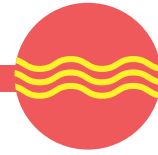
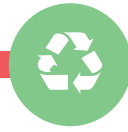


Waste Management in Europe

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Research Unit

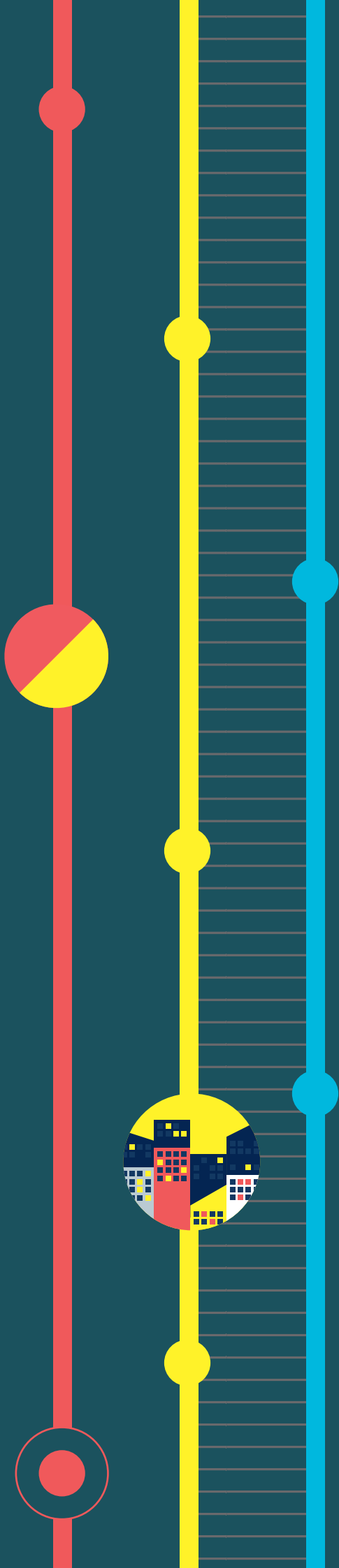
February 2023





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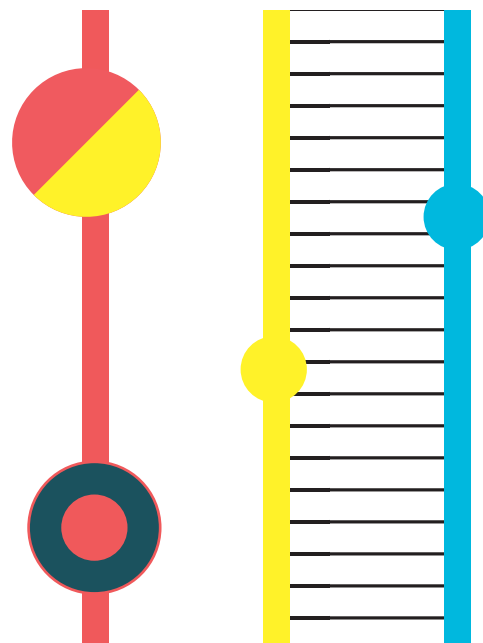


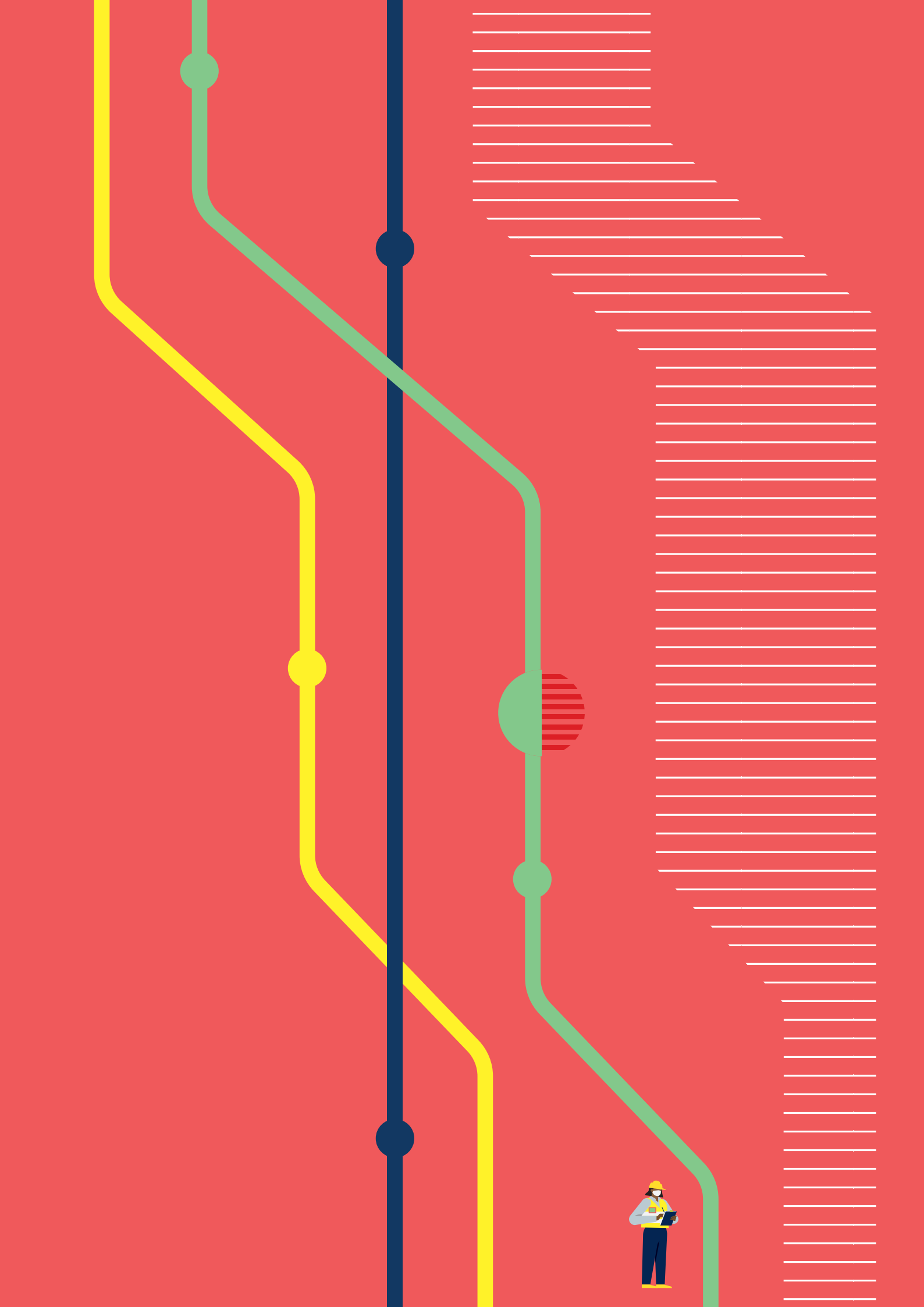
1. Introduction

Waste management is the process of collecting, transporting, disposing, recycling and monitoring of waste. This report, which has been commissioned by the European Public Service Union (EPSU), aims to make a contribution to research in waste management by providing:

- an overview of the main trends in waste management, covering types and quantities of waste and trends in terms of waste treatment;
- an outline of the employment structures in different areas of waste management and critical assessment of the claim that the move towards a circular economy creates jobs; and
- an analysis of the most important multinational companies that are active and emerging in Europe's waste management market.

The report follows two earlier publications for EPSU on waste management, [Good Jobs in the Circular Economy? Waste Management in Europe](#) (2018) and [Safe Jobs in the Circular Economy? Health and Safety in Waste and Wastewater Management](#) (2020).



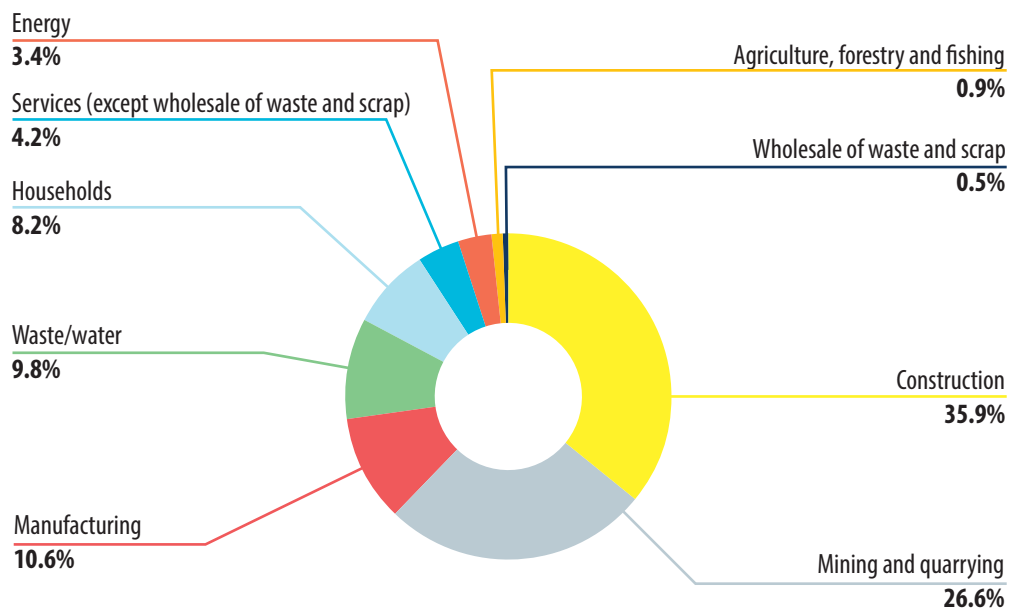


2. Trends in waste management

2.1 Waste quantities

The total waste generated in the EU, which includes the waste from all economic activities and households amounted to 2.3 million tonnes in 2018 (latest figures available). This is equal to around 5.2 tonnes per capita of the EU population. While public attention is often focused on household waste, this makes up only just over 8% of the total (see Figure 1), compared to more than 35% generated by construction and over 26% by mining and quarrying.

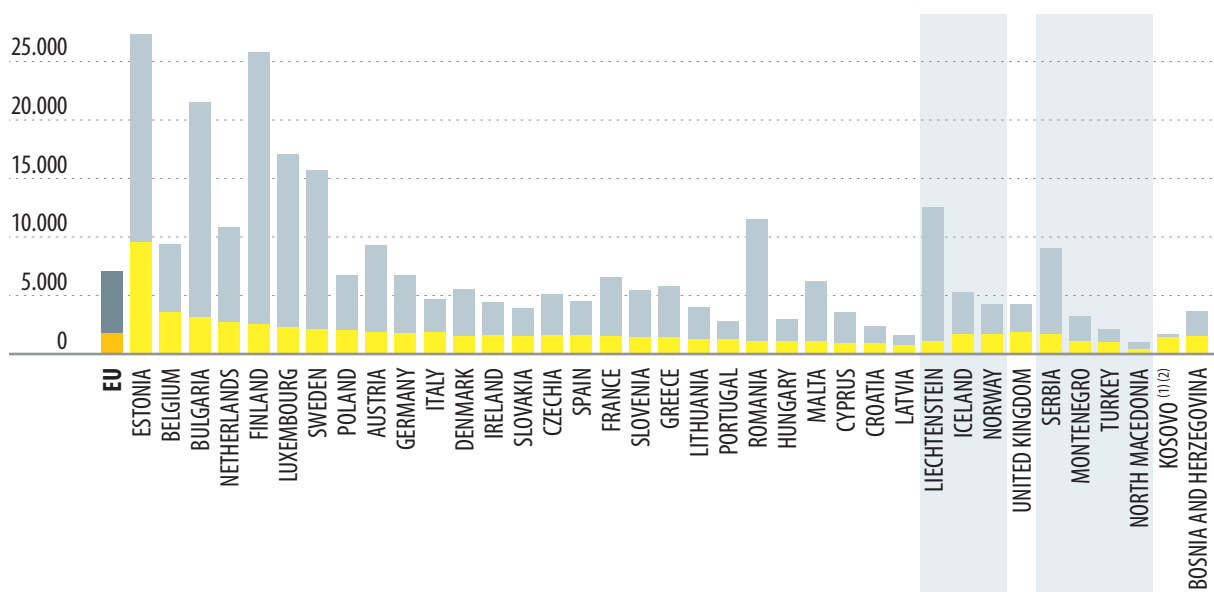
Figure 1: Waste generation by economic activities and households, EU, 2018
 (% share of total waste)



Source: Eurostat (online data code: env_wasgen)

Together the waste from mining and quarrying and from construction and demolition is classified as major mineral waste and accounts for almost three quarters (74%) of all waste. The share of mineral waste varies considerably between EU countries (See Figure 2). In Romania, Finland, Sweden and Bulgaria relatively large mining and quarrying activities take place while in Luxembourg construction and demolition activities produce large amounts of major mineral waste that account for 86%-90% of total waste. When excluding waste from major mineral waste Estonia was still leading in Europe mainly due to energy production based on oil shale.

Figure 2: Waste generation in the EU by country (2018)
(kg per capita)



Note: sorted on total waste generated.

⁽¹⁾ This designation is without prejudice to positions on status, and is the line with UNSRC 1244/1999 and the ICJ Opinion on the Kosovo Declaration of Independence.

⁽²⁾ 2016.

