Briefing

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Understanding waste streams

Treatment of specific waste

SUMMARY

Waste streams are flows of specific waste, from its source through to recovery, recycling or disposal. Together they make up the overall waste treated in the European Union (4.6 tonnes per capita in 2012). Waste streams can be divided into two broad types: streams made of materials (such as metals or plastics) or streams made of certain products (such as electronic waste or end-of-life vehicles) which require specific treatment and ultimately feed into materials-related streams.

Reports suggest that the new legislative proposal on waste to be tabled by the European Commission by the end of 2015, as part of the new 'circular economy' package, is likely to focus on individual materials. Each waste stream has its specific characteristics and applicable legislation, including in terms of treatment method, hazardousness, practical recovery and recycling possibilities.

Broadly, a set of general principles apply across waste streams. Waste streams can be divided into two main categories: material-related streams (including metals; glass; paper and cardboard; plastics; wood; rubber; textiles; bio-waste) and product-related streams (including packaging; electronic waste; batteries and accumulators; end-of-life vehicles; mining, construction and demolition waste).

A number of aspects need to be considered in assessing different waste streams: sources of waste to be treated and uses of treated waste; applicable recycling and recovery methods; specific opportunities and challenges, in particular related to recycling; and applicable European Union legislation and its implementation.

Packaging waste (paper, glass, plastics, metal).

In this briefing:

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Glossary

End-of-waste: stage at the end of the waste treatment process when materials are no longer considered waste, provided they meet certain conditions known as 'end-of-waste criteria'.

Extended producer responsibility: an environmental policy approach in which a producer's responsibility for a product continues after the consumer has finished using it.

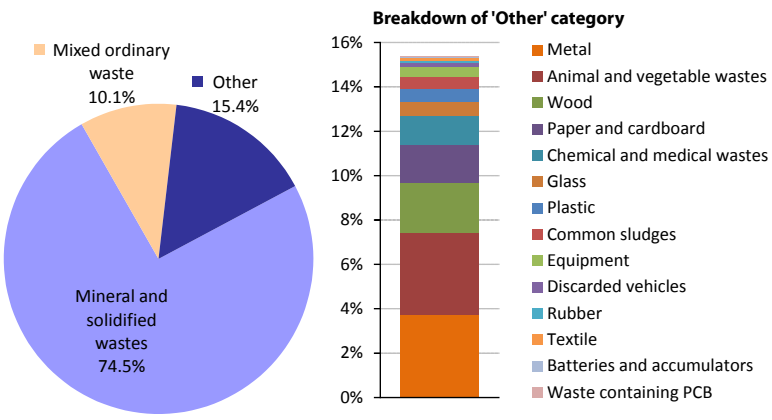
Recyclable waste: ferrous and non-ferrous metal, glass, paper and cardboard, rubber, plastic, wood and textile wastes, whether hazardous or non-hazardous; based on Eurostat classification.

Waste stream: the complete flow of waste from its domestic or industrial source through to recovery, recycling or final disposal.

Background

In 2012, 2.3 billion tonnes of waste (or about 4.6 tonnes per capita) were treated in the European Union (EU). 'Mineral and solidified waste' (mainly soils, construction and demolition waste) accounts for almost three quarters of the total weight of waste treated. 'Mixed ordinary waste' (mainly household and similar waste) accounts for 10% of total waste, while recyclable wastes (metal, wood, paper/cardboard, glass, plastics, rubber and textile) account for 5%. Although some waste categories may appear small in comparison with the total, their volumes remain significant (for instance 1.6 million tonnes – or 3 kg per capita – of batteries and accumulators).

Figure 1 – Waste treatment by waste categories in EU28, 2012



Quantities in million tonnes	
Total	2309.0
Mixed ordinary waste	1720.4
Recyclable waste	233.6
Metal	86.3
Animal and vegetable wastes	84.8
Wood	52.9
Paper and cardboard	38.8
Chemical and medical wastes	30.0
Glass	15.5
Plastic	12.7
Common sludges	12.6
Equipment	10.2
Discarded vehicles	4.8
Rubber	2.4
Textile	2.4
Batteries and accumulators	1.6
Waste containing PCB	0.04

Data source: Eurostat (env_wastrt), 2015.

