for government and the UK, suggests that the idea of the circular economy is the 'only viable option to maintain standards of living' with an ever-expanding human population.

As readers of *Resource* are sure to know, the circular economy, restorative and regenerative by design, aims to keep products, components and materials at their highest utility and value at all times. It builds on themes such as waste reduction, recycling, reuse, material efficiency, security of supply, sustainable consumption and production, better design and sharing of resources. This is in contrast to our current predominantly linear economy, which follows a 'take, make, dispose' model of production. 'Green construction', or sustainable building, undoubtedly will have a role to play in the coming circular economy, by creating structures that are environmentally responsible

and resource-efficient throughout the entirety of their lifecycles.

Some circular projects carried out in the UK so far include the Queen Elizabeth Olympic Park, built for the London 2012 Olympic and Paralympic Games, which aimed to create a place to host the games and also to create a successful new piece of the city afterwards. Its legacy was therefore built into its initial designs, focusing on using minimal material that could be deconstructed.

But, while there are a growing number of examples of sustainable construction out there - many of them evaluated and documented by BREEAM, the main sustainability assessment method for master-planning projects - designing for disassembly or circularity is still relatively rare in the construction field.

The Circular Building

An idea for a sustainable building is being developed by engineer and design specialists Arup with its 'Circular Building', which aims to represent a viable example of circular economy principles in industry. The building, constructed and shown at the London Design Festival from September to October 2016, was designed for disassembly and contains numerous new solutions to ways the industry can work towards zero waste. Arup says it created the building to test the maturity of circular economy thinking within the construction industry.

Developed in partnership with The Built Environment Trust, Frener & Reifer and BAM, the Circular Building was constructed using materials and products leased rather than purchased, and every part of the building can be reused, remanufactured or recycled at the end of its life.

Richard Boyd, member of Arup's Materials Consulting team, who worked on the Circular Building, tells me: "Arup

has a growing awareness that material use is a major issue for the sustainability of the built environment. The circular economy allows us to develop the built environment that we need by being much more resourceful and more collaborative about how we use resources."

The full-scale prototype was designed and constructed with materials that can be removed with minimum damage, helping each component to retain its value. At the end of a typical building's life, materials cannot always easily be reused, as information such as their chemical composition or strength is not available, so the Circular Building includes a 'Materials Database' to solve this problem: digital technology is used to 'tag' all items with a unique QR code containing sufficient detail to allow designers in the future to understand what material is in the built environment and when it would be available for use.

Moreover, the structure of the building is designed to be demountable and reusable. The steelwork is made from off-cuts left over by other projects; the size of the building was adjusted to suit the steel lengths available. The building itself is comprised of an outer 'skin' made of interchangeable boards of compressed agricultural waste, 'Wikipanels', put together through mechanical and push-fit connections rather than adhesives to allow deconstruction. Like a Lego house, it can be assembled several times over, according to its creators.

The ventilation for the building is made from recycled plastic, cardboard and remanufactured drinks cans, and forms a system that monitors the house and adjusts energy use to maximise efficiency. Its electrical system is low voltage and off-grid, facilitating future flexibility and ease-of-maintenance, and consists of power supplied by a saltwater battery made from abundant, nontoxic materials.

Of course, bringing about the circular economy is a major and challenging task that will require designers to start thinking about just about everything in new and disruptive ways. As Boyd explains: "The designers had to start asking themselves new questions about the design process, as they were trying to solve new problems: What happens to a particular product at its end of life, and what can I do with it at the end? Can it be reused or recycled, can it be returned to its supplier, can it be leased instead of bought?"


Simon Anson, Project Architect of Arup Associates, adds: "As designers, we need to explore this new future and show the possibilities of how to create a world that does not inhibit, yet improves quality of life for people while caring for the planet. The circular building is a small first step into this future."

To bring about this future, though, collaboration will be required on many levels, in addition to design innovation. Speaking about the lessons learned in the development of the building, Boyd explains: "The key lesson is that to make this change happen, there has to be an open collaboration conversation between clients, designers, contractors, and the supply chain.

"Design drive becomes less about shifting the maximum amount of material, and more about durability, motivating less use of material... [actors in the supply chain] need

"WE NEED TO EXPLORE THIS NEW FUTURE AND SHOW THE POSSIBILITIES OF HOW TO CREATE A WORLD THAT DOES NOT INHIBIT, YET IMPROVES QUALITY OF LIFE FOR PEOPLE"

to understand that their criteria can change from selling products to offering a service." Changing to more of a service-based model in this way will bring about economic benefits, he insists: "This offers guaranteed revenue streams because longer-term contracts insulate business against the volatility of the construction industry."

The prototype Circular Building has now been disassembled and its future is currently being explored. Arup is looking to apply the lessons learnt about the circular economy to other buildings. Boyd says: "Arup wants to start to engage our clients and other collaborators. We will be looking to carry on the conversation that this has started." Lewis Blackwell, Executive Director of the Built Environment Trust, adds: "Knowledge-sharing and recruiting people into the circular community needs to be done. We need to spread the values we care about for these very good reasons. We need to get the word out and bring people in." 



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GLASS

TAKING THE WEIGHT OFF

Glass has plenty of attributes that make it ideal for packaging some types of product, though its heavy weight isn't necessarily one of them. Will Simpson investigates the modern phenomenon of lightweighting and discovers just how low glass could go

Glass was the first material to be recycled on a mass scale in the UK - bottle banks have been a common feature of British towns and cities since the 1970s - and a long-established recycling infrastructure has meant that 'new' bottles made in the UK can contain up to 90 per cent recycled material.

Whilst its recyclability is beyond dispute, in the last decade or so, there have been moves to make glass go even further by reducing the average weight of containers, or 'lightweighting'. The idea is that this uses less material and less energy and thus reduces the environmental impact.

Lightweighting's turning point was the launch of the first Courtauld Commitment in 2005, when manufacturers first agreed to reduce packaging and improve resource efficiency within the UK grocery sector. In its wake, between 2006 and 2008, WRAP ran the Container Lite programme, which aimed to reduce waste glass through demonstrator projects showing how weight reductions can be achieved. Running parallel to this was Glass Rite, a British Glass/WRAP co-project that brought together producers, retailers and bottle manufacturers to encourage lightweighting in the wine industry. During those two years, more than 300 wine labels converted to lighter bottles.

The project boasted some significant successes. Kingsland, one of the UK's largest wine suppliers, reduced its 650-gramme (g) bottle down to 484g and its 460g bottle to 400g, a move that saved the company more than 1,600 tonnes of glass and 1,140 tonnes of CO2 per year. Glass Rite also had an effect on the way wine was transported. Rebecca Cocking, Head of Container Affairs at British Glass, explains: "I know of one company who thought, 'Hang on - we're shipping wine from Australia to the UK in heavyweight bottles. Is there any way we can do it in a more environmentally-friendly

way?' So, they began to import in bulk and then bottled - using lightweight containers - in the UK. They saved not only on the lightweighting but also transportation costs."

Beyond commercial considerations, the other main driver in the rise in lightweighting has been technology. As Fiacre O'Donnell, Head of Strategic Development at UK Glass Manufacturer Encirc, explains, the main breakthrough here has been the emergence of what is known as 'narrow neck press and blow' (NNPB) technology to make the bottles. Traditionally, glasses have been made through a process known as 'blow blow' (BB), whereby, in O'Donnell's words: "The gob of glass is

"Lightweighting means that you're not just using less raw materials, you're also saving on things like energy consumption in the logistics for both empty and finished goods"

delivered into the blank mould. In the BB process, air is used to compact the glass down into the blank mould forming the finish on the bottle (screw threads, cork or whatever). The blank is then transferred into the blow side where the bottle is blown up to its final shape." O'Donnell continues that, with NNPB, the second half of the process is the same, but in the first half, the 'gob' is displaced with a plunger in the mould, rather than being blown. He continues: "NNPB allows you to get an even distribution of glass. That means that whenever you make the bottle, the wall of thickness on every part of the bottle is consistent. A lovely consistent walled thickness gives the container strength. But you have to have a skilled workforce to do this... 'Blow blow' lets you compensate because [the bottles] are heavier. You've got a wee bit more tolerance on them. With NNPB you have

Feature

a minimum amount of tolerance on the bottle, so your operators have to really know what they're doing."

For drinks manufacturers, lightweighting has certainly resulted in savings. Simon Gilleard, Packaging Development Manager from AB In-Bev, the brewing and beverage multinational, suggests that a mere 10g reduction in the 30-centilitre Budweiser bottle it manufactures has resulted in a saving of 3,250 tonnes of material per year. "You're not just using less raw materials, you're also saving on things like energy consumption in the conservation process and on logistics for both empty and finished goods like less fuel consumption."

"Whilst we are challenging ourselves as an industry to reduce the weight of our containers, we're being restricted somewhat by government policy in allowing material to be co-mingled"

So, if there are huge benefits in terms of savings, especially of raw materials, why, you might ask, aren't all bottles being lightweighted? Well, there are certain physical restrictions on how light you can go – the nature of what's contained in the bottle being one crucial one. "If you've got something that is carbonated, then obviously you've got to have a certain amount of thickness", explains Cocking. "You don't want something that could easily blow or shatter because of the internal pressure. The more carbonated... a drink is, the heavier the container needs to be."

But the biggest barrier, she suggests, could be a psychological one. "If you take a premium spirit, there is a perception from a consumer point of view that a heavier bottle means it's more prestigious – it's got that 'premier' feel. Therefore, there are some concerns that if you take the weight out to the point where people ask, 'Is this glass or is this plastic?' they may feel it's an inferior product."