Source: Eurostat (online data code: env_wasgen)

Waste caused by waste and water services (208 million tonnes in 2018) increased by 176% between 2004 and 2018 (Eurostat, 2022), due to the increase of secondary waste produced through recycling and energy-recovery activities (European Environment Agency, November 2019), particularly the increase in waste incineration, where ashes and residues remain that still need to be put in landfill. This waste is especially toxic and thus the trend of an increase of waste incineration needs to be considered carefully (see section 3.3). The significant rise of waste from waste clearly demonstrates that a circular economy does not mean that actually all waste is re-used. Hence, zero-waste is an illusion (Weghmann 2020).

A more positive trend is that waste from manufacturing in Europe fell by nearly a quarter between 2004 and 2018 (Eurostat, 2022), although this is mainly due to the decline in manufacturing itself as a result of production (and hence the waste it is causing) being moved to other parts of the world.

There are large variations in the trends in quantities of household waste generated across Europe, although the average amount of municipal waste per person in Europe stayed relatively constant between 2005 and 2020 (Figure 3). Denmark produces the most per person (845 kg per capita), while Romania generates the least – only 282 kg per capita. However, these statistics not only reflect differences in consumption patterns and wealth, but also depend on how municipal waste is collected and managed and therefore how the data is collected. There are also differences in how waste from commercial activities is collected and managed together with waste from households thus affecting the figures (Eurostat, 2021).



Plastic waste

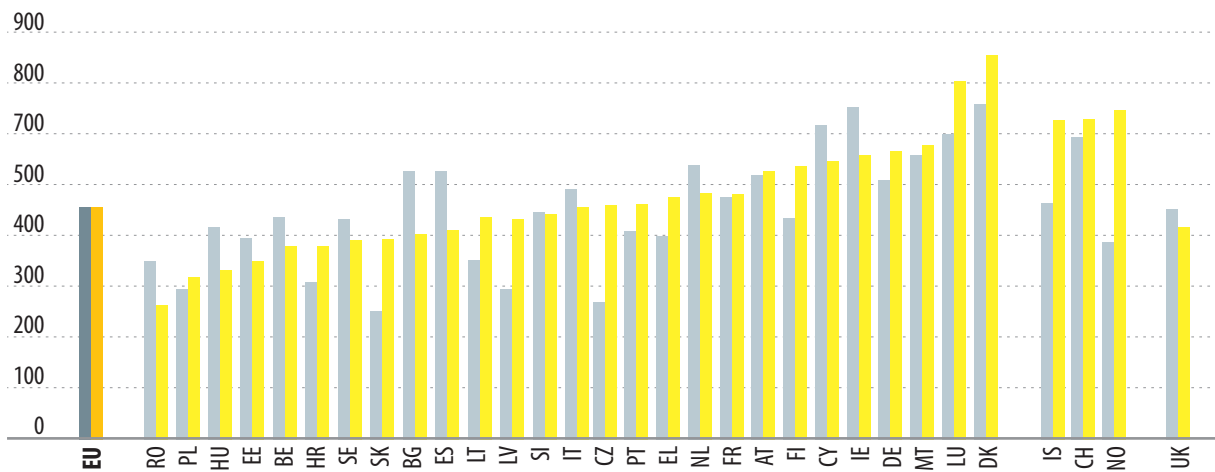
Globally plastic production – and hence plastic waste – is rising fast. Over half of the world’s plastic has been produced since 2005 and a recent study found that just 20 multinational petrochemical corporations dominate the market and are backed by large financial institutions ([The Plastic Waste Makers Index](#), 2021).

Single use plastic is the greatest source of plastic waste. Over 60% of plastic waste in Europe is from packaging, which increased by 26% between 2009 and 2019, reaching 15.4 million tonnes, with Germany the largest producer and responsible for over 18% of Europe’s plastic packaging waste (Tiseo, 2021).

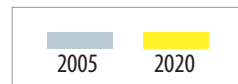
Globally only 14% of plastic packaging is currently recycled and in reality this means “downcycling” – the creation of an inferior-quality product. Manufacturers usually prioritise virgin plastic as not only cleaner but also cheaper, due to the costly sorting and processing requirements (see section 3.2 on recycling). Recycled plastic cannot be used with a lot of products, such as food, due to health and safety regulations.

With the increase of plastic waste, the question of what to do with it becomes ever more pressing. A lot of the plastic waste from richer countries, including in the EU, get exported to countries with weaker environmental and labour standards (see section 2.3).

Figure 3: Municipal waste generated by country (2005 and 2020)
(Kg per capita)



EU: estimate
 2019 data: Ireland, Italy, Greece and Austria
 2018 data: Bulgaria, Iceland and United Kingdom
 Source: Eurostat (online data code: env_wasgen)





Covid 19 and health care waste

A February 2022 study by the World Health Organisation (WHO) pointed out that the COVID-19 pandemic led to an increase in waste from personal protective equipment (PPE), testing kits and vaccinations. Europol, the European Union's law enforcement agency, has revealed that in some countries this has resulted in illegal disposal methods being used (Europol, 2020).

While the treatment of PPE varied across Europe, EU countries mostly advised their residents to dispose of masks, gloves and test kits in mixed municipal solid waste, which is then incinerated or sent to landfill (European Environment Agency, 2021a).

A 2021 report by ACR+, the Association of Cities and Regions for Sustainable Resource Management, on the impact of COVID-19 on municipal waste management systems found that the pandemic and the consequential staff shortages had a severe impact on waste collection. The higher amount of waste and the reduced waste collection capacity led to lower sorting capacity and an increase of fly-tipping (ACR+, 2021). The WHO also pointed out that across the globe staffing problems among healthcare workers led to difficulties in ensuring the safe management of healthcare waste (WHO, 2022).

2.2 The Circular Economy

The transition towards a circular economy is one of the flagship policies under the European Union's Green Deal. The circular economy is about moving away from a throw-away culture to a sustainable economy that moves from a linear (extract, make, dispose) to a circular system (recycle, reuse, remake, share) (see Figure 4). In other words, the circular economy aims to fundamentally change waste management in Europe: treating it as a resource rather than something we just want to get rid of.

In theory, the circular economy is based on the waste hierarchy set out in Figure 5. So, the priority is waste avoidance and to maintain products, materials and resources for as long as possible by keeping them in the product cycle. The idea is that the more that is re-used then the less that is discarded and the fewer raw materials will need to be extracted. The EU's latest Circular Economy Action Plan includes a set of ambitious measures to reach the political objectives set (see box 1).

In practice, however, the EU's circular economy strategy risks doing the exact opposite: facilitating the generation of more and more waste. The action plan is based on a green-growth agenda, that promises to maintain production and consumption while being resource efficient and consuming and producing within the means of the planet. It thereby focuses first and foremost on recycling (see section 3.2) rather than on reuse and repair (see section 3.1). And it has very little to offer on waste avoidance – even though this should be the absolute priority according to the EU's own waste hierarchy framework.

Figure 4: The linear and circular economies

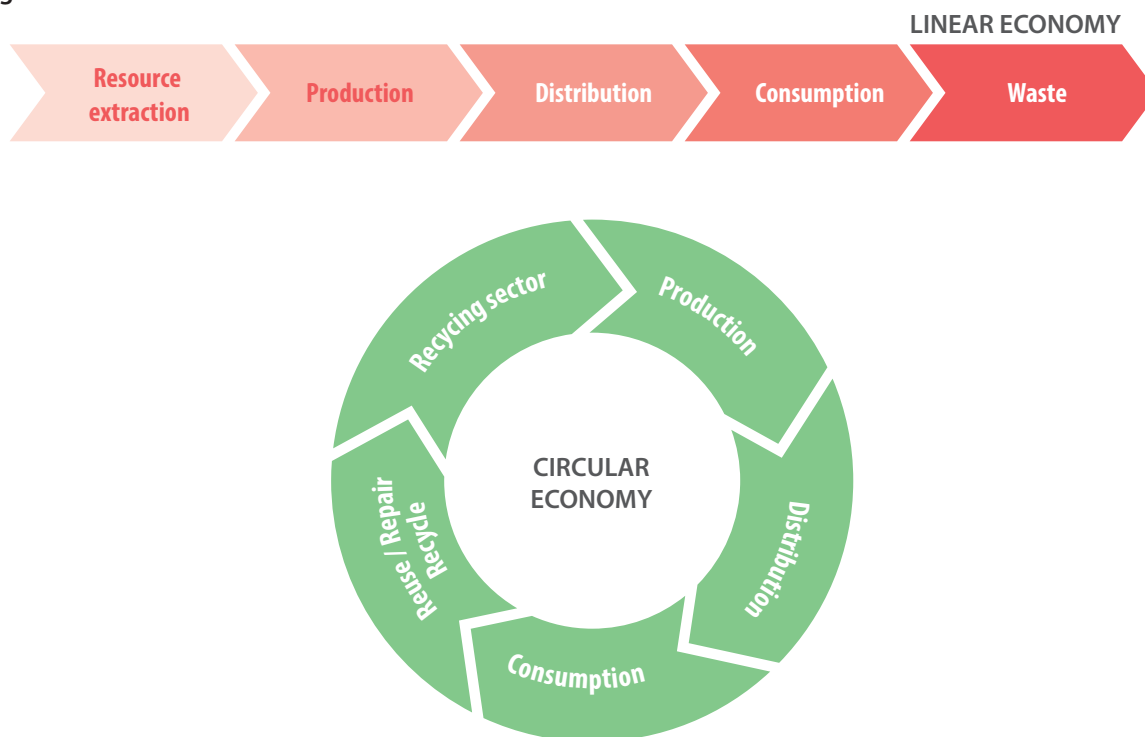
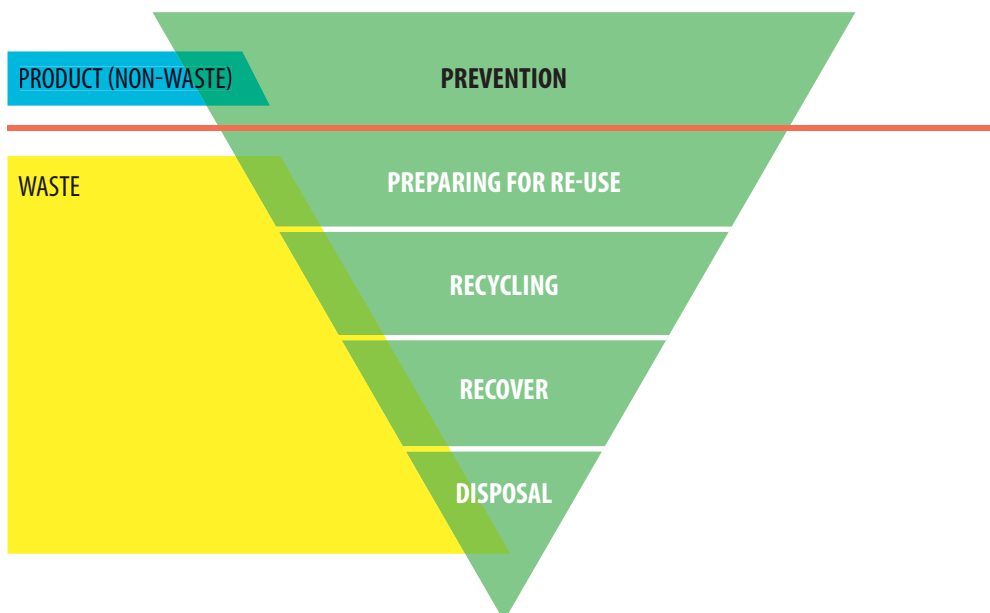


Figure 5: The waste hierarchy



Currently the concept of a circular economy is often promoted as a business opportunity through which public-private partnerships (PPPs) are encouraged. For example, the city of Valladolid is one of the first in Spain committed to a transition towards a circular economy through a subsidy programme that has supported almost 100 projects. It also launched the 'Aran Valley Innovation HUB to promote creativity and public-private partnerships' (Euro Cities 30 November 2021). The EU finances circular

economy initiatives in Valladolid, the Circular Labs, that encourages the transition towards a more circular economy through ‘business, competition and innovation’ (Circular Labs, 2019). The risk is that the concept of the circular economy becomes hijacked as an opportunity for companies to reinforce their market position.



Box 1 The New Circular Economy Action Plan

In March 2020 the European Commission launched [A New Circular Economy Action Plan](#), which became one of the main pillars of the European Green Deal, what the Commission calls “Europe’s new green growth agenda”. The plan aims to:

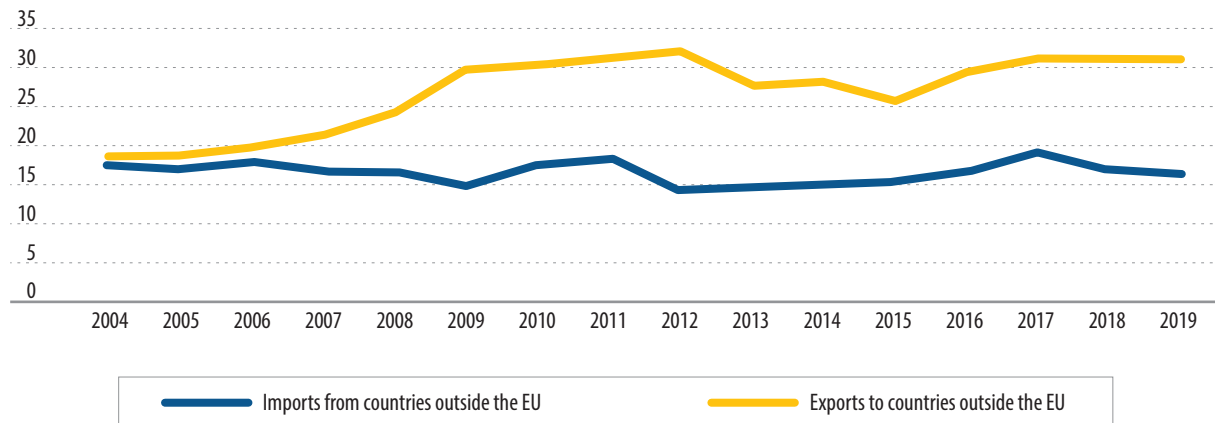
- make sustainable products the norm in the EU;
- empower consumers and public buyers;
- focus on the sectors that use most resources and where the potential for circularity is high such as: electronics and ICT; batteries and vehicles; packaging; plastics; textiles; construction and buildings; food; water and nutrients;
- ensure less waste;
- make circularity work for people, regions and cities; and
- lead global efforts on circular economy.

