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Waste shipments Making good use of the internal market **Circular economy** Redesigning the supply chain **Plastics recycling** No need to raise the bar again **Waste textiles** Decoupling growth and waste **Nonferrous metals** Waking the sleeping giant **Circular economy** Is circularity always sustainable? **Battery recycling** Making batteries separate again **Plastics recycling** Takeout food without remorse

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The wrong signal

So far, the European Commission has given the impression that it is really interested in a sustainable, circular future for Europe. However, since December 31 there can be some doubt about that. Just short of midnight, the Commission suggested that atomic energy and gas should be part of the taxonomy and therefore considered as "green investments". I have to concede that you need a great deal of fantasy to come up with something like this. Well, of course it is easier to assume that the Commission was pressured into the decision. But let's be honest: in terms of sustainability it was a very short-sighted one. Not only will it lead to power plants continuing to pollute the environment for decades to come, it also shows that the Commission is not really up for the fight and caves in when the right person demands it. Including atomic energy and gas in the taxonomy is simply the wrong signal – and who knows if it will be the last? Furthermore, it will be difficult to take the Commission seriously next time they talk about sustainability and the Green Deal.

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Atlas of Plastic Waste launched

The Basel Action Network has joined forces with academics at Columbia and Yale Universities to create the Atlas of Plastic Waste, mapping thousands of plastic waste dumps scattered around the world.

The project aims to harness human discoveries, along with inputs from satellite and computer technology, to identify and map sites in every country where plastic waste ends up in the terrestrial environment. The goal is to provide an evolving database that will raise awareness with environmental officials and the general public on the unsustainable characteristics of plastic and how it has become an unwanted geographic feature of our collective landscape and Earth's biosphere.

In addition to thousands of formal landfills that are chock-full of plastic waste, there are even more unmapped informal dumps.

"The plastic dumps are often adjacent to recycling facilities, scattered between urban residential areas, along beaches and rivers, in canyons and ravines, on the edges of farmland everywhere on Earth," said BAN's Executive Director Jim Puckett. "It's not a pretty picture, but one that we all must comprehend and apprehend. Our Atlas aims to make our romance with plastic and its consequences tangible and real."

BAN, as a core member of the Break Free From Plastics Movement, will be asking anyone across the globe to register any local dumps they are aware of, including both official and unofficial landfills containing plastic waste on an interactive online portal. With these locations recorded, the project will then use satellite data to view these dumps and create a machine learning algorithm that can find more sites independently/automatically using computer technology and artificial intelligence.

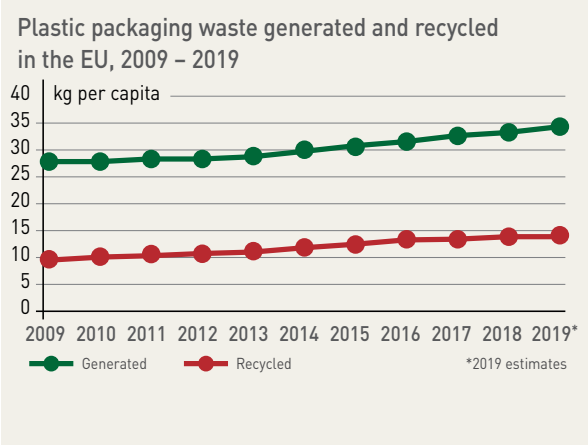
Aluminium beverage can recycling remains at 76 per cent in 2019

A new report by Metal Packaging Europe and European Aluminium shows that the overall recycling rate for aluminium beverage cans in the European Union, Switzerland, Norway and Iceland remained stable at 76% (75.8%) in 2019. With growing can consumption, the total amount of aluminium recycled from cans reached a record level of 488,000 tonnes and represents a total Greenhouse Gas (GHG) emissions saving of 4 million tonnes of CO_2 (equivalent to the amount of GHG emissions produced by a European town of 440,000 inhabitants like Bratislava, Tallinn or Murcia).

Can manufacturers (members of Metal Packaging Europe) and their aluminium suppliers (members of European Aluminium) welcomed the new result but say that with some extra effort, the recycling rates could go even higher. In March 2021, the two industry associations launched their joint roadmap towards 100% can recycling by the year 2030. This target can only be reached if existing packaging collection systems in Europe are further improved or replaced by deposit return systems for beverage cans and other beverage containers.

EU recycled 41 per cent of plastic packaging waste in 2019

In 2019, each person living in the EU generated 34.4 kg of plastic packaging waste, of which 14.1 kg was recycled. This information comes from data on packaging waste published by Eurostat recently. Between 2009 and 2019, the volume of plastic packaging waste generated per inhabitant increased by 24% (+6.7 kg). The recycling volume of plastic packaging waste increased sharply over the same period, by 50% (+4.7 kg). Despite this improvement, the amount of plastic packaging that wasn't recycled has increased by 2.0 kg per inhabitant since 2009 due to the greater increase in the absolute amount of plastic packaging waste generated.



In 2019, an estimated 41% of plastic packaging waste was recycled in the EU. Nine EU Member States recycled more than half of the plastic packaging waste generated: Lithuania (70%), Czechia (61%), Bulgaria (59%, 2018 data), the Netherlands (57%), Sweden and Slovakia (both 53%), Spain (52%), Cyprus (51%) and Slovenia (50%).

In contrast, less than one third of plastic packaging waste was recycled in Malta (11%, 2018 data), France (27%), Ireland (28%), Austria (31%), Poland (32%) and Hungary (33%).

Source: ZenRobotics

First autonomous sorting plant for C&D and C&I waste

Danish environmental services company Solum A/S will open one of Scandinavia's most modern and advanced sorting plants based on AI and robotic technologies developed by ZenRobotics.

The new plant, designed around ZenRobotics' technology and distributed by ReTec Miljø, is expected to be operational in the summer of 2022. The new, fully autonomous robotic sorting station will sort up to 25,000 tonnes of mixed waste per year. Smart robots will sort materials such as combustible waste, bulky waste, metal, wood and plastic received from municipalities, industry and business.

The automated robots are powered by advanced AI and sensor technologies, which make it possible to continuously fine-tune the fractions and separate different types of waste, thus improving recycling rates and supporting the circular economy principle. Solum's new robotic waste sorting plant consists of multiple robot arms that lift objects of up to 30 kg and together handle up to 4,000 picks per hour, even 24/7. By comparison, a human can handle approximately 700 picks per hour and cannot work 24 hours a day without breaks. The sorting plant eliminates the occupational health risks associated with manual sorting, increases the degree of purity by up to 98% and reduces the associated costs.

Solum's new facility is a fully autonomous standalone robotic sorting station that is independent from other operations and replaces manual processes in waste sorting. Before robots come into play, the material first goes through a simple screening step where fines and foils are sorted out. The material is then loaded into a feeding bunker where the material flows evenly and autonomously to the robots through a loader. The AI-powered sorting robots work independently and empty the feeding bunker during the day and again during the night when employees at the site go home. In the morning, the employees arrive and fill the feeding bunker, and the process starts all over again.

Large-scale recycling plant with 40,000-tonne capacity

As the demand for recycled plastics grows, so does the size of the machines. This applies to the processing of polyolefins as well as to PET recycling.

With its unique dimensions and production capacity, this new size of plant features a screw diameter of 280 mm, implemented for the first time in a Vacurema Basic 2628 T large-scale project for producing rPET pellets. Erema has just shipped the plant to a customer in Brazil.

Up to 40,000 tonnes per year of rPET meeting the highest quality standards can now be produced. "For this purpose, we installed a screw with a length of ten metres, a diameter of 280 millimetres and a weight of 3.5 tonnes, which is the largest ever used in one of our recycling machines," explains Managing Director Michael Heitzinger. The screw was manufactured by 3S, a subsidiary of Erema GmbH. No less impressive is the reactor of this recycling system, which, with a height of around 10 metres, is also unique and almost reaches the roof of the new production hall. 500 tonnes of input material were recycled during the test phase, which was subject to strict quality control. "The entire project was a great team effort," Heitzinger said, thanking everyone involved.

Just four years ago, the largest extrusion line supplied by Erema was designed for a throughput of 15,000 tonnes per year. Customers ordered this size of plant once or twice a year. In the meantime, machines like this leave the production site in Ansfelden every month. As early as 2020, Erema proved to be a pioneer and reliable partner for implementing unique large-scale projects. That was when the food and beverage packaging manufacturer Envases Universales Mexico commissioned two Vacurema Basic 2625 T machines, each with a screw diameter of 250 mm and a capacity of 30,000 tonnes per year.

Source: Erema

New material handlers from Sany

Source: Sany

According to the manufacturer, the compact material handlers SMHW48G5 and SMHC48G5 have the most powerful engines in their class. These mobile handling machines feel at home wherever there is a great deal to be moved. With respective attachment devices, they are impressive at the port, timber yard, recycling centre or scrapyard thanks to their excellent capacity and fast, safe work. In addition to the standard boom at 17 m in length, boom lengths of 11.5 to 20.0 m are available, thereby ensuring the machinery adapts optimally to the tasks at hand.

Alongside the version with an undercarriage on wheels, Sany is also offering the machine with a crawler undercarriage. Pylons at different heights can also be selected. There are currently two models at 40/48 t available in Europe; the global portfolio of the machinery ranges from 30 to 70 t.

At 252 kW engine power, Sany claims to offer the most powerful engines in this class. It can maintain the required speed even at peak loads thanks to its performance reserves. What's more, the hydraulic pumps always provide exactly the performance required at the time – the best conditions for exemplary cost-effectiveness at high load capacities and material handling of up to 520 t per hour.

New presidents for BIR Paper and Ferrous divisions

The board of the BIR Paper division has appointed Mr Francisco Donoso as new divisional president. Mr Donoso is Managing Director at ALBA Servicios Verdes (Spain) and has been a member of the Paper divisional board since 2008. He is also Vice-President of the Spanish BIR member association REPACAR and board member of the 'Union de Empresas de Recuperacion'. He holds a degree in biological sciences and a Master in Business Administration.

New president of the Ferrous division is Mr Denis Reuter. He is COO at TSR Recycling GmbH & Co. KG (Germany) and has been a member of the Ferrous divisional board since 2019. He joined TSR in 2010 and is currently responsible for all the trading activities in both ferrous and nonferrous metals of the entire Group.

Source: BIR

Francisco Donoso

EU's circular material use rate increased in 2020

In 2020, the EU's circular material use rate (referred to as the circularity rate) reached 12.8%.

This means that almost 13% of material resources used in the EU originated from recycled waste materials. This information comes from data on circular material use rates published by Eurostat today. The article presents a handful of findings from the more detailed Statistics Explained article on circular economy – material flows,

Compared with 2019, the circularity rate increased by 0.8 percentage points (pp). The rate has maintained a stable growth trend since 2004 (8.3%), the first year for which data are available.

The circularity rate is the share of material resources used that came from recycled waste materials, thus saving extractions of primary raw materials. The circularity rate is part of the EU monitoring framework on the circular economy.

In 2020, the circularity rate was highest in the Netherlands (31%), followed by Belgium (23%) and France (22%). The lowest rate was recorded in Romania (1%), followed by Ireland and Portugal (both 2%). Differences in the circularity rate among the Member States are based not only on the amount of material recycled in each country, but also on structural factors in national economies.

Depending on the main type of material, the circularity rate also presents some considerable differences, but small increases were registered in all 4 categories. In 2020, the circularity rate for metals was 25% (+0.7 pp compared with 2019), for non-metallic minerals (including glass) 16% (+0.7 pp), biomass (including paper, wood, tissue, etc.) 10% (+0.2 pp) and fossil fuels 3% (+0.5 pp).

Poland introduces registration system for waste shipments

From 1 February 2022, all waste shipments to and in transit through Poland must be registered in the so-called SENT module. The regulation is being implemented by Polish authorities in order to better control waste shipments and reduce environmental crime in the country.

The SENT system in Poland (Electronic Transport Supervision System) was originally introduced in 2017 to register the transport of goods such as chemicals, fuels and tobacco, and is primarily a tool to increase tax revenues and reduce crime. From 1 February this year, the system will also be made mandatory for the transport of waste, both to and in transit through Poland. This includes all waste covered by the Waste Shipment Regulation, EU 1013/2006.

All industry players involved in the transaction of waste to or in transit through Poland will have to comply with the new regulations, explains Wojciech Oset, Account and TFS Manager at Geminor Poland.

– Companies dealing with cross-border waste shipments will be required to register each shipment of waste via the electronic PUESC platform of the Polish Ministry of Finance, which will be implemented through the SENT module offered within the PentaTAX platform.

– When it comes to importing waste to Poland, the entity responsible for registering the shipment is the consignee. However, in the case of transit through Poland, the registration is to be made by the transporter. In addition to registering the waste shipment, the transporter is required to provide geolocation data and the driver will have a reference number and active locator, says Oset.

According to the Polish authorities, the purpose of the SENT initiative is to tighten the waste management market and to prevent illegal waste shipments. The Polish Ministry of Climate believes that the new solution will also have a positive impact on the competitiveness of the waste management market, bringing common rules to the industry.

Any breach of the SENT registration of waste shipments will also be penalised with significant fines: If a shipment is not reported correctly in SENT, a fine will be levied, calculated at 46 per cent of the gross value of the transported goods, and never less than 4,350 euros. If a report is not updated by the carrier prior to transport, it may involve a fine of at least 2,200 euros.

– The Polish authorities want more control over shipments and are sending a signal that they are taking the fight on environmental crime seriously. This is yet another regulation that, in addition to the coming upgrade of the Waste Shipment Regulation (WSR), will reduce cross-border waste crime, but also increase the complexity of waste management in Europe, concludes Wojciech Oset, Account and TFS Manager at Geminor Poland.

Source: Geminor

Metso Outotec sells recycling business

Metso Outotec has successfully completed the divestment of its waste recycling business to Ahlström Capital. The business will continue its operations under the name M&J Recycling and its headquarters are in Horsens, Denmark.

Metso Outotec has also signed an agreement to divest its metal recycling line of business to an affiliate of Mimir, an investment company based in Stockholm, Sweden.

The transaction is expected to be closed during the first half of 2022. The parties have decided not to disclose the value of the transaction. The divestment will not have a material impact on Metso Outotec's financial results.

In October 2020, Metso Outotec announced its intention to divest its recycling businesses, which have since been reported as part of discontinued operations in Metso Outotec's financial statements.

The metal recycling business sold to Mimir includes the brands Lindemann and Texas Shredder. The business will change name in conjunction with the divestment and operate globally under the Lindemann brand, with headquarters in Düsseldorf, Germany. Its current payroll of approximately 160 employees will transfer to the new company in connection with the transaction. The net sales of the business totalled 77 million euros in 2020.

No need to raise the bar again

POP BFRs have been a topic of discussion for quite a while. Lowering the thresholds could make the recycling of certain waste streams quite difficult, especially waste plastics from WEEE. EERA, the European Electronic Recyclers Association, has summarised the arguments against further lowering the thresholds in its position paper „Why a further lowering of LPC and UTC threshold values for POP BFRs risks having adverse results for the environment".

By Michael Brunn

As EERA points out, the policy objectives of a circular economy and a non-toxic world can only be achieved by finding an intelligent balance. The discussion regarding POP BFRs has been running for more than 15 years. However, POP BFRs are already governed by a variety of regulations. „The fact is that those POP BFRs have been regulated and restricted for more than a decade and that therefore these substances are fading out, even without moving the goal posts," EERA says.