Furthermore, even if we are becoming accustomed to lighter bottles in Europe, businesses can sometimes be reluctant to rollout lighter bottles across the global market: "You've got to look at it from a manufacturer's point of view", says Cocking. "It's not as easy as saying, 'Yes, we'll do them all.' Say you're a whisky manufacturer – it could be the majority of your bottles are not even sold in the UK. Even if in the UK, we all say, 'Yeah, fine, we'll take Bell's in a lightweight container', the Asian market might refuse it because lightweight to them is saying, 'This is cheap, this is nasty.'"

Lightweighting also brings up a thorny issue for the glass producers. Glass is heavily dependent on the recycled material it receives, the cullet, to give it its proper name. The problem is that the lightweighting process places a higher premium on the quality of the recycled cullet, at a time when its quality, due to the increasingly co-mingled nature of UK recycling, is declining. O'Donnell explains: "Even a

little piece of contamination – be it metal or ceramic or whatever – will have a hugely detrimental effect on a lightweight container, whereas you can more easily get away with it in a heavier container. Whilst we are challenging ourselves as an industry to reduce the weight of our containers, we're being restricted somewhat by government policy in allowing material to be co-mingled." At present, 1.6 million tonnes of glass is collected every year, but only 600,000 tonnes of that goes back into producing new glass. "It's a big concern for us", O'Donnell admits.

Assuming these barriers can be overcome, how far can lightweighting go? In 2015, Adnams claimed to have produced the lightest ever ale bottle – a 500-millilitre (ml) bottle that, prior to its first round of lightweighting in 2007, was over 450g, but was reduced initially to 299g and then last year to a mere 280g. "I think it would be tough to go further", says Ben Orchard, Adnams's Environmental Sustainability Manager. "Especially when you consider what the bottle has to go through – structural rigidity and health and safety wise. I would like to think we can go lower, but we are probably pushing the limits."

Gilleard, though, is keeping an open mind. "I wouldn't like to say how far it can go. If you look at the trends, it just keeps going. The opportunities are ongoing and we are continually seeing developments from suppliers and benchmarking internally and externally for ways to improve further. There may be breakthrough technologies coming through to help and take lightweighting even further – this could be anything from supplier capability through to internal processes around bottle handling."

Whether glass can go any lighter remains to be seen, but the days of carting heavyweight bottles back from the supermarket or off licence would appear to be numbered. [O](#)



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Material gains

How can risk-averse councils get the most value out of the recyclables they collect and feed them into a more circular economy? An idea finding favour in Wales and Scotland is a materials brokerage service. **Charles Newman** reports

“There are benefits for both the public sector, in terms of market stability and economies of scale, and the private sector, in terms of assured supply of high-quality materials and potential for inward investment”

his phone off. At that time, some LAs couldn't even sell their recycling, and wound up stockpiling it instead, while some waste companies saw a noticeable dent in earnings. Inevitably, the experience was worse for some than for others. Notably, recycling with little or no contamination could still find a market, which is hardly surprising as quality usually sells. However, this slump highlighted the importance of collectors having a stable market. While commodity prices are not quite as dire today (though some markets currently have difficulties), the issue is still of primary importance. One comment I hear often at the moment is: 'What's the point of recycling

more if there aren't the markets for the material?' In truth, though, there is always a market for recyclable material – the challenge is finding one that offers the right price. Along with the product, there are some other obvious features that help make a sale, such as having the contacts and expertise to negotiate the contracts with a reprocessor or merchant. For individual LAs that collect and sell recycling, this diverse set of skills can be asking a lot of one or two people. Currently, LAs typically negotiate material outlet contracts infrequently, often with a number of years between rounds. As such, collective memory and expertise are difficult to maintain. Meanwhile, sitting on the other side of the table are counterparts in a deal who are specialist purchasing managers for merchants or mills, with a far better understanding of the market. This asymmetry has contributed to the argument that councils should pool resources through a materials brokerage, which enables them to delegate the selling job to a skilled negotiator who deals with contracted consumer counterparts regularly. Furthermore, representing a larger tonnage of saleable material inevitably improves the bargaining position. There are also features of having to operate commercially that do not fit squarely with how local authorities work, as Steve Read, who is both Head of Service for the Gloucestershire Joint Waste Team and Managing Director of Somerset Waste Partnership, observes: "There are rather strict procedures internally applied for procurement – even though we are *selling* material and there is some good WRAP guidance on avoiding making this too complex. LAs are risk-averse bodies and are less good at risk assessing where some procurement processes can be appropriately streamlined.

"Another issue we have encountered is receiving income from the people we sell to in a timely manner. As this is determined on the basis of tonnages received by the purchaser, we have to await information from them in order to send them an invoice. While [it's] not rocket science, there is more than one opportunity for delay in the system."

It seems clear that there is scope for government to improve the position of LAs selling recycling and contribute to a robust circular economy (more on this later). Certainly, a strategic materials brokerage appears to be an option that may be of a sufficiently win-win nature to find favour. While in the past a small number of authority groups have struck good deals collectively and some private-sector merchant operations function like brokerages, until recently there has been no attempt to resolve some of the problems just mentioned. In 2014, Zero Waste Scotland started work on a brokerage service with an initial emphasis on glass, but an eye on potentially also brokering dry mixed materials and residual waste. There is, however, still no UK-wide strategic element in brokerage, and both the Welsh and Scottish governments now see this lack of strategy as an omission to be rectified. Commenting on the decision to move forward with the initiative, Charlie Devine, Head of Resource Management for Zero Waste Scotland, said: "The market for waste materials collected by Scottish local authorities and other public bodies is highly fragmented, meaning that Scotland loses the value of much of its secondary materials. The brokerage service seeks to address

these issues by matching up the supply and demand for materials, helping create the right conditions for investment in sorting and onward processing jobs here in Scotland. "There are benefits for both the public sector, principally in terms of market stability and economies of scale, and the private sector, in terms of assured supply of high-quality materials and potential for inward investment."

This emphasis on material quality and consistency is a key consideration. The challenge is for different LAs under the umbrella of a brokerage to meet the same requirements, when each has its own collection service profile. As anyone familiar with the issue knows, there are a multitude of factors that contribute to the quality of recyclables resulting from an LA collection service, including the sorting method, technology, operative training and public education. It's entirely feasible that a materials marketing service can handle variations in quality, as well as inconsistency from suppliers, as merchants (who are brokers) currently do. However, this will impact on the value obtained, as reprocessors price in the cost of dealing with contamination and the potential that material received could be highly contaminated. As far as the business case goes, a brokerage must achieve both better value for money and ease of dealings. However, if it is to be of strategic benefit, contributing to the circular economy, then it will also require measures to ensure a reliable product. Crucially, the appetite of producers and manufacturers further



along the supply chain is influenced by the quality and consistency of material from reprocessors, so there is an onus to provide a consistent supply to the reprocessor.

“The Scottish Materials Brokerage Service is an important part of delivering Scotland’s ambitions for a more circular economy, which will see valuable products and materials remain in useful circulation for longer, creating and sustaining jobs”, says Devine.

“Importantly, there are particular opportunities for the brokerage service in the context of the drive for greater consistency and improved quality that [the] Scottish Household Recycling Charter – which 20 councils have now signed up to – will deliver.”

Indeed, it appears that support is building across the UK to harmonise the recycling collection services delivered by LAs. In England, WRAP recently put forward three preferred models for councils to consider when looking at a service change. In Wales, the government’s Collections Blueprint, backed by capital investment and expertise, has played a pivotal role in raising municipal recycling rates and improving the quality of recyclable material for sale.

Recently speaking to the Welsh Local Government Association (WLGA), Lesley Griffiths, Cabinet Secretary for Environment and Rural Affairs, reaffirmed the intention of her predecessor to support the development of a brokerage: “I have seen how effectively some local authorities market the materials they collect to maximise income. I know WRAP, through the Collaborative Change Programme, is managing the marketing of materials for several local authorities, and I want to build on this.

“There is work under way looking at a materials brokerage for Wales, including the added value which it might be able to bring, not only in earning income for local authorities, but also interesting reprocessors in the opportunities presented by high tonnages of high-quality materials being offered to market in Wales.

“Welsh Government has been approached by materials reprocessors interested in the possibility of locating new facilities in Wales, provided materials are presented in ways which meet required quality standards. I want to seize this opportunity for new investment and new jobs in Wales as well as seeing Welsh local authorities providing consistently high-quality, higher-value materials to market.”

For a brokerage to play a strategic role, encouraging investment in reprocessing infrastructure closer to where the recycling is collected, sorted and stored, it will need to build confidence among its customers. A quality-oriented brokerage sends clear signals to those considering investment in plant and logistics that the material consistency and a long-term view of the market are already in place.

To demonstrate this requires some transparency. There is a justifiable expectation that Wales, which already has a track record of reporting the end destination for LAs’ recycling, has the stakeholder buy-in required. Audit information not only has the potential to encourage customer confidence, it also can play a

role in quantifying the environmental contribution of LAs’ recycling, such as CO2 emissions. By playing a central role in collecting this data, a brokerage can also play a strategic role in ensuring the best outcomes for sustainable development objectives.

“Whilst price is a major consideration to the reprocessor, in my experience, quality and reliability of supply can often carry more weight than a few pounds per tonne. Contaminated feedstock causing damage to [a] plant can make the price difference per tonne seem vanishingly trivial”, notes Andy Moore, Director for UK Recyclate, who has promoted the development of high-quality recycling systems.

“There could be an improvement for material consumers in this arrangement. A brokerage will surely employ people whose whole job is dealing with material movements and deals. These are fellow experts with whom the reprocessor can identify and readily develop mutual understanding and trust through regular contact. So, as with the local authority, time spent negotiating deals or sorting out problems is a cost and sometimes a problem. There appears to be a win-win here in the smoothing of this process via a brokerage. Both the authority and the consumer should save time and trouble.”