It is striking that the EU promotes processes that ensure that resources are kept in the EU economy for as long as possible without paying any attention to the workers who operate the circular economy. The action plan only mentions workers once and that is in conjunction with the job creation that is assumed to be facilitated by a transition towards a circular economy if the workers acquire the skills that are needed (see section 4.2.1). The health and safety risks that workers face are not considered at all. However, to enable the transition towards the circular economy the EU’s policies need to go beyond speculation about the quantity of jobs and start to look into the quality of the jobs.

2.3 Waste exports

The EU’s waste management system depends heavily on exports (as well as imports – see section 3.3 on waste incineration). In 2021, the EU exported around 33 million tonnes of waste, most of it went to poorer, less developed countries with weaker environmental standards and less protection for workers’ rights (Abnett, 2021). Exports of waste from the EU to non-EU countries increased by 66% between 2004 and 2018 (Eurostat, 2020).

Figure 6: European Union's imports and exports of waste
(million tonnes)



Source: Eurostat, 2020

Before 2018 China took two-thirds of global plastic waste, but then banned imports that did not meet new purity standards. Consequently, the plastic waste shipments to China dropped by 99% in 2018 compared with 2017 (Staub, 29 January 2019) and EU waste exports to China fell from a peak of 10.1 million tonnes in 2009 to just 1.2 million tonnes in 2019 (Eurostat, 2020). Other countries picked up the waste burden and, according to Eurostat, in 2019 most of the EU's waste went to Turkey (around 11.4 million tonnes), a threefold increase on 2004 (see box 2). India became the next main importer taking 2.9 million tonnes from the EU and 1.9 million tonnes from the United Kingdom in 2019. Indonesia has also become a destination for increasing waste exports from the EU.

While exported waste should be recyclable and, since 2021, already sorted, it is still usually contaminated. Hence, shipping waste across the globe increases the risks of contamination as the conditions of storage are generally optimal for the growth of harmful bacteria. This not only decreases the recyclability of the waste but also increases risks for the workers exposed to these dangerous substances (Weghmann 2020). Lessons could be learnt from China and Hong Kong that introduced a 0.5% contamination threshold for non-hazardous contaminants in plastic waste imports, thereby specifying the “almost free from contamination” language used in the Basel Convention, the international agreement that regulates trade in waste. The Rethink Plastic Alliance argues that Europe should follow suit and adopt a European-wide 0.5% contamination threshold for all its exports as well as intra-EU waste trade (Rethink Plastic Alliance, 2021).

There is considerable intra-European trade in waste, with Switzerland and Norway taking a lot of waste from the EU, while countries such as Denmark, Sweden and the Netherlands are dependent on waste imports to feed their waste-to-energy facilities (see section 3.3). There is also some evidence of an increase in illegal waste dumping and illicit intra-EU trade, for example between Germany and Poland (Bronska, 2021).



Box 2 Europe dumps its waste in Turkey

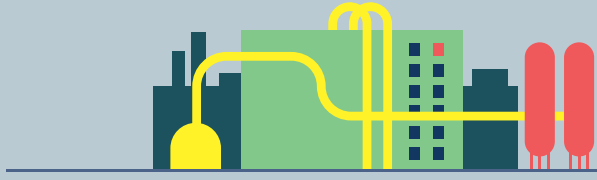
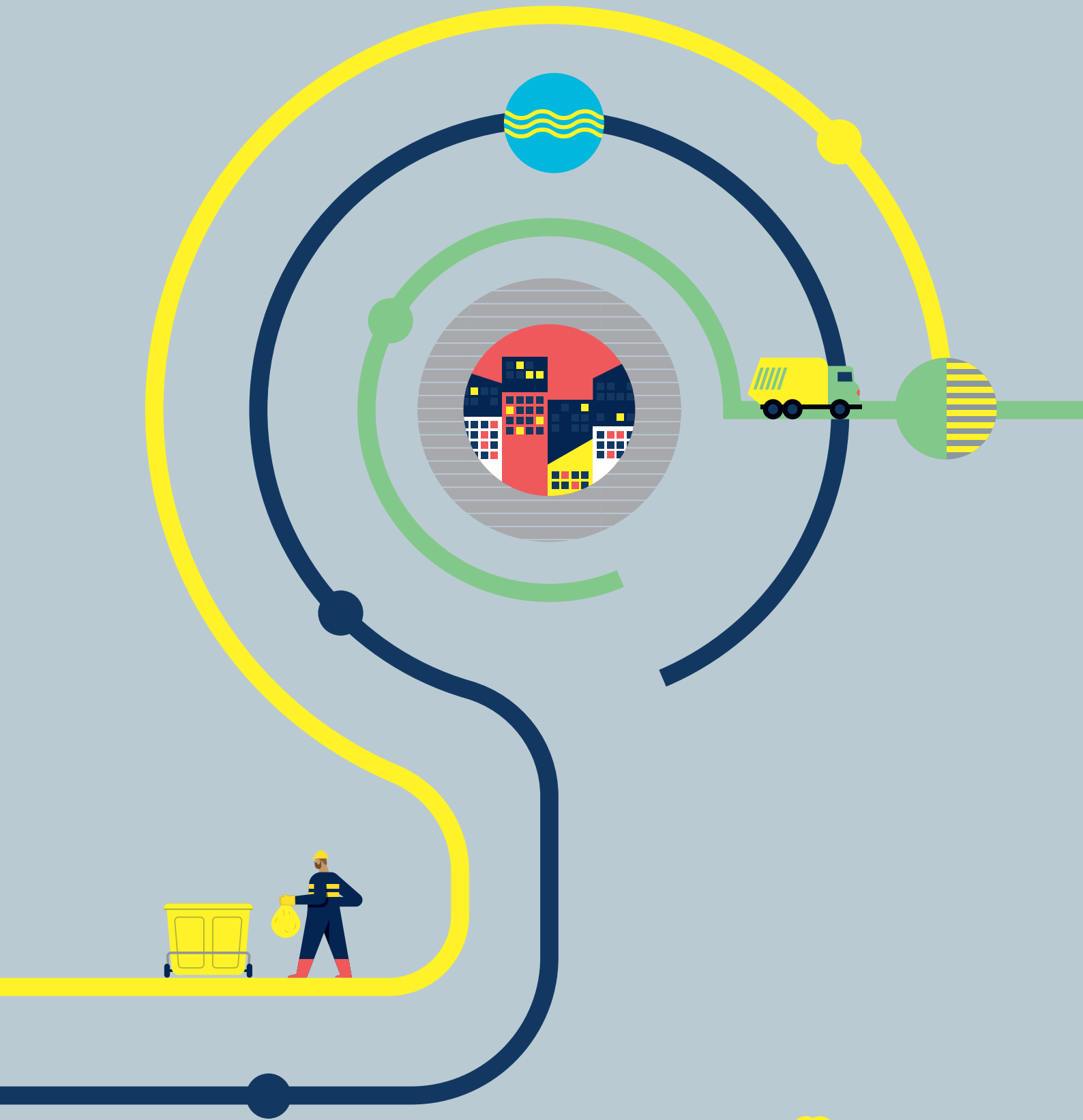
In 2021, almost half of all the waste exports from Europe went to Turkey. Ferrous metals (iron and steel) account for 19.5 million tonnes (59%) of all EU waste exports, with most, 13.1 million tonnes or 67%, going to Turkey. Turkey also takes 10% of the EU's paper waste (Vaclavova, 2022).

While there are formal recycling companies which export waste from Europe to use as raw materials or energy, the vast majority of exported waste – including medical waste – is dumped in open areas in certain districts of cities like Adana, Istanbul and Izmir. A representative from the DISK trade union confederation explained that waste imports are not controlled properly at the border and once the waste is in the country nobody checks where it goes and if it is recycled (Interview on 21.07.2022).

In local government, waste workers are formerly employed, with job security, decent pay, union representation and relatively high unionisation rates. In contrast, waste workers in privatised services tend not to be unionised and work in difficult conditions and on low wages (interview on 21.07.2022).

The DISK representative explained that, alongside the municipal operations, there are also informal waste collection and processing systems, usually involving migrants and socioeconomically disadvantaged groups, including many women and children. There are reports of Syrian operators bringing in Afghan workers, especially to do solid and plastic waste picking. The ethnic divisions between informal workers create significant barriers to collective organisation. Certain districts are managed by waste pickers from Eastern Turkey, creating a kind of area division that leads more often to conflict between different groups of workers than solidarity. The work is divided through informal networks, which block workers who are outside the network. These informal waste management systems are also further fragmented through subcontracting, where some workers employ others informally to sort waste, which they then sell to companies and recycling plants.

Source: Interview with a trade union representative of the DISK-Confederation of Progressive Trade Unions of Turkey on the 21.07.2022. Interview conducted by Safak Tartanoglu Bennett



3. Trends in waste treatment

3.1 Waste prevention

In the EU waste prevention is understood as actions that ‘prevent products, substances or materials from becoming waste’ (European Commission, 2022), by reducing the quantity of materials used in products in the design phase, increasing the use of products, through the sharing economy, and/or extending the life of products through repair. The waste hierarchy is the overarching principle of waste policies in the EU (EEA 2017) with waste prevention as the priority and therefore also the fundamental basis of the circular economy (see Figure 5). In practice, however, it receives the least attention with almost no obligation on EU member states to reduce waste. The Single Use Plastics directive does aim to phase out some plastics but there is no overarching legislative framework for waste prevention as there is, for example, for recycling.

Previous EPSU research has shown that the Action Plan for the Circular Economy of the European Commission emphasises the responsibilities of producers as well as consumers, but mainly looks at the issue of waste prevention through increased recycling. Yet, waste prevention measures should not be conflated with or used as a synonym for recycling. Waste prevention can only be achieved through less packaging, production and indeed less consumption. Hence a social and cultural transformation is required to avoid waste. Yet such an approach stands in contradiction to the EU’s economic growth model (Wegmann 2020). Waste avoidance can also potentially be hindered by an expansion of waste-to-energy (WtE) schemes, as these often need waste in order to operate. The risk is that the use of private WtE incinerators can commit municipalities to deliver specific amounts of waste to feed the incinerators or face fines. Several countries and regions with large WtE incinerators already have a problem of overcapacity and have hence become dependent on imported waste (see section 3.3).

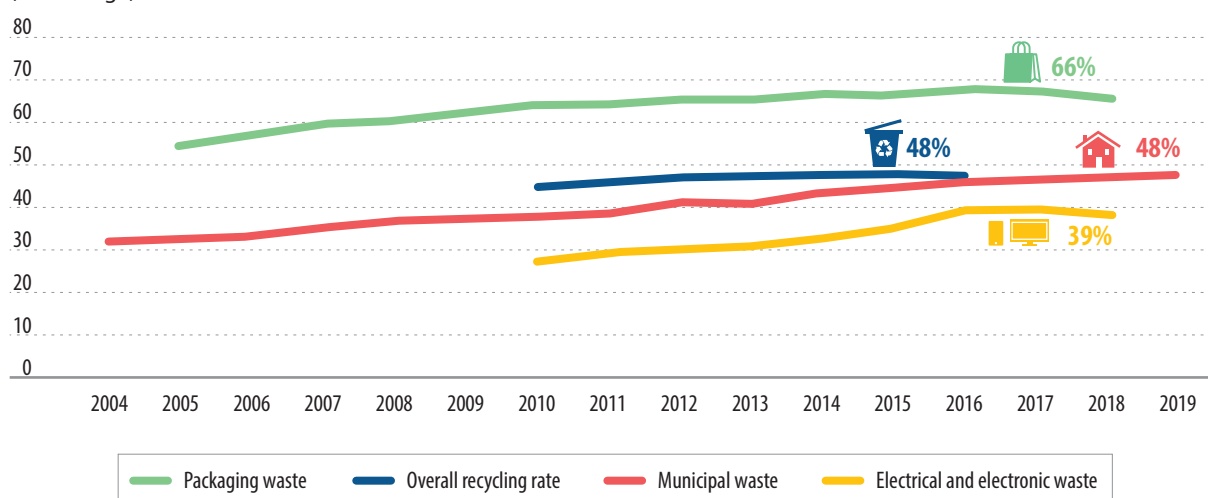
3.2 Recycling

Recycling rates in Europe for municipal waste, packaging waste and waste electrical and electronic equipment (WEEE) have been increasing (see Figure 7). The overall recycling rate — the ratio between total waste generated excluding minerals and the quantities that were managed through recycling — was almost half (48%) of the total waste generation in 2016 (latest data available – new data were due to be released in 2021 but have still not been published). For municipal waste more recent data are available with the amount of recycled municipal waste rising from 37 million tonnes (87 kg per capita) in 1995 to 107 million tonnes (241 kg per capita) in 2020. Overall, the share of municipal waste recycled rose from 19% in 1995 to 48% in 2020 (Eurostat, 2021).