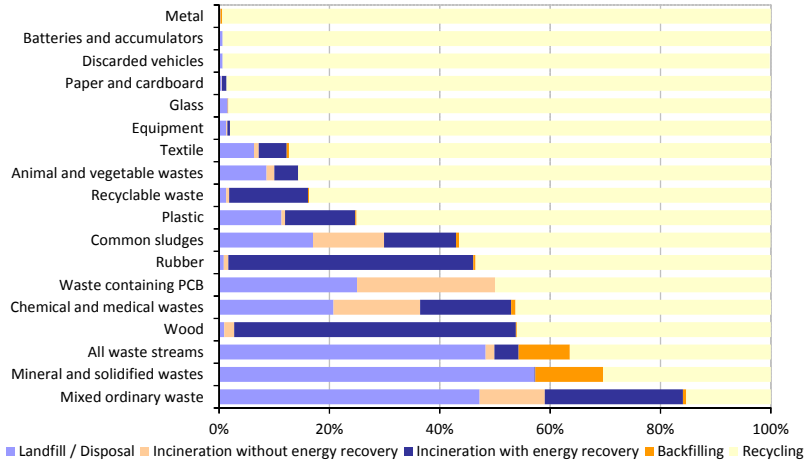
EU waste management policy is built mainly upon policy strategies,[1] three overarching directives,[2] and legal acts applying to specific waste streams.

Two **principles** apply across all waste streams. The 'waste hierarchy' sets a priority order among five waste treatment methods: 1) prevention, then 2) preparing for re-use, 3) recycling and 4) (energy) recovery, with 5) disposal as the least preferred option. The 'polluter pays principle' requires polluters to bear the cost of preventing, controlling and cleaning up pollution, to ensure that these costs are reflected in the price of goods and services causing pollution at the production and/or consumption stage. Implementing these principles, extended producer responsibility (EPR) is used in several waste streams across the EU. It implies that producers take over the (financial and/or operational) responsibility for collecting or taking back used goods, for sorting them and for their eventual recycling.[3]

The Waste Framework Directive sets general principles relating to **end-of-waste status**, and provides that implementing acts on end-of-waste criteria for specific materials be adopted under the 'regulatory procedure with scrutiny', granting the European Parliament and Council a right of veto. A 2010 study by the European Commission's Joint Research Centre (JRC) identifies streams suited for end-of-waste criteria assessment (metals, plastics, paper, textiles, recycling aggregates from construction and demolition, ashes and slag, bio-waste materials) and streams which may sometimes be suited for this purpose (solid waste fuel, wood, waste oil, tyres, solvents). So far, implementing acts have been adopted for metal, glass and copper.

Treatment methods vary across waste categories. Eurostat data for the EU28 in 2012 indicate that across all waste categories, 48% of waste collected is landfilled and 36% is recycled. Because of its nature, 'mixed ordinary waste' has the lowest recycling rate of all categories (15%). Six waste categories have recycling rates higher than 98%. 'Recyclable' waste has lowest recycling rates in plastic (75%), rubber (54%) and wood (46%) wastes. (Figures relate to separately collected materials and may not reflect actual treatment – as a fraction may end up in the 'mixed ordinary waste' category).

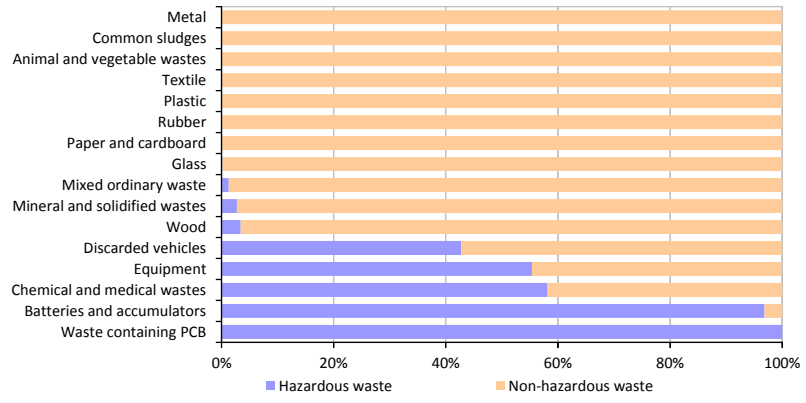
Figure 2 – Treatment method by waste category in EU28, 2012



Data source: Eurostat (env_wastrt), 2015.

EU legislation differentiates between **hazardous and non-hazardous waste**, through a series of criteria listed in annex 3 of the Waste Framework Directive. Hazardous waste is subject to specific obligations (such as labelling, controls, and bans on mixing and on shipments to non-OECD countries). Eurostat data for the EU28 in 2012 indicates that, across all waste categories, 3.3% of waste measured by weight is hazardous (see figure 3).

Figure 3 – Hazardous waste in waste categories in EU28, 2012



Data source: Eurostat (env_wastrt), 2015.