It’s view that Steve Read echoes: “To some extent, [a] brokerage might help in that we would potentially contract with just one body under a single contact to sell our material and, secondly, they would hopefully do the data collecting and invoice chasing! There is a risk, however, that another link in the chain would add further delay to the system, although that would probably be outweighed by the avoided cost of doing the chasing.”

This reflects the principal justification of any brokerage: improving the process of transaction, for the benefit of both buyers and sellers. But what makes the current ideas taking root in Wales and Scotland really interesting is the potential for this to play a strategic role in delivering wider economic and environmental benefit.

According to Moore: “Besides its normal commercial activities, a strategic brokerage should foster better vertical integration within the supply chain so that collectors, reprocessors and remanufacturers grasp something of each of the other’s needs and numbers. As far as possible without breaching commercial confidentiality, a strategic brokerage should also be in the business of information sharing and communication with regard to recycling and related issues between stakeholders, contractors, clients and even householders in the form of suitable texts and pictures for instruction leaflets, et cetera. Understanding is aided by transparency of process and motive. Current arrangements are often opaque and an obstacle to building common purpose – surely yet another key driver of the circular economy.”

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REJECTED Hypotheses

Following a flurry of media disparagement around the 2014/15 stats on local authority recycling rejects, Eunomia consultants **Peter Jones** and **Andy Grant** analyse England's recycling data to truly understand the figures

Is the recently reported increase in recycling rejects in England (due to an increase in the amount of contamination in recycling bins) caused by growing confusion amongst the public, as the national press would have us believe?

The Defra stats obtained by a BBC freedom of information request – and reported on with such disparagement by the likes of the *Daily Mail* and *Daily Express* – do show a substantial increase in the reported amount of local authority rejects. But, while an 84 per cent increase since 2011/12, and a 2014/15 figure of 338,000 tonnes of rejected material might sound bad, it's still barely three per cent of the 11 million tonnes of material collected for recycling. For a complex, diversified system that relies on public participation, and which has to deliver material good enough to reprocess, a 97 per cent success is quite an impressive result.

Earlier this year, in contrast to the newspapers' assumption that the increase in process rejects must be increasing public confusion, we identified a couple of other possibilities that would also explain the 184,000 tonne rise documented in Defra's figures: better data capture, or better sorting at materials recovery facilities (MRFs). However, we didn't attempt to assess which is the most plausible. In this article, we begin that tricky task.

We should also state a background assumption: any authority that collects a large proportion of its recycling co-mingled should, if it is reporting accurately, have a reject rate above zero per cent. A plausible minimum level of rejects is a matter for debate, but we think five per

cent would be low and two per cent exceptional.

Kerbside-sort systems, though, can plausibly give rise to very low levels of rejects. Indeed, under the outgoing WasteDataFlow reporting rules, reject counts were focused on primary MRFs rather than any subsequent sorting by reproprocessors. This made it possible for some multi-stream authorities to correctly report zero per cent rejects, although this would have overstated the amount of material put to beneficial use.

Systematic analysis

The 51 authorities that are currently using kerbside sort-type systems have an overall reject rate of less than one per cent. Comparing the 2011/12 and 2014/15 statistics, their reject rate has gone up by some 0.2 per cent, with rejects rising from 5,027 to 13,872 tonnes; but the data reveals that most of this increase is accounted for by issues with waste wood and kerbside recycling in South Gloucestershire. Since the reject figures are consistently and explicable low for these authorities, we have excluded them from the analysis that follows.

Part of the explanation for the overall increase in rejects might be the increasing popularity of single-stream and two-stream collection systems. Over the period since 2011/12, Eunomia's records indicate that more than 60 authorities have moved from multi-stream to single-stream or twin-stream systems – the exact number depends on how you count authorities in waste partnerships. Of these, 23 reported zero rejects in 2011/12; only six did in 2014/15.

The total amount of reject material from councils that switched away from multi-stream collections accounts for 38,500 tonnes (13 per cent) of the increase in rejects between the two years. But a couple of observations diminish the significance of 'switching' as a contributing factor to the rise in rejects.

The rise in rejects in these 'switching' authorities is very similar to the overall average increase in rejects (about 575 tonnes per council).

More than 15,000 tonnes of the switchers' increase was garden waste rather than dry recycling, and 14,300 tonnes of this was reported by the Dorset Waste Partnership. Excluding this outlier figure brings the average increase amongst 'switching' authorities significantly below the national average increase in rejects.

MRFs have indicated that they tend to look favourably on material from councils that have recently switched from a kerbside sort to a co-mingled system. The data perhaps supports the idea that such councils' recycling yields relatively low levels of rejects at least in the early years after the system change.

Because of the very small contribution to rejects from authorities that switched away from kerbside sort, we also exclude these figures from the analysis that follows and focus simply on the collection authorities and unitaries that collected some or all of their material co-mingled throughout the period 2011/12 to 2014/15.

Small change

Of these authorities, 157 saw their reject tonnage go up, while 47 saw it stay the same or decrease. But before we conclude that this reflects a widespread increase in public confusion, it's worth looking at where the increase in rejects has taken place.

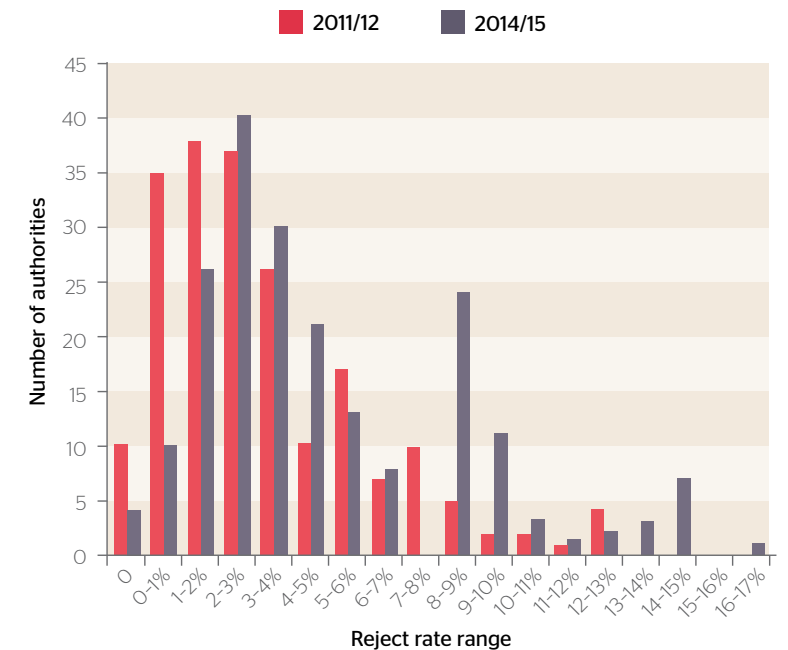
The top chart (right) shows that 43 fewer authorities reported 0-2 per cent rejects in 2014/15 than in 2011/12, while the number reporting 2-10 per cent increased by 33. Where no authority reported a reject rate above 13 per cent in 2011/12, 11 did in 2014/15.

Perhaps more significantly, the great majority of the tonnage increase in rejects is accounted for by councils that in 2011/12 reported 0-3 per cent rejects, while the tonnage attributable to councils with 2011/12 reject rates above 10 per cent has actually decreased, as shown in the bottom chart (right).

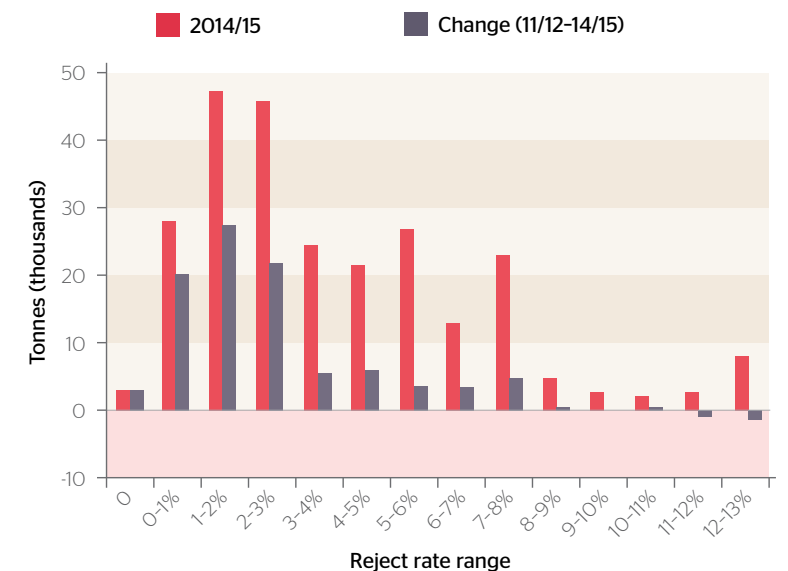
While the analysis above is not conclusive, it is suggestive. Around 13 per cent of the 184,000-tonne increase in rejects appears to be associated with authorities that switched from source-separated collection schemes that are more likely to separate out non-target material before they ever get into the system. Around eight per cent seems to be attributable to garden waste issues in Dorset in 2014/15. A few per cent here and there are attributable to specific issues at individual authorities (some of which already had high rejects in 2011/12), which were explained in the BBC article that brought this issue to the fore – Greenwich using an 'out-of-date' MRF, for example, resulting in a 3,000 tonne increase.

But most of the rest has occurred across a wide range of councils that formerly had improbably low rejects; many still have reject rates below five per cent. Meanwhile, the authorities that had the highest level of rejects in 2011/12 have (taken as a group) seen their reject tonnage decreased.