However, there is a huge difference between countries when it comes to municipal waste recycling: Germany leads with a rate of 67% and only seven other countries have achieved the EU target rate of 50% (Slovenia, Austria, the Netherlands, Belgium, Switzerland, Denmark and Italy (European Environment Agency, 2021b) In contrast, countries, such as Romania, Turkey, Malta and Montenegro recycle less than 20% of municipal waste (European Environment Agency, 2021).

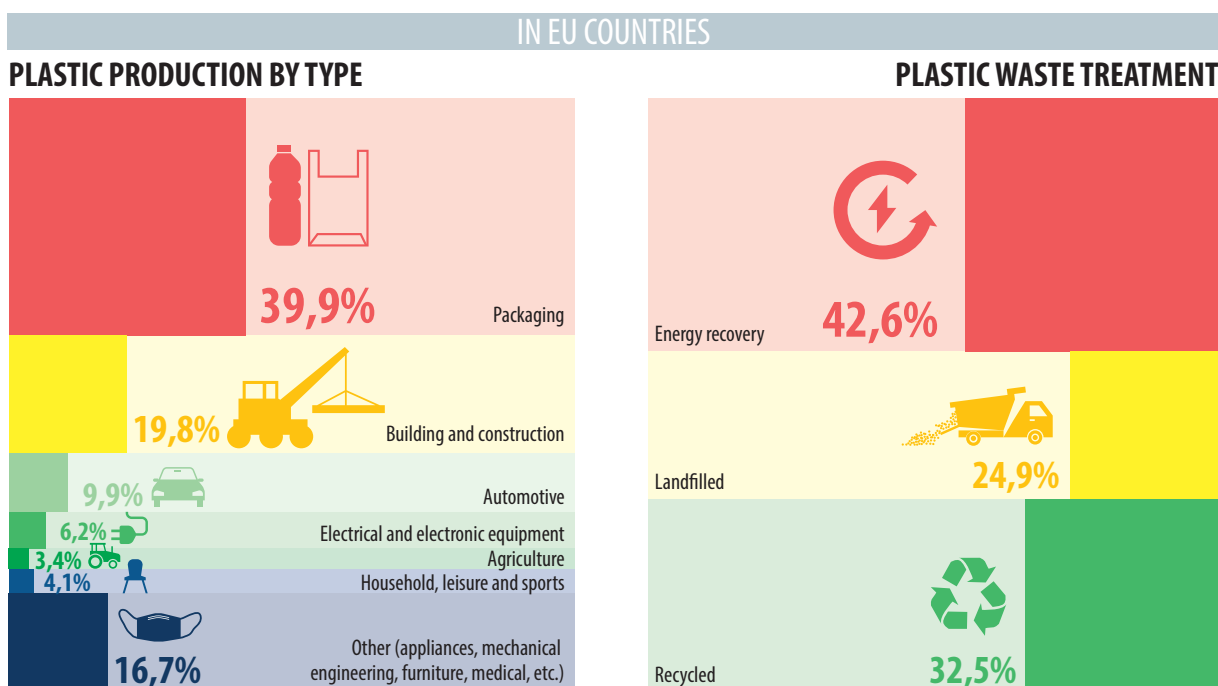
Caution is required in evaluating Europe’s recycling rates, especially in terms of plastic waste because the lobby group, Plastics Recyclers Europe, points out that the figures are based on the amount of plastic waste collected rather than the amount actually recycled (Wecker, 2018). Most of Europe’s plastic waste is still burned in waste-to-energy incinerators (see Figure 8, see section 3.3). In Germany, for example, Europe’s poster child for recycling, 60% of household plastic waste is incinerated – mostly used to fuel cement production (Plastic Atlas 2019). The rest is supposed to be recycled but one third of recyclable waste is sent abroad and it is then questionable if it is really recycled (see section 3.2). So, less than 30% is sent to German recycling factories but again a third of the waste entering recycling

Figure 7. Recycling rates in Europe by waste stream
(Percentage)



Source: EEA

Figure 8. Plastic waste treatment in the EU



Source: Eurostat, data from 2016.

factories is burned. As of 2017, out of the 5.2 million tonnes of plastic waste generated in Germany, only 810,000 tons – just 15.6% – was actually recycled (Plastic Atlas, 2019). The fact that the official recycling rate figures overestimate actual levels of recycling is likely to be true for Europe in general and not just for Germany. A recent study estimated that the overall end-of-life recycling rate for post-consumer plastic packaging waste in the EU27 in 2017 was just 14% (not accounting for exported waste) (Antonopoulos et al 2021).



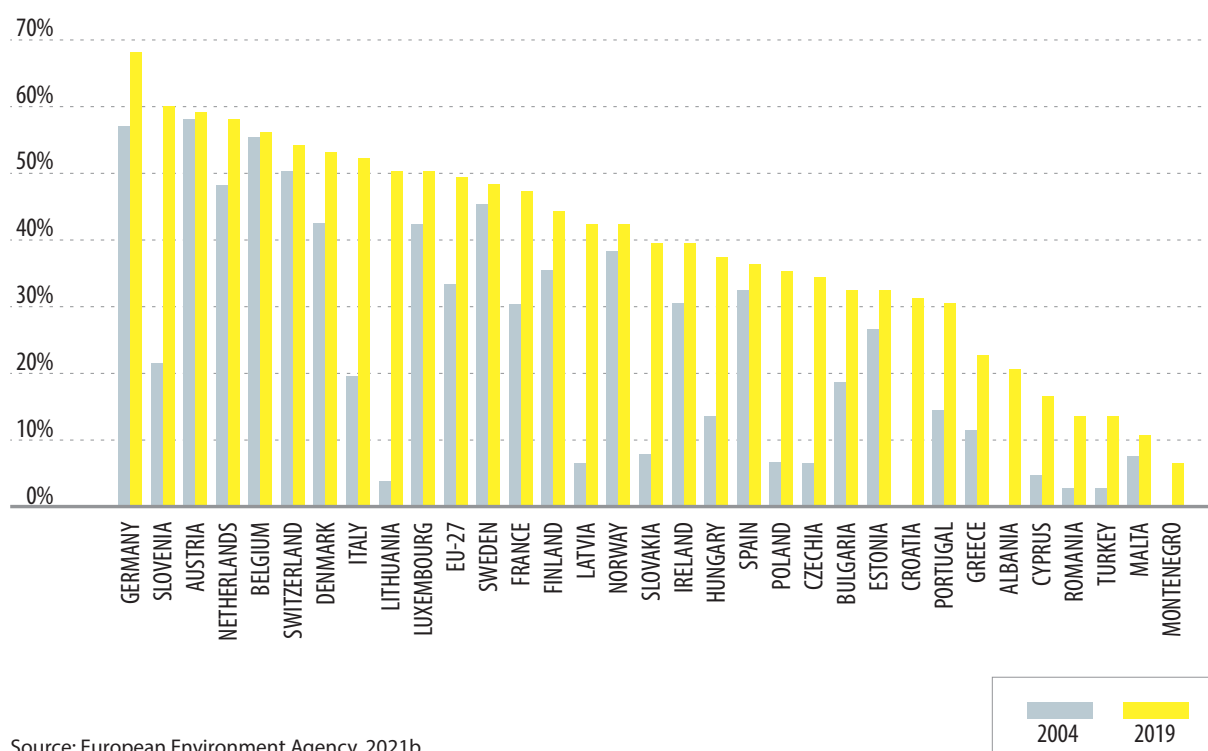
Key recycling targets and legislation

Proactive waste policies and legislation have been key drivers of increasing recycling rates in Europe. The most important ones are:

- the Waste Electrical and Electronic Equipment (WEEE) Directive that sets targets for the separate collection and recycling of electrical and electronic waste;
- the Waste Framework Directive with targets for the recycling and preparing for reuse of municipal waste; and
- the Packaging and Packaging Waste Directive that defines targets for recycling packaging waste.

In total, EU waste legislation includes more than 30 binding targets for the period 2015-2030. The current target is that by December 2025 65% of packaging waste has to be recycled.

Figure 9: Municipal waste recycling rates in Europe by country



Source: European Environment Agency, 2021b

In order to achieve higher recycling rates – of waste actually recycled and not just collected – Europe needs to substantially improve its local recycling capacity. More research is needed on the recycling industry in Europe, especially, a more detailed understanding of the material recovery facilities (MRFs, also referred to as sorting plants) and recycling plants that are essential to the two key stages within recycling value chain (Antonopoulos et al 2021). MRFs receive separated waste and further sorts it into specific streams. In the recycling plants the waste is then processed into secondary raw materials for the manufacturing of goods (for example packaging) (Antonopoulos et al 2021).

As of 2015, there were almost 1,200 active plastic sorting and recycling plants in Europe (Ecoprog, 2015) and initial research suggests that there is considerable variation, in terms of quantity, purity and complexity, in sorting and recycling rates in Europe (Villanueva and Eder, 2014; Cimpan et al., 2016; Ragaert et al., 2017, Antonopoulos et al 2021). Sorting became especially important when the export of unsorted plastic waste from the EU to non-OECD countries was banned (Sanders, 2020). Currently, it is estimated that 300 additional sorting and recycling plants with a capacity of around 5.2 million tonnes will be commissioned by 2025, but this is not nearly enough.

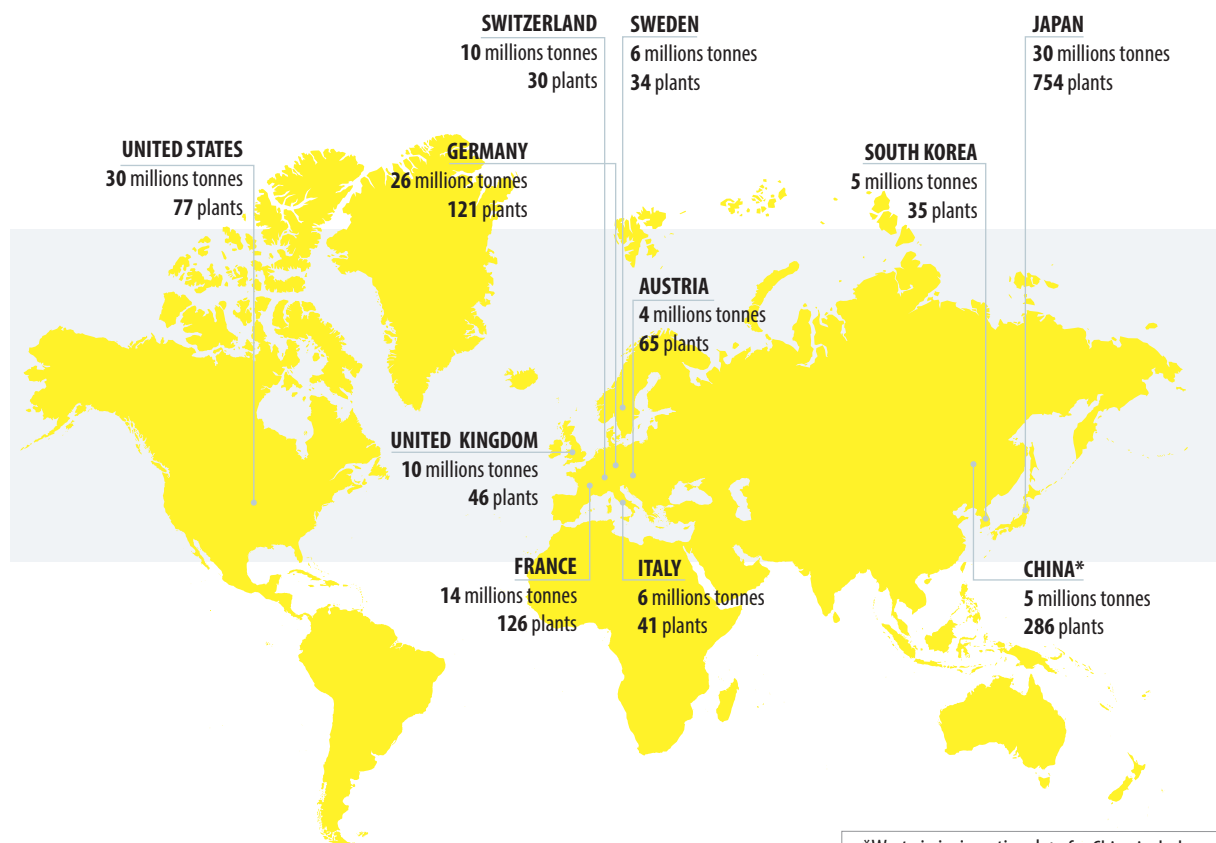
In order to improve recycling, the process needs to start far earlier than when the waste arrives at the sorting and recycling plants. The recyclability is already determined by the design of goods. Antonopoulos et al (2021) show that films and other problematic contaminants in the input-waste significantly weaken the recovery rates. To improve recycling, the collection system also matters as the recyclability of waste depends on the degree to which it is contaminated. Eriksen et al. (2019) also show that improvements in the design and collection systems are key for higher recyclability.

3.3 Waste incineration

Waste incineration in Europe is increasing sharply, especially of municipal waste. Between 1995 and 2018 waste incineration has risen by 117% from 32 million tons (67 kg per capita) in 1995 to 70 million tons (136 kg per capita) in 2018. This increase has mainly been caused by a decrease in the use of landfill (see section 3.4) (Levaggi 2020).