WEEE plastics account for a significant volume of highly valuable plastics. The EEE industry has pledged to take up large volumes of properly recycled plastics to reduce WEEE. Therefore, more WEEE plastics need to be recycled and greater capacity is required. EERA names three reasons for insufficient capacities:

- A lot of WEEE plastics leave the EU undocumented
- The legislative landscape for recycling WEEE plastics is complex
- The never-ending discussion about POP thresholds

The circular economy also needs more types of WEEE plastics recycled from the complex overall mix. „This is only possible through innovation, which is linked to new technologies to separate and meet the legal thresholds of POP BFRs in recycled articles," EERA states. Lower thresholds will only lead to less innovation. „A major problem with any reduction of the POP BFR threshold is related to the issue of the practical implications of the screening methods." Screening waste is considered a very complex matter. Although it is easier with recycled plastics, it limits the values that can be measured. EERA sees it as likely that WEEE plastics will be driven into undocumented channels if another threshold reduction is put in place. EERA therefore recommends keeping the thresholds at the levels decided upon two years ago.

Approximately 2.6 million tonnes of WEEE plastics are generated every year, but only slightly more than half of this amount is delivered to specialised WEEE recycling facilities. WEEE plastics are a complex mixture of technical plastics, but until recently only ABS, PS and PP were recycled. Since 2018, PC-ABS has also been recycled and, as EERA points out, more types can be expected to be added. Mechanical recycling is considered the best possible route in terms of environmentally sound management. According to EERA, some 98 per cent of plastics containing POP BFR that are officially collected are separated and disposed of via official WEEE channels.

Until a few years ago, most WEEE plastics were exported to China at low logistical cost. However, since the ban in that country, the material has been shipped to other countries, mainly in the Far East. According to EERA, this fact, in combination with the current complex waste legislation, explains why Europe has insufficient recycling capacities. „Recycling capacities in the EU need to be increased and investments can only be stimulated by legal certainty and the possibility to import the mixed plastics from other EU countries," the organisation states.

The most frequently used separation technique is by density. This works best for PP, ABS and PS. However, as WEEE plastics have overlapping densities, further separation technologies are required. The BFR-rich fraction still includes valuable polymers. In order to recycle greater volumes of this material, more research needs to be conducted. As EERA states, these solutions will likely consist of high-tech, sensor-based techniques.

So far, only a small proportion of WEEE plastics are being used to manufacture new products, but demand is growing quickly. According to EERA, the low percentage of closed-loop plastics can be explained by OEM manufacturers using even lower thresholds than those set by law. „Lowering legal thresholds further will thus likely even raise the requirements set by the EEE industry, thus reducing the uptake of PCR content from WEEE in new products."

In terms of a circular economy, it is important that other polymers are recovered from WEEE as well. As EERA states, its members are working on new separation and dissolution technologies. Dissolution would also enable the recovery of bromine and antimony. The current thresholds can be met, EERA says, but lowering them would cause problems.

Making batteries separate again

In their report "Removable, replaceable and repairable batteries – How to improve the circularity of rechargeable batteries in consumer electronics and light electric vehicles", the European Environmental Bureau and Right to repair explain the pitfalls of battery recycling.

By Michael Brunn

Rechargeable lithium-ion batteries are embedded in most consumer and personal electronic equipment in Europe. Since 2010, most manufacturers have chosen to use adhesives and solders to integrate the batteries. "As a result, repairing, reusing, repurposing and recycling LIBs and the devices they power has become increasingly difficult and sometimes simply impossible," the report states. This results in disposed devices, low battery collection rates and increased safety incidents in the waste management chain. "Prematurely ending the life of LIBs and electronic devices has significant environmental, economic and social implications."

As the report further points out, LIBs account for 62 per cent of all rechargeable batteries put on the European market. Of all the LIBs, 55 per cent are used in laptops and tablets, 16 per cent in mobile phones and 16 per cent in power tools. The global market for LIBs is expected to grow significantly. Most end-of-life batteries come from consumer electronics. These manufacturers have been using LIBs since the 90s. In other applications, LIBs did not come into use in larger numbers before 2010 and those products usually also have longer lifetimes.

The report names three barriers to repairing batteries. First is an inaccessible design due to welded or glued battery casings. Second are software blocks, which is the biggest barrier for batteries in e-bikes and smartphones that can be disassembled. They need software resets that cannot be done by independent repairers. And finally there is a shortage of spare parts. Many manufacturers change the design of their battery packs every two to three years, which makes it difficult to get spare parts afterwards. On the other hand, battery cells are in short supply. All these barriers are also relevant for the replacement of batteries.

Battery failure is one of the most common problems in consumer electronics and often the first component to fail in light electric vehicles (LEVs). Access to information and good quality replacement batteries depend on the manufacturers. The prices for a replacement in consumer electronics range between 25 and 100 euros. For e-scooters and e-bikes, the price is above 100 euros.

Another problem is that the batteries cannot be used for a second life. Most batteries have a state of health between 60 and 80 per cent when discarded. The remaining capacity might not be enough for the product it is intended to power, but could be repurposed for other products.

"Non-removable, or challenging-to-remove batteries, decrease the rate of battery collection and increase the risk of safety incidents at waste facilities," the report states. Most batteries have to be removed manually at the waste management facilities. Due to their varying shapes and sizes and a lack of proper automation of the sorting process, this proves to be a very difficult task. "Recyclers report that battery removal has become increasingly complicated, as battery sizes are decreasing and there is a trend towards soft pouch cells, gluing batteries into the device." Therefore, the recyclers mostly remove the "low-hanging fruits", which are mainly the large batteries.

The report points out that the collection rate for LIBs is significantly lower that for any other battery type across all EU member states. "Another consequence of the increased difficulty of remaining batteries is that the number of fires in the WEEE management chain is growing." The streams most affected are mixed WEEE and small household appliances. Therefore, the EEB and Right to Repair suggest some additions to the upcoming legislation to make sure that batteries can easily be repaired or replaced in the future.

Source: Joshua Woroniecki; pixabay.com

Making good use of the internal market

With the new waste shipment regulation, the EU wants to reduce exports of waste drastically. However, in its briefing "Linking cross-border shipments of waste in the EU with the circular economy", the European Environmental Agency (EEA) emphasises the relevance of waste shipments within the EU to support the circular economy concept.

By Michael Brunn

Retaining the high value of material that becomes waste is an essential condition for establishing a circular economy. "This will reduce the demand for extracting natural resources, which is associated with significant environmental and climate impacts globally," the EEA says. High-quality recycling has the potential to reduce these impacts substantially. "Shipments of non-hazardous waste for recycling purposes could be key to achieving this, especially for improving the secondary raw material markets, which in turn play a key role in meeting the EU's raw material demands through secondary material sources."

Shipments of waste within the EU can lead to building at scale. This reduces both the cost of waste treatment and the price of secondary materials. There is an opportunity to develop good quality, technologically advanced recycling facilities and economically competitive business models. The right incentives for increasing cross-border shipments would increase security of supply for recyclers. At the same time, it would increase the producers' confidence in having a steady stream of secondary material resources available. The strategy could also improve cost competitiveness compared with primary material. "This in turn could lead to the higher uptake of secondary raw materials in production processes."

More than 90 per cent of waste generated in the EU is treated in the country of origin. "This is in line with the proximity principle underpinning EU laws, which calls for waste to be treated as closely as possible to the point of generation to avoid the environmental impacts of transporting waste and to avoid exporting the impacts of waste management operations." However, according to the EEA, the main barrier to cross-border shipments is not the administrative workload, but waiting times and the cost of shipment. This decreases profit margins and slows down the movement of resources.

However, the EEA states that the volume and value of waste shipped within the EU is significant. The amount grew to approximately 6 per cent in 2018. "The trends indicate that the secondary material markets for recyclable waste are growing in the EU." In 2018, 49.2 million tonnes of waste were exported within the EU. In 2019, the value totalled 12.2 billion euros with 69 per cent of the value coming from metals. The EEA points out that there are differences between member states in terms of exports. Countries that export less may have sufficient capacity for all their waste streams. Smaller countries usually export more. "In terms of receiving waste, steady and large imports of specific types of recyclable waste indicate that a country is cost-competitive for treating those types of waste."

The biggest exporters of plastics within the EU are France, Germany and Sweden. Most exports go to the Netherlands, the Czech Republic and Romania. Most glass exports come from Belgium, Hungary, Greece, the Netherlands, Romania, Sweden and Slovenia and go to the Czech Republic, Germany and Poland. Austria, Belgium, Germany, Finland, France, Poland and Sweden are the biggest exporters of textile waste with Bulgaria, Spain, Hungary, Italy, the Netherlands, Poland and Romania being the biggest receivers. Paper and cardboard mostly goes from the Czech Republic, Denmark, France and Poland to Austria, Germany, Spain, Hungary and the Netherlands. When it comes to incineration, Germany and Sweden are net importers, but the volumes imported are small.

Germany, France and the Netherlands are the main exporters of ferrous metals, while Italy, Belgium, Spain and Luxembourg are on the receiving side. "Imports into Italy are relatively high due to the widespread use of electric arc furnaces in iron and steel production in Italy, and these can use a much higher proportion of waste material than blast furnaces (which are more common in German steel-making plants)." Germany has the largest volumes of import and export of steel. According to the EEA, this reflects Germany's role as the largest steelmaker in the EU. However, the shipments are under 10 per cent of the country's total steel production.

Looking at nonferrous metals, a significant volume comes out of Germany and also goes into Germany. Other major exporters are France and the Netherlands, while Austria, Spain and Italy are seeing increasing volumes of imports. However, the EEA points out that countries with large ports may ship a lot of the imported material outside of the EU, especially the Netherlands. "In general, the functioning of a country's waste management system is a critical determinant of the value of waste shipments," the EEA concludes.

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Not all recycled plastic is equal

The rising cost of recycled plastics has been making headline news of late, the impact of which could mean that virgin plastics will become cheaper than recycled plastics, even after the imminent UK Plastic Packaging Tax has come into force.

By Professor Edward Kosior of Nextek and NEXTLOOPP

The tax is due to be imposed in the UK from April at a rate of £200 per tonne on plastic goods that fail to have at least 30 per cent recycled content, but there are serious concerns that it will not be a sufficient incentive to reduce our dependence on virgin plastic.

This begs the question, shouldn't the real issue go beyond economic gains? Shouldn't we be focusing instead on defining which solutions will cut our greenhouse gas emissions and the annual flows of waste plastic into the oceans?

Whether this jolts our consciences or not, it is worth noting that if we are to make impactful decisions that turn the tide on climate change, we need to base all our business decisions on their global CO_2 impact.

As such, when it comes to plastic recycling, this means addressing the fact that not all recycled plastics have the same carbon footprint.

A recent Life Cycle Assessment conducted by Plastics Europe compared the carbon footprint of a range of different recycled plastics. The LCA found that recycled HDPE, which is used in a wide range of applications from milk and shampoo packaging to bleach bottles, and the recycled polypropylene (PP) used in most pots, tubs and trays that contain food, have a 25 per cent smaller carbon footprint than recycled PET.

The assessment went on to show that 30 per cent recycled content PP or HDPE plastic has the same carbon footprint as 73 per cent recycled content PET.

PP accounts for around 20 per cent of the world's plastic, yet unlike PET, which has been an unparalleled plastics recycling success story, PP is missing from the recycling stream in most countries around the world.

The UK uses 700,000 tonnes of PP per annum, which, at best, gets downcycled into lower-value products or goes to landfill – and there certainly is no recycled food-grade PP. In the US it is estimated that 827,000 tonnes of PP per annum are generated by single-family households. Yet, despite this fact, the lack of infrastructure to collect and recycle means that PP is on the verge of being removed from use in the US.

This recent LCA highlights a glaring fact – the non-recovery of PP is a significant missed opportunity from a business, economical, and above all environmental perspective. It points to the fact that recycled PET, whilst undoubtedly valuable, is not as environmentally beneficial as recycled PP or HDPE.

Today's decisions need to be founded on the impacts they are likely to have on our greenhouse gas emissions (GHG). As such, if recycled PP and HDPE plastics have a vastly reduced carbon footprint compared with recycled PET, it makes sense to boost the recycling of these polymers.

If we drill down further to the 210,000 tonnes of food-grade PP packaging used in pots, tubs, trays and films each year in the UK alone, we can see an emerging pattern of untapped resources. An equivalent volume of recycled resin, containing 30 per cent recyclate, would save 63,000 tonnes of virgin plastics being produced and the equivalent volume of PP food-grade packaging being reused to its highest purpose, rather than going to waste-to-energy, landfill or into lesser polymers.

Global waste currently generates more than 1.3 billion tonnes of CO_2e. Over half of the CO_2e savings will come from higher recycling rates and by increasing the recycled content of all material in the recycling stream.

It has been estimated that by significantly improving waste collection, sorting and recycling we can reduce GHG emissions by between 2.1 and 2.8 billion tonnes of CO_2 per year compared to 'business as usual'.

Surely this fact highlights the urgency to aim for increased recycling above financial gain. We need to ensure that everything we put into production is designed to be either recycled or reused and this means taking into account which plastics have the smallest carbon footprint and enhancing their collection and recycling potential.

It also requires upping our collection efforts. Materials need to be collected separately for recycling. In many countries this does not happen efficiently and in some countries it is totally absent. The situation needs to change by developing the collection infrastructure, educating communities and incentivising diversion from waste destinations. Investment in recycling business infrastructure needs to be on the same scale as the petrochemical industry if we are to have an impact on recovering these materials.

We certainly can no longer afford to be complacent about the actions we take to drastically reduce our CO_2 emissions and, as such, we need to keep reminding ourselves why there is the likes of a Plastic Packaging Tax in the first place.

Source: Adam Novak; pixabay.com

A lot of promising potential

Although no one denies the relevance of waste management, it is seldom considered as a main contributor to cutting carbon emissions. The study "CO_2 reduction potential in European waste management" conducted by CE Delft and Prognos on behalf of FEAD, ESWET, the Dutch Waste Management Association and RDF Industry wants to change that with some impressive figures.

By Michael Brunn

The study analyses the net carbon savings that have already been achieved by the waste management industry. It also identifies hitherto untapped potential for avoiding carbon emissions by implementing the recent EU waste legislation.

The authors have developed three different scenarios: Baseline 2018 describes the status quo with carbon emissions saved from current waste processing in the EU 27 and the UK in 2018. Projection 1 includes the implementation of the current waste legislation. It calculates the carbon emissions generated by waste processing in the EU, given the successful implementation of the existing waste regulation and the recycling targets set by the EU 27 and the UK, which are extended to cover commercial and industrial waste. Projection 2 includes further potential to cut carbon emissions from waste processing with the impact of a more ambitious carbon emissions legislation that envisages more recycling and less landfilling.

In the EU, 402 million tonnes of waste were generated in 2018, which amounts to 784 kilograms per inhabitant. 50 per cent of this waste was recycled and 28 per cent was treated thermally, including energy recovery. The study estimates a total material recycling rate of 73 per cent by 2035 in the more ambitious Projection 2, due to the decreasing volume of waste landfilled. Approximately 104 Mt will be treated thermally. The carbon emissions savings are calculated at 96 Mt CO_2eq. In Projection 1 they are estimated at -235 Mt CO_2eq in 2035 and -267 Mt CO_2eq in Projection 2. According to the study, there is an additional potential of 6 Mt CO_2eq by treating currently unknown plastics and textile wastes.

According to the study, paper and cardboard (76 Mt), biowaste (37 Mt) and plastics (1 Mt have a net carbon footprint in the baseline scenario. Ferrous metals (121 Mt, aluminium (59 Mt and wood (23 Mt have net carbon savings in this scenario. As the primary driver of carbon reduction, the study names the reduction of organic fractions allocated to landfill. Additional major reductions come from decreased volumes and improvements in carbon factors relating to co-incineration.