Change in distribution of reject rates (excl. KSS)



2014/15 rejects and change by 2011/12 reject rates (excl. KSS)



Confused story

This is difficult to reconcile with the 'confusion' explanation. Are we to understand that confusion has increased only in areas where formerly there was none, but where people were more confused in 2011 about what to recycle, matters have improved?

It is also a poor fit with one of the alternative theories we advanced: that the figures accurately report improved sorting of rejects by MRFs. In fact, the starting level of rejects in the councils where most of the increase has occurred was implausibly low.

It is, though, consistent with another theory – better reporting by councils (or by MRFs to councils) of an issue that has been there in co-mingled systems all along.

This article is a version of one that originally appeared on the Isonomia blog. For more, visit www.isonomia.co.uk

A HEATED DEBATE

Following several high-profile setbacks for ‘advanced conversion technologies’, some are now questioning whether gasification and pyrolysis can ever work at a large scale to treat residual waste. **Libby Peake** investigates

For well over a decade now, various forces in the UK have been trying to develop advanced conversion technology (ACT) for the treatment of residual waste as an alternative to landfill or mass-burn incineration. Way back in 2003, the previous Labour government launched its New Technology Demonstrator Programme with the aim of overcoming the ‘real and perceived risks’ associated with technologies like anaerobic digestion (AD), mechanical biological treatment (MBT), mechanical heat treatment (MHT), gasification and pyrolysis. And while AD has since gone on to become the government’s preferred method of

meaningful degree. Three others that received funding didn’t complete the programme: the Novera gasification pilot in East London withdrew for commercial reasons, while the Compact Power gasification and pyrolysis plant near Bristol was unable to commence construction in time for the project (though it was later built and acquired by New Earth Technologies – more of which in a moment) and the Yorwaste pyrolysis plant in Scarborough was never able to start meaningful operation.

And despite the passage of 13 years, the technologies still haven’t really taken off as far as the treatment of mixed residual waste goes. New Earth eventually built its ACT plant in Avonmouth near Bristol, and began exporting power in 2013, but, as Director M J Richardson explained in a letter to stakeholders in 2015, ‘the level of performance has consistently fallen well short of targeted levels’ while ‘[o]perational, manpower, maintenance and repair costs have consistently proved to be much higher than originally planned’. His letter warned that the poor performance of the combined gasification and pyrolysis plant increased the risks to the overall New Earth business, and the official decoupling of the firm’s energy and waste interests was not enough to prevent New Earth from going into administration this summer. New Earth’s decoupled energy business, formerly NEAT Technology and now known as Syngas Products Group, is still trading, however.

New Earth is not the only large company to struggle with the technology, either: in 2009, Scotgen opened a 20,000 tonne per annum gasification plant in Dargavel, which it claimed was ‘Europe’s most advanced waste-to-energy facility’. Following a major fire in 2013 and a series of permit breaches, though, it had its environmental

dealing with organic waste (there are well over 100 operating AD plants that deal exclusively with waste, and significantly more that deal with agriculture residues and slurries) and MBT and MHT are becoming more common, the advanced thermal treatment (ATT) technologies still haven’t overcome the hurdles that became evident during the 2003 demonstration programme. Indeed, only one ATT project – the ex-incinerator on the Isle of Wight that Energos retrofitted with gasification technology – was even able to complete the project to a

“We hope this latest admission of defeat acts as a wake-up call for the government, who have been unwisely stoking this whole misadventure with environmentally-harmful subsidies and other unwarranted financial support”

permit revoked by the Scottish Environment Protection Agency (SEPA). At the time, Ian Conroy, Technical Support Manager in the South West for SEPA, said: “The facility started operations more than four years ago, and in that time has never achieved a level of compliance which would give SEPA any degree of confidence that future operation would be any different. The facility has consistently failed to meet any reasonable expectation of environmental performance and the predicted level of energy recovery at approximately three per cent is particularly disappointing and unsatisfactory. SEPA has taken this serious and unusual action of revoking the permit following careful consideration and assessment of the regulatory options available.” Scotgen has since gone into administration, but the facility and assets were acquired by Rank Recycling Scotland, which applied for a new permit, though it is unclear if this is still being pursued.

Earlier this year, meanwhile, American gas producer Air Products announced it was leaving the energy-from-waste business altogether, ceasing the development of two mammoth gasification projects in the Tees Valley, which together would have handled 700,000 tonnes per annum (tpa) of waste. The move wasn’t a complete surprise as the company had previously indicated it was experiencing problems: in a 2015 company conference call, CEO Seifi Ghasemi was asked about the then-three-year delay to the project, with Goldman Sachs analyst Robert Andrew Koort querying: “Is that an indictment of the technology or is there some other issue at work?” Ghasemi responded: “It’s just related to the technology. We have always said that there is a chance that the technology will not work.” This point was reiterated in a January company conference call, when Ghasemi said: “There is a still significant outstanding question about if we will ever be able to get it to work on a sustainable basis... The technology is proving to be a lot more difficult than people thought at the beginning.” Subsequently, this April, after the company had finished construction of one of the plants and started on the other, it announced that it was unable to overcome the ‘design and operational challenges’, and so wrote off the entire project at an estimated cost of US\$1 billion (around £700 million at the time) and the loss of hundreds of jobs.

Since then, Energos, the only ATT company to complete the New Technologies Demonstrator Project with its retrofitted gasification plant (a conversion that had its own problems with emission breaches and low levels of energy recovery), has also gone into administration following ‘contractual disputes’. And there are a string of other gasification proponents that have likewise folded or given up on the technology over the years, as highlighted in a recent UK Without Incineration Network (UKWIN) briefing: BCB Environmental; Bioflame; Biossence Renewable Energy; Compact Power Holdings; Interserve; the list goes on. So, what’s going wrong?

Before we consider the complications of using the technologies at a large scale to treat mixed waste

“Small-scale plants seem to become unmanageable when upsized to large scale – which is necessary for the huge capital costs to be justified”

streams, a brief explanation of the technologies themselves is in order. Though they come in a variety of forms – with sometimes bewildering names like fluidised bed, counter-current fixed bed or co-current fixed bed gasification, plasma arc gasification, free radical gasification or flash vacuum pyrolysis – the two technologies, like incineration, are essentially thermal processes. They use high temperatures to break down organic or fossil-fuel based material, such as paper and plastics, to liberate energy. Unlike incineration, however, only a very limited amount of oxygen is present in gasification, while pyrolysis occurs with no oxygen, and both take place at extremely high temperatures (typically above 430°C for pyrolysis, and above 700°C for gasification). Rather than directly releasing energy, the processes produce ‘syngas’, made up of hydrogen and carbon monoxide, which can be used to produce energy through steam turbines, for instance, or can, in theory, be used directly as a fuel, which would result in higher conversion efficiencies.

Advocates of the technologies say they have many potential benefits over incineration, including potentially higher efficiency, lower emissions (as there is no flue gas to clean) and the potential to deal with heavy metals (in some versions) by trapping them in a glassy and chemically stable form. Moreover, they can operate through a modular system, allowing for more flexibility than a mass-burn incinerator.

And while both technologies have been widely used by other industries – to treat coal and peat, for instance – as we’ve seen, their success in the waste industry has so far been limited. Shlomo Downen, from UKWIN, has been outspoken on the drawbacks of the technology, saying after Air Products withdrew from the sector: “Gasification and pyrolysis are synonymous with technology failures, bankruptcies and broken promises. As such, UKWIN is unsurprised that Air Products failed to get an unworkable technology to work.

“We hope this latest admission of defeat acts as a wake-up call for the government, who have been unwisely stoking this whole misadventure with environmentally-harmful subsidies and other unwarranted financial support. Investment should focus on sorting technologies and other infrastructure that will move us towards a circular economy, not wasted on disposal technologies which, even if they worked, would still be destroying valuable materials whilst exacerbating incineration overcapacity.”

Putting aside the (perfectly valid) arguments about the technology’s potential to destroy valuable materials, I ask him what makes the technology so tricky to crack when it comes to the treatment of mixed municipal

waste, and he explains: “My understanding of the wider question of gasification failures is that the more heterogeneous the feedstock, the more likely it is to fail... When you are burning a homogeneous feedstock, you can anticipate its behaviour and you can design around that behaviour. But if you have a mix of materials, you can't be certain that that batch will behave in the same way as your previous batch, because it's based on

“At the moment, we are seeing the supply chain for fuels maturing quite a lot, and we are seeing sophisticated MRFs being built that can supply these plants more effectively”

compositions. So, it becomes unpredictable, like trying to hit a moving dartboard.”

Scaling up a facility, which inevitably makes structures more complex, can lead to further complications, he says, as “even if the various components have been shown to work separately, the configuration often does not work”. He adds that, while proponents of the technology point to some small-scale demonstrator projects as proof of concept, he isn't aware of any successful, large-scale facilities relying on a mixed-waste feedstock operating anywhere in the world, adding: “As soon as you scale up from a demonstrator project to a facility that could take 100,000 tonnes of feedstock per year, then you greatly increase the chance of air getting into the gasification unit [a problem that is even more serious in a pyrolysis unit] when you don't want it to, and then you've got all sorts of problems.”

This view is backed up by Peter Selkirk, Chair of PyroPure, which uses pyrolysis and gasification on very small batches of niche waste streams, like medical and hazardous waste, who suggests that technical issues mean that upscaling the technologies can be very difficult (and expensive): “Small-scale plants seem to become unmanageable when upsized to large scale – which is necessary for the huge capital costs to be justified. The root cause of most problems is the intrinsic variability of waste feedstocks.”