Further developments can be expected in this policy area in the near future. The European Commission has announced that it intends to present a new legislative proposal on waste by the end of 2015, after withdrawing its original circular economy package[4] in February 2015. Press reports suggest that the new proposal will be 'material specific'.

Waste streams, whether relating to materials or to certain products containing such materials, have varying characteristics. These are outlined below for selected waste streams of particular relevance to EU waste policy. Details on the treatment of municipal waste (which broadly corresponds to 'mixed ordinary waste') can be found in the EPRS briefing 'Understanding waste management'.

Material-related streams

Metals

Metallic wastes are divided into two broad categories: ferrous metals (steel and iron), accounting for 80% of metal waste; and non-ferrous metals (aluminium, copper, zinc, lead, nickel and others),[5] accounting for 9% of metal waste. The remaining 11% waste is mixed ferrous and non-ferrous metal. End-of-waste criteria defining when metal scraps cease to be waste and become secondary raw materials were set in 2011 for iron, steel and aluminium, and in 2013 for copper.

Sources of metallic waste depend on the metal type. Iron and steel come mainly from industry, households (packaging) and end-of-life vehicles. In contrast, non-ferrous metals come first and foremost from industry, with the notable exception of aluminium (used in cars and trucks, buildings and packaging).

Metals industry on circular economy

Trade bodies for steel (Eurofer), aluminium (EAA) and non-ferrous metals (Eurometaux) support a more harmonised approach to measuring recycling, based on the amounts actually recycled and not on the amounts collected. EAA and Eurometaux call for quality recycling to be prioritised and for exports of metal scrap to be better monitored. Eurofer and EAA favour a life-cycle analysis approach to take into account the recycling credentials of metal products.

Metals recycling can deliver significant **energy and cost savings**. Steel production in electric arc furnaces uses almost exclusively scrap metal as raw material. It consumes three times less energy and significantly less water than the basic oxygen converter technology using mostly iron ore. In Europe, 54% of steel is produced from iron scrap. Aluminium recycling enables up to 90% energy savings, as well as cost savings compared to production from bauxite, the most common aluminium ore. Data from the European Aluminium Association indicate that half of the aluminium in Europe is produced from recycled sources and that over 90% of aluminium in cars and trucks as well as buildings is recycled. Similarly, recycling other non-ferrous metals enables cost savings as well as energy savings ranging from 20% to 90%.

Although metal is in principle 'infinitely recyclable', a recent report by Dovetail, a US consultancy, points out that in practice there are some **limitations to recyclability** of metals, and steel in particular. Approximately 10% of the steel scrap available globally contains other metallic or non-metallic elements, due to the use of additional metals in steel alloys and coatings. As a result, each time scrap steel is recirculated, the concentration of residuals rise, making processing more difficult. The study concludes that improvements in contaminant removal and recovery of metals are essential to enable closed-loop recycling.

Rare earths

Rare earth elements are a group of 17 metals critical to clean energy and high-tech growth industries, and mined overwhelmingly (95%) in China. However, recycling of rare earths remains limited. A study, published in 2015 by the European Parliament, identifies challenges and opportunities linked to the recovery of rare earths from electronic waste.

Glass

The main **source** of glass for recycling is packaging, which accounts for 65% of the glass produced in the EU in 2014, according to data from the European glass industry. On average, 70% of container glass is recycled in the EU, and new container glass uses 52% of glass cullet (crushed glass used as secondary raw material), according to industry data. Glass is mainly recycled as packaging and glass wool. In 2012, end-of-waste criteria defined the point at which glass cullet ceases to be waste and becomes a secondary raw material. The Eurostat price indicator for glass cullet in the EU is relatively stable and reached an average €48.20 per tonne in 2014.

Recycling enables **energy and cost savings** in the production process. Because cullet melts at a lower temperature than raw materials, recycling can save around a third of the energy used in production. The by-products of the production process are usually re-used immediately. The recycling process needs glass cullet to be sorted by colour (white or coloured), either at source or after collection at extra cost, and to be clean of impurities such as labels, metal, ceramics or cork. Glass containing lead (e.g. lead crystal) must not be mixed with lead-free glass. The main challenges for glass recycling are that lead concentration tends to rise after consecutive recycling processes; and that flat glass, which accounts for 26% of European glass production, is under-used in recycling (both as a source and as a product of secondary raw material).