In 2018, the volume of residual waste and waste-derived fuels totalled 237 Mt or 462 kilograms per capita. 52 per cent of this amount was thermally treated, the rest was landfilled. In Projection 2, fractions suitable for thermal treatment are no longer allocated to landfill. The net carbon footprint in the baseline is 182 Mt CO_2eq, which is reduced to 120 Mt in Projection 1 and to -52 Mt in Projection 2. As mentioned above, the main driver is the reduced allocation to landfill. Moreover, less residual waste will be available, as more waste is sorted for recycling.

Paper and cardboard have the largest carbon footprint of any selected waste streams with 76 Mt CO_2eq. The study estimates an increase in the recycling rate from 57 to 82 per cent. At the same time, a decrease in landfilling from 24 per cent to 8 per cent in Projection 1 and less than 1 per cent in Projection 2 is estimated. In terms of energy recovery, a decrease from 15 to 10 Mt is expected in Projection 1, compared to an increase to 14.5 Mt in Projection 2 due to re-allocation from landfill. The carbon footprint is expected to drop to 18 Mt and -4 Mt respectively. According to the study, these are the largest potentially additional net carbon savings of all the selected waste streams. Obviously, the primary driver is again the reduced allocation to landfill.

Glass already has the third-highest recycling rate of all selected waste streams in the baseline scenario. The study expects an increase in the recycling rate from 67 to 85 per cent and at the same time a decrease in landfilling from 18 to 5 and less than 1 per cent respectively. The net carbon footprint will therefore decrease from -3.5 Mt to -4.5 Mt CO_2eq emissions in both projections.

Plastic waste has the lowest recycling rate next to textile waste. The study points out that there is a great deal of uncertainty concerning plastics. "Plastics account for a larger amount of waste, the current treatment of which is unknown, but estimated at 7.8 Mt." Another uncertainty factor relates to the amount used in co-incineration. The study estimates an increase in the recycling rate from 15 to 56 per cent in Projection 2. Landfilling will decrease from 30 to 12 and 2 per cent respectively. Emissions will be reduced from 1 Mt to -19 and -23 Mt CO_2eq respectively. Including the material treated via unknown methods, the emission avoidance potential is estimated at -24 and -28 Mt CO_2eq.

Ferrous metals have the highest recycling rate and the largest net carbon savings potential of all waste streams in the scope of the study. It projects an increase in the recycling rate from 83 to 95 per cent

with a decrease in landfilling from 11 to 3 and 1 per cent respectively. The net carbon savings will increase from -121 Mt CO_2eq to -132 and -135 Mt respectively. "By avoiding the production of primary ferrous metals, recycling provides for very substantial net carbon savings of 121 Mt," the study points out.

Aluminium has the second highest recycling rate and second largest net carbon avoidance potential. The recycling rate is predicted to increase from 75 to 92 per cent with the landfill rate decreasing from 16 to 4 and 1 per cent respectively. The net emission savings will increase from 59 to 68 and 70 Mt CO_2eq respectively.

For wood, the study estimates an increase in the recycling rate from 35 to 46 per cent. Landfill will decrease from 6 to 2 and below 1 per cent respectively. The carbon emissions savings will decrease from -23 to -21 and -10 Mt respectively. "Wood presents a counter-intuitive waste stream, as in this case carbon emissions increase, primarily due to the reduced amount allocated to thermal treatment with more fossil fuel avoided than recycling," the study explains.

Waste textiles have the lowest recycling rate of all waste streams in the scope of the study. The recycling rate is expected to increase from 15 to 46 per cent, with a decrease in landfilling from 36 to 13 and 4 per cent respectively. Carbon emissions savings will increase from 1.3 to 10.2 and 11.8 Mt CO_2eq respectively. An increased amount of material being allocated to recycling leads to a high level of carbon savings.

Biowaste has the second-largest positive carbon footprint. The study assumes an increase in composting and anaerobic digestion from 24 to 67 per cent and a decrease in landfilling from 35 to 8 and below 1 per cent respectively. Carbon emissions are therefore expected to decrease from 37.1 to 5.3 and -3.6 Mt CO_2eq respectively.

For waste tyres, the study anticipates an increase in the recycling rate from 62 to 82 per cent. The carbon savings are 3 Mt CO_2eq in the baseline scenario, stable in Projection 1 and -6 Mt CO_2eq in Projection 2.

The total amount of residual waste and waste-derived fuels is expected to decrease from 237 to 190 Mt. Thermal treatment for this waste stream will increase from 52 to 61 and 100 Mt respectively. This waste stream allows for substantial net carbon emissions avoidance, mostly derived from not allocating the waste to landfill. The emissions are expected to decrease from 182 to 120 and -52 Mt CO_2eq respectively.

Considering the nine waste streams selected, the waste management industry is already avoiding 96 Mt CO_2eq more than it produces. In Projection 1 the avoidance potential is 150 Mt and in Projection 2 a further 146 Mt. The largest emission reductions can be achieved by diverting organic waste streams from landfill.

Source: Pexels; pixabay.com

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Redesigning the supply chain

The white paper "Delivering on circularity: Pathways for fashion and consumer electronics" by DHL describes steps and measures that are necessary to make these two sectors more circular.

By Michael Brunn

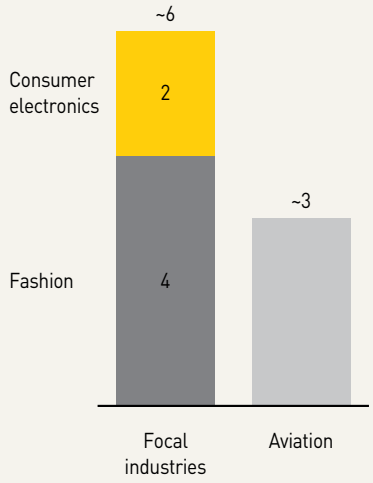
The transition towards sustainable energy and decarbonisation are usually seen as the main levers for reducing GHG emissions. However, as mentioned in the white paper, circularity is the much-needed additional piece in the puzzle. "To move away from the traditional paradigm, production volumes and materials need to be optimised, product life cycles must be extended, new models for product use have to be developed, and solutions for end-of-life recycling need to be found." A shift in the supply chain paradigm has the potential to cut emissions by up to 40 per cent, the white paper states. At the same time, it is more cost-effective than any other approach to decarbonising the supply chain. Circularity can also have a positive impact on other environmental and social issues. In this case, the fashion and consumer electronics sectors are considered as predestined frontrunners. "Since increased circularity builds on an increasing number of multidirectional flows of goods, logistics service providers are the needed enablers and accelerators of the transition."

Consumer goods are responsible for 25 per cent of all GHG emissions, second only to the mobility sector. A considerable share of these emissions is generated by the fashion and consumer electronics sectors. "As such, the positive impact that circularity in these two industries could have on the climate, the environment, and society is tremendous." Both industries rely on resource-intensive materials and production processes. So far, they have relatively few systematic circularity measures in place, but at the same time high reach and relevance to almost everyone. They both have very complex and globalised supply chains as well as strong visibility and multiplier effects.

Circularity is all about flows of physical goods and relies on a careful orchestration of physical supply loops across different elements. The white paper assumes that logistics will play a more pronounced role during the extended lifetime of products and raw materials.

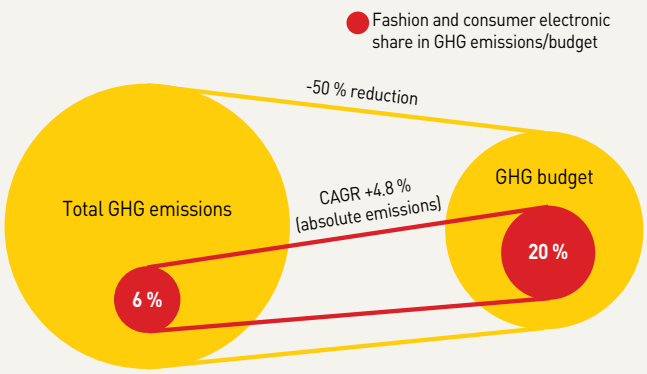
It is estimated that between 4 and 8 per cent of global GHG emissions are generated by the fashion industry. The consumer electronics sector adds another 2 per cent. This combined share of at least 6 per cent is close to the overall emissions of the entire EU. "At current consumption levels and under current approaches to managing the life cycles of these products, emissions from these industries would grow by 60 per cent by 2030 and account for around 20 per cent of the UN GHG emissions target for 2030, which is set at half of today's emissions." The consumption of non-renewable resources is a key problem in these industries. In consumer electronics products, a large number of different metals are needed, including some rare metals. These resources are scarce. In fashion, synthetic textile fibres are produced using fossil fuels. In addition, both

SHARE OF GLOBAL GREENHOUSE GAS EMISSIONS



Source: McKinsey Fashion on Climate Report; Institute of Positive Fashion Circular Fashion Ecosystem Report; GreenIT Report "The environmental footprint of the digital world"; McKinsey & WEF Clean Skies for Tomorrow Report; Shift Project "Lean ICT" Report; European Commission "Reducing emissions from aviation"

FASHION AND CONSUMER ELECTRONICS GREENHOUSE GAS EMISSIONS 2020 VS. 2030, IN PERCENT OF TOTAL EMISSIONS



Note: Assuming current consumption patterns and halved GHG budget in 2030 for 1.5 degree goal. The 50% budget reduction objective is based on the United Nations Framework Convention on Climate Change.

Source: United Nations Framework Convention on Climate Change; McKinsey "Fashion on Climate" Report; Shift Project "Lean ICT" Report

industries account for extensive land use. The fashion industry also accounts for a huge amount of water consumption – approximately 150 trillion litres per year globally. Waste is another issue: e-waste is the fastest-growing waste stream worldwide, with consumer electronics being a prime contributor. Today, 80 per cent of e-waste is not even collected for recycling. Waste from fashion is mostly landfilled or incinerated, accounting for approximately 75 per cent of the produced volume. Furthermore, both industries have negative social implications.

In both cases, the majority of GHG emissions are generated in the production phase – in fashion 71 per cent, in consumer electronics 80 per cent. "Since production is the overwhelming driver of emissions in both fashion and consumer electronics, extending the lifetime of these products and putting their residual value back into the production phase are crucial elements in reducing the production footprint."

In terms of circular economy practises, 'reduce' is one of the main levers. Moreover, there is a significant level of overproduction, especially in fashion, approximately 20 to 30 per cent. The goal should be to reduce the overall volume as well as changing the profile of inputs.

Fixing damaged products is an obvious intervention that would contribute towards extending the life and maintaining the value of goods. The upcoming "right to repair" legislation will reinforce these activities.

The average time of use for fashion products is a little more than three years, for smartphones two to three years. Reselling those products would reduce GHG emissions significantly, but the resale rates in these sectors are lower than in others. There is also a significant volume of totally unused clothes.

Refurbishment is becoming increasingly important and is already commonplace in consumer electronics – especially with smartphones and B2B products. In fashion, refurbishment is quite rare – with the exception of luxury clothing – despite the fact that refurbished garments and smartphones generate 55 per cent fewer emissions than new products.

At a certain point, repair or refurbishment are no longer viable options. However, there is still value in the product itself, which can be extracted through recycling. However, in the fashion industry, the use of recycled materials only accounts for about five per cent of the total material processed worldwide.

As the white paper further states, every stakeholder has a role in implementing the principles of a circular economy. The implementation must benefit all stakeholders and society as whole. It also requires close collaboration. Therefore, the paper has identified three core enablers and ten building blocks.

"Circular consumer behaviour not only increases the number of goods that flow back into the cycle, but also signals demand to brands for circular products." Some companies already encourage circularity-related activities among consumers. Logistics providers can enable easy and convenient return models. Regulators are strengthening both public knowledge and consumer awareness and creating the guardrails to enable additional post-sale usage.

Supply chains need to be redesigned and new supply models developed. Accessing end-of-life products will require convenient return flows and collection options that incentivise consumers to participate. "The volume of return flows will increase as a result of circularity, implying that return flows need to be well integrated into the existing supply chain."

Ensuring transparency and orchestration becomes even more important, yet challenging. "Advanced technologies and tracking tools provide the digital backbone to achieving transparency in an environment of circular and multidirectional product flows." The study sees the logistics players as natural anchors and orchestrators that can offer expertise and experience in tracking and tracing goods across entities and transportation modes as well as data analytics.

One key challenge is the large numbers of different materials used to make one product and the difficulty of disassembly. "Above all, the feasibility of combining a circular product design with business growth and profitability is imperative to incentivise companies to innovate their product portfolio." A mono-material design could facilitate recycling. In addition, repair and recycling are often complicated by the way in which certain materials or product parts are held together.

Another aspect is the development of innovative raw materials, which need to be energy-efficient and easy to recycle. In the case of textiles, this could be hemp and plant- or fruit-based "leathers" that cause fewer emissions. The development of new materials often goes hand in hand with mono-materials. Using recycled material increases the stability of raw material supply and improves companies' resilience.

Manufacturers need to develop solutions that minimise the amount of waste generated and reuse as much of that waste as possible. For example, wastewater can be reused for various purposes. The problem of overproduction can be solved by optimising for agility with on-demand manufacturing.

ENVIRONMENTAL IMPACT OF FASHION AND CONSUMER ELECTRONICS

	Water use	Land use	Waste
	156.5 trillion liters	40.6 million hectars	146 million tons
Fashion	150	40	92
Consumer electronics	6.5	0.6	54
Equivalent to	~40% of US population's annual water consumption	More than the area of Germany and Switzerland	~50% of Europeans' annual waste

source: Scientific Data "A global-scale data set of mining areas"; Green IT Report; Global E-Waste Monitor; BBC "Why clothes are so hard to recycle"

Packaging solutions for products as well as for external shipping need to be optimised. However, producers are increasingly tackling the product packaging issue. The external (shipping) packaging has received less attention thus far, although it contributes up to 30 per cent of total e-commerce-related GHG emissions," the paper states. The major consideration is the trade-off between emissions and waste: Lower emissions can be achieved with single-use packaging, higher emissions come from multiuse packaging. The logistics providers can play a critical role in collecting packaging and managing the flow accordingly.

Smart product return and recovery solutions are another aspect. In return management, financial incentives are already successfully being used. "It is highly convenient and financially attractive for consumers to return unsuitable products after purchase, as free return shipping with print-at-home shipping codes and full money back for unwanted products is offered as a default by most major e-commerce players." Several countries have regulatory measures in place, e.g. a ban on the destruction of returned goods. For logistics players, the combination of different kinds of return flows is key. This could include collecting unwanted products together with end-of-life products, which would increase the convenience for consumers and contribute towards improving circularity. "Therefore, the critical challenge will be to optimise the operational setup of returns for maximum efficiency."

"Models such as pay-per-use, product rental, and product lease can play important roles both in terms of environmental impact and business revenue," the paper further states.

Logistics can play a key role in supporting reverse logistics. "Logistics can also help as an intermediary by screening returned products for their suitability for refurbishment and resale and then forwarding them to the respective partner." However, the paper points out that resold and refurbished items will need a sufficiently large ecosystem to gain a significant market share.

In addition, viable repair business models are needed, in which logistics can play a significant role. For example, minor repairs could be outsourced to logistics providers, who could also bundle items from a wide range of points of origin. However, there is a conflict of interests for the manufacturers. More repairs lead to lower sales and manufacturers therefore have an interest in making the repair option expensive. However, this is also due to small-scale and often manual repairs. "Hence, it is crucial to develop new, scalable repair business models with attractive economics for providers and consumers, while also ensuring convenient access to repair services for consumers." The paper points out that for manufacturers, in the context of rental, leasing and refurbishment business models, repair can become an attractive option and would be another opportunity to tie customers to a given brand. Governments could also incentivise repair, e.g. with lower taxes.

The paper states that higher collection rates could help avoid a great deal of waste. "Next to implementing national collection systems, motivating consumers via incentives is an important lever to increase systematic waste collection." These incentives could include minimised costs for disposal or the offering of vouchers for returning end-of-life items.