A brochure for GoGreenGas's pilot demonstration plant, which will use gasification (and which says it has overcome the technical hurdles associated with producing clean syngas – more of which in a moment), elaborates: “[A]pplying this

technology to waste or biomass has proved extremely challenging for previous developers. The primary challenge is producing a syngas that is free of tars. The tars foul catalysts, preventing any conversion of the syngas. However, the structure and composition of waste and biomass feedstocks mean that they are gasified at relatively low temperatures of tar generation. Wastes, and to a lesser extent biomass, contain high levels of contaminants such as sulphur, chlorine and heavy metals. These poison the catalysts used to convert the syngas to methane.’

Downen suggests that the high-profile failures/withdrawals/administrations, combined with the conclusion of government subsidies in the form of Renewable Obligation Certificates (ROCs) at least, mean that the number of proposed ACT facilities going through the application process has fallen off in recent years (and UKWIN keeps a very detailed list of potential, existing and prevented incinerators – including those that use gasification and pyrolysis technology – on its website), but others insist that the technology is going to expand in the coming years and that the high-profile problems are not representative of the technology in general.

Several of the gasification and pyrolysis companies I spoke to seemed reluctant to speculate on the specific cause of Air Products' failure, and even companies that were involved with the Tees Valley project did not want to be drawn on the problems it faced. In a 2012 press release, Waste2Tricity described itself as the 'structured solutions provider instrumental in introducing the Tees Valley site' where Air Products attempted to build the two giant gasification plants, further quoting Managing Director John Hall as saying: “Air Products are the pathfinder in this sea change of energy conversion technologies.” However, neither Waste2Tricity nor Peel Environmental, which are still developing the Bilsthorpe Energy Centre, a proposed 100,000tpa commercial and industrial waste facility due to use technology very similar to that which Air Products failed to get off the ground, were available to speak for the purposes of the article. The companies did, however, send through statements highlighting the “extensive work” they've done “to demonstrate how the facility will work, which included obtaining R1 efficiency status during the planning process”.

As for the Tees Valley development, though, the overriding feeling from other commentators seemed to be that it was a matter of scaling up too quickly with unproven technology. Some even suggested that the setback at the Tees Valley plants was only temporary and that we will still see those plants come online in the future.

And it seems that some investors (and the government) still want to back ACT. Adam Baddeley, Eunomia Research & Consulting's Head of Energy, says that, from the people he's spoken with “the investors

are really keen, are very interested in ACTs at the moment”, in part (which some might find depressing) because “clean tech investors were putting a lot of money into wind and solar, and that market has gone down, the government has withdrawn support to the extent that people can't build new wind or new solar at the minute”. Moreover, although the ROCs aren't available to new proposals, ACT facilities might still be able to get support through the government's Contracts for Difference (CfD) scheme, which aims to stabilise revenues for investors in low-carbon electricity projects by paying generators the difference between the 'strike price' – a price for electricity reflecting the cost of investing in a particular low-carbon technology – and the 'reference price' – a measure of the average market price for electricity in the UK's energy market. Although Theresa May's government appears to have other priorities, a new auction for CfDs is expected soon, and the Department for Business, Energy & Industrial Strategy recently launched a consultation on the matter, asking whether CfD 'is the right support mechanism' for ACT technologies. Baddeley explains, though, that if ACTs remain in the 'less established technologies' CfD pot, competing against technologies like biomass CHP and off-shore wind, it would continue to incentivise the technologies, giving “them the edge over other technologies – over incineration, anyway, as they can then offer a lower gate fee”.

And as for the technological hurdles, Baddeley suggests that while operators will “have to accept that you are likely to have more downtimes at these plants”, many of the hurdles can be overcome through proper preparation of the feedstock (in addition to choosing the right technology, of course): “I think the main issue with any of these is making sure that you get the right feedstock and that usually needs greater treatment than with a traditional incinerator. But I think at the moment, we are seeing the supply chain for fuels maturing quite a lot – people are realising they have to do it, they can't just bung any old thing into these plants, and we are seeing more quite sophisticated MRFs being built, so they can supply these plants more effectively.”

Those operating or looking to operate gasification plants, meanwhile, are even more optimistic, with some saying they have developed technology that can handle municipal waste with limited or no pre-treatment. Chinook, which recently began operating the world's largest industrial waste gasification plant in the West Midlands – capable of processing 160,000tpa of automotive shredder residues (ASR) (a homogenous waste stream, in other words) – says its technology could equally be applied to black bag waste. The company is currently building a 500,000tpa gasifier for mixed waste in the Emirate of Sharjah and has two further projects in the UK – one of which, in Nottingham, will process a mixture of RDF and residual C&I waste – at 'advanced stage', awaiting clarity from the government's CfD

auction. The key to successfully treating mixed waste through gasification, according to the company, is to rely on batch processing as opposed to the more common continuous process, a move it says eliminates the need to pre-treat waste.

Rolf Stein, CEO of Advanced Plasma Power, a partner in the GoGreenGas project mentioned above, meanwhile, tells me that the project's use of two “tried and tested and well proven” technologies – fluidised bed gasification combined with a plasma arc converter that cleans the gas by exposing it to high temperatures and UV to crack the problematic tars and hazardous organic materials – means it will succeed where several others have recently failed. In partnership with the National Grid and Progressive Energy and with funding from the Network Innovation Competition and the Department for Transport, Advanced Plasma Power will be launching a GoGreenGas demonstration plant in Swindon in November that will treat waste through gasification to create bio-substitute natural gas (BioSNG), a step further than the syngas typically produced by gasification (used to run steam turbines), as it can be injected into the National Grid or even used as a fuel for heavy goods transport. The project will still be at a fairly small scale – scaling up to 10,000tpa from a 1,000tpa pilot – but Stein anticipates future full-scale commercial plants starting at 50,000tpa.

With regards to feedstock, he also maintains that the technology can get by with limited processing (although a bit of drying, he says, is preferable “because otherwise all you do is heat up that moisture content before cooling it down and then having to deal with liquid effluent at the end of the process”, adding that items like glass and

“The short answer is there aren't any problems with applying gasification to municipal waste, really. The problem, I think, has arisen by people trying to do something new”

metals should ideally be removed because they have no energy value, though they do, of course, have economic and material value). He adds that the pilot plant was able to handle “a very broad range of RDFs”, as well as even mined landfill waste, and anticipates the scaled-up technology will be able to do likewise.

Asked what problems there are with applying gasification to municipal waste, Stein responds: “The short answer is there aren't any, really. The problem, I think, has arisen by people trying to do something new.” With several plants due to launch in the coming years, an upcoming decision on CfD scheme financing, and the Green Investment Bank already supporting several projects, the question of whether or not the technology can work to treat municipal residual waste might soon be answered once and for all, at least! Watch this space. ●

SOIL

THE FORGOTTEN RESOURCE

A substance that can provide sustenance to maintain life on earth, that prevents flooding and desertification and that could even reverse climate change might sound impossible, but there's just such a material right under our feet. So why are we ignoring its health?

Libby Peake discovers the virtues of soil

The *Oxford English Dictionary's* primary definition of the word 'resource' is: 'A stock or supply of money, materials, staff, and other assets that can be drawn on by a person or organisation in order to function effectively.' Think of such assets in a circular economy context, and it's most likely that what will spring to mind are things that can be taken from a set reserve of materials and used to make products in a sustainable way – whether they be raw materials like metals or oil, secondary materials, or indeed 'waste'. But there's one resource that clearly isn't thought of enough, that is virtually taken for granted, and that's soil. Scientists are now warning, though, that continuing to ignore it could have devastating consequences.

Explaining this resource blindspot rather bluntly (in 2012, but it could equally be said today), Professor John Crawford of the University of Sydney told *Time* magazine: "[S]oil isn't sexy. People don't always think about how it's connected with so many other things: health, the environment, security, climate, water."

Put simply, soil is more than just 'dirt', and is vital in many ways in addition to providing a place to grow the food that is needed to sustain life. Topsoil is full of microorganisms, holding more than a quarter of all biodiversity on earth, with Crawford explaining that "if you hold a handful of soil [like that pictured on the cover and following page], there will be more microorganisms in there than the number of people who have ever lived on the planet. These microbes recycle organic material, which underpins the cycle of life on earth, and also engineer the soil on a tiny level to make it more resilient and better at holding water."

Unfortunately, degradation, which is now extremely widespread, drastically reduces soil's ability to retain water, with Crawford noting: "Even moderately degraded soil will hold less than half of the water than healthy soil in the same location. If you're irrigating a crop, you need water to stay in the soil close to the plant roots. However, a staggering paper was published recently indicating that nearly half of the sea level rise since 1960 is due to irrigation water flowing straight past the crops and washing out to sea."

What's more, because these microbes need carbon for food, soil is actually the second largest carbon reservoir on the planet – second only to the oceans – holding four times more carbon than all the world's plants and trees. EU soils store nearly 50 times as much carbon as its member states emit as greenhouse gases every year. This means that improving the health of our soil could play a major part in preventing catastrophic climate change (more of which in a moment).

But first, what's gone wrong?

For starters, it seems we didn't learn the lessons of the Dust Bowl of 1930s, when extensive and deep

plowing of the soil in the American Great Plains displaced native grasses that normally trapped the soil and moisture, leading to widespread drought and wind erosion (and to the dust storms that gave the period its name). Analogous modern farming practices have played a major part in pushing us towards a similar crisis today: the trend towards monoculture and continual tilling or ploughing of fields has seen much of the carbon in soil released into the atmosphere, meaning the microbes that make soil so useful have less to sustain them, which of course has a knock-on effect to the plants that grow in the soil. The modern tendency to remove crop stubble from fields – to use as animal feed, for instance – also damages soil because bare, exposed soil leads to the breakdown of soil structure, which also allows carbon to be released. And this is all compounded by heavy reliance on chemical fertilisers and pesticides, which kill soil's biodiversity and, having done that, make the plants dependent on them, catching farmers in a vicious cycle where they are forced to pump more chemicals onto the land to keep it productive.