Paper and cardboard

In the EU, 54% of the paper industry's raw material comes from recovered paper and cardboard, and 72% of paper and cardboard is recycled, according to the paper industry (CEPI).[6] The European Recovered Paper Council (ERPC) indicates that waste paper is collected from trade and industry (50%), households (40%) and offices (10%), and that it is mainly used to produce newspapers and packaging. The Eurostat price indicator for ordinary grade waste paper in the EU fluctuates along with global paper prices and reached on average €126.60 per tonne in 2014.

Although paper is one of the most recycled materials in the EU, no end-of-waste criteria have been defined. An implementing act defining the point at which recovered paper ceases to be waste was vetoed by the European Parliament in 2013 (see box). The industry works on the basis of a 2002 European Standard, updated in 2013, defining quality levels for recovered paper and tolerance levels for impurities.[7] CEPI calls for the current definition of 'recycling' in EU legislation to be clarified.

Recycling enables **resource savings**, as one tonne of paper and cardboard substitutes for three tonnes of wood, with associated energy and water savings. Although paper fibres can be recycled several times, they cannot be recycled indefinitely; as a result, recovered fibre needs to be associated with (products made of) virgin pulp. In Europe, paper fibre is recycled on average 3.5 times and 20% of paper is not recyclable or collectable, according to the ERPC. As waste paper from industrial sources is already largely recovered, future potential for higher recycling rates lies mainly with households and offices.

EP on paper end-of-waste criteria

In its resolution of 10 December 2013 vetoing the implementing regulation on end-of-waste criteria for paper proposed by the Commission, Parliament took the view that the regulation would grant end-of-waste status to paper before it had been properly recycled (when still containing very high levels of impurities compared to the industry standard). Parliament estimated that it would stimulate global exports of very low quality waste paper, leading to a decrease in the European paper recycling rate (due to lack of secondary raw materials) and ultimately to adverse environmental impact.

Plastics

There are over 1 000 types of plastics, mainly derived from petroleum products,[8] commonly grouped into three broad categories: thermosets (hard and durable plastics used, for instance, in car parts), thermoplastics (easily moulded into packaging) and elastomers (soft plastics with rubber-like properties). Plastics Europe, a trade body, indicates that European plastics demand amounted to 46.3 million tonnes in 2013; the main uses were packaging (39.6%), building and construction (20.3%), automotive (8.5%) and electronics (5.6%). It indicates that in 2012, 38% of waste plastics in Europe were landfilled, 36% incinerated with energy recovery and 26% recycled. Recent trends show a decrease in landfilling and an increase in energy recovery and recycling. The main sources of waste plastics for recycling are packaging, agriculture, and end-of-life vehicles. The Eurostat price indicator for waste plastics in the EU fluctuates along with global oil prices and reached on average €356.40 per tonne in 2014.

EU strategy on plastic waste

In 2013, the European Commission presented a green paper on plastic waste in the environment to prepare the forthcoming review of the waste legislation.

In its resolution of 14 January 2014, Parliament calls for binding targets for collection, sorting and recycling, as well as mandatory criteria for plastics recyclability. It advocates recycling as the best option to meet environmental targets, and urges that plastic waste be used for energy recovery only in cases where all other possibilities have been exhausted. Finally, it calls for phasing out the most dangerous plastics and those which contain substances hampering recycling processes.

Products derived from plastics recycling include synthetic textiles (duvets, fleeces), car parts (interior, bumpers), buildings (isolation), and packaging. Plastic waste **treatment methods** include mechanical recycling (mainly for thermoplastics sorted in homogenous plastic type streams); energy recovery (making use of the high energy content of plastics compared to other waste); or backfilling (construction). Chemical recycling methods, using gasification or pyrolysis to break down plastics in synthetic gas and liquids, remain little used.

Among **factors limiting plastics recycling** are streams containing mixed plastics, the presence of hazardous substances, and insufficient investment in recycling facilities due to a lack of stable plastic waste supplies. PVC is an example of a plastic requiring more complex recycling methods, where industry has undertaken a voluntary commitment in terms of sustainability.

Other recyclable waste

Wood waste comes mainly from industry, construction and demolition, as well as packaging. According to the quality grade,[9] wood waste is recycled (e.g. as panels or pellets); incinerated, with energy recovery; or treated at special facilities. In 2012, 51% of EU wood waste was incinerated, while 46% was recycled, according to Eurostat.

The vast majority of **rubber waste** comes from tyres, which are made of natural and synthetic rubbers, carbon blacks, and reinforcing materials such as metals and textiles. The 1999 Landfill Directive bans the landfilling of tyres. Tyres removed from vehicles are treated in various ways: re-use, re-treading, energy recovery (in incinerators or cement production) and recycling (e.g. as flooring and roofing materials, or as foundations for roads and railways).