The paper also promotes advanced recycling technologies. However, recycling has a low-volume challenge, especially for textiles. "To support the collection of sufficient quantities for recycling, logistics players have the capacity to steer and aggregate volumes of appropriate waste flows, creating a scalable business case for investing in new technologies and innovations." Logistics companies could presort goods to make recycling more efficient. However, advanced recycling technologies are needed to increase material valorisation.

The paper offers a roadmap with immediate next steps for each major stakeholder group.

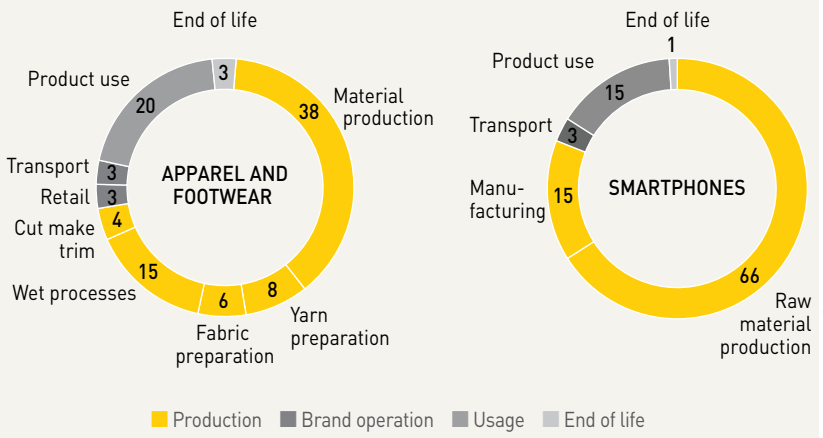
"The work of brands and manufacturers includes circularity target-setting and making the business model adjustments that move them toward those targets." Concrete measures are the definition of measurable targets, product and business model innovation, and partnerships with peers and suppliers. The paper points out that the brands need to look beyond merely manufacturing their products for holistic circularity.

"Consumers can commit to engaging in more circular behaviour of their own, helping other stakeholders optimise 5 R-related interventions by offering feedback, and by sharing their experiences with their social networks, contributing to scale." This includes adopting circular behaviour, adapting purchasing behaviour, peer education and feedback loops.

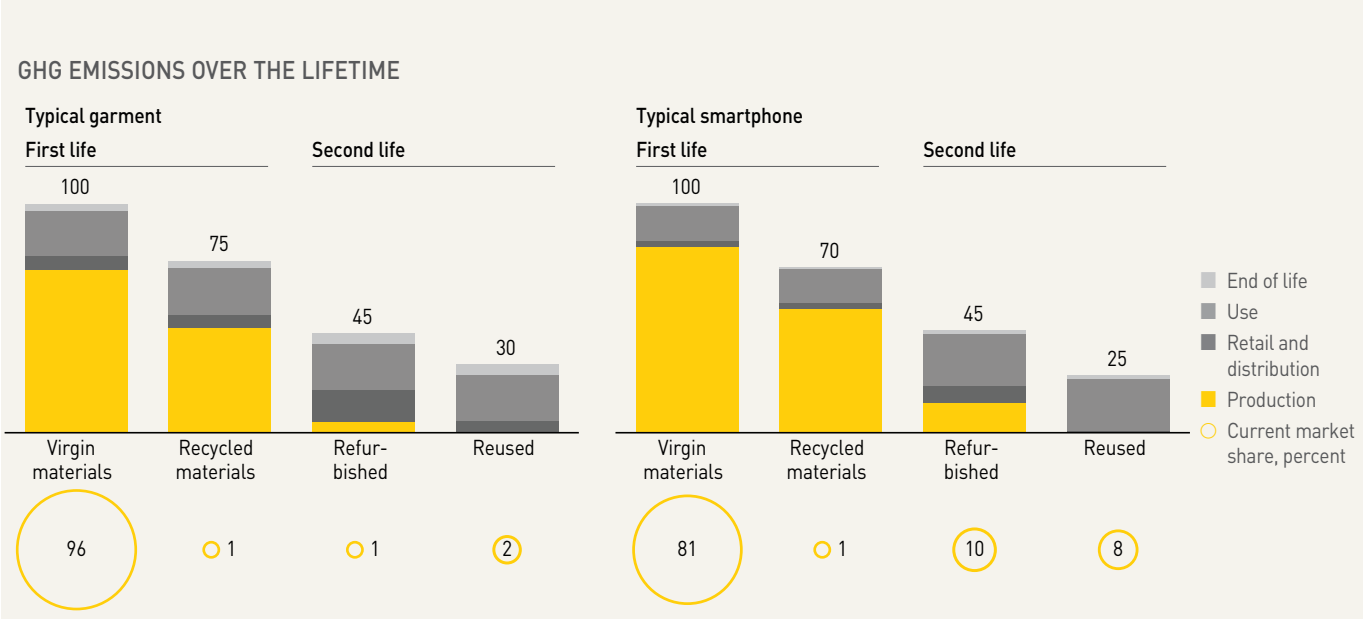
"The actions that logistics players will take involve innovation and transparency along the supply chain and efficiency in transportation." These activities include redesigning the supply chain to include reverse logistics offerings and solutions for sophisticated and cost-effective return flows. Other possible measures are improved supply chain transparency, transportation decarbonisation and the exchange of best practices.

"The work of governments will be to use both their economic and their legislative influence as well as their immense

GHG EMISSIONS ALONG THE VALUE CHAIN



Source: McKinsey "Fashion on Climate" Report; Shift Project "Lean ICT" Report; Green IT Report; Apple; Backmarket



public platforms to encourage circularity via legislation, incentivise innovation, track progress, and promote awareness of the importance of circularity." This work includes introducing regulatory guardrails, supporting technology and product innovation, raising public awareness, monitoring and progress management.

"Circularity has started to become a self-reinforcing interplay between manufacturers and consumers, with governments creating a conducive environment for a range of "closed loop" activities and logistics players providing efficient infrastructure for a new, more complex, environmentally friendly flow of goods. As such, transitioning from supply chains to supply loops puts us on a clear path to reducing GHG emissions," the paper concludes.

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World consumes half a trillion tonnes of virgin material since Paris Agreement

The throwaway global economy is fuelling the climate crisis with more than half a trillion tonnes of virgin material consumed since the 2015 Paris Agreement, according to a report from impact organisation Circle Economy that was launched at the end of January.

It warns that world leaders are missing the opportunity to achieve deep cuts in emissions by adopting circular economy strategies that reduce demand for resources, and it identifies a roadmap that could help them meet the target of limiting global warming to 1.5°C.

By Circle Economy

Source: Eduardo Davad; pixabay.com

Circular economy solutions can have a huge impact on climate change because 70% of greenhouse gas emissions are related to production and the use of products – from the buildings we live in and the transport we use, to the food we eat and the clothes we wear.

However, national climate pledges focus overwhelmingly on cutting emissions by reducing fossil fuel use. They barely mention resource extraction and consumption rates, and only one third mention the topic of a circular economy.

The report warns that the global economy is consuming 70% more virgin material than the world can safely replenish: annual resource use was 89.8 billion tonnes in 2016, but passed 100 billion in 2019 and is estimated at 101.4 billion last year. More than 90% of what we take from the Earth to fulfil our needs and wants goes to waste, with just 8.6% of materials recycled.

Martijn Lopes Cardozo, Circle Economy CEO, said: "Our insatiable demand for resources and throwaway economy is threatening the planet's future and driving us down the road to climate breakdown. Leaders from government, business and civil society must put circular solutions on the global agenda and ensure they feature strongly when countries update their national climate pledges ahead of COP27 in Egypt."

The global economy is consuming 70% more virgin material than the world can safely replenish

Source post-it: Andreas Lischka

World leaders committed to limiting climate change to 1.5°C at the COP26 summit in Glasgow. However, new pledges still leave the world on course for 2.4°C, and to meet 1.5°C a further 19-23 billion tonnes of annual emissions must be cut by 2030, Climate Action Tracker calculates..

Circle Economy has identified 21 solutions that could close this gap if adopted worldwide, cutting 22.8 billion tonnes (22.8 Gt) of emissions on top of current pledges. They provide a roadmap to guide nations, cities and businesses on how to reduce emissions by cutting the use of virgin material – minerals, ores, fossil fuels, metals and biomass – which each can adapt to suit their own context.

The solutions aim to transform our linear "take-make-waste" economy by applying a series of strategies that would cut annual material use to 79 billion tonnes (79 Gt), nearly double the circularity of the economy to 17%, and keep the world on track for 1.5 degrees:

- Use less – for example, resource-efficient building construction using lightweight design and local materials could save 3.45 Gt of emissions and 4.05 Gt of materials.
- Use longer – for example, refurbishing and renovating buildings to prolong their life could save 2.15 Gt of emissions and 5.28 Gt of materials.
- Regenerate – for example, using seasonal and local food and other methods of sustainable food production can save 2.07 Gt of emissions and 3.4 Gt of materials.
- Use again – for example, using recycled metal and plastics to make vehicles and recycling vehicles at the end of their life could save 1.5 Gt of emissions and 3.33 Gt of materials.

Frans van Houten, CEO of Royal Philips and Co-Chair of the Platform for Accelerating the Circular Economy, said: "It's clear – we must act now! There's no time to lose. By applying the circular solutions outlined in this report, we can reduce the use of scarce materials and dramatically cut emissions – thereby fighting climate change and biodiversity loss. But we can only do it by joining forces. That's why I'm calling on all CEOs and business leaders, governments and NGOs to step up and accelerate our combined efforts, so we can reach the goal of doubling circularity within 10 years. Let's take bold actions and deliver impact."

The global use of materials has more than tripled in the 50 years since the Club of Rome predicted that rapid economic growth and natural resource exploitation would lead to the 'collapse of civilisation' by 2040. In 1972, when it published its landmark report, Limits to Growth, the world extracted 28.6 Gt of materials. By 2000 it was 54.9 Gt and in 2019 it reached 101.6 Gt.

In 2019, the extraction of materials was higher than 100 Gt

With global population set to pass 10 billion in the second half of the century, resource use and emissions will grow further without radical action. If business as usual continues, material use is predicted to reach 170-184 Gt a year by 2050. For example, it is estimated that the area covered by buildings will nearly double in the next 40 years, the equivalent of building a city the size of Paris every week.

The circular economy principle now features in many governmental and multilateral policies and goals, from the EU Circular Economy Action Plan to the UN Sustainable Development Goals, but the focus often falls narrowly on recycling and there is limited recognition of its role in reducing emissions. An emphasis on material efficiency over reducing consumption is also limiting: the Netherlands, for example, is a global frontrunner in material efficiency gains, but its use of natural resources is barely declining.

The report says: "Transitioning to a fully circular economy within a generation will require urgent and large-scale actions from all parts of society. National and local governments will need to provide direction and enabling conditions, consumers will need to make choices that encourage circularity, and businesses will need to redesign their processes from the ground up."

Stientje van Veldhoven, Vice President and Regional Director Europe at the World Resources Institute, said: "Preventing and reducing resource use and increasing the use of materials are key to protecting both the Earth's environment and its capacity to provide for current and future generations. We need to measure and analyse to be able to steer. The Circularity Gap Report has provided valuable insights on these topics over the past five years and it continues to inform progress and the action required to accelerate the circular transition."

Kate Raworth, Author of Doughnut Economics and Senior Teaching Associate at the Environmental Change Institute, University of Oxford, said: „Circularity is not becoming a reality at anything like the speed or scale that these times demand, and over the past five years the Circularity Gap Report has provided essential and authoritative analysis to make that painfully clear. I hope that future editions, over the coming five years, will be able to reflect a profoundly different story, using innovative metrics and powerful case studies to document the industrial circular transformation that is so urgently needed."

Is circularity always sustainable?

It is mostly taken for granted that a circular economy will automatically lead to greater sustainability. But is this really the case? Scientists from the University of Augsburg in Germany have developed a model to assess a variety of factors over a longer period of time. The results were published in the article "Does increased circularity lead to environmental sustainability?", which was published in the Journal of Industrial Ecology.

By Michael Brunn

The circular economy principle aims to maximise resource efficiency by keeping materials at their highest value for as long as possible. The highest level of resource efficiency can be achieved when the original function of a product is maintained. Therefore, reuse is prioritised over all other strategies. However, the authors state that a sustainable strategy does not always deliver sustainable results. Possible side effects such as rebound effects or burden shifting can reduce sustainability.

The circular economy concept actively aims to initiate changes in consumer behaviour, production patterns or both. Over the years, this should lead to changes in the range of products in stock. As the authors point out, it is important to evaluate the environmental impacts of these changes over multiple years. With this point in mind, the study provides a dynamic model to qualify future product stocks and flows after the implementation of a circular economy strategy. In a second step, the environmental implications were assessed through an LCA.

WEEE is the fastest growing waste stream globally, with annual generation expected to increase to 52.2 million tonnes worldwide. It is composed of a mixture of materials and thus needs appropriate end-of-life treatment. The management of this waste stream is therefore of special interest when it comes to implementing a circular economy concept. The WEEE Directive promotes the waste hierarchy, with preparation for reuse ranked higher than recycling. However, there are no incentives to increase preparation for reuse.

The case study explores changes in stocks and flows and the resulting environmental impacts attributable to various reuse targets, using the example of washing machines in Germany from 2015 to 2050. Washing machines are the most relevant WEEE product by weight in Germany. The study uses three different scenarios: The business-as-usual scenario (BAU, S1) is based on the current reuse share of 0.5 per cent. Scenario 2 (S2) calculates a prepare-for-reuse target of 5 per cent as suggested by the European Parliament. Scenario 3 (S3) is the most optimistic and shows the impact of WEEE reuse if the full potential is exploited.

The yearly in-stock use was calculated according to the number of households (an increase from 35.3 million in 1991 to 44.2 million in 2050) and the average number of households

with washing machines (starting with 87 per cent in 1987, the figure increases to 96 per cent in 2016 and then stays constant until 2050). The study assumes that the in-stock use will increase from 30.5 to 42.6 million by 2050. The average lifetime was calculated at 12.3 years for new products and 9.2 years for reuse.

A higher share of reuse leads to more less efficient products

A higher share of prepare-for-reuse leads to a higher share of reused products in stock. During the first years, the PfR target differs only marginally between the scenarios. After 2020, however, the differences in stock increase. For S3, the rate will be 18 per cent in 2030, while S1 is close to zero. By 2050, the differences are even more obvious. "A higher share of reused products also implies a higher share of older and less efficient products in stock," the authors point out. In 2050, in S1 nearly all products will rate A or better, while in S3, 16 per cent of the products will still be rated A+++ or worse.

Source: Gerd Altmann; pixabay.com

While in S1 the share of reused products would be 0.4 per cent, in S3 it would be 43 per cent. "Whereas in S1 almost all products end up being recycled, in S3 close to 44 per cent will be reused in 2030." They also remain part of in-use stock in the following years. However, in S1 the stock of the following years is filled with new and more efficient products. "These two implications have controversial effects on the environmental impacts. Whereas manufacturing generates impacts, a more efficient in-use stock diminishes environmental impacts."

The environmental impact assessment shows that an increase of in-stock use does not to lead to an increase in impact over time due to the efficiency gains of products and the increase in renewable resources. In 2015, the climate change impact was 7 billion kg CO_2eq. By 2050 it will be 3.5 billion kg for S3 and 3.6 billion for S1. Although the reuse targets differ significantly, the climate change difference is only marginal. "This can be attributed to the fact that the impacts of CC mainly arise in the use phase. The impacts of production avoided due to a high reuse rate are compensated by the higher impacts in the use phase compared to more inefficient products in stock." Depending on year and scenario, the impacts of production are between 11 and 29 per cent.