“Soil isn't sexy. People don't always think about how it's connected with so many other things: health, the environment, security, climate, water”

Again in *Time* magazine, Crawford added that the way the modern agricultural system has developed means farmers aren't always incentivised to maintain the health of their soils, with so much of the attention given to increasing yield (much of which is currently wasted, of course!) instead: "Soil is not costed into food, which means that farmers don't have the financial capacity to invest in their soil to turn the situation around. Crop breeding is exacerbating this situation. Modern wheat varieties, for example, have half the micronutrients of older strains, and it's pretty much the same for fruit and vegetables. The focus has been on breeding high-yield crops that can survive on degraded soil, so it's hardly surprising that 60 per cent of the world's population is deficient in nutrients like iron. If it's not in the soil, it's not in our food."

The consequences of these shortsighted policies are pretty drastic. Scientists from the University of Sheffield's Grantham Centre for Sustainable Futures have gone so far as to describe the effect of soil degradation as 'catastrophic', following a 2015 study that calculated that nearly a third of the world's adequate or high-quality food-producing land has been lost, and at a rate that far outstrips the natural processes to regenerate soil, which can take decades or even millennia – it takes roughly 500 years of unimpeded ecology to generate 2.5 centimetres of topsoil. The terrifying statistics don't end there,

either: an earlier University of Sheffield report warned that there are only 100 harvests left in our soil (or perhaps as few as 98 now, as that study was published in 2014), and, in addition to the third of food-producing land already gone to dust, scientists estimate that potentially more than half of agricultural land worldwide is moderately or severely affected by soil degradation, with more than a quarter of EU land affected by soil erosion due to water.

“The focus has been on breeding high-yield crops that can survive on degraded soil, so it’s hardly surprising that 60 per cent of the world’s population is deficient in nutrients like iron. If it’s not in the soil, it’s not in our food”

Even more worrying, perhaps, is that it’s not just cropland that is seeing its soil degrade. Roughly two-thirds of the world is suffering from desertification, with much of it occurring in the vast grasslands used for grazing around the world. The assumption held for decades by the vast majority of scientists and conservationists was that desertification is caused by overgrazing of livestock – predominantly cattle, sheep and goats – as intensive grazing leaves the soil bare. However, ecologist Allan Savory says this assumption is as false as the long-held belief that the earth was flat.

Giving a TED talk in 2013, he said he realised this when he observed that desertification is a major problem in American national parks, where there has

been no grazing for 70 years. “What we had failed to understand”, he claims, “was that [in] these seasonal humidity environments of the world, the soil and the vegetation developed with very large numbers of grazing animals, and that these grazing animals developed with ferocious pack-hunting predators. Now, the main defense against pack-hunting predators is to get into herds, and the larger the herd, the safer the individuals. Now, large herds dung and urinate all over their own food, and they have to keep moving, and it was that movement that prevented the overgrazing of plants, while the periodic trampling ensured good cover of the soil.”

So, the answer to desertification and to the linked problem of climate change, Savory says, is that (in addition to ending the common practice of burning soil, which leaves soil bare, while releasing carbon and damaging pollutants) is to “do the unthinkable, and to use livestock, bunched and moving, as a proxy for former herds and predators, and mimic nature. There is no other alternative left to mankind.” He admits that it is extremely complex, but says that “holistic management and planned grazing”, in which herders bunch their animals and “mimic nature” by moving them every few days to encourage optimal grass growth, can “address all of nature’s complexity and our social, environmental, economic complexity” – increasing vegetation cover, stopping desertification and, crucially, reversing climate change.

Away from the grasslands, back at the arable farmlands, scientists say there are solutions there, too, but they’re solutions that must be implemented immediately to avoid irreparable damage to the soil and the planet’s climate, which the soil protects with such little recognition.

Increasingly, experts are calling for a move away from industrial agriculture to a more holistic approach that recognises the interdependence of living systems and restores soil through measures including treating land with compost, organic fertiliser or even human sewerage, crop rotation, limited tilling (or no tilling whatsoever, where possible), and using cover crops (such as temporary crops planted between the main cash crops) or retaining crop residues to avoid bare land, while also discouraging erosion and helping retain carbon. Scientists agree that such a move, known as ‘regenerative farming’, will lead to more carbon sequestration, though estimates vary as to what extent. According to one recent white paper on regenerative organic agriculture from the Rodale Institute, though, implementing these practices around the world would not only ‘comfortably feed the growing human population’, it would also repair damaged ecosystems and could potentially sequester more than 100 per cent of current annual carbon emissions.

Such a move would, of course, require bold policymaking and a willingness to take on the likes



of Monsanto, Syngenta and others that dominate industrial agriculture (which I would suggest ought to be referred to as ‘big agro’ from now on), but scientists and regular citizens alike are increasingly recognising the need to do so, and calling on governments to join them. Duncan Cameron, Professor of Plant and Soil Biology at the University of Sheffield, told the *Guardian* ahead of last year’s climate talks in Paris: “We need a radical solution, which is to re-engineer our agricultural system. We need to take land out of production for a long time to allow soil carbon to rebuild and become stable. We already have lots of land – it’s being used for pasture by the meat and dairy industries. Rather than keep it separated, we need to bring it into rotation, so that that there is more land in the system and less is being used at any one time.


“We can’t blame the farmers in this. We need to provide the capitalisation to help them rather than say, ‘Here’s a new policy, go and do it.’ We have the technology. We just need the political will to give us a fighting chance of solving this problem.”

More recently, an umbrella organisation of more than 300 civil organisations from throughout the European Union (EU), People4Soil, has been echoing this call by launching a European Citizens’ Initiative demanding that the EU recognise soil as ‘a shared heritage that needs EU-level protection’ and to close the ‘legal gap’ that means that there is currently no law ensuring its conservation for future generations.

The group is calling for a specific legal framework to protect soil, which it says should feature (amongst other measures) an ‘acknowledgment of ecosystem services provided by soil and the recognition of its importance for biodiversity conservation and food security’, as well as ‘the deployment of policies

“We have the technology. We just need the political will to give us a fighting chance of solving this problem”

committed to reverse the declining trend in soil organic matter and to reduce inputs by synthetic fertilisers and pesticides’.

If we get this right, there’s no reason why every generation to come shouldn’t benefit from the resource of healthy soil and the advantages it brings. Interestingly, the word ‘resource’ originates from the Old French dialect *resourdre*, meaning to rise again (based on Latin *surgere*, ‘to rise’) and so, perhaps, soil, rather than being forgotten should be viewed as the archetypal resource. It’s not something that can be stockpiled in a finite supply and used for our own ends, but it is a substance that we can work with again and again, that rejuvenates with incredibly advantageous consequences, allowing ecosystems and, with them, human life to continue thriving long into the future. 





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Ocean plastic products

With predictions that there could be more plastic than fish in the ocean by 2050, and at least 150 million tonnes of the stuff already polluting our seas, it's clear something must be done. They may only represent a drop in the ocean (sorry!), but here are some companies creating products from ocean waste.

Research by **Elena Holmes**



Image: Petr Krejčí for Studio Swine



Image: Petr Krejčí for Studio Swine



Image: Juriaan Boolj for Studio Swine



Image: Juriaan Boolj for Studio Swine

Sea Chair

Designed to recycle ocean plastic on board fishing vessels, the 'Sea Chair' was made in collaboration with local fishermen and presented at the Royal College of Art. Studio Swine, which developed the idea, has even released an open-source manual that will allow anyone to use plastic caught in fishing nets or found washed up on shore to make the chair: all they have to do is chop it into small bits, melt it in a DIY furnace, and then form the resulting molten mixture into a seat and three legs (using flat slabs to form the seat and folded aluminium scrap to mold the legs), before cooling the bits in seawater and then assembling.



Image: ECONYL

Recycled swimwear

The ECONYL reclaiming programme was established by the Aquafil Group to recover plastic waste worldwide (see *Resource* 74). Nylon waste is collected and sent to the ECONYL waste treatment centre in Ajdovščina, Slovenia, where nylon fabrics at the end of their lifecycle, including used fishing nets, are collected. The polymers produced from the recycling process are processed into textile yarn, which are used in the creation of items such as swimwear, like the Divesangha rash guard, below right.



Image: ECONYL



Image: ECONYL



Image: Divesangha



Beach hut

Singapore-based Spark Architects has created a beach hut made from discarded plastic collected from the beaches and seas of South East Asia. The prototype hut for Singapore's East Coast Park is intended to animate the shoreline and provide rentable occasional accommodation, whilst educating the public about the problems caused by dumping plastic into the sea.