Three quarters of **discarded textiles** in the EU are landfilled or incinerated, with the remainder recycled, according to a 2013 report by Friends of the Earth Europe. The JRC report mentioned above estimates that separately collected textiles contain on average

40%-50% wearable textiles for possible re-use, 25%-30% suitable as cleaning cloths, 20-30% suitable as secondary raw materials (for instance as insulation materials) and 12% other materials. Several initiatives aim to increase textiles recycling.[10]

Bio-waste

Bio-waste is understood as a large proportion of biodegradable waste.[11] It is estimated that two thirds of EU bio-waste comes from municipal sources (household waste and green waste) and one third from industrial sources (food processing industry). Bio-waste recovery occurs mainly through composting and digestion, thus producing compost or biogas. Whereas market prices for compost are low for standard qualities, they are considerably higher if composts are tailored to specific needs.

Food waste

In the EU, food waste is estimated at one third of the food produced, or 180 kg per capita every year. According to the Commission, households and the food processing sector are the main sources of food waste.

In its resolution of 19 January 2012 on avoiding food wastage, Parliament considers cutting food waste along the entire food chain to be vital, calls on the Commission and Member States to take action, and welcomes initiatives aimed at recovering unsold and discarded products throughout the food supply chain to redistribute them to people lacking purchasing power.

Bio-waste **treatment** can occur through aerobic (with oxygen) or anaerobic (without oxygen) decomposition by micro-organisms. Aerobic decomposition produces compost; anaerobic decomposition produces biogas (mainly methane) and digestate (a liquid by-product). The main constraints are linked to maintaining good conditions for decomposition (suitable mix of waste sources, temperature, pH levels), avoiding contamination with pathogens and minimising potential health and environmental nuisances, such as dust or odour emissions. Alternatively, bio-waste can be incinerated to produce energy.

EU legislation encourages the treatment of bio-waste. The 1999 Landfill Directive sets reduction targets for the share of biodegradable municipal waste going to landfills, to be met at the latest by 2020. The 2008 Waste Framework Directive mandates Member States to encourage the separate collection and treatment of bio-waste.

A 2013 European Parliament study looking at prospects for recycling agricultural, forestry, and food waste and residues for bioenergy and biomaterials, concludes that this sector should be encouraged, while enhancing transparency in all aspects of its development and ensuring strong sustainability standards.

Hazardous material-related streams

Waste oils are hazardous waste resulting almost exclusively from industrial sources. It is estimated that 40% are recycled or incinerated with energy recovery, while 25% are illegally burned or dumped in sewage. Although used oil can be collected, recycled and used again, the cost of sorting and recycling is relatively high, making it difficult to compete with virgin oil. The 2008 Waste Framework Directive mandates Member States to encourage the separate collection and treatment of waste oils.

Waste **paints and solvents** are one of the main sources of hazardous waste. It is estimated that 61% of the 1.6 million tonnes generated every year are recycled or undergo energy recovery. The disposal of solvents (and of other substances, such as titanium dioxide, used as an opacifier in paints and other products) is regulated by the 2010 Industrial Emissions Directive.

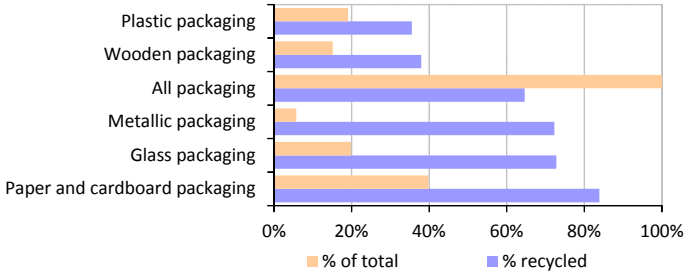
PCBs and PCTs are persistent organic pollutants[12] with high adverse effects on environment and health. The 1996 Directive on PCBs/PCTs requires Member States to draw up inventories and to decontaminate equipment by 2010. In its 2014 'fitness check', the Commission noted that these objectives have largely not been met, even though these substances remain a concern.

Product-related streams

Packaging

Eurostat data illustrate the share of different materials in EU packaging waste, measured in weight: paper and cardboard (40%); glass (20%); plastic (19%); wood (15%); and metal (6%). In 2012, 65% of packaging was recycled, although material-specific recycling rates varied a great deal, from 84% for paper and cardboard packaging to 36% for plastic packaging.

Figure 4 – Materials and recycling rates in packaging waste in EU28, 2012



Data source: Eurostat (env_waspac), 2015.