Terrestrial ecotoxicityshows a different picture, since it is dominated by the production phase. "A decline in production due to increased reuse therefore leads to reduced total impacts." While the BAU scenario has 31 million kg 1.4-DCBeq, the S3 scenario has a much lower impact of 23 million kg.

The study assumes that products that have already been reused cannot be reused again. "Even if the reuse target is almost 90 per cent by 2040, the actual share of reuse over all EoL products never exceeds 60 per cent during the research period," the authors state. In this case, the share of reuse peaks in 2040. This explains the increase in production and impacts from 2040 onwards.

Human carcinogenic toxicity has slightly more differences between the scenarios, but is neither strictly dominated by the production or the use phase. Water consumption is similar to climate change, as it is dominated by the use phase. Increased reuse leads to more inefficient products in use and therefore has a negative effect.

S3 with the highest reuse rate is most beneficial for 18 out of 19 impact categories. The exception is water use, but even here the impact is only slightly higher than in the BAU scenario (< 1%). On average, scenario 3 reduces the impact by 8.9 per cent. "Taking aside the marginally negative effect on WC, we can confirm the assumption that the implementation of a PfR target (up to nearly 90%) reduces environmental impacts since the burden of manufacturing new products avoided exceeds the impacts of additional resource consumption during the use of older, less efficient reused devices." The reuse target of 5 per cent would only lead to average savings of 1 per cent.

"The results reveal that PfR might not be the solution if the target value is a reduction of CO_2 equivalents in order to limit climate change, but in a discussion about the future availability of raw materials or the health of ecosystems, reuse has a potential to reduce risk," the authors say.

Low reuse targets will lead only to small environmental savings

However, they point out that due to the rather long research period, further changes in the energy mix or in production or recycling processes may lead to different results.

"It can be assumed that a reuse rate of more than 80% will lead to significant environmental savings," the study concludes. However, the approach shows that this is not necessarily the case. In terms of climate change, reuse rarely has any impact. Therefore, it is necessary to include detailed environmental assessments. "If the environmental sustainability of an economy is solely assessed by its circularity (in the form of recycling or reuse rates), important information is missing."

A milestone in Ghana

Dr Siaw Agyepong, CEO of the Jospong Group, with Gottfried Reither, Director System Technology (left), and Key Account Manager Markus Maierhofer (right)

Source: Komptech

Since 2018, Komptech has been active on the African market with a great deal of success. In cooperation with the Jospong Group, 14 mobile processing lines and the first stationary plant are currently in operation in Ghana, with a second under construction. In addition to machines, there is a local demand for waste processing knowledge.

By Andreas Kunter, Komptech

Each year, Ghana generates about five million tonnes of municipal waste, an estimated 60 per cent of which is organic. Of this amount, about one quarter can be composted, giving an annual return of some 750,000 tonnes of valuable soil improver. All told, around 80 per cent of the waste of this West African country is either reusable or recyclable. In recent years Ghana has decentralized its waste disposal system, creating the conditions for better waste recovery. Local government and the private sector are putting the necessary structures in place. This makes Ghana one of Africa's most advanced countries in terms of waste disposal. Zoomlion Ghana Ltd (Jospong Group) is a pacemaker as Ghana's largest waste disposal and processing company.

When Komptech and the Jospong Group together planned the first waste treatment facilities in Ghana in 2018, the decision was made to use a combination of mobile and semi-mobile machines. Gottfried Reither, Director System Technology at Komptech, explains: "Zoomlion urgently needed facilities to treat about 600 tonnes of municipal waste daily in Accra. A stationary plant requires infrastructure and above all a reliable supply of electricity, which was not available. However, thanks to autonomous operation with diesel engines or generators we were able to set up the lines as needed, and they were ready for immediate operation. When organized recovery is just getting started, flexible machinery is better as a first step." The specially developed Komptech processing plants select the biogenic components out of the waste and send them to composting, while separating the recyclables out of the rest, so that only a small remaining amount of waste is landfilled.

Before working with Komptech, Zoomlion had tasked an Asian machine manufacturer with the construction of a stationary

A bird's eye view of KCARP – the Kumasi Compost and Recycling Plant – with two million inhabitants, Kumasi is Ghana's second largest city.

First comes the mechanical preparation in which the recyclables are separated, followed by the biological treatment. The organics are first opened up and then composted in windrows. The subsequent fine processing provides high-quality compost.

Source: wikipedia.org

facility. However, neither the performance nor the aftersales service were up to expectations, so Jospong Group representatives travelled to Europe to look around for the right partner. They found it in Komptech. Reither: "We looked at pictures of the existing plant in Adjen Kotoku and could tell immediately that it wasn't going to work." As a systems technology professional, he saw four design flaws right from the photos. He grabbed a pen and sketched out how a preparation process could work well under the existing conditions. The Ghanaian delegation liked the pragmatic approach and invited Komptech for a visit to the Ghanaian capital of Accra. A first order for five semi-mobile lines was followed by another for nine. Each of them is capable of processing 200 tonnes of mixed domestic waste per day.

For Kumasi north of Accra, Zoomlion needed a substantially larger facility with a capacity of around 600 tonnes of mixed domestic waste per day. In this case, for economic reasons waste separation needed to be electrically powered. An existing hall was converted for the purpose. "When the infrastructure is there for it and the composition of the waste is known, a stationary solution is more economical. The higher efficiency of electric systems also plays into it," explains Reither. Furthermore, some machines such as ballistic sifters and post-shredders are only available as stationary machines. However, they can achieve a more differentiated separation of the waste stream, so that more recyclables can be extracted. The new facility in Kumasi uses a Terminator 3400 shredder, followed by two-stage screening to 0-80 mm, 80-300 mm and >300 mm fractions. At four processing stations, Zoomlion employees assist with separation. The plant has therefore created 400 new jobs. After the manual removal of contraries and shredding, the input material is fractioned by Komptech drum screens. The fines (<80 mm) go through a 2SE star screen and then to composting in a tunnel system.

The resulting compost is subsequently prepped with Cribus 3800 drum screens and a wind sifter. A Ballistor 6300 separates the 80–300 mm fraction into cubic and flat fractions. Recyclables such as wood, PET, PE, PP and nonferrous metals are manually picked from the cubic fraction. Ferrous metals are removed automatically. Recyclables are manually picked from the >300 mm fraction as well. Reither: "Technically, the Kumasi plant absolutely meets European standards."

Zoomlion Ghana Limited

Zoomlion Ghana Limited is Ghana's largest waste disposal and treatment company. It offers integrated waste management solutions that include collection, transport, transfer, sorting, recycling and disposal. The company was founded in 2006 by Dr Joseph Siaw Agyepong and is a member of the Environmental Services Providers Association (ESPA) of Ghana and the International Solid Waste Management Association (ISWMA, USA). Zoomlion employs around 3,000 people and manages over 85,000 workers through various public-private partnerships. A member of the Jospong Group, the company operates in five countries in Africa.

In order to provide service for the Jospong Group, Komptech has set up a local presence in Ghana. Komptech Service Technician Eric Martey is stationed there and regularly inspects all the plants. Manfred Harb, Director Customer Services Komptech, explains: "When we set up a new service structure, there are three possibilities. We find a local service partner with a spare parts warehouse. Or we provide service with a Komptech technician and use spare parts from our stock or the customer's stock. Or we contract maintenance by the customer with our assistance."

In all of these cases, sales and service partners as well as the customers are trained on the machines on site, through documentation and commissioning, to transfer the necessary knowledge and also pass along beneficial experience. In addition, maintenance agreements include a Komptech technician present as supervisor for inspections during the first 3000 operating hours. "As a rule, after this time most maintenance and repair events have come up at least once, and the customer has been able to gain sufficient experience. We also use digital systems like Connect, Assist and Track to make information available and help with service," adds Harb.

Source: Komptech

Left: Up to 600 tonnes of household waste can be processed per day. The steadily growing amount of plastic is clearly evident.
Right: The final conditioning of the compost is done by drum screening and wind sifting.

Decoupling growth and waste

Although prevention is at the top of the waste hierarchy, the volumes of waste generated are still increasing. An absolute decoupling of economic growth and waste production has not yet been achieved. With their report "Progress towards preventing waste in Europe – the case of textile waste prevention", the European Environmental Agency (EEA) makes some suggestions regarding how the ever-growing amount of textile waste could be reduced.

By Michael Brunn

Waste prevention is a key part of the strategy for managing the transition towards a circular economy. It can be applied to various waste streams. "Textile waste is a prime candidate stream that would benefit greatly from implementing waste prevention on account of the high levels of consumption of textile products in Europe and its increasing waste generation," the EEA states. Textiles are a key sector of interest in the circular economy action plan. The European Commission is currently preparing a strategy to tackle the problem.

The volume of waste generated in the EU has been increasing constantly since 2008. However, the EEA points out that mineral waste accounts for the majority of the additional amount and the increase in waste generation is actually lower in real terms. So far, the EU has only achieved a relative decoupling. Waste generation is increasing more slowly than economic growth, but there is no actual reduction in the amount of waste generated. As the EEA states, there is no observable impact from waste programmes that have been ongoing in the member states since 2013. However, the EEA points out that the waste intensity (i.e. waste generation per unit of GDP) has decreased from 68 kg per 1,000 euros in 2008 to a current figure of 60 kg per 1,000 euros. The EEA considers waste intensity as a useful measurement for monitoring progress towards decoupling.

The textile industry is highly globalised. Between 2000 and 2014, global production almost doubled. Clothes are nowadays treated as disposable goods, i.e. so-called fast fashion. "Fashion trends at low prices encourage disposability and rapid turnover and they consequently lead to large amounts of waste." This fact makes the sector highly relevant for applying waste prevention measures.

The textile industry is an important manufacturing sector in Europe, which is the second largest exporter of clothing and textiles. "Europe is a leading region for the production of high-quality clothing and it is highly innovative in textile research and textile design," the EEA says. In 2018, 171,000 companies were operating in this sector in Europe. They employed 1.7 million people and generated revenue of 178 billion euros. However, the textile industry is also the fourth highest pressure category in terms of its use of primary raw materials and generating waste, after food, housing and transport. It is also the fifth highest category in terms of GHG emissions.

The EEA emphasises that there are no reliable data on used textiles. It is estimated that one third of textiles placed on the market are collected separately at the end of their useful lives. The rest is stock or ends up being disposed of as residual waste. The amount of post-consumer textiles that are collected separately in the EU per year is estimated at 1.6 to 2.5 million tonnes. A significant amount of the textile waste generated is of plastic origin. "Therefore, there is a significant amount of non-separately collected textiles that are collected mixed with residual waste, rendering them unavailable for recycling or reuse."

Between 50 and 75 per cent of textiles are collected for reuse, either within the EU or for the export market. The majority of the rest is recycled, but mostly into low-grade products. "Still, high-quality fibre-to-fibre recycling is virtually non-existent at the commercial scale on account of the many technical and commercial challenges, and textiles are generally downcycled into insulation or filling materials." A considerable amount goes into residual waste and therefore ends up being either landfilled or incinerated.

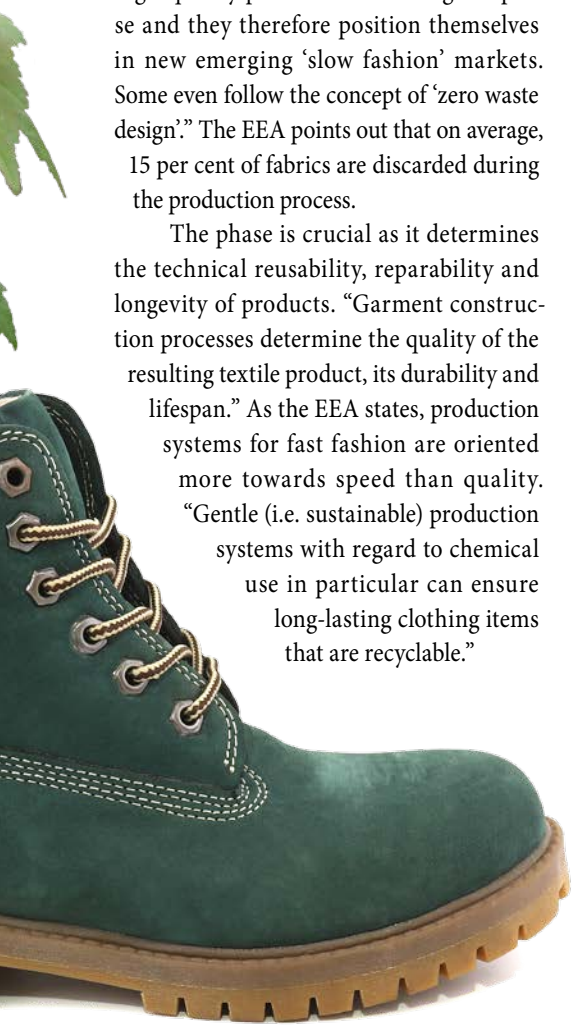
The EEA states that the increasing generation of waste is driven by a varie-

Source shoe: Omer Yontar, Source plant: Holger Langmaier; pixabay.com

ty of factors. Among them are a continuous drop in production costs, which makes cheap, mass-produced garments accessible to a wide audience. "The acceleration of fashion trends, reduced product lifetimes and increased affordability have led to an acceleration in the consumption of clothing, resulting in increased waste volumes." As the EEA states, the rising consumption of textiles is not necessarily driven by functional benefits, but rather by the desire to satisfy emotional needs and by symbolic and social communication.

The product design phase is crucial for determining the longevity of textiles through the choice of materials, the fibre blend and the production processes used. This phase also determines the potential for textiles to be recovered at the end of their life cycles. "Ever more brands and businesses are establishing eco-design principles aiming for high-quality products with a long use phase and they therefore position themselves in new emerging 'slow fashion' markets. Some even follow the concept of 'zero waste design'." The EEA points out that on average, 15 per cent of fabrics are discarded during the production process.

The phase is crucial as it determines the technical reusability, reparability and longevity of products. "Garment construction processes determine the quality of the resulting textile product, its durability and lifespan." As the EEA states, production systems for fast fashion are oriented more towards speed than quality. "Gentle (i.e. sustainable) production systems with regard to chemical use in particular can ensure long-lasting clothing items that are recyclable."



Another core issue is overproduction that generates large amounts of unused textiles. "To prevent overproduction, some brands have embraced a demand-driven model in which consumers pre-order garments." However, so far there have been no policy interventions to regulate the textile production stage at European level. The EEA names the ban on destroying unsold items and waste prevention targets for the production stage as possible measures to be introduced. It also hints at the growing relevance of online clothing markets, which can both ease and accelerate the purchase of clothing, but also have the potential to raise awareness and change consumer behaviour.

As the EEA points out, the use phase of textiles has shortened significantly over recent decades. "This is to some extent explained by the lower quality of clothing items produced on the market, but also by changes in consumption patterns and societal expectations of clothing. Apparel is no longer purchased to fulfil an essential human need, but to meet seasonal fashion trends." People between 18 and 34 are among the high-frequency purchasers and therefore an important group for targeting with awareness-raising campaigns. Reuse and repair services could be encouraged by economic incentives such as tax breaks.

The EEA further says that recent circular economy-inspired business models that promote sharing or leasing mostly focus on specific clothing types. However, so far there is no evidence of any impact on waste prevention. The EEA even sees the risk of an increasing number of clothing items in people's wardrobes. "High-quality textile reuse represents an opportunity for the European textiles industry to reduce its environmental impact, providing that sufficient sorting capacity is available, including pre-sorting at source (e.g. separate collection of carpets, reusable clothing, denim, non-reusable items)." Currently, collection and sorting processes are often dominated by NGOs and charitable organisations. When the separate collection of waste textiles becomes mandatory in 2025, the EEA sees the need to harmonise sorting procedures. It further states that extended producer responsibility (EPR) might lead to waste prevention. To date, France is the only EU member state with a mandatory EPR for textiles.