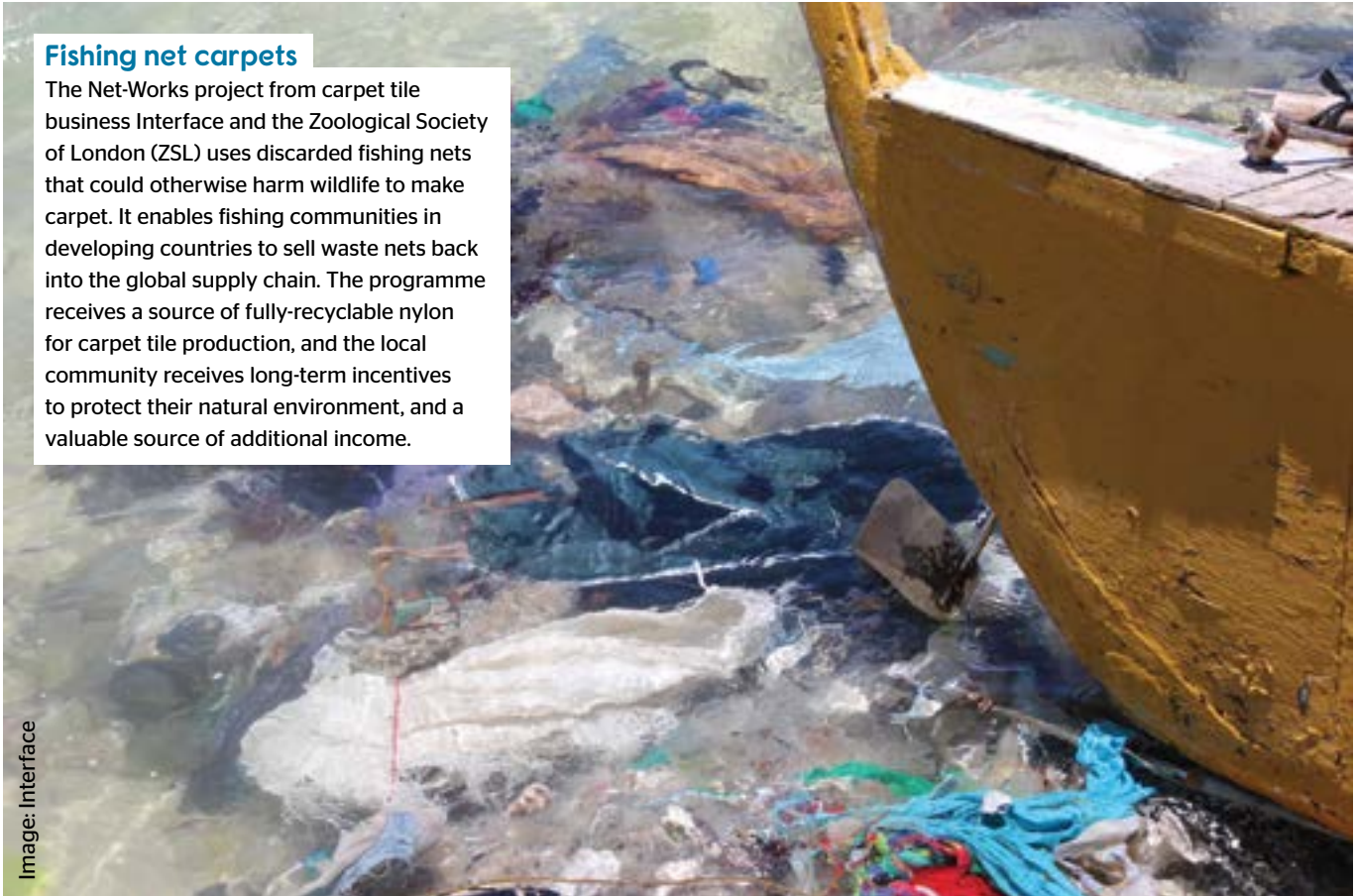
Image: Spark Architects



Recycled shoe

Adidas collaborated with Parley for the Oceans, an organisation that raises awareness about the environmental destruction of the oceans, to create a trainer made from recycled plastic ocean waste. The running shoe is constructed from plastic collected from coastal areas in the Maldives, as well as material sourced from illegal deep-sea fishing nets known as 'gillnets'.

Image: adidas



Fishing net carpets

The Net-Works project from carpet tile business Interface and the Zoological Society of London (ZSL) uses discarded fishing nets that could otherwise harm wildlife to make carpet. It enables fishing communities in developing countries to sell waste nets back into the global supply chain. The programme receives a source of fully-recyclable nylon for carpet tile production, and the local community receives long-term incentives to protect their natural environment, and a valuable source of additional income.

Image: Interface



Image: Interface



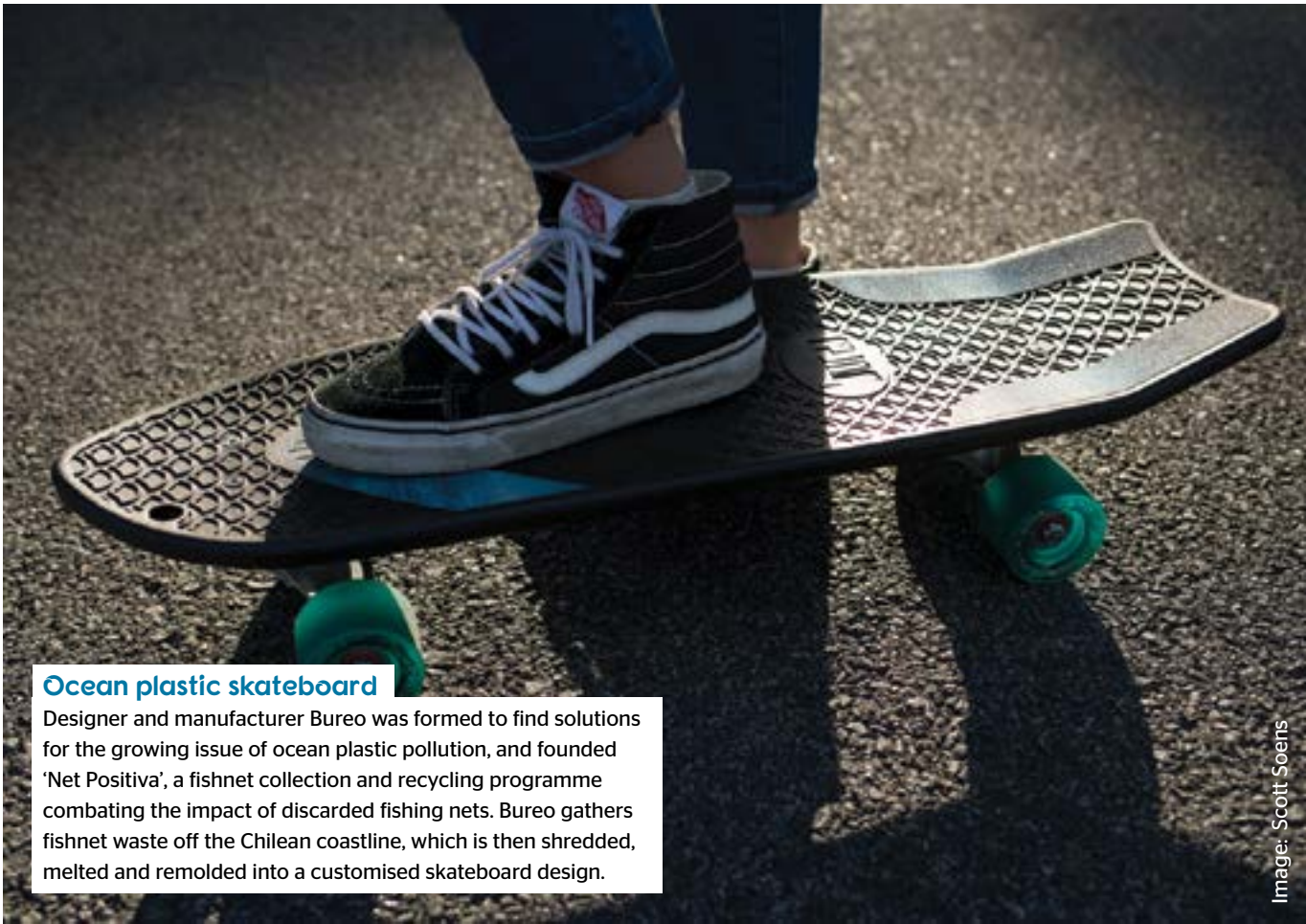
Image: Interface



Image: Bureo



Image: Bureo



Ocean plastic skateboard

Designer and manufacturer Bureo was formed to find solutions for the growing issue of ocean plastic pollution, and founded 'Net Positiva', a fishnet collection and recycling programme combating the impact of discarded fishing nets. Bureo gathers fishnet waste off the Chilean coastline, which is then shredded, melted and remolded into a customised skateboard design.

Image: Scott Soens



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Madam president

After 25 years, Margaret Bates has plenty of experience with waste. **Resource** talks to her about her newest role – as CIWM President – amongst a diverse range of topics

When Professor Margaret Bates, the new President (of the Chartered Institution of Wastes Management) started in the field, she often found herself going to events as the only woman, and perhaps that is part of the reason she is so recognisable today. As her presidency indicates, things have changed dramatically in the intervening few years, as she herself remarks: “People used to accuse the industry of being old, grey-haired men – well it’s not now, there’s a lot of much younger people than me, very dynamic people who want to show how professional they are.”

Bates has come a long way from her school years, when she flunked her A-levels, something she regularly reminds her students, before going to the University of East London, from Norfolk via Lancashire, to read Environmental Microbiology. It was here that, lured by the promise of free food and free beer, she went on field trips to opencast coalmines or landfills. She was eventually offered a PhD funded by the Department of the Environment, studying landfill microbiology and the impact of co-dispersal, looking at heavy metals and whether they stop degrading.

She then worked her way from lecturer to professor at the University of Northampton, developing an expertise in landfill, energy from waste, resource efficiency and, more recently, waste electrical and electronic equipment (WEEE). As someone who found her niche early on, she was, like it or not, destined for waste, and has made many contributions to the sector. A member of the CIWM East Anglian Centre Council and Chair of CIWM’s Scientific and Technical Committee for the last six years, Bates has overseen the commissioning of research that has helped to raise the profile of the institution and represented CIWM on the All-Party Parliamentary Sustainable Resource Group (APSRG) enquiry into waste exports. Talking to her before her inauguration as

CIWM President, it’s clear how engaging she finds the industry: “I love working in this sector. Waste and resources is this incredibly innovative sector that people still think is a dustbin man and a landfill, whereas it probably couldn’t be any different from that if it tried. The collection guy’s role is now a lot more sophisticated than it used to be. They’re looking for contamination, making sure they only take the right things, so it makes the downstream process much better.