The 1994 Directive on packaging and packaging waste harmonises measures related to the management of packaging and packaging waste and defines 'essential requirements' for packaging with a view to protecting the environment and safeguarding the functioning of the internal market. It requires Member States to take measures to prevent packaging waste and to develop packaging re-use systems. The original 1994 Directive, and the amended version from 2004, set targets with regard to recovery and recycling of packaging waste. Targets set in 2004, to be met by 2008 (except for Member States with a derogation[13]), relate to the overall recovery and recycling rates (60% and 55-80%, respectively) and to minimum recycling rates for specific materials: glass (60%), paper and board (60%), metals (50%), plastics (22.5%), and wood (15%).

In its 2014 report on the '**fitness check**' of five waste streams directives, the European Commission concludes that targets have generally been met, with a large number of Member States over-achieving on targets, and only a few Member States lagging behind, although there are some uncertainties about the quality of data provided by Member States. The report highlights, however, that the market share of reusable household packaging is decreasing and identifies potential conflicts between packaging re-use schemes and recycling schemes. The Commission suggests strengthening eco-design requirements in order to fully integrate end-of-life impacts.

Lightweight carrier bags

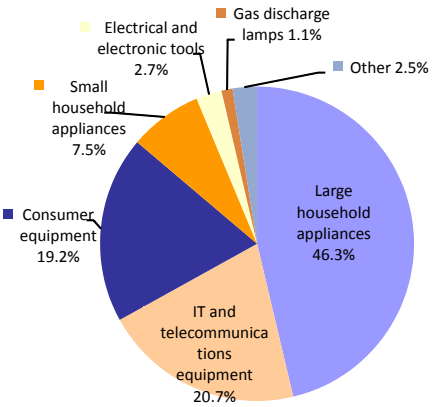
The Directive on lightweight plastic carrier bags of 29 April 2015 amending the Directive on packaging and packaging waste requires Member States to make sure that annual per capita consumption of such bags is reduced to 40 by 2025 and/or that they are not provided free of charge to consumers after December 2018.

The main driver for reaching the targets set in the Directive is **extended producer responsibility schemes**, according to the Commission and stakeholders. Although most Member States have developed EPR schemes for packaging (e.g. a Green Dot company), EPR packaging schemes requirements are not defined in the Directive, and their effectiveness varies a great deal. Research published in 2014 suggests that in some Member States, producers are not paying the net cost of packaging waste management; it also notes the presence of 'free riders' – companies who produce packaged goods but do not contribute financially to their recovery and processing. Europen, an organisation representing the European packaging supply chain, calls for better implementation of EU legislation, for a definition of EPR for used packaging, and for the introduction of EPR minimum performance requirements to create a level-playing field.

Electrical and electronic waste

Electrical and electronic waste, also referred to as 'waste of electrical and electronic equipment' (WEEE), or 'e-waste', is one of the fastest growing waste streams, at 3-5% per year. Almost half of e-waste by weight is made up of 'large household appliances' (e.g. fridges, washing machines), while 'IT and telecommunications equipment' (e.g. computers, phones) and 'consumer equipment' (e.g. TV-sets, hi-fi) account for about 20% each (see figure 5). In 2012, 9 million tonnes of electrical and electronic products were put on the EU market and 3.5 million tonnes of e-waste were collected through regular channels for treatment. The remaining 5.5 million tonnes were either kept by consumers in their homes; collected outside regular channels but properly treated; collected outside regular channels and improperly treated (or illegally exported abroad); or disposed of with mixed ordinary waste (going to landfills or incinerators).[14]

Figure 5 – Waste categories of collected WEEE in EU28, 2012



Data source: Eurostat (env_waselee), 2015.

The Directive on waste of electrical and electronic equipment (WEEE Directive), updated in 2012, sets incremental targets on several aspects: minimum rates for separate collection, recovery and recycling/preparing for re-use.[15] It also allows consumers to return appliances to any shop selling small electrical goods without having to purchase new goods. Provisions on shipping have been tightened so as to impede illegal shipments of e-waste to non-EU countries for environmentally harmful disposal. The Directive on the restriction of the use of hazardous substances in electrical and electronic equipment (RoHS Directive), updated in 2011, restricts the use of lead, mercury, cadmium, chromium and brominated flame retardants in such equipment. It contains a list of exemptions (some of them limited in time) updated by way of delegated acts. In May 2015, Parliament vetoed a Commission proposal for a delegated directive to allow cadmium in lights, on the grounds that it lacked factual justification.