According to the EEA, collection systems remain a key challenge. All but five per cent of textile waste could be put to alternative use. The obligation for separate collection has considerable potential to eliminate textile waste from landfilling. "However, increased waste collection does not necessarily lead to an equivalent increase in reuse," the EEA says. Although increased collection would make more textiles available for recycling, it would not necessarily result in greater reuse. "Furthermore, the complexity of drivers in combination with globalised production chains makes measures specifically challenging to address."

However, the EEA sees a variety of policy options to reduce textile waste. These include regulatory incentives to enforce durability standards and circular design requirements, the banning of destroying unsold goods, and stricter regulations governing the use of chemicals within the textile industry to increase the longevity of textiles. The EEA also calls for the promotion of research and innovation to develop durable and circular textiles and technological innovations as well as the promotion of collaboration and exchange platforms between the various stakeholders along the supply chain. The EEA further suggests producer awareness campaigns on durability, repair and reuse as well as the establishment of an EPR scheme, which should be harmonised at EU level.

Regarding consumers, the EEA also calls for economic incentives to use repair services. Green public procurement should also play a more prominent role. Further policy aspects are clothing labels and certification programmes that address the longevity of textiles and/or the inclusion of aspects of longevity in existing labels and certifications. Consumers need more detailed information regarding the environmental impact of their textiles through harmonised methods such as the EU's product environmental footprint. The EEA also suggests cooperation among countries towards finding a common methodology and format for reportin

Waking the sleeping giant

What happens when a young plumber turns to recycling? At least in this case he builds a huge recycling company operating in three different countries – and is on his way to waking up the "sleeping giant's" recycling potential.

By Michael Brunn

When we talk about recycling, the discussion is quite honestly hardly ever a global one. The focus mostly lies on Western development markets with at least moderate, sometimes even high recycling rates. However, if you look at Africa, things are completely different. This is why Raymond Onovwigun has founded a recycling company that is totally focused on recycling in Africa. Raymond, who was born in London and has roots in Nigeria, founded Romco Metals in 2015. Before the age of 23 he had only been to Nigeria twice – admitting that he had missed the opportunities the continent presents. He also states that he had the typically western idea of Africa being a desolate continent, in need of charity. However, while visiting Nigeria what actually caught his attention were the piles of waste. "And where others saw waste, I saw value," he explains.

Considering that today there are only around 60 aluminium recycling facilities on the entire African continent, this certainly was an opportunity. To compare: Europe has more than 250 of those facilities. Another aspect was that only an estimated 13 per cent of recyclable goods are salvaged and recycled in Nigeria, with practically no formal waste management system in place. Both of these aspects may be the reason why Africa on the one hand represents a fifth of the world's population, but only produces approximately one per cent of secondary aluminium worldwide.

Back in London, Raymond founded Romco Metals. In Nigeria, he used a lot from his aunt, who had no need for it, to sort and to bale metal waste. Today, his company produces 3,000 tonnes of secondary raw material per month – material that can substitute primary raw material. However, it must be stressed that Raymond was not always in the recycling business. Actually, he began his professional life in the plumbing industry with quite some success. He saw the potential of recycling and developed his company more

Romco Metals has operations in Nigeria and Ghana and employs almost 250 people

towards facility management, including waste disposal services. He explains that he grew up around the corner of the EMR plant in London "And I fell in love with the process".

Now Raymond has his own recycling company, operating in three African countries, where he is trying to take the global problem from the top level all the way down, as Raymond puts it. "We have built a systematic, scalable model and are committed to reducing the environmental impacts of raw materials mining." This includes utilising blockchain technology to offer transparency and traceability across the whole value chain. With five furnaces in Nigeria and two in Ghana, Romco Metals generates revenue of 30 million pounds per annum. Raymond's company, which is based in UK, with operations in Nigeria, and Ghana, employs almost 250 people.

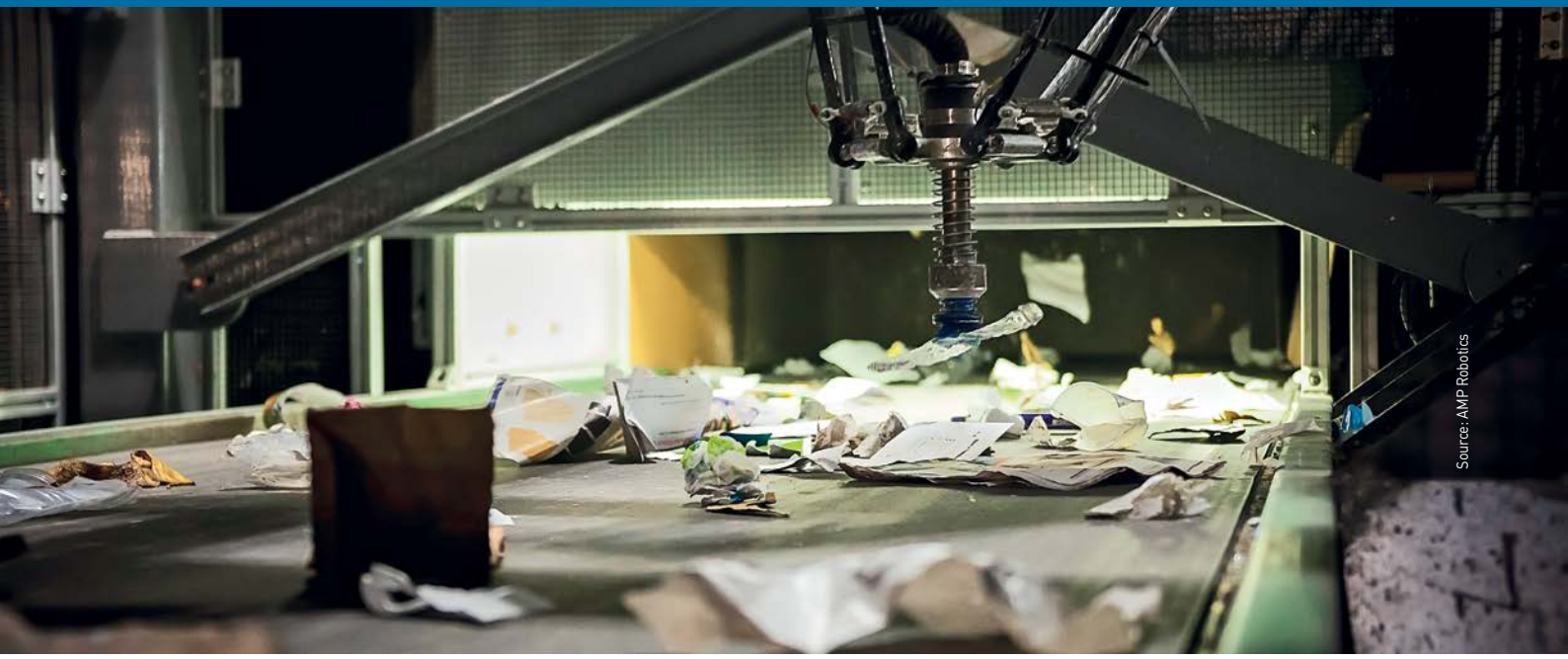
Raymond points out that there is a lot of talk about opportunities in Africa, but it is much harder to get anything done. He sees his company at the forefront of that change, driving forward recycling. He states that more of a ground floor approach is needed in Africa. "You have to build your own infrastructure," he says. "Building up from the ground is essential in this market." This includes not only increasing the capacity in all of Romco Metals' plants, but also educating the customer base and building hubs across the region. This is not as easy as it may sound, since governments and municipalities are usually the contacts. However, this is not the way it works in Africa, where local access is critical to success. Raymond points out that there are different rules and different systems for each country. South Africa is much more developed than the sub-Saharan countries, for example. But according to Raymond, even those countries are developing quickly and putting regulations in place. Many countries have signed the free trade agreement, which makes trade easier – but one has to keep in mind that Africa is a continent, not a country.

Raymond describes Africa as a "sleeping giant" with a good future for recycling to come. However, so far most of the material that Romco Metals processes is exported. But this is something Raymond does not really want to change since recycling is a global business. And the demand for metals will increase in the coming years. Especially aluminium and copper are needed for the green transition. The copper business in particular is something Raymond wants to expand in the foreseeable future. He intends to install five new plants across the continent and wants to scale up his business. As he points out, he wants to help build an efficient recycling infrastructure on the African continent and achieve high recycling rates. "We want to be part of the change we see everywhere," he states.

However, even Raymond's stellar career was not without its lows. In particular, coming down with malaria and typhoid and being close to death was a life-changing experience for him. "I have experienced almost everything and I sometimes thought that this is the biggest mistake of my life," he says. On the other hand, with his personal experience, a pandemic may be a little bit easier to handle. Raymond is still fairly optimistic that his company can continue to make an impact in Africa. He says that there is a real opportunity to embed a sustainable infrastructure into the design of expansion across the country. Raymond considers circular economy principles as fundamental to sustaining growth in Africa – quite a good reason to close the loops.

Sources: Romco Metals

Raymons Onovwigun wants to install five new plants across Africa. He especially wants to expand the copper business.


Source: AMP Robotics

How AI and data capture are improving MRF operations

It's been a mere few years since robots first made inroads into recycling, but the impact they are having on the productivity and efficiency of materials recovery facilities (MRFs) is evident. They're addressing many of the central challenges the industry faces, from worker safety and bale purity to labour shortages and lowering the overall cost of recycling. And as we emerge from the trenches of the pandemic, artificial intelligence (AI) and robotics technology have helped recycling businesses be resilient, as the importance of recycled materials as feedstock for our supply chain have come sharply into focus.

By Gary Ashburner,
AMP Robotics

We installed our first AI-guided robotics systems in the UK at Recyco, a leading recycling and waste management business in Northern Ireland, in September. Omagh-based Recyco operates a dry mixed recycling facility; it takes in commingled recyclables, which generally consist of cardboard, paper, plastics, aluminium, steel, and glass, and separates these into individual bales of commodities that are marketed and sold for further reprocessing.

The two main challenges Recyco faced were labour shortages and contamination. To address these main points, the company decided to install two robots – a single AMP Cortex™ unit along with a tandem unit – on its fibre lines for quality control to improve pick rates and bale purity. We completed the installation over the course of a weekend, without the need for downtime, ready for the shift the next morning.

The tandem unit replaced four people over two shifts, effectively eliminating the need for eight people per day; the single robot replaced two people per day. Together, this amounted to robots substituting for 10 manual sorters that Recyco had struggled to secure. The combination of Brexit and COVID had exacerbated already severe staffing shortages for businesses like Recyco, given the arduous nature of the job of manually sorting through recyclables. The ability to keep operating amid labour challenges has been a major benefit to owners and operators like Recyco's Michael Cunningham.

"The robots have allowed us to take back control of our plant. The benefits I'm seeing from using robots and AI, as opposed to human

labour, is that productivity remains consistent right across the shift. There are no breaks, no holidays, no sick days. They're doing every bit as good a job as human labourers were previously," he said.

Our robots quickly doubled the pick rates Recyco was accustomed to, maintaining and even improving the purity of its bales, which the company depends on to maximize prices with its end-market buyers.

As we look to the future, it's AI that offers great potential to continue to transform recycling, delivering more value to MRFs and beyond. Robots are one application of AMP Robotics' core AI technology today; each robot leverages AI to digitize the objects that pass by on a conveyor belt. Looking for specific colours, shapes, textures, logos, and more to recognise patterns correlated with material type, the platform learns to identify objects in the same way a human does. The software understands the heterogeneity, value, and contamination in material streams. It grows smarter and more effective over time as our fleet of AI-guided robots expands. This is material intelligence – a new category of information.

As Extended Producer Responsibility schemes emerge and mature around the world, solutions that further integrate AI and data into an MRF will be highly sought after to aid compliance and reporting requirements. One of these solutions is AMP Clarity, a web-based data portal that surfaces real-time material characterization and performance measurement throughout key process stages of an MRF's sorting operations. It allows operators to do things like graphically compare material stream data to historical baselines, define material count thresholds and create alerts triggered by movement above or below these thresholds, export data for further analysis and integration into business intelligence platforms, and more. This is all intended to support the monitoring and analysis of the material composition as it flows through a facility, providing visibility into and feedback about material streams.

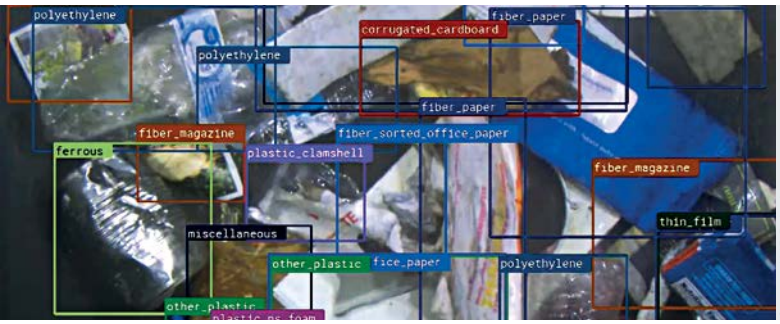
For instance, in the UK, current guidelines require sampling for incoming material streams by supplier and material stream output for specified target material. Sample size depends on the material type – plastics, for example, is 20 kilograms for every 20 tonnes of outgoing material. The current consultation document for EPR suggests increasing this sampling frequency by five to 15 times, adding more time, paperwork, space, staffing, and ultimately, costs to an MRF's operation.

Clarity can simplify both material analysis and reporting. Its interface displays the recognised material type, the confidence factor on the proper material type identification, and the target surface area. Either AMP or the customer can fine-tune the target material by robot confidence. So, if it's a high confidence factor, the robot will take whatever action the customer has designated—either leave the material on the belt or pick it and drop it into one of the designated chutes. The customer can prioritise the material type to pick first when the robot has a choice of material in its view. If one commodity is more valuable than another, the robot will pick first whatever the customer has set as the highest priority. Conversely, if it's a low confidence factor, the customer can decide whether to identify it or classify it as "other material." Clarity reports material composition analysis by material type as well as the total amount of material seen by the system. This delivery of real-time monitoring and analysis enables data-driven decision-making to:

- Optimize recovery: See what's in your material stream, which trucks it's coming from, and when volumes are hitting your lines at different times, then take action to adjust and improve.
- Gain real-time performance insights: Track how your QC stations, container lines, fibre lines, and last chance lines are performing during specific times. See where, and when, spikes are happening so you can address issues, and analyse bale quality, bunker, or specific shift data.
- Reduce downtime and risk: Know immediately when there is a process interruption or safety hazard on lines throughout your operation.

The artificial neural network of our AI platform encompasses the largest known real-world dataset of recyclable materials for machine learning. We're capturing data on more than 10 billion objects annually, and that number continues to compound. We can classify more than 100 different categories and characteristics of recyclables across single-stream recycling, e-scrap, and construction and demolition debris.

It's impossible to manage what you can't measure. As its sophistication grows, AI will take on an increasingly significant role in helping operators understand not just the what, but the why, behind changes in the material they're processing. As we extend our efforts to deploy technology that shifts the economics of recycling and grows the circular economy, the further embracing of AI and the data as well as the insights it yields will keep the industry moving forward.



Source: AMP Robotics

AMP's proprietary AI technology applies computer vision and deep learning to guide high-speed robotics systems to precisely identify and differentiate recyclables found in the waste stream by color, size, shape, opacity, consumer brand, and more, storing data about each item it perceives.

Time for a national strategy

In the United States, recycling is mainly the obligation of each individual state. The recycling landscape is therefore far from consistent. The US Environmental Protection Agency (EPA) wants to change that now with its "National Recycling Strategy".