There has also been an increase in waste-to-energy (WtE) incineration, where energy is generated in the form of electricity and/or heat from burning municipal and other household-related solid waste. Six countries – Germany, France, the Netherlands, Sweden, Italy, and the UK (before Brexit) – account for three quarters of the EU’s incineration capacity (Hockenos, 2021) – see Figure 12 and the maps in figures 10 and 11).

Figure 10: Top 11 countries with the most thermal WtE plants, including amount of waste incinerated with energy recovery



*Waste in incineration data for China includes incineration with and without energy recovery.

Source: UNDP 2019

Figure 11: Waste to energy in Europe (2018)

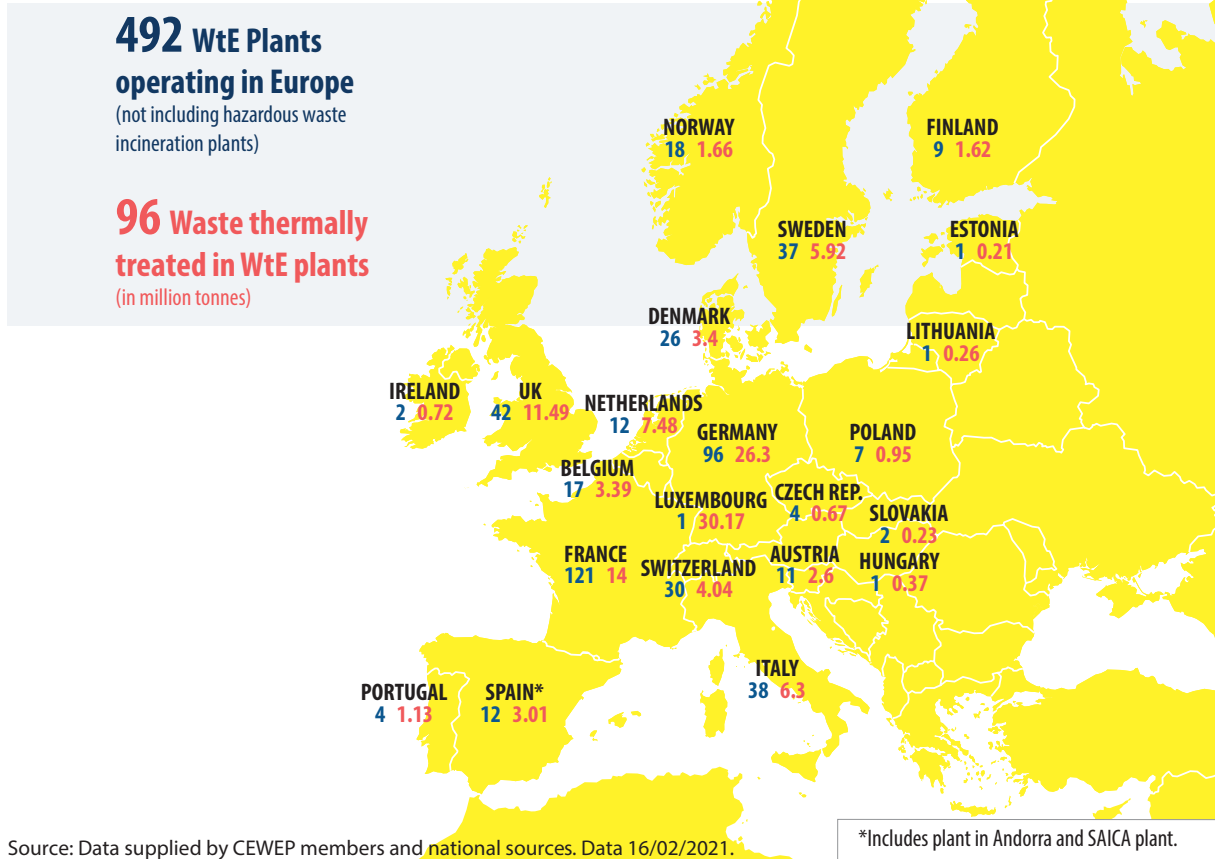
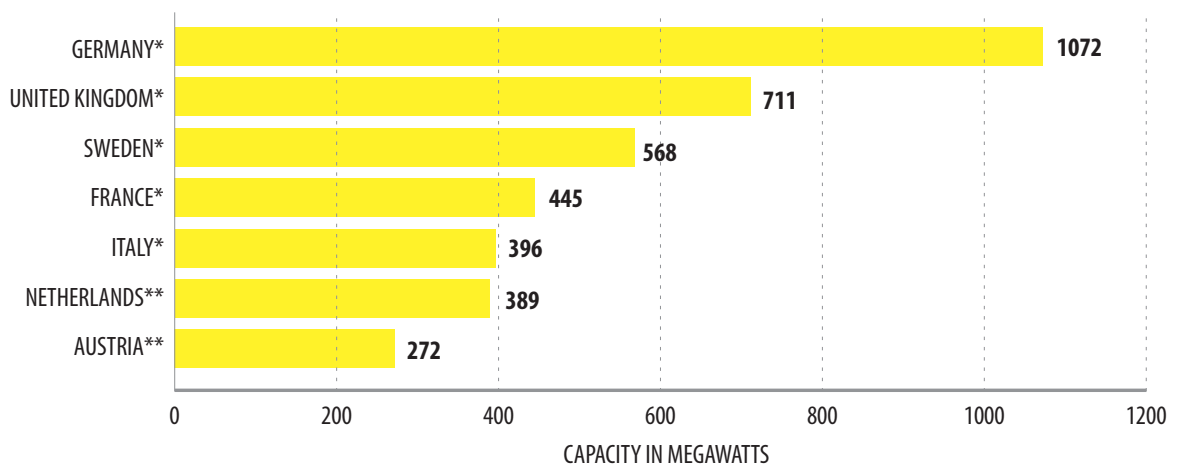


Figure 12: Cumulative installed capacity of municipal waste energy in Europe in 2020 (by country, in megawatts)



Source: Statista 2022.

While WtE sounds like a resourceful way of dealing with waste, and indeed has been branded as part of the circular economy (Recycling Magazine, 2021a), it neither contributes much to energy production nor is it very environmentally friendly. According to Eurostat, in 2018, WtE produced about 2.4% of energy in Europe (40.4 million tons of oil equivalent), with almost all coming from municipal waste (Levaggi 2020). In Germany WtE contributes about 4.3% of its overall energy (Hockenos, 2021). Even the Confederation of European Waste-to-Energy Plants (CEWEP), admitted that WtE doesn't make sense as an energy source alone (CEWEP, 2020).

While WtE is has been branded by some as renewable energy it is actually not that clean. In 2019, WtE incineration emitted 52 million tonnes of carbon dioxide, more than the annual greenhouse gas emissions of Portugal (Hockenos, 2021). This is not only bad for the environment but also for residents living nearby often negatively affecting the health of marginalised people in society. A recent study by Greenpeace showed that incinerators are three times more likely to be located in the poorest and most racially mixed areas than in the wealthiest, whitest ones (Roy, 2020).

Several studies have shown that WtE plants burn mostly recyclable or compostable waste (Zero Waste Europe 2017) and that they require a minimum amount of waste in order to be able to operate. Large-scale incinerators need about 100,000 tonnes of municipal solid waste a year, creating a dependency on waste that can be at odds with waste prevention and recycling. The risk of too little waste and hence the under-supply of the plants is especially severe when the plants are privatised (see section 5.2). Incinerators are expensive to build, so in order for the companies to recover the investment costs and to make profits they usually demand very long-term contracts with municipalities stretching over decades (20-50 years). These contracts usually bind municipalities to deliver a minimum quantity of waste or to pay compensation fees if they fail to meet the minimum. As such, waste incineration, especially when privatised, tends to discourage recycling and waste prevention policies (UNDP 2019). The United Nations Development Programme warned:

“A large scale modern thermal WtE plant requires at least 100,000 tonnes of MSW per year over its lifetime. As with all large investment projects, thermal WtE can potentially create lock-in effects that may lead to plant overcapacity and hamper efforts to reduce, reuse and recycle (UNDP 2019).”

The CEWEP, which represents about 410 plants from 23 European countries, disputes this and argues that WtE does not stand in competition to waste avoidance or recycling and nor is there a 'lock-in-effect':

“CEWEP firmly believes that investment in new or expanded WtE capacity should only take place in well justified cases, in full respect of the waste hierarchy. The efforts for waste prevention, source separation and recycling as well as landfill diversion as set in the EU waste targets must be considered appropriately in the national/regional waste management plans, which are the basis for permits for WtE. This way no so-called “lock-in effect” is created by WtE. It rather goes hand in hand with quality recycling paving the way for a transition to a circular economy.” (CEWEP, 2020)

Indeed, one could argue recycling and WtE could go hand in hand. Countries that have a high WtE capacity are also having high recycling rates. For example, Germany, incinerates about 30% of its MSW but recycles about 70% of it (Levaggi et al. 2022). Yet, as shown above the actual recycling rate is much lower and (see section 3.2 on recycling). Therefore, one might argue that these countries would have higher actual recycling rates if they would not incinerate so much. Academic research

to date shows that cities and regions that host large WtE facilities often display lower recycling rates (Malinauskaite et al. 2017). Also, another study from 2020 found that cities and regions that host large WtE facilities not only often display higher per capita levels of waste generation but also lower recycling rates (see Levaggi et al., 2020). This seems to be confirmed as many European countries with traditionally good recycling rates are now struggling to reach the EU's MSW recycling targets, such as Netherlands, Denmark, Austria, Sweden and Norway. In order to reach the targets these countries have to withdraw plastic wastes from WtE (Ecoprog, 2015).

Most countries with many WtE plants become import dependent on waste. For example, Sweden imported 1.1 million tonnes of waste for energy recovery in 2014 (UNDP 2019). Also, Denmark, which is one of Europe's biggest waste producers, still has a shortage of waste as it struggles to feed its waste incinerators. By 2018 it had to import nearly a million tons of waste (Schaart 2020). In 2020 Denmark decided to decrease its incineration capacity by 30% by 2030, with the closure of seven incinerators in order to expand recycling. These decisions were enabled by the fact that Denmark's incinerators are in public ownership (see section 5.2) and hence the country is not facing legal lawsuits for compensation due to the decision to close the plants. Also, some parts of Belgium are now seeking to reduce their incineration.

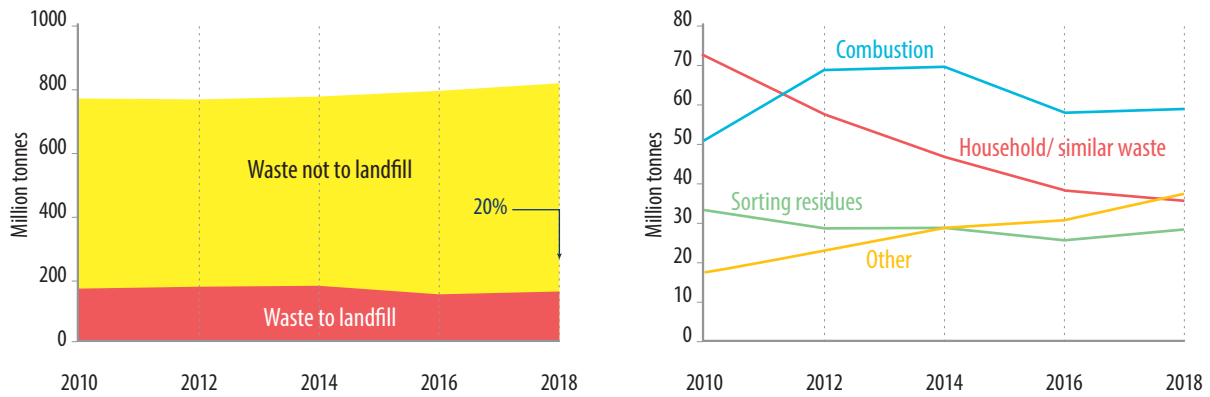
However, elsewhere in Europe the trend of more WtE incineration still continues. For example, Italy, Spain, Poland and the UK, new WtE plants are build (Gardiner, 2021). As such even the OECD warns that if government subsidies support profits in the WtE market, the risk of over-investment grows. (Levaggi, et al. (2020).

3.4 Landfill

Landfill is the least desirable option of the waste hierarchy (see section 2.2) and can pose environmental risks, impacting on the quality of ground and surface water. Landfill use for municipal waste in Europe fell by 58% between 1995 and 2020, by which time only 23% of municipal waste was going to landfill, compared to 61 % in 1995 (Eurostat, 2021). However, municipal waste only accounts for around 8% of total waste generated in the EU (see section 2.1) and when looking at all waste treated (excluding exports but including imports) then nearly 40% goes to landfill (Eurostat, 2022).

In Spain, Portugal, Greece and most Eastern European countries, landfill is still the predominant form of waste treatment (Levaggi 2020). A European Commission report suggested that landfill taxes could be used to ensure that landfill is not the cheapest option and thus force EU countries to change to alternative methods. There is also the problem of landfill being increasingly used for waste from sorting residues (mainly secondary waste from waste treatment facilities). This waste is especially toxic and raises serious questions about the increase in waste incineration and, in some cases, the need to import waste to run incinerators (see section 3.3).