Official data on the **implementation** of the updated directives are not yet available. The European Commission recently launched court proceedings against Poland, Slovenia and Germany for failure to transpose the WEEE Directive. The European domestic equipment industry (CECED) points out that, unlike when EPR schemes for electronic waste were set up, the value of recovered materials can now outweigh the costs of collection, treatment and management, and estimates that only one third of WEEE is collected by EPR schemes, with commercial collectors playing an increasing role. It calls for improved reporting of volumes collected and better enforcement of legislation to ensure fair competition.

As electronic waste is a complex mixture of various (hazardous) materials and components, it usually requires manual treatment to separate materials. Its management presents an opportunity as well as a challenge. Electronic waste is a potential 'urban mine', containing scarce and expensive resources, such as (precious) metals and rare earths needed for the production of modern electronics. However, it also includes a 'toxic mine' of hazardous substances which can cause major environmental and health problems if not properly treated.

Batteries and accumulators

Eurostat states that, in 2012, 1.6 million tonnes of waste batteries and accumulators were generated in the EU. As there are many types of rechargeable and non-rechargeable batteries and accumulators with various component metals, batteries first need to be sorted by type, then recycled according to a specific process. If they are not collected separately, batteries and accumulators enter the municipal waste stream and are either landfilled or incinerated.

The 2006 Directive on batteries and accumulators aims to improve the waste management and environmental performance of batteries and accumulators, as well as to ensure the functioning of the single market by establishing rules for their collection, recycling, treatment and disposal. It also sets limit values for certain hazardous substances (in particular mercury and cadmium) in batteries and accumulators. The Directive provides for the creation of extended producer responsibility schemes and sets recycling and collection targets to be met by 2010, 2012 and 2016.

In its 2014 '**fitness check**' report, the European Commission indicated that four Member States do not comply with the Directive. The Commission provided an overview of the implementation of collection rate targets in Member States, noted that collection rates for automotive and industrial batteries are high but that small portable batteries are often not collected (in spite of improvements), and underlined the key role of consumer awareness. The report suggested possible changes to the Directive, inter alia: clarifying the definition of portable batteries, so as to avoid industrial batteries being collected as portable ones, and addressing battery design with a life-cycle approach.

End-of-life vehicles

Every year, 8-9 million tonnes of end-of-life vehicles (ELV) are generated in the European Union. Eurostat data indicate that across Member States, from 80% to 100% of materials from ELVs collected through regular channels are recovered or recycled. ELVs are generally treated in a series of steps: removal of fluids and hazardous components; removal of components suitable for re-use; shredding; and separation in various materials for recycling or recovery (foams and dust, steel and iron, non-ferrous metals, plastics and glass).

The 2000 Directive on end-of-life vehicles aims to ensure appropriate management of ELVs in the EU. It encourages manufacturers and importers to limit the use of hazardous substances and to develop the integration of recycled materials. The Directive sets targets for recovery and recycling to be met by 2006 and 2015.[16]

In its 2014 '**fitness check**' report, the European Commission indicates that Member States are on track to meet the 2015 targets and that the Directive has spurred innovation in car manufacturing and recycling, thanks to significant investment from the industry. However, it also underlines that the collection and treatment of ELVs by illegal operators and the illegal shipment of ELVs remain major

Other streams regulated under EU law

The 2011 Directive on radioactive waste aims to ensure responsible and safe management of spent fuel and **radioactive waste** by laying down general principles for national frameworks. Shipments of radioactive waste are covered by Regulation 1493/93 and Directive 2006/117.

The 1986 Directive on sewage sludge aims to encourage the use of **sewage sludge** in agriculture and to prevent adverse environmental and health effects. In its 'fitness check', the Commission notes that the Directive in its present form lacks coherence with the Waste Framework Directive and is outdated: some Member States have banned its use, while others have set lower levels of allowed sludge contaminants.

implementation challenges, as there appears to be a gap in several Member States between the numbers of de-registered and dismantled ELVs. A 2010 EP study highlights that there is room for improvement in ELV treatment as regards removal of hazardous materials and recycling/recovery of materials, in particular glass and plastics. It also notes that official recycling and recovery figures may be over-estimated. The Commission recently launched court proceedings against Poland and Romania for failings related to the ELV Directive.

Mining, construction and demolition waste

Mineral and solidified waste is the largest waste stream in the EU. It originates from two main sources: mining waste, and construction and demolition waste (CDW).

Mining waste involves topsoil or rock that must be removed to gain access to the mineral resource, as well as tailings remaining after minerals are extracted from the ore. Although most of this waste is inert, some fractions may contain large quantities of dangerous substances, such as heavy metals, which can pose environmental and health risks. The 2006 Mining Waste Directive aims to prevent or reduce these risks. Good practice is established in the JRC's best available techniques.