By Michael Brunn

As the EPA states, it is time to transform the US recycling system. "Our current recycling system is at a crossroads and desperately needs creative energy to better serve the needs of the American people," says Michael S. Regan, EPA administrator.

The strategy consists of five objectives:

- Improve markets for recycled commodities
- Increase collection rates and improve the materials management infrastructure
- Reduce contamination in the recycled materials stream
- Enhance policies and programmes to support circularity
- Standardize measurement and increase data collection

The National Recycling Strategy is planned as the first part of a series of strategies to support the circular economy. It focuses on the national municipal solid waste recycling system. "The purpose of the National Recycling Strategy is to identify deliberate objectives and stakeholder-led actions to create a stronger, more resilient, less impactful and more cost-effective US MSW recycling system."

The EPA sees two major global trends that are motivating changes to the US recycling system. Changes in global trade are shifting markets for recycled materials, further amplifying the need for new markets and improved infrastructure in the US. There is also an increasing awareness of the extent and the impacts of mismanaged waste on the environment, which leads to increasing demands for accountability and transparency in the economy. The EPA also states that it wants to achieve a recycling rate of 50 per cent by 2030.

One main aspect of the strategy is the improvement of markets for recycled commodities. This is to be achieved by promoting market development. The EPA wants to conduct market development workshops and dialogues to spur market development for recycled materials and to identify solutions to recycling system challenges. It also wants to support regional market development entities and produce an analysis of market development opportunities that are suited to rural areas. Another aspect is to create market development toolkits for communities.

The EPA wants to produce an analysis of different types of end markets that consider recycled material consumption, resilience, environmental benefits and other relevant factors for decision-makers. The use of recycled material feedstocks for manufacturing in domestic markets is to be increased. This is to be achieved by raising awareness of the regional feedstocks available to local manufacturers.

Source referred statue of liberty: xxx Source disposal: pixabay.com

The EPA also wants to draw up a plan to develop the required capacity and improvement of domestic markets to use recycled materials that are generated in the US.

The EPA wants to increase the demand for recycled materials through polices, programmes, initiatives and incentives. Therefore, strategies for addressing materials with less mature markets need to be identified as well as strategies to address barriers to using recycled content in products. The agency also wants to develop messaging about buying sustainable products with recycled content. It also wants to encourage institutions, corporations and governments to adopt procurement policies that lead to the purchasing of more sustainable materials made with recycled content.

Other aspects are to explore the possible ratification of the Basel Convention and to encourage the environmentally sound management of scrap and recyclables traded with other countries.

The EPA points out that the infrastructure in the US has not kept pace with the rapidly changing recyclables streams and that products are not designed with the current infrastructure in mind. "Investment and innovation are necessary to increase collection opportunities, improve the sorting of materials, boost the efficiency of materials processing infrastructure, increase the collection of materials and create a more resilient recycling system." Therefore, the understanding of the available infrastructure and needs has to be improved. The EPA wants to create a national map of the existing recycling infrastructure to depict available recycling system capacity. It also wants to conduct a needs assessment of recycling infrastructure in the US as well as an environmental justice assessment of the non-hazardous solid waste management infrastructure.

Another aspect is to raise awareness and the availability of public and private funding as well as incentives and effective strategies to access these funding options. Public and private funding opportunities need to be increased. The EPA also wants to compile and share available funding sources as well as related resources.

The consideration of recoverability and sustainability in the design of new products also needs to be increased. This includes engaging in outreach efforts to boost participation in recycling, to provide data and analysis to support the increased collection of recyclables and to implement incentives, policies and programmes that result in higher collection rates. The EPA also emphasises the necessity to reduce contamination levels in the recycled materials stream to improve the quality of the stream.

The EPA also wants to enhance education and outreach to the public on the value of recycling and how to recycle properly. With this point in mind, it wants to develop messaging and educational materials highlighting the importance and the value of recycling as well as developing common recycling messages on key issues to promote awareness, increase recycling participation and ensure a more consistent stream of recyclable materials. The agency also sees a need to improve the consistency of labelling for recyclable products, recycling bins and trash bins. It is also essential to ensure that resources are available for educational and outreach initiatives.

A further aspect is to enhance policies and programmes that support circularity. The EPA intends to strengthen federal coordination to support and encourage actions that improve the recycling system. It wants to conduct an analysis of different policies that could address recycling challenges as well as a study on reflecting environmental and social costs in product pricing. The agency also sees the need to coordinate domestic and international interests.

Finally, the EPA intends to standardise measurement and increase data collection. In order to do so, it wants to develop and implement the national recycling system's definitions, measures, targets and performance indicators. The agency wants to create a tracking and reporting plan, recycled content measures and to coordinate domestic and international measurement efforts. The agency also sees the need to increase data availability and transparency regarding the recyclable materials generated and the materials manufacturers need.

No further capacity needed

Source: Francis Ray; pixabay.com

Due to various changes, the export of waste from the EU to other countries is likely to continue decreasing, which means the material will have to be treated within the member states. However, in its report "Waste trade and incineration – debunking an unnecessary alliance", Zero Waste Europe states that this does not mean more incineration capacity is needed.

By Michael Brunn

With its National Sword policy, China shone a light on the global waste trade in 2018, the report states. Half of the world's plastic waste had previously been recycled in that country. However, the waste streams were simply diverted to Southeast Asia and Turkey. Together with the Basel Convention, the EU's waste shipment regulation is supposed to ensure that shipments are conducted in a controlled and limited way. However, the report points out that in 2020 the EU shipped 32.7 million tonnes of waste outside the EU, both municipal and non-municipal waste. More than half of these shipments consisted of metal waste (17.4 million tonnes), followed by paper waste (6.1 million tonnes) and plastic waste (2.4 million tonnes). Today, however, 40 per cent of this waste is sent to Turkey. "Recent changes to the Basel Convention improved the rules for exporting plastic waste, but they remain insufficient and the EU is now looking at adopting a ban on waste exports outside of its territory," the report says. The waste that cannot be exported would have to be treated within the EU, ideally by either recycling or reusing it. However, according to the report, the incineration industry claims that the potential waste export restrictions would lead to the need for more incineration capacity. The report wants to show that this is not necessary.

There are two possible options: a waste export ban outside the OECD, or a waste export ban outside the EU and EFTA countries. The first option would still allow exports to Turkey or the UK. The second would only allow exports to Iceland, Lichtenstein, Norway or Switzerland, which currently take only about 10 per cent of the EU's waste exports. For these scenarios, Zero Waste Europe assumes that the bans will come into effect in 2025 and projects the likely tonnages up to 2035.

The assumption is that approximately 30 million tonnes of waste would be exported from the EU annually. In the first scenario, 52 per cent would go to OECD countries, while 48 per cent would remain within the EU. In the second scenario, as mentioned, only 10 per cent would be shipped to EFTA states, while 90 per cent would have to be treated within the EU. According to the report, in this case the tonnages shipped to EFTA states could increase, but the option was not included since these countries do not have significant additional capacity.

It is likely that most of the waste currently exported will have to be treated within the EU going forward. "Therefore, a plan needs to be put in place that is consistent with meeting the EU's recycling, residual waste, and waste reduction targets; and that does not rely wholly on incineration." Historically, the lower-quality waste was exported to international markets. However, that has changed over the years, since the importing countries have become stricter in terms of quality. This

Main destinations for waste from the European Union, 2020 (in Million tonnes)

Source: Eurostat

trend is expected to continue. "In addition, the quality of recycling material sorted in the EU will have to improve in the future to meet recycling targets, and thus the quality of exports will improve as well," the report says.

The report presents three recycling scenarios for the repatriated waste: Low, Medium and High. The Low scenario envisages recycling rates of 50 per cent for paper and cardboard, 20 per cent for plastics, 60 per cent for metals and glass, and 50 per cent for other waste. "The Low scenario is then based on the idea that the waste currently being exported is of lower quality than what is recycled in the EU. Therefore it is either not recyclable, or contains high amounts of contamination consisting of other materials – such as if the material exported as paper and cardboard were to actually contain some metal and plastic."

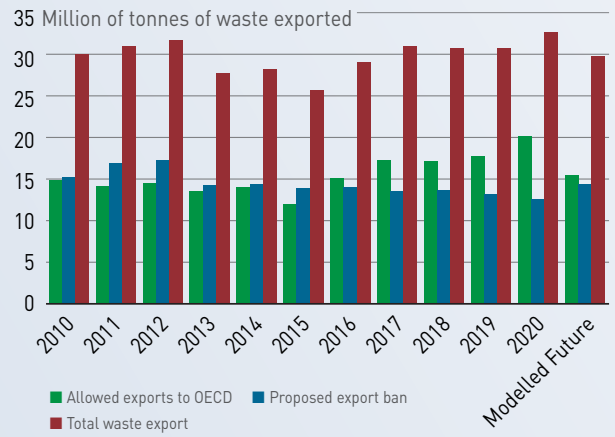
In the Medium scenario, recycling rates are 72 per cent for paper and cardboard, 33 per cent for plastics, 75 per cent for metals, 76 per cent for glass, and 75 per cent for other waste. However, since the quality of material has already increased and needs to go further to meet the high recycling targets, the High scenario assumes that all the material repatriated is sorted correctly. This would lead to recycling rates of 95 per cent for paper and cardboard, glass and other waste, 80 per cent for plastics, and 100 per cent for metals.

"Where exactly we would be within this range would depend on the accuracy of the sorting and the quality of the sorted outputs at the time when the ban takes effect, as well as on the state of global material markets. If other countries relax their import rules again, we could be heading towards the Low recycling scenario; if the current trajectory in terms of materials markets and recycling quality continues, then we could be closer to the High scenario," the report explains.

As the report points out, other changes will also have an impact on incineration capacities, such as the recycling targets for municipal waste and the 10 per cent cap on waste to landfill in 2035. Here, the report considers two scenarios: a business-as-usual scenario in which the waste generated per capita stays constant, and a waste reduction scenario with 10 per cent reduction per capita. If all the targets are met, the amount of waste going to incineration is expected to be relatively constant. "The increase in recycling required to meet targets effectively offsets the reduction in landfilling to keep incineration stable over time."

To determine the potential impact on incineration, all scenarios mentioned above are combined. As the report states, the amount of waste incinerated is above current levels in only three of the twelve combined scenarios. "These three are all when the ban applies to all waste going outside the EU + EFTA," the report states. The maximum increase would be 13 per cent above current levels. According to the report, "If the recycling rate of the repatriated waste were indeed this low, other waste would still need to be reduced or recycled in order to meet the EU's Waste Framework Directive targets, thus opening up further capacity in existing incineration facilities. Therefore, we conclude that the current incineration capacity should be sufficient to deal with the additional waste no longer being exported."

Tonnages of waste exported from the EU from 2010-2020, classified as waste exported to OECD countries which would continue to be allowed (about 52% of the total waste exported) in our first export ban scenario, and waste exported to other countries outside the OECD that would be banned in the future.



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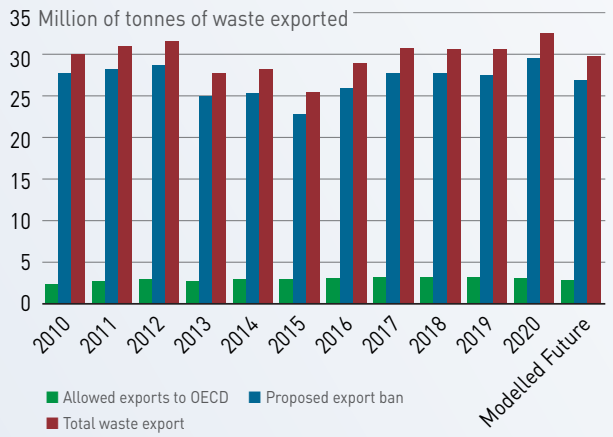
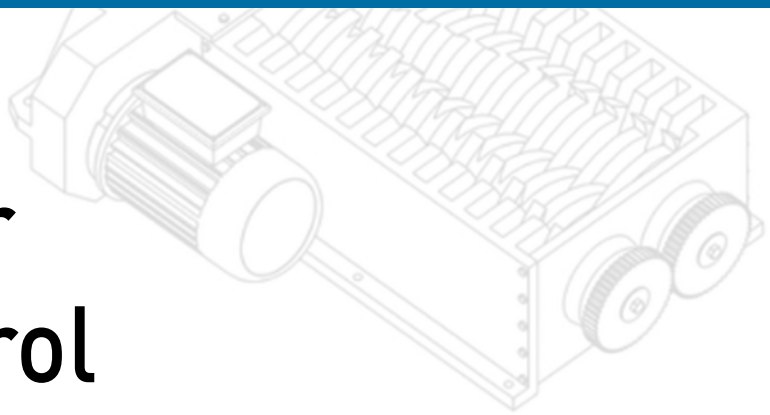


Source: zerowasteeurope.eu



Using VSDs for shredder control

We've all faced a situation where our handy office shredder grinds to a halt when it becomes jammed or overloaded. In this scenario, you can usually press the reverse button to remove the blockage. However, for larger shredders in industrial applications, such as those used for recycling plastics and metals, there are greater benefits in finding a more efficient way of responding to overloading and blockages. This article describes how systems integrator and WEG partner Technidrive engineered a bespoke solution for shredder control using a variable speed drive (VSD).

By Marek Lukaszczyk, WEG

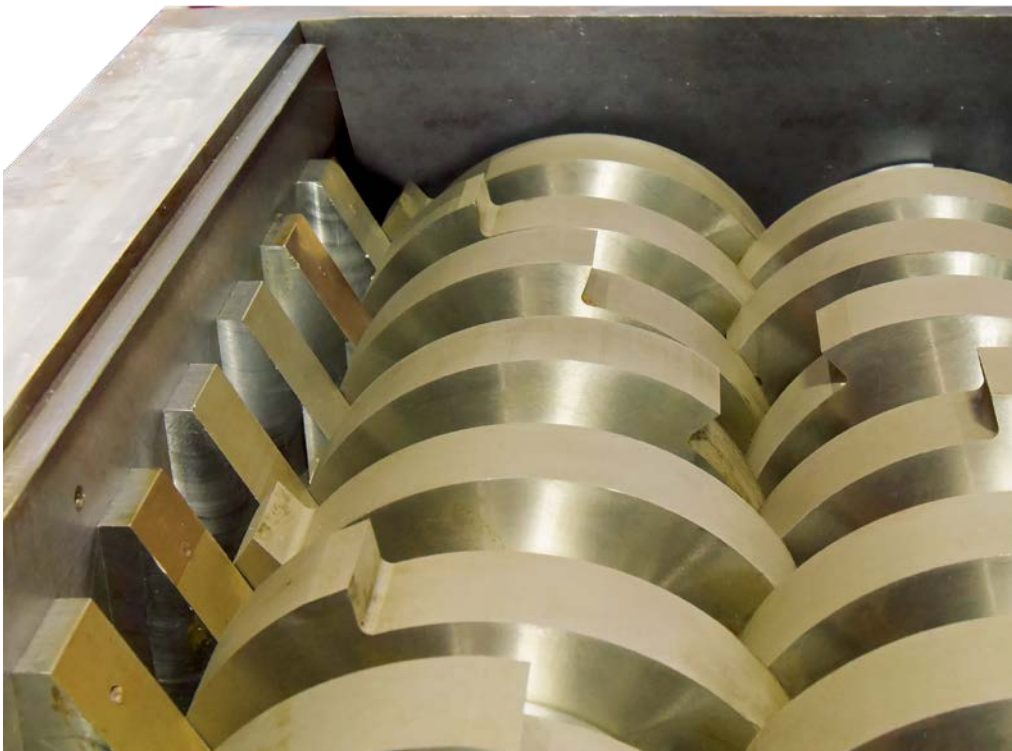
The shredding action for larger shredders, such as those common in industrial applications, is not dissimilar to what you would observe for your office or household shredder. Larger shredders are often used in recycling applications and can shred anything from waste and plastics to metals and cars.