Figure 13: Amounts and share of waste deposited in landfills, EU27 (by type of waste category)



Source: European Environment Agency, 2021c



European regulations on landfill

European Directive 1999/31/EC on the landfill of waste regulates what type of waste can be sent to landfill sites. Article V was amended by Directive (EU) 2018/850 to include the following targets:

- By 2035, the amount of municipal waste sent to landfill sites should be reduced to 10 per cent or less of the total amount of municipal waste generated (by weight);
- By 2030, waste that is suitable for recycling or other material or energy recovery should not be disposed of in landfill sites; and
- Separately collected waste should not be accepted in landfill sites.



4. Employment

4.1 Employment in waste management

Employment in waste management¹ increased by nearly 39% from 0.8 million to 1.2 million full-time equivalents between 2000 and 2018 (the latest figures available). The EU defines waste management as ‘activities and measures which prevent the generation of waste and reduce the harmful effects of waste on the environment’. These statistics on waste management include waste collection, waste treatment and disposal of waste including low-level radioactive waste, monitoring and regulation activities, as well as street cleaning and the collection of public litter (EEEA, 2020). Considering that waste in Europe has been rising in the last two decades it is not surprising that employment levels have also been going up. However, it is interesting to note that in the same time employment in wastewater management decreased by nearly 28% from 0.7 million in 2000 to 0.5 million in 2018.

4.2 Employment in the circular economy

Data and research on employment in the circular economy usually covers the recycling, repair and reuse sectors and does not take into account are jobs that have to do with waste prevention as well as employment in eco-innovation, eco-design and product-service-systems that cut across all sectors. Previous EPSU reports (Wegmann, 2017, 2020) have noted how analyses of the circular economy have largely ignored the working conditions of employees in the sector, focusing more on its assumed job creation potential.

4.2.1 The job creation potential of the circular economy

The circular economy is seen as an innovative and inclusive solution to the European Union’s most pressing environmental and social issues (see for example Cambridge Econometrics, Trinomics and ICF 2018; Friends of the Earth, 2010; Mitchell, 2015; Morgan and Mitchell 2015). The underlying assumption of all these studies is that circular economy activities (recycling and repair) are labour-intensive, so job losses resulting from the move away from the linear economy should be offset by the overall gains.

A frequently cited study by Cambridge Econometrics, Trinomics and ICF 2018, which was commissioned by the European Commission, is based on economic modelling that predicts that the net increase in jobs by moving to a more circular economy is approximately 700,000 compared to the baseline (Cambridge Econometrics, Trinomics, ICF, 2018). However, it is questionable whether these forecast predictions of employment creation will become reality as this depends on a number of factors, not least whether Europe will increase its localised recycling capacity or continue to depend on exporting large quantities of recyclable waste and/or on burning it in waste-to-energy plants (see sections 2.3 and 3.3).

¹ A note on data and methods: This data draws on Eurostat’s classification of environmental protection activities (CEPA). Waste management is classified as CEPA 3.

Table 1: Employment in the environmental goods and services sector

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
EU27 (FROM 2020)	1.069.000 s	1.069.000 s	1.113.000 s	1.101.000 s	1.119.000 s	1.192.000 s	1.197.000 s	1.209.000 s	1.239.000 s	1.287.000 s
BELGIUM	:	:	:	:	24.851	25.198	26.254	26.415	27.039	27.086
BULGARIA	:	:	:	18.613	16.798	19.610	22.732	22.495	22.099	23.430 b
CZECHIA	:	:	:	:	33.094	34.976	35.119	34.984	35.140	35.713
DENMARK	:	:	6.968	7.022	7.254	8.131 b	8.216	8.981	9.553	9.788
GERMANY*	:	:	:	:	139.693	140.332	136.500	140.691	153.160 e	157.093
ESTONIA	:	:	:	:	2.241	1.940	2.263	2.615	2.676	3.058
IRELAND	:	:	:	:	8.758 e	8.996 e	11.608 e	11.988 e	10.484 e	9.703 e
GREECE	:	:	:	:	9.862	11.587	11.901	14.425	16.424	17.389
SPAIN	:	:	:	:	103.852	113.700	110.217	109.908	112.436	116.560
FRANCE	86.527	90.846	91.515	88.282	90.484	87.819	84.343	84.421	90.054	91.525
CROATIA	:	:	:	:	14.913	15.167	14.504	15.040	16.026	16.684
ITALY	:	:	:	:	122.857	123.359	125.716	129.213	192.212	192.436
CYPRUS	:	:	:	:	:	:	:	:	1.987	2.448
LATVIA	:	:	:	:	4.645	4.644	5.004	4.753	4.881	5.108
LITHUANIA	3.570	4.691	5.093	5.099	5.499	5.430	6.307	6.323	6.624	6.488
LUXEMBOURG	1.169	1.006	1.437	1.358	1.351	1.326	1.431	1.755	1.690	1.765
HUNGARY	:	:	:	:	:	:	:	:	:	:
MALTA	:	:	1.287	1.286	1.317	1.264	1.280	1.374	1.340	1.422
NETHERLANDS	:c	:c	:c	:c	:c	:c	:c	:c	:c	:c
AUSTRIA	14.721	14.654	15.232	15.508	15.536	15.686	16.167	16.498	17.140	17.630
POLAND	:	:	:	:	19.099	20.285	33.484	41.346	40.123	38.347
PORTUGAL	:	:	:	:	20.000	20.454	21.028	23.344	23.815	24.076
ROMANIA	21.353	28.816	51.431	39.840	37.583	37.092	41.564	36.698	38.004	38.988
SLOVENIA	5.146	5.233	5.005	5.606	6.034	5.882	6.424	7.156	7.333	7.550
SLOVAKIA	:	:	:	:	:	:	:	:	9.836 e	9.709 e
FINLAND	:	:	:	:	15.075	14.427	14.087	13.412	13.566	13.271
SWEDEN	:	8.562	8.764	8.919	9.220	9.421	:c	8.883	:c	:c
NORWAY	:	:	:	:	:	:	:	:	:	:
SWITZERLAND	21.583	21.248	19.924	20.769	18.599	19.956	21.582	20.590	20.697	21.057
UNITED KINGDOM	98.993 e	105.054 e	103.018 e	96.012 e	104.035	102.354 b	110.523	125.943	125.882 ep	:
SERBIA	:	:	:	:	:	20.126 p	19.225 p	16.201 p	15.801 p	17.963 p
EU28 (2013-2020)	:	:	:	:	:	:	:	:	:	:

Time frequency Annual. Statistical classification of economic activities in the European Community (NACE Rev. 2) Total - all NACE activities. Classifications of environmental activities: environmental protection activities (CEPA) and resource management activities (CReMA) Waste management. National accounts indicator (ESA 2010) Total employment domestic concept. Type of expenditure Total environmental goods and services sector. Unit of measure Full-time equivalent (FTE).

Special value

: not available

Available flags:

ep estimated, provisional
 bp break in time series, provisional
 b break in time series
 c confidential
 e estimated
 p provisional
 s Eurostat estimate

* until 1990 former territory of the FRG.

Furthermore, the study doesn't take into consideration that a large chunk of the recycling and repair work in Europe is done in the informal economy (see section 4.2.3). A recent analysis estimated that over 20% of the total employment in the circular economy is informal. Unpaid labour can also be common in the repair sector, in particular repair activities of medium-high technological level products, such as the metal mechanic and electronic sectors, and the repair of computers (Llorente-González and Vence (2020). These underline the importance of considering the key geo- and socio-political dimensions – where do we deal with waste and who is dealing with waste, and what are their pay and working conditions (Weghmann 2020).

However, existing data shows that while there is indeed an increase in employment in circular economy activities, the job creation potential predicted in the studies above might be exaggerated. According to Eurostat² there is a slow growth of employment in the circular economy sectors (recycling, repair and reuse), from 3.33 million in 2011 to 3.55 million in 2018 (so an increase of 220,000 jobs in seven years). Overall, jobs in the circular economy account for 1.7% of the total employment in the EU. However, there is a negative correlation between per capita GDP and the share of circular economy activities of total employment (Llorente-González and Vence 2020). The lowest share of circular economy employment is with 1.13% in Belgium and the highest of 2.72% in Lithuania (Cihlarova 2021).

4.2.2 Working conditions and health and safety in the circular economy

A 2020 study analysed the 24 productive activities that, according to Eurostat, make up the repair, reuse and recycling sectors in the European Union and found that employment in these industries is dominated by low-wage and labour-intensive jobs (Llorente-González and Vence 2020). This is consistent with earlier EPSU reports that, while pointing to the limited research, have noted that the few studies that are available reveal a grim picture of workers in recycling facing long hours, few breaks, monotonous tasks in a noisy, smelly and confined environment, facing a conveyor belt running at a high speed (Weghmann 2017; Weghmann 2020).

These studies also indicate that most of the workers in recycling plants are migrants, and typically paid the minimum wage. Even less research has been done on working conditions in the re-use and repair sector (Weghmann 2017; Weghmann 2020). As outlined above, a study conducted by Llorente-González and Vence (2020) shows that unpaid and low-paid work in the repair sector (in particular of machinery and metal products) has increased significantly.

Furthermore, their study shows that the circular economy is based on existing labour market inequalities. For example, in the repair sector 'many of the independent repairers are, in practice, outsourced employees of the original manufacturers, which implies a covert precarious labour relationship' (Ibid.) Also, intra-EU inequalities pave the way for a circular economy on low wages as circular economy employment is higher in poorer EU Member States (Llorente-González and Vence 2020).

² A note on data and methods: employment in the circular economy (recycling, repair, reuse) is measured with the statistical classification of economic activities (NACE), as units producing environmental goods and services can engage in a range of activities, and hence goes beyond an environmental domain. Eurostat has classified 24 productive activities that make up the circular economy (NACE Rev. 2), a full list can be seen here: https://ec.europa.eu/eurostat/documents/8105938/8465062/cei_cie010_esmsip_NACE-codes.pdf



Organising waste workers in Germany and the fight for a sectorial minimum wage

Union density in waste management is just a bit higher than the average union density in Germany. Around 23% of waste workers are members of the ver.di trade union (around 40.000 out of the 175,000 workers in the sector). The union faces two big challenges in recruiting and organising waste workers: Firstly, the membership is ageing with the average union member around 55 years old, which partly reflects the trend for the sector as a whole, which is not particularly attractive to younger workers, leading to an acute shortage of employees. Younger workers are also less likely to be trade union members. Secondly, many waste workers especially in recycling are migrants, mostly of Eastern European origin, posing barriers to trade union organising in terms of language, lack of trust in trade union activities due to the experience under communism and cost-of-living pressures that leave little time for trade union organising activities.

Nonetheless, ver.di has been very active in fighting for a sector-wide minimum wage in waste management which has usually been set above the national minimum wage (NMW). The sector minimum was €10.00 per hour in October 2019, compared to the NMW of €9.19 from 1 January 2019, then €10.25 October 2020 (NMW of €9,35 from January 2020) and €10.45 in October 2021 (NMW of €9.50 from January 2021 and €9.60 from July 2021 onwards). In this way, waste sector minimum wage can be seen as positively influencing the level of the NMW. Ver.di's campaigns and lively protests certainly were a factor in securing higher minimum rates, although the union has not been able to take strike action because of the challenge of organising the mostly low paid and workforce.

There is a huge gap in terms of pay and working conditions between public and private sector waste operators, with private sector wages around 20% lower than those negotiated in the public sector. In some cases, ver.di has managed to sign collective agreements in the private sector with better pay and conditions but only at individual workplaces or companies.

Source: Interview with Ver.di on the 09.08.2022, conducted by Vera Wegmann

To date most research is conducted with the purpose of promoting the circular economy, mostly consisting of reports from public institutions and civil society organisations,³ with little research that assesses the employment implications arising from a transition towards a more circular economy (with some notable exceptions, such as Llorente-González and Vence 2020).

³ Circle Economy, EHORE (2017) Circular Jobs: understanding Employment in the Circular Economy in the Netherlands 10; European Environmental Agency (2016) Circular economy in Europe. Developing the knowledge base, European Environment agency; Ellen MacArthur Foundation, SUN Foundation, McKinsey Center for Business and Environment (2015) Growth within: a circular economy vision for a competitive europe. Isle of Wight; European Commission (2018) Socio-economic analysis of the repair sector in the EU. Study to support eco-design measures to improve reparability of products. Final Report and Annex: member State Reports. Directorate-General for Environment; Morgan, J., Mitchell, P. (2015) Employment and the circular economy Job creation in a more resource efficient Britain.

4.2.3 Informal employment in the circular economy

There is a whole parallel informal waste industry that is absent from the EU's circular economy agenda. This involves collecting waste from bins and dumpsites as well as extracting and repairing reusable material, including systems that often have their own supply chains with intermediaries and wholesalers and may even involve international trade (Rosa and Cirelli 2018). A significant amount of informal recycling and repair work takes place particularly in Eastern and Southern Europe, however, it can also be found in Northern and Central Europe. The increase in informal operations is in part the consequence of official circular economy programmes. Most significantly, the deposit refund schemes (DRS), which were pioneered in Sweden and operate in 10 European countries – Croatia, Denmark, Estonia, Finland, Germany, the Netherlands, Norway, Sweden, Iceland and Lithuania – have facilitated work in the informal waste economy. Without informal workers the high collection rates in DRS schemes of over 90% (Deloitte 2019) could never have been achieved, yet their labour remains unacknowledged.

There is a significant research and policy gap on the informal waste management in Europe. One study from 2016 suggests that there could be as many as one million active informal re-users and recyclers in Europe, who have kept many tonnes of waste out of landfill (Scheinberg et al. 2016). A more recent study based on empirical data on waste management in Serbia between 2016 to 2020 found that the informal sector contributed 63% of all separated waste sent to recycling facilities (Jovičić et al. 2022).