Construction and demolition waste arises from activities linked to buildings and infrastructure as well as road planning and maintenance. It contains numerous materials (e.g. excavated soil, concrete, bricks, wood, glass, metals, plastic, gypsum, solvents and asbestos). While many of these may be recovered or recycled, others are hazardous and require special treatment. The 2008 Waste Framework Directive mandates Member States to recover or recycle (including through backfilling operations) 70% of non-hazardous construction and demolition waste by 2020.

Mining, construction and demolition waste may be used in construction projects (for backfilling and drainage) or to restore former quarries or landfill sites, provided that hazardous parts have been removed. The European Commission estimates that there is high potential for recycling and re-use of CDW. Recycling and re-use appears to be high in some Member States (but low in others), according to Commission data. The European Aggregates Association indicates that 6% of aggregates in Europe come from recycled construction and demolition material.

Ship recycling

The 2013 Ship Recycling Regulation aims to reduce the negative environmental and health impacts linked to the recycling of EU-flagged ships, especially in South Asia, where many have been 'beached' with high adverse effects on health and the environment. In particular, it seeks to ensure that hazardous waste from ship recycling is subject to environmentally sound management. Two international treaties also apply: the Nairobi Convention on the removal of wrecks (entry into force 2015) and the Hong Kong Convention on ship recycling (not yet entered into force), whose requirements are implemented in the EU Ship Recycling Regulation.

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Endnotes

1 The main waste-related strategies are the 2005 Thematic strategy on waste, the 2011 Roadmap to a resource-efficient Europe, and the 2013 7th Environment Action Programme 'Living well, within the limits of our planet'.

2 The legal acts setting the general framework are the 2008 Waste Framework Directive, the 1999 Landfill Directive, and the 2006 Waste Shipment Regulation.

3 For more details about extended producer responsibility, read the Development of guidance on extended producer responsibility report published by the European Commission in 2014.

4 On 2 July 2014, the European Commission put forward, within the circular economy package, a first legislative proposal amending the Waste Framework Directive, the Landfill Directive and four directives related to specific waste streams.

5 Other non-ferrous metals are mainly gold, silver, manganese, platinum, palladium and rhodium. Toxic metals (such as mercury or cadmium, with the exception of lead) are not usually considered non-ferrous metal waste.

6 An industry report on paper recycling indicates that since 1998, paper recycling volumes have grown by 45% while paper consumption volumes have stayed at the same level.

7 The 'European list of standard grades of paper and board for recycling' (EN 643) divides recovered paper into five groups: ordinary grades, medium grades, high grades, craft grades and special grades, with each group divided in subgroups.

8 Some plastics (bio-plastics) are vegetable-based and can be composted. However, not all compostable plastics are vegetable-based (e.g. oxo-biodegradable plastics).

9 Wood waste grades are: A (clean recycled wood), B (industrial feedstock), C (Fuel grade) and D (Hazardous waste).

10 For instance, UpShirt, a project of NGO Zero Waste Europe; an initiative by the Nordic Council of Ministers; or EcoProFabrics, a research project funded by the European Commission.

11 The 2008 Waste Framework Directive defines 'bio-waste' as 'biodegradable garden and park waste, food and kitchen waste from households, restaurants, caterers and retail premises and comparable waste from food processing plants'; it does not include other biodegradable waste such as forestry and agricultural residues, manure, sewage sludge, or paper and cardboard. In contrast, the 1999 Landfill Directive has a wider definition for 'biodegradable waste': 'any waste that is capable of undergoing anaerobic or aerobic decomposition, such as food and garden waste, and paper and paperboard'.

12 Since 2004, persistent organic pollutants are covered by the Stockholm Convention.

13 Sixteen Member States have derogations to meet the 2008 targets. For more details, see an overview of targets and derogations by Eurostat.

14 A 2015 United Nations University report estimates that 11.6 million tonnes of e-waste were generated in Europe in 2014 and that 700 000 tonnes of WEEE are disposed of as part of mixed ordinary waste every year in the EU.

15 Minimum rates for the separate collection of WEEE are to be met by the end of 2015, 2018 and as of 2019, with derogations granted to 10 Member States. Recovery targets as well as recycling/preparing for re-use targets for individual product categories are to be met by August 2015 and August 2018. Recovery and recycling targets as of August 2018 have also been set.

16 The 'reuse and recovery' of materials in ELVs is required to reach at least 85% (by 2006) and 95% (by 2015) by an average weight per vehicle and year, while the 'reuse and recycling' is required to reach at least 80% and 85% by the same years.

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