With a greater focus on sustainability in the UK, these shredders are playing an important role in the development of a circular economy. For example, about 85 per cent of steel is recycled at the end of its first useful life, meaning shredders that can shred cars and scrap metal are in demand. However, while more shredding is important in increasing recycling rates, the process itself should also be as energy-efficient as possible. VSDs can contribute here by improving the efficiency of shredder control.

Larger shredders also share the same tendency we have all witnessed on a smaller scale — something jams between the teeth and the mechanism grinds to a halt. These blockages persist when the mechanical drive does not have sufficient torque to drive through the object that has caused the jam. Repeated jams can limit throughput and wear down the parts used in the shredder, raising maintenance costs.

There are two options for a shredder facing this common problem. Firstly, the shredder can simply drive through the blockage, although it obviously requires sufficient torque to do this. Secondly, there is a reversal function to rotate the blades back in the opposite direction, to clear the jam before resuming. For large shredders, this reversal function is triggered automatically.

Although reversals might be a simple solution for your everyday shredder, too many reversals significantly curtail throughput on larger industrial shredders. If you can successfully monitor the load the shredder is facing and control the speed, you can cut out unnecessary reversals and improve the



efficiency of the process. That's the primary advantage of VSDs in shredding applications, but further benefits include energy savings and reduced maintenance costs.

Systems integrator Technidrive was called upon to provide a control system for a shredder in a recycling application. Technidrive selected the mechanical drive system, including the electric motors and gearboxes to drive the two shredder shafts. Next, they went about supplying the control system.

For this they turned to WEG for a VSD paired with a WEG motor. Specifically, Technidrive's engineers chose the WEG W22 premium efficiency IE3 motor. "We opted for this motor due to the robust cast iron frame and high efficiency," explained David Strain, technical director at Technidrive. "Another key benefit was that pairing this with the WEG VSD allows us to give the customer a 3-year manufacturer's warranty."

The VSD gathers real-time data on torque, current, voltage, DC bus voltage and frequency. With some clever programming, Technidrive was able to engineer the VSD to allow it to decide when a reversal of the shredder should take place, based on this data.

Technidrive supplied a control system with an HMI touchscreen on the front panel, which was connected directly to WEG's VSD. An additional benefit of this solution was there was no need for an external programmable logic controller (PLC). The customer could now alter the current and speed using the HMI, and vary these depending on real-time data. This would provide for a more efficient throughput, while also allowing the flexibility to adjust for different materials.

As this shredder was used for shredding different materials such as plastics and metals, a solution that provided flexibility was important. This was a bespoke solution, using a piece of programming engineered specifically for the customer. Technidrive also took care of the installation and training with WEG products.

VSDs are used in a variety of applications to provide control of motors. They convert constant frequency and voltage input power to adjustable frequency and voltage source for controlling the speed of AC induction motors. VSDs allow for controlled starting, stopping and acceleration as well as dynamic torque control during a motor's operation.

When materials get jammed in a shredder, the quickest fix is for the shredder to drive through it. This is achieved by reducing speed in order to gain torque. If possible, this is preferable to a reversal, which takes more time and therefore reduces throughput. With a VSD, the speed control and the more accurate measurement of torque means enhanced efficiency.

Traditionally, shredders reverse based on current. When the motor is overloaded, it draws current. However, current can be susceptible to power factor, voltage drop or other factors. Using a VSD provides a more accurate measure of the torque and therefore the true load of the motor.

"Most shredders don't use VSDs," explained Strain. "By monitoring the torque more accurately you measure the true force that is on the shaft and therefore you can protect that shaft and reverse at the correct times." This protects the motor and the equipment from damage by ensuring reversals take place when necessary. More importantly, it cuts out unnecessary reversals and controls the speed in a way that allows the shredder to drive through when necessary, improving throughput.

In addition to these benefits, the use of WEG products was key to delivering the flexibility required by the customer. "A major advantage of our products is the flexibility of our software," commented Marek Lukaszczyk, European and Middle East marketing manager at WEG. "Our drives come with soft PLCs built into them, providing an enhanced level of control without the need for an additional PLC. This was a major benefit in this application."

"We could have engineered a similar result with a VSD and an external PLC, but with WEG we were able to take their standard off-the-shelf inverter, which includes safe stop, soft PLC, and DC bus chokes, and engineer them into a specialised application. That's a key advantage that other similar products don't offer," explained Strain.

The customer has been very satisfied with the end result. While many shredders don't have VSDs, those who do adopt this technology are set to enjoy improved throughput as well as savings in energy and maintenance costs. Maybe we will still have to put up with our flimsy office shredder jamming from time to time, but those operating with larger shredders can now enjoy the option of a custom-engineered VSD to offer better shredder control.

Source: Shutterstock / Sanit Fuangnakhon

The shredder is used for different materials – therefore the solution had to offer high flexibility. A combination of a drive with VSD and customized software was able to meet the requirements. Integrated components such as safe stop, soft PLC, and DC bus chokes brought further advantages such as energy savings and lower maintenance costs.

Takeout food without remorse

Due to the high demand for takeout food and beverages, Hong Kong has a huge problem with single-use plastics. The Eat Without Waste initiative and ADM Capital Foundation have analysed four solutions to tackle the problem. Their report "Eat without waste – Hong Kong's takeout packaging challenge" provides some insight into the challenges and their possible solutions.

By Michael Brunn

Hong Kong's consumers are the biggest spenders on restaurant-prepared food in the Asia-Pacific region, spending nearly double the average figure. This in turn leads to a disproportionately high use of SFP. Approximately 21.7 million takeout meals were sold per week in Hong Kong in 2019, in other words, three to four meals per person per week. "The underlying driver for the city's growing pile of SFP waste is the large number of meals prepared outside of the home," the report states. It explains that in Hong Kong not everyone has access to a kitchen or lives in a house with a shared kitchen. On the other hand, SFP is also often used for on-site dining.

It is estimated that in 2019, 3.94 billion single-use food and drink containers were used in Hong Kong, mainly for hot food. Most of the local fast food and low-end outlets use EPS containers due to their heat-retaining quality and low cost. The mid- to high-end locations typically use PP containers. In correlation with the population growth in the city, a total consumption of 4.15 billion containers per annum is expected by 2030. Due to the pandemic, consumer takeout habits have caused further growth in usage. Therefore, the use of takeout containers is likely to be even higher in 2030.

The total of solid waste for disposal increased from 4 to 5 million tonnes in the 90s to 5.7 million tonnes in 2019. Of this amount, 4 million tonnes were municipal solid waste. Moreover, the per-capita waste disposal figure increased from 1.27 to 1.47 kilograms per day between 2011 and 2019. These numbers are far higher than for other large cities in the region. "The increase in MSW disposal has been accompanied by a decrease in recycling rates, especially in the last decade," the report states. This fact is explained with insufficient and inconvenient existing recycling facilities and a general distrust in the recycling system. The situation has also led to the problem of littering through food containers.

Hong Kong produces much more waste than other cities in the region

The report analyses four main ways to tackle the problem: Recycling, bring-your-own (BYO), composting and reuse.

For most recycling streams, consumers are required to clean the containers after consuming the products. Depending on the material, the consumer can drop the container into a mixed recyclables bin, which is then sorted at the recycling facility. For some materials, however, the containers have to be placed in designated bins.

The system-related cost of using and recycling PP containers is estimated at HKD 0.93, which is the cheapest of the four solutions. Three quarters of the cost is driven by the container purchase. Treatment and transportation represent only a small part of the cost, due to economies of scale. Five per cent of the cost relates to the hot water required to clean the containers. A further fifteen per cent goes towards rental space for collection bins, processing and maintaining collection bins, and retrieving the containers from their drop-off points. Alongside BYO, recycling has the highest per-container usage of water

Source: pyalis14; pixabay.com

due to manual washing. The recycling of one container generates 147 g of carbon emissions across its life cycle. Furthermore, 75 per cent of these emissions are generated during the production phase, while the recycling process only accounts for 5 per cent of total emissions.

There are no technical performance limitations to recycling and no future packaging innovations are required. However, the greatest demands in terms of recycling are placed on the consumers, as they have to clean the containers, keep them separate and return them to the appropriate recycling stream. On the other hand, the relevant collection and treatment structure is already in place. According to the report, recycling has the potential to address 69 per cent of the containers put on the market – but this rate can only be achieved with a major shift in consumer behaviour. Otherwise, 57 per cent is considered as a realistic figure. The report emphasises that recycling has the highest potential impact of all four solutions.

In the BYO scenario, consumers bring their own containers for their food or beverages when purchasing takeout meals. The scenario also leaves consumers with the responsibility to clean the container. So far, only few establishments in Hong Kong actively promote and incentivise BYO. However, many eateries, especially smaller ones, permit BYO without promoting it.

The cost per container is assumed to be HKD 0.45 for 50 use cycles. Moreover, the cost is almost completely driven by the purchasing cost of the container. "Consequently, each further use cycle helps drive down the overall solution cost." There is also a small amount required for cleaning as well as marginal costs for recycling at the end-of-life stage. BYO is the solution with the highest water consumption. The figure could, however, be reduced by more efficient washing, e.g. by using dishwashers. BYO emits 35 g of carbon per container use. Besides the emissions generated when producing the container, the majority is accounted for by the energy used for washing. However, the advantage in this case is that the containers can be used for multiple purposes and are already available in most households.

"The main technical performance issue is the lack of standardised sizes and shapes, which may not be compatible with the beverages or food being served at different outlets," the report states. It also points out that the solution is consumer-driven. Consumers need to bring their own containers, plan in advance, and are responsible for carrying or storing the containers until their next use. The food and beverage operators will also need to adapt in various ways. However, there is no need for an infrastructure until the containers have reached the end of their useful lives. According to the report, this solution has the potential to address 70 per cent of containers on the market by 2030. However, in order to reach this target, both consumers and operators will need to change their habits.

Compostable SFPs can be placed in the compostable waste stream after use. The stream could be a generic organic waste compost bin or a dedicated packaging compost bin. "Hong Kong does not have scaled-up processing facilities equipped to handle compostable packaging," the report explains. With the current infrastructure, compostable food and beverage containers could not be handled today, which leaves very few options for this solution.

The cost is estimated at HKD 2.78 per container, based on the assumption that an appropriate processing capacity is in place. Of this amount, HKD 2.70 relates to the purchase price of the container. The processing cost is based on those recorded for other cities, but even higher costs would not make much difference to the overall expense. However, this does not include the washing stage. Per container use, the report has calculated 174 g of carbon emissions, which is the highest of all four solutions. More than 99 per cent of that amount is attributable to the production of the bagasse fibre and product moulding.

In most cases, the highest burden lies on the customers

Conventional PLA is not suitable for hot meals or hot beverages. Moreover, it does not biodegrade in home composting systems. "Industrial composting facilities are pivotal to implementing this solution. Without them, the composting solution does not keep any containers from being sent to landfill."

The solution could replace 51 per cent of SFPs on the market. However, sufficient capacities are needed. The collection challenge lies in ensuring that enough conveniently located collection points are in place. It also has to be determined whether containers can be collected together with other organic waste.

In comparison to BYO, in the reuse solution the containers are loaned to consumers and managed by a third party at system level. Logistically this is one of the more complex solutions, because the containers need to be moved between various parties. The customer borrows the containers for takeout food or beverages and needs to return them after use.

There are two options for return. Either the customer returns the container to a dedicated collection point or it is picked up from the consumer at a pre-arranged time. The containers can be cleaned by the F+B operator, a centralised washing facility, or at the site of one operator on behalf of the other participants.

Monetary incentives should also be considered in order to motivate customers to return the containers within a certain period of time. Customers could also be charged a subscription or a usage fee to help finance the system.

Reusable container systems are globally still an emerging solution, the report states. In Hong Kong, there are only a handful of small-scale pilots. Space is an important factor for the F+B outlets as well as for the return process.

With an estimated HKD 6.08, reuse is the most expensive solution, which is more than double the cost of the next most expensive option. The various transport costs account for 41 per cent and cleaning for another 41 per cent when using a third-party commercial washing facility. Containers are more expensive than for BYO. The drop-off point costs account only for 2 per cent of the total cost. Washing the containers in commercial dishwashers leads to the least amount of water being used. The overall emissions per container use are calculated at 6.6 g.

There is no single solution to solve the problem

Reusable containers are built robustly for repeated use and require more standardisation than other solutions. A limited set of designs must be able to handle a wide variety of foods. The containers also need to be resistant to retaining odours, oils and colour staining.

With a sizeable shift in current practices by all stakeholders, 33 per cent of containers could be eliminated by 2030. But as the report points out, even under ideal conditions, the cost of a reuse system will never be very low without funding from the government. Therefore, the report sees this solution limited to selected areas and applications.

The report points out that the key is to scale any solution quickly. "Growth in demand drives interest and investment on the supply side, while growth in supply drives convenience and normalisation." This goes for all of the solutions.

"No solution is completely straightforward to implement, and they all require commitment and effort from multiple parties," the report continues. System-level thinking and coordination is required. The report proposes this approach: "Track all single-use food service packaging, not just plastics. Use a portfolio of tools. Start now." Trying to eliminate just one type of SFP will only cause a shift to other SFPs. However, no SFP type is completely without an environmental impact and none of the four solutions can cover the entire scope of cups and containers.

Recycling and BYO show the most promise, as they have the potential to keep the largest amount of SFPs out of landfill. "Importantly, both solutions can be dialled up and down relatively easily." Reuse has the highest potential from an environmental impact perspective, but the solution is hindered by comparatively high costs and logistical demands. With the right collection and processing infrastructure in place, composting could replace a substantial share of SFP volumes.

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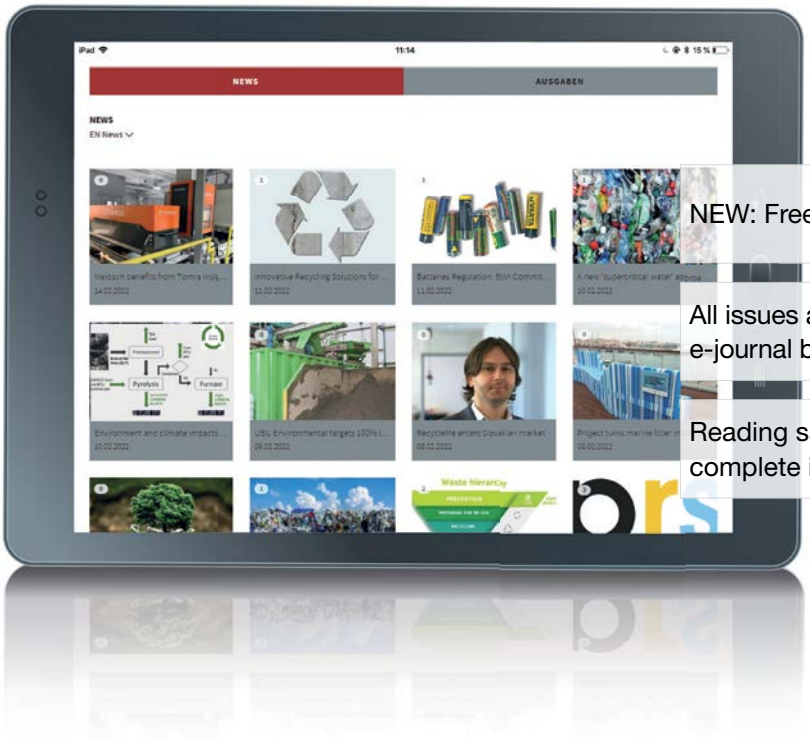

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