Informal waste collection is often illegal as waste formally belongs to the waste disposal company once it is in the bins (Rosa and Cirelli 2018). As such competition can arise between the formal and informal waste management systems (Gittins 2020). Research from across the world suggests that this is especially the case when waste management is privatised, with private companies targeting informal waste workers as their work undermines their abilities to make profit (Sandhu et al. 2017; Van Niekerk and Weghmann 2019; Weghmann 2020).

This informal work is often carried out by marginalised and vulnerable groups of society. Several studies suggest that most informal waste workers in Europe are usually of Roma and Sinti ethnicity (Rothensteiner et al. 2012; Vaccari & Perteghella 2016; Scheinberg et al. 2016; Gittins 2020) or migrants/refugees often without formal identity papers; and/or are young or elderly people; and/or homeless (Scheinberg et al. 2016). This research indicates that informal waste workers are usually earning less than the minimum wage, as they don't receive a wage but survive on the little money they make by selling the material. They are also exposed to greater health and safety risks as they work without protective clothing (Weghmann 2018).

4.3 The impact of digitalisation and automation on employment in waste management

According to a survey of about 1000 international waste industry experts by the International Solid Waste Association, the biggest change in waste management will come in the form of near fully automated recycling and sorting plants (EIONET, 2020). Examples from Europe include:

- Norway: the world's first fully automated mixed waste processing facility opened in 2016, just outside of Oslo. It processes household and food waste from 10 municipalities (Maile, 2019).

- Sweden: the world's first automated textile sorting plant started operating in 2020 in Malmö. It can handle 4.5 tonnes an hour and workers are only needed to start and stop the plant, feed the material in, and take the bales out (Recycling Magazine, 2021b). Site Zero is planned to start operating in 2023 and will be able to recycle all the plastic waste generated by Swedish households (200,000 tonnes a year). It will employ only 150-200 workers (EUWID, 2021a).
- Switzerland: there is a fully automated recycling plant that recovers valuable high-purity materials from construction and demolition (C&D) waste. Robots pick up to 12,000 items per hour with up to 30kg weight, separating mineral materials and foreign impurities from mixed C&D streams. In one hour the plant sorts 200 tonnes of material and operates around the clock (Steed, 2021).
- Germany: a new automatic recycling sorting plant using artificial intelligence (AI) opened near Munich in 2022. Operated by only 50 workers, it runs around the clock processing around 120,000 tons of lightweight packaging annually. (Recycling Magazine, 2022).

The use of robotics in waste management is likely to increase in the future not only in waste sorting but also in waste collection and sweeping. For example, in Germany Enway operates autonomous, self-driving street sweepers and in Sweden the Volvo Group and Renova (Sweden) have developed an autonomous, self-driving refuse truck (EIONET, 2020).

Use of the Internet of Things in the waste management sector enables the use of sensor-supported containers, the electronic processing of documentation and the networking of vehicles to improve logistics. For example, in Sweden Smart Recycling AB optimised bin emptying logistics based on level sensors and GPS coordinates of containers (EIONET, 2020).

AI can also be used in the waste management sector for sorting by using image recognition, autonomous vehicles and sweeping robots. For example, in Hamburg, Germany the city cleaning agency uses AI to spot illegally dumped waste and littering. It encourages citizens to take pictures of the waste and litter with their phones and software identifies the images and redirects it to the appropriate agent (EIONET, 2020).



5. Public and private ownership

5.1 Public ownership and insourcing

There is a clear public-private split in the provision of waste management across Europe. While privatisation has been a significant trend over many years, there is now evidence of services being insourced – brought back under direct public management. The [Public Futures](#) database, maintained by the University of Glasgow, identifies at least 12 cases in Spain, 11 in Germany, 13 in Denmark and 19 in Norway, 15 in the UK and one each in Poland and Portugal (see table 1). The number of insourcing cases is likely to be much higher, as many are not recorded. For example, in Norway in 2017, the failure of RenoNorden, one of the country's largest waste companies, led to over 100 services being insourced (Monsen and Pettersen 2020, see box 3). This highlights the opportunities that arise from company failures (Weghmann 2020). There has also been a clear trend in Germany, where a quarter of all municipalities were using in-house services for waste collection in 2015, compared to only 14% in 2003 (Demuth 2022). While there are several reasons for insourcing, in Germany, for example, it was often the result of cost-benefit analyses by municipalities (Weghmann 2021).

Box 3: Insourcing waste services in Norway



Over 100 municipalities have taken waste collection (back) into public ownership after the collapse of one of Norway's largest waste collection companies, RenoNorden. This wave of insourcing was facilitated by the active campaigning of the trade union Fagforbundet and its local branches and shop stewards, which used the bankruptcy as a basis for arguing that waste collection should be taken back into public hands.

The privatisation of waste collection had had a detrimental effect on workers who faced lower wages and pensions and longer working hours – even up to 90 hours a week in some cases – than those employed by municipalities. The Kragerø municipality in southern Norway was one of the first to insource the service, delivering not only better pay for employees but also lower fees for residents.

In total, 137 municipalities were affected by RenoNorden's collapse and by February 2019, 110 had insourced their waste services. For some it was the first time that they had delivered the service in-house while others decided to pool resources and create inter-municipal waste companies.

The example of Norway shows the advantages of public municipal waste collection, with municipalities having better democratic control, while keeping capacity and know-how in-house, with better working conditions, pensions and training opportunities for employees. It has also meant greater control over recycling (Monsen and Pettersen 2020)

Table 2: Waste insourcing in Europe

LOCATION	SERVICE	POPULATION	YEAR	HOW DE-PRIVATISATION HAPPENED	LEVEL OF NEW SERVICE PROVISION	OLD OPERATORS	NEW OPERATORS	OWNERSHIP STRUCTURE	MOTIVATIONS
DENMARK									
Helsingør	Integrated waste management	62686	2019	Contract expiration*	Municipal	NA	Forsyning Helsingør	Public company	Cost reduction
Langland	Waste collection	12000	2018	Contract termination *	Municipal	N/A	Langland forsyning A/S	Public company	N/A
Hillerød	Waste collection	50650	2017	Contract termination*	Municipal	N/A	Halsnæs Forsyning	In-house service	Cost reduction, Quality of service provision, Policy objectives
Frederiksberg	Waste collection	50000	2012	Contract expiration*	Intermunicipal	R98	Amager Ressourcecenter, ARC	In-house service	N/A
Halsnæs	Waste collection	30644	2015	Contract expiration*	Municipal	N/A	Halsnæs Forsyning	In-house service	Cost reduction, Policy objectives
Hvidovre	Waste collection	500	2019	Contract expiration*	Intermunicipal	Remondis A/S, and four others	Amager Ressourcecenter, ARC	In-house service	Policy objectives
Sønderborg	Waste collection	27400	2020	Contract expiration*	Municipal	N/A	Sønderborg Forsyning	In-house service	Policy objectives
Kerteminde	Waste collection and treatment	23000	2009	N/A**	Municipal	N/A	Kerteminde Forsyning A/S	In-house service	N/A
Tårnby	Waste collection and treatment	43000	2019	Contract expiration*	Intermunicipal	?	Amager Ressourcecenter, ARC	In-house service	N/A
Dragør	Waste collection and treatment	14000	2019	Contract expiration*	Intermunicipal	Marius Pedersen	Amager Ressourcecenter, ARC	In-house service	N/A
Faxe	Waste collection and treatment	35000	2019	Contract expiration*	Municipal	N/A	Faxe forsyning and Faxe Affald A/S	In-house service	N/A
Rødovre	Waste collection and treatment	40000	2020	Contract expiration*	Municipal	M. Larsen Vognmandsfirm, bought by Remondis A/S in 2018	Tekniske Forvaltning (Technical Management), part of the municipality	In-house service	N/A
Copenhagen	Waste collection and treatment	623000	2021	Contract expiration*	Intermunicipal	NA	Amager Ressourcecenter, ARC	In-house service	N/A
FRANCE									
Cahors	Waste collection	41300	2015	Contract expiration*	Intermunicipal	Prévoist environnement et Sictom	N/A	N/A	N/A
Briançon	Waste collection and recycling	20800	2013	Contract expiration*	Intermunicipal	Veolia	N/A	N/A	Bankruptcy
Arcachon	Waste collection and recycling	11454	2016	Contract expiration*	Intermunicipal	La Sita (Suez)	La communauté d'agglomération du bassin d'Arcachon sud (Cobas)	In-house service	N/A
GERMANY									
Augsburg	Waste processing	378938	2019	Contract expiration*	Municipal	AVA (Abfallverwertung Augsburg)	AVA (Abfallverwertung Augsburg)	Public company	Cost reduction, Quality of service provision
Bremen	Waste collection, Waste disposal site, Waste processing	557464	2018	Contract expiration*	Municipal	Nehlsen (Eno)	Die Bremer Stadtreinigung	Public company	Cost reduction, Working conditions, Democratic/public control

LOCATION	SERVICE	POPULATION	YEAR	HOW DE-PRIVATISATION HAPPENED	LEVEL OF NEW SERVICE PROVISION	OLD OPERATORS	NEW OPERATORS	OWNERSHIP STRUCTURE	MOTIVATIONS
Dresden	Waste collection, Waste processing	543825	2020	Contract expiration*	Municipal	Veolia	Stadtreinigung Dresden GmbH	Public company	Democratic/public control
Fröndenberg, Wickede	Waste collection, Waste processing	33952	2012	Contract expiration*	Intermunicipal	N/A	Kommunalservice Wickede-Fröndenberg	Public company	N/A
Kiel	Integrated waste management	243148	2012	Contract expiration*	Municipal	N/A	Abfallwirtschaftsbetrieb Kiel (ABW)	Public company	Cost reduction, Democratic/public control, Policy objectives
Lüneburg	Integrated waste management	174257	2007	Contract expiration*	Regional	N/A	GFA Lüneburg	Public company	N/A
Landkreis Mayen-Koblenz	Integrated waste management	214786	2016	Contract termination*	Intermunicipal	Different private operators	Abfallzweckverband Rhein-Mosel-Eifel	In-house service	Cost reduction, Policy objectives
Ostholstein	Waste collection, Waste disposal site, Waste processing	200581	2017	Contract termination*	Intermunicipal	NAD GmbH (formed by Nehlsen GmbH 74,8% and Otto Dörner 25,2%)	ZVO Entsorgungs GmbH	Public company	Cost reduction, Democratic/public control, Quality of service provision
Aachen, Düren	Waste collection, Waste processing	340150	2006	Contract termination*	Intermunicipal	Different private operators	Zweckverband Regio Entsorgung	In-house service	Cost reduction, Working conditions, Democratic/public control, Policy objectives
Landkreis Deggendorf, Landkreis Freyung-Grafenau, Landkreis Passau, Landkreis Regen, Stadt Passau	Waste collection, Waste disposal site, Waste processing	510000	2016	Contract expiration*	Intermunicipal	Different private operators	Zweckverband Abfallwirtschaft Donau-Wald (ZAW Donau-Wald)	In-house service	Cost reduction, Quality of service provision
Bergkamen	Waste collection	52329	2006	Contract expiration*	Municipal	N/A	GSW – Gemeinschaftsstadtwerke Kamen-Bönen-Bergkamen GmbH	Public company	Cost reduction, Working conditions, Democratic/public control
Rhein-Hunsrück	Waste collection and treatment	103767	2006	N/A*	Municipal	N/A	Rhein-Hunsrück Entsorgung	Public company	Cost reduction
NORWAY									
Trondheim	Waste collection	95000	2006	Contract expiration*	Municipal	N/A	Trondheim renholdsverk A/S	In-house service	N/A
Fet, Gjerdrum, Sørum, Skedsmo, Lørenskog, Nittedal, Enebakk, Aurskog-Høland	Waste collection	200000	2017	Private withdrawal*	Intermunicipal	RenoNorden	ROAF IKS	In-house service	Bankruptcy
Gjøvik, Østre Toten, Vestre Toten, Nordre Land, Søndre Land	Waste collection	71300	2017	Private withdrawal*	Intermunicipal	RenoNorden	Horisont Renovasjon A/S	In-house service	Bankruptcy
Gran, Hole, Jevnaker, Lunner, Ringerike	Waste collection	66900	2017	Private withdrawal*	Intermunicipal	RenoNorden	HRA Transport A/S	In-house service	Bankruptcy

LOCATION	SERVICE	POPULATION	YEAR	HOW DE-PRIVATISATION HAPPENED	LEVEL OF NEW SERVICE PROVISION	OLD OPERATORS	NEW OPERATORS	OWNERSHIP STRUCTURE	MOTIVATIONS
Kragerø	Waste collection	10500	2017	Contract termination*	Municipal	RenoNorden	Kragerø municipalitie	In-house service	Bankruptcy
Åfjord, Bjugn, Rissa, Ørland	Waste collection	20200	2017	Private withdrawal*	Intermunicipal	RenoNorden	Fosen Renovasjon IKS	In-house service	Bankruptcy
Austrheim, Fedje, Gulen, Lindås, Masfjorden, Meland, Modalen, Radøy, Solund	Waste collection	37700	2018	Private withdrawal*	Intermunicipal	RenoNorden	NGIR IKS	In-house service	Bankruptcy
Bremanger, Eid, Gloppen, Hornindal, Selje, Stryn, Vågsøy	Waste collection	33000	2017	Private withdrawal*	Intermunicipal	RenoNorden	Nomil IKS	In-house service	Bankruptcy
Giske, Haram, Norddal, Sandøy, Skodje, Stordal, Stranda, Sula, Sykkylven, Vestnes, Ørskog, Ålesund	Waste collection	105000	2017	Private withdrawal*	Intermunicipal	RenoNorden	Årim IKS	In-house service	Bankruptcy
Molde, Aukra, Eide, Fræna, Gjernes, Midtsund, Nesset	Waste collection	51300	2017	Contract termination*	Intermunicipal	RenoNorden	RIR IKS	In-house service	Bankruptcy
Leka, Bindal, Nørøy, Vikna	Waste collection	11300	2017	Contract termination*	Intermunicipal	Miljøservice Ottersøy	ReTrans Midt A/S	In-house service	Quality of service provision
Malvik, Selbu, Meråker, Tydal, Innerøy, Stjørdal	Waste collection	26000	2018	Contract termination*	Intermunicipal	RenoNorden	ReTrans Midt A/S	In-house service	Quality of service provision
Overhalla, Namsos, Namdalseid, Grong, Høylandet, Flatanger, Fosnes, Osen, Roan	Waste collection	26000	2018	Contract termination*	Intermunicipal	Retur A/S	ReTrans Midt A/S	In-house service	Quality of service provision
Hamar, Ringsaker, Løten, Stange	Waste collection	93500	2019	Private withdrawal*	Intermunicipal	RenoNorden	SIRKULA	In-house service	Bankruptcy
Bykle, Valle, Evje, Hornes, Bygland, Iveland	Waste collection	8300	2019	Private withdrawal*	Intermunicipal	RenoNorden	Setesdal Miljø og Gjenvinning IKS	In-house service	Bankruptcy
Beiarn, Bodø, Fauske, Gildeskål, Hamarøy, Meløy, Saltdal, Steigen, Sørfold	Waste collection	12500	2019	Private withdrawal*	Intermunicipal	Retur AS	IRIS Salten A/S	In-house service	Bankruptcy
Farsund, Lyngdal	Waste collection	18000	2019	Contract expiration*	Intermunicipal	B. Hansen renovasjon A/S	RFL a/s	In-house service	Bankruptcy
Stavanger, Sandnes	Waste disposal site	135000	2017	Private withdrawal*	Intermunicipal	RenoNorden	Renovasjonene IKS	In-house service	Bankruptcy
Oslo	Waste collection, Waste disposal site, Waste processing	650000	2017	Contract termination*	Municipal	Veireno	Renovasjons- og gjenvinningsetaten (REG, City of Oslo)	In-house service	Working conditions, Bankruptcy, Quality of service provision, Non-compliance with contract

LOCATION	SERVICE	POPULATION	YEAR	HOW DE-PRIVATISATION HAPPENED	LEVEL OF NEW SERVICE PROVISION	OLD OPERATORS	NEW OPERATORS	OWNERSHIP STRUCTURE	MOTIVATIONS
SPAIN									
El Boalo	Integrated waste management	7399	2016	Contract termination*	Municipal	N/A	N/A	In-house service	Quality of service provision, Policy objectives
Hernani	Integrated waste management	20222	2018	Contract expiration*	Municipal	FCC	Garbitania Zero Zabor	In-house service	Cost reduction, Democratic/public control
Arteixo	Waste collection, Waste processing	31534	2018	Contract expiration*	Municipal	As Mariñas (consortio of Ferrovial and Cespa)	Ayuntamiento de Arteixo	In-house service	Quality of service provision
León	Waste collection	129551	2013	Contract expiration*	Municipal	Urbaser	N/A	In-house service	N/A
Granadilla de Abona	Waste collection	43455	2017	Contract expiration*	Municipal	N/A	Servicio Municipales de Granadilla (Sermugran)	In-house service	N/A
Torrelavega	Waste collection	51687	2019	Decision*	Municipal	Geaser	Agua Torrelavega	N/A	Cost reduction
Mislata	Waste collection and recycling	43281	2015	Contract termination*	Municipal	Sociedad Agricultores de la Vega	Nemasa (owned by municipality)	In-house service	N/A
Castelldefels	Waste collection	63255	2016	N/A*	Municipal	N/A	Empresa municipal SAC	In-house service	N/A
Huesca	Waste collection, Waste disposal site, Waste processing	52059	2021	Contract expiration*	Municipal	FCC	Gestión de Residuos Huesca (GRHUSA)	Public company	Cost reduction, Democratic/public control
Aspe	Waste collection	20180	2013	Contract termination*	Municipal	Servicios de Levante SA (SELESA)	Ayuntamiento de Aspe	In-house service	Cost reduction, Working conditions
Astorga	Waste collection	12078	2021	Contract expiration*	Municipal	Urbaser	Municipio Astorga	Public company	Quality of service provision
Alcalá de Guadaíra	Waste collection	70155	2021	Contract termination*	Municipal	Valoriza Servicios Medioambientales SA	AIRA Gestion Ambiental Sociedad Anónima	Public company	Quality of service provision, Non-compliance with contract
NETHERLANDS									
Westland	Waste collection	107674	2010	Contract expiration*	Intermunicipal	AVR	HVC	In-house service	N/A
Peel & Maas	Waste processing	43309	2016	Contract expiration*	Municipal	Van Gansewinkel/Renewi	Municipality Peel & Maas	In-house service	N/A
Peel & Maas	Waste processing	43309	2018	Contract termination*	Municipal	N/A	Municipality Peel & Maas	In-house service	N/A
UNITED KINGDOM									
Northumberland	Waste collection	316028	2011	Contract expiration*	Regional	N/A	N/A	N/A	Cost reduction, Policy objectives
London Borough of Islington	Waste collection	239142	2013	Contract expiration*	Municipal	Enterprise	Islington Borough	In-house service	Cost reduction
Liverpool	Waste collection	493856	2016	Contract expiration*	Regional	Enterprise Liverpool Limited (ELL), a Joint Venture between the City Council and Amey plc (Amey plc is the parent company of Amey LG)	Liverpool Street Scene Services	N/A	Cost reduction

LOCATION	SERVICE	POPULATION	YEAR	HOW DE-PRIVATISATION HAPPENED	LEVEL OF NEW SERVICE PROVISION	OLD OPERATORS	NEW OPERATORS	OWNERSHIP STRUCTURE	MOTIVATIONS
Peterborough	Waste collection	196640	2019	Contract termination*	Municipal	Amey	Peterborough Ltd	In-house service	Cost reduction, Policy objectives
Hertfordshire	Waste collection	1184000	2019	Contract termination*	Municipal	Veolia	N/A	N/A	Cost reduction
London Borough of Islington	Waste collection and recycling	239142	2012	Contract expiration*	Municipal	Enterprise	N/A	In-house service	Cost reduction
London Borough of Hackney	Waste collection and recycling	275929	2013	Contract expiration*	Municipal	May Gurney	N/A	In-house service	Cost reduction
Borough of Corby, Borough of Kettering	Waste collection and recycling	61255	2019	Contract expiration*	Intermunicipal	Kier Environmental Services Limited	Corby and Kettering Shared Street Scene Service	In-house service	Cost reduction
Greater Manchester	Waste collection and recycling	2756000	2019	Contract termination*	Intermunicipal	Viridor Laing	Greater Manchester Combined Authority (GMCA)	In-house service	Cost reduction, Lack of investment
London Borough of Tower Hamlet	Waste collection and recycling	307964	2020	Decision*	Municipal	Veolia	N/A	In-house service	Cost reduction, Quality of service provision
Neath Port Talbot	Waste processing	227079	2005	Contract termination*	Municipal	HLC Environmental Projects	Crymlyn Burrows waste treatment plant	In-house service	Cost reduction
North Tyneside	Waste processing	205985	2009	Contract expiration*	Municipal	External contractor	Waste disposal and recycling services	In-house service	Policy objectives
Lewes District Council, South East, United Kingdom	Waste processing	92177	2011	Contract expiration*	Municipal	N/A	Kerbside Recycling Collection Service	In-house service	Cost reduction
Banbridge District Council, Northern Ireland, United Kingdom	Waste processing	16637	2012	Contract expiration*	Municipal	Bryson Recycling	N/A	In-house service	N/A
Falkirk	Waste processing	160340	2016	Contract expiration*	Municipal	N/A	N/A	N/A	Cost reduction
POLAND									
Jaworzno	Waste collection	91563	2020	N/A*	Municipal	AVR, Miki	Wodociągi Jaworzno	Public company	Cost reduction, Quality of service provision
PORTUGAL									
Paços de Ferreira	Waste collection	6782	2020	Contract expiration*	Municipal	SUMA	City of Paços de Ferreira	In-house service	Cost reduction, Democratic/public control, Quality of service provision, Policy objectives

* Remunicipalisation (through local government)

** Municipalisation (through local government)

Source: Source Public Future Database

5.2 Increased privatisation in incineration

The private sector has a strong involvement in waste incineration in Europe, and this is increasing with the rise of waste-to-energy (WtE) schemes (see section 3.3). For example, private companies control the largest WtE plants in Sweden and run the largest incinerators in Italy (though with municipalities holding minority stakes through public-private partnerships (PPPs)) (Levaggi et al. 2022). In Germany there is a public-private split in waste incineration, but more than 60% of all incinerators are completely privatised or run by PPPs. With WtE incinerators the share of private participation is even higher with 86% fully privatised, 9% run by PPPs and only 5% in public ownership (Weghmann 2021). There is some public ownership in other parts of Europe, including in Austria where municipalities run major WtE plants, such as Vienna's landmark Spittelau facility, and in Denmark where most incinerators are owned by local authorities (Malinauskaite et al. 2017; Levaggi et al. 2022).

A recent study compared private and public ownership of WtE and concluded that "private ownership generally leads to inefficiencies" (Levaggi et al. 2022: 37). This can be seen from the experience of two cities – Belgrade and Ljubljana (see box 4 and box 5) – which illustrates that public ownership and control is essential for a holistic waste management system that allows the prioritisation of environmental concerns over profit.

Waste to energy: a tale of two cities

Box 4: WtE in Belgrade: the failures of privatisation



In September 2017, the City of Belgrade signed a 25-year PPP contract with the Suez-Itochu consortium for the provision of municipal waste treatment and disposal services. The core of the contract was the construction and operation of a WtE facility that would treat 340,000 tonnes of municipal waste annually, around 66% of the total generated in the city. The deal also included the closure and partial remediation of the existing Vinča landfill site, the construction and operation of a new leachate-controlled landfill site (170,000 tonnes per year) and a facility for processing 200,000 tonnes of construction and demolition waste a year (Radovanović 2019).

The PPP contract, said to be the largest signed in Serbia at the time (Politika, 2017), has an estimated annual value of €38.3 million (tax included) (Radovanović 2019), with the total payment to the consortium amounting to €957 million over the course of the contract.

The PPP was financed through loans from the World Bank's International Finance Corporation (IFC) which consulted the city authorities on the legal, regulatory, technical and financial aspects of the project as well as on the public procurement procedures and the selection of the bidder. Early in the process it became clear

that the bidders for the contract were mostly interested in the WtE process that would incinerate municipal waste without prior treatment and not in developing municipal waste separation and recycling systems. Initially the European Investment Bank offered financial support, but then withdrew in 2019, when the European Commission expressed concerns that the project would prevent Serbia from achieving the EU's recycling and circular economy objectives (Radovanović 2019).

Belgrade's commitment to deliver around 66% of the city's municipal waste without prior sorting or treatment is at odds with the EU's binding obligation that by 2030 at least 60% of municipal waste in each member state should be prepared for reuse or recycled. Serbia is preparing to enter the EU but currently its recycling rates are almost non-existent (European Environment Agency, November 2021). It is estimated, in fact, that recycling in Serbia has even declined in recent years with its recycling rate as low as 0.4% in 2019 (Balkan Green Energy News, 2021) and with most recycling carried out by the informal sector (European Environment Agency, November 2021).



Box 5: Zero-waste in in Ljubljana: successful public ownership

In contrast to Belgrade, Ljubljana in Slovenia demonstrates how a publicly funded waste management system can not only achieve great recycling rates but work in line with the city's waste prevention mechanisms. Between 2006 and 2017, Slovenia managed to achieve the most significant decrease in landfilled municipal waste in the EU, cutting it by almost 70%.

Funded by the EU Cohesion Fund (€77.6 million, 66%) and the national and local government, the construction of the Regional Centre for Waste Management (RCERO) treatment plant was completed in October 2015. The facility serves 37 municipalities in central Slovenia and processes over 170,000 tonnes of waste annually – over 150,000 of mixed municipal waste and over 20,000 tonnes of separately collected biowaste (Balkan Green Energy News, 2019). RCERO includes various treatment mechanisms, strictly following the waste hierarchy and aiming at sending as little waste as possible (around 5%) to landfill. A lot of waste is recycled through mechanical treatments and is used to produce solid fuel. While unrecyclable materials are processed into fuel, which has a similar calorific value to brown coal and bio-waste is turned into compost. The plant also includes a WtE facility, but it only burns what cannot be recovered.

Ljubljana is also a pioneer in waste prevention, operating packaging-free vending machines for basic household items and all municipal institutions are required to use toilet roll that is produced from re-cycled milk and juice packaging (Dakskobler, 2019).

The example of Ljubljana shows that when waste management is publicly owned and operated it facilitates an integrated system where waste prevention can go hand in hand with recycling as well as WtE, rather than having these three waste management strands competing with each other for profit.