“We’re also incredibly good at partnerships because nobody works in isolation. We’ve got this amazingly efficient service that’s delivered to a householder, that they only notice when it goes wrong. People focus on the three missed collections, not the million perfectly sound ones. And we’ve managed to get to a point where we’re saying our recycling rates aren’t good enough, and I’m not going to argue, but if you consider that we’ve actually got the majority of people to think about their waste, rinse it out, put it in the right box and put those boxes out on set days, which has absolutely no direct benefit to them whatsoever... We’ve managed to achieve good recycling rates, but imagine if there was actually an incentive on people to recycle more, then what might we achieve, rather than just asking them nicely in slightly different ways.”

Indeed, while she can point to a lot of progress on the recycling collection front, Bates, who often has people come up to her and ask her why they can’t recycle certain materials, is clear that we must move higher up the hierarchy now. She explains: “They don’t say, ‘Why did I buy this thing that can’t be recycled?’ Or ‘Why was someone allowed to manufacture something when there is no sustainable end of life solution for it?’ It’s ‘Why can’t you recycle this?’ I think we have issues where people think it’s totally acceptable to buy whatever you want as long as you put it in the right box at the end. We don’t have a system where people actually think about what they buy, other than, maybe now, plastic bags!”

The impact of the five-pence charge on a carrier bag is something Margaret finds indicative of the need to incentivise. “I know people who would not bother if they dropped a 5p, but they’ll bother to carry a bag, and I wonder if it’s just making you think more about it: a carrot and a stick are basically different sides of a 5p coin. Saying we couldn’t put pay as you throw out there because it would disincentivise people seems ridiculous to me. We incentivise good behaviour in water and energy use because people pay for it, but yet in other things we don’t really bother because ‘it’s too hard and people wouldn’t understand’. But if I asked someone with a large family, ‘Did you realise that you could save a couple of hundred quid a year by recycling more, buying less, using reusable bottles or a fizzy drinks maker rather than buying big bottles every time?’ that would be worth it, wouldn’t it?”

She continues: “People say that if we did do any kind of proportionate charging we’d get an increase in fly-tipping. Well, we already have an issue with fly-tipping. What would happen though is if we started to make people pay and be more responsible for it, we might have more money to spend on getting the fly-tippers. We need to have people to have a better understanding of what the sector does and what it achieves and therefore value it as a sector.”

Away from the domestic concerns of 5p charges and fly-tipping, Bates is involved in areas including waste and human health, sustainable procurement, resource efficiency for businesses, and developing the policy and infrastructure for electronic waste in Africa. She has advised two African governments (Kenya and Nigeria) on policy relating to wastes management and delivered training on developing policy and regulation for several more (through the United Nations University). Her work abroad has enabled her to see a bigger picture: “I find it odd that we focus very much on treatment and disposal, and think of ourselves as the developed nation in waste management terms, whereas

if you look at other countries where their waste management is nowhere near as good, they have the top of the hierarchy – the repair and reuse – really well sorted, which leads to incredible social, environmental and economic gains... A lot of developing countries, when they do something that’s good they shout about it, whereas we tend to go, ‘Oh well that worked, that’s good then.’”

She remarks, too, that overseas a career in waste and resource management is deemed worthy, something that perhaps we haven’t promoted as well in this country. “There’s a story about JFK going to NASA and asking one of the janitors, ‘What’s your job?’ And the janitor said, ‘My job is to put a man on the moon.’ It means that everyone, whether you be the guy at the collection point, the person manning the helpdesk for the council or someone who is working for a reuse charity, what you’re doing is to make people’s lives better, to use stuff better and make the environment better, and that’s pretty cool.”

Accordingly, Bates is keen on to ensure we are all taking the same language. “When people in the sector talk about food waste, we know exactly what we mean, and then you talk to people who you think know exactly what we mean and it turns out they don’t. I asked someone the other day if they used food waste and they said they don’t generate any. I said, ‘Don’t be ridiculous of course you do – you have coffee, you have tea, you boil eggs, you peel carrots...’ ‘But

“We’re all making people’s lives better, helping to use stuff better and make the environment better – that’s pretty cool”

that’s not food waste’, they said. ‘Scraps left on the plate are.’ And this is someone who is very intelligent who just has a perception of what it is, so no matter how well we’ve done we’ve still got loads to do.”

This is especially true when reaching out to other countries. Bates recounts an encounter in Uganda, where she witnessed people burning medical waste in open pits, because although the government told them not to burn plastic, they hadn’t explained why. Once Bates and her team explained it, they stopped. Likewise, while in the Ivory Coast, she took a photo of a woman with her baby strapped to her back, going through rubbish trying to pick out recyclables to sell: “If you step back a bit you see that the site is



covered in smoke, it’s constantly on fire, so we know that the life expectancy of those people is going to be dramatically reduced, that the chances of her baby having long-term issues are great, but that’s why people in our industry do what we do. I showed that picture to my students and talked about what we were doing. If our industry wasn’t so good in this country and we didn’t have the regulatory environment we have, we could be in that situation. Luckily we have initiatives,

manufacturing even though it’s providing the raw materials, then the circular economy is never going to happen. It’s encouraging that the National Infrastructure Commission has got waste as one of their priority sectors. It’s encouraging that the Government Office, the Chief Government Scientist at GO-Science are doing a report on waste and resource management – it’s all encouraging, but let’s see what the impact is.”

What she would like to see is an acknowledgement that there’s an issue with investment in the sector and for government to state that it is going to keep landfill tax for at least the next X years, that the EU’s landfill diversion targets will also be kept so those looking for investment in infrastructure can guarantee that the policy framework will not dramatically change. “We can’t put development of infrastructure, innovation, et cetera on hold until we’ve sorted out all the intricacies of Brexit. We need some stability now because waste is always changing, and if we add an extra change to that, then change upon change is chaos. I would like to see it where we have ministers who we keep, who get appointed to positions because they are genuinely interested in them.”

We’ve bounced from topic to topic (“You know I can’t stick to one point”) but one thing is clear, CIWM has a dedicated, resourceful and opinionated new president who’s not afraid to try new things, or rather, is petrified, but loves it (how she describes jumping out of a plane this summer) and we can’t wait to see what she does next. 🌱

A sideways view by Ray Georgeson



Ray Georgeson

Full English Brexit?

It was probably the only moment of real levity at the end of what was a depressing and shattering summer for those of us that campaigned hard for a Remain vote in the EU referendum. Yes, it was the moment when the leader of the Welsh Conservatives misread his autocue during his party conference speech and said “Brexit means breakfast”, instead of the even more vacuous mantra of the new Prime Minister, namely “Brexit means Brexit.” Add to that the shifting political sands of what might constitute a ‘hard Brexit’, a ‘soft Brexit’ and even a ‘full Brexit’, as coined by the defence secretary, and one begins to wonder if any of these apparently very clever people in the highest offices of state have any idea at all what they are talking about.

I joke about it, but it is with the hollowest of hollow laughs, as there isn’t really any humour in this sorry situation at all. As the value of the pound falls even faster than some English local authorities’ recycling rates and the hardening messages from many major businesses about the impact of leaving the single market appear to go unheeded, the government appears hell-bent on denying the economic uncertainties and likely negative impact on jobs and growth that any shape of Brexit will bring. It’s equally hard to give credibility to the senior Brexiteers’ optimism that there are world markets just waiting to be captured by British firms, when the self-same people spent the entire campaign promising money to the NHS that disappeared

into mythology just as fast as the pound fell. Germany exports four times as much to the rest of the non-EU world as the UK does, and does this perfectly efficiently from within the EU. Facts are lost in the enveloping fog of little-Englandism, xenophobia and British Bulldog baloney that has been allowed far too much legitimisation in the post-referendum chaos.

And what of our own corner of the policy world? It’s no surprise that, yet again, environmental concerns do not feature heavily in any of the discourse. However, there are real concerns and no real answers. Defra tell us it remains engaged with the negotiations on the Circular Economy Package as long as we are members, yet its negotiating positions haven’t been very positive anyway, and I’m quite sure we are getting at best a polite hearing and at worst the cold shoulder. Europe can’t even agree anyway on a unified methodology for actually calculating recycling, so the argument over percentage-based targets is frankly absurd. But to change it and shape it well, we need to be in it, and a scenario in which we have all the legislation but none of the say (such as EEA membership) seems even dafter than ‘full Brexit’ (whatever that means!).

Some are valiantly suggesting there will be opportunities post-Brexit to shape a new British approach to environmental and waste policies. I try hard to buy this argument, but find it a challenge. Most environmental progress in recent decades has come on the back of EU legislation, much

of which was opposed by UK industry and government in one form or another – the Landfill Directive being a classic example. Are we really going to rip up the *acquis communautaire* and indulge in green one-upmanship with our EU neighbours? I doubt it, but would be very pleased to be proved wrong. There are areas where we could indeed make real progress without an EU to drive policy, such as reuse and repair, but the deregulatory character of the current government would need to cut some slack to the arguments in favour of smart regulation for good environmental, social and economic benefits for this to gain traction. I hope that the case for reuse can be made and heard – it would be a glimmer of hope in what may be thin pickings for our industry in other areas.

We also need to make the case again for the role of modern manufacturing, reprocessing and utilising the secondary resources to add economic value, regardless of whatever Brexit scenario we end up with – hard, soft, or full English Brexit (especially if our Scottish friends finally decide they’ve had enough of us and end up choosing the EU ahead of the UK). This time, we need to re-contextualise as part of the government’s intent to develop a new ‘industrial strategy’. This may well present an opportunity and we must try to grasp it.

So, we soldier on through the fog and uncertainty. Whatever happens, I’ll never look at a full English breakfast in the same way again. I feel a new enthusiasm for croissants coming on... ☺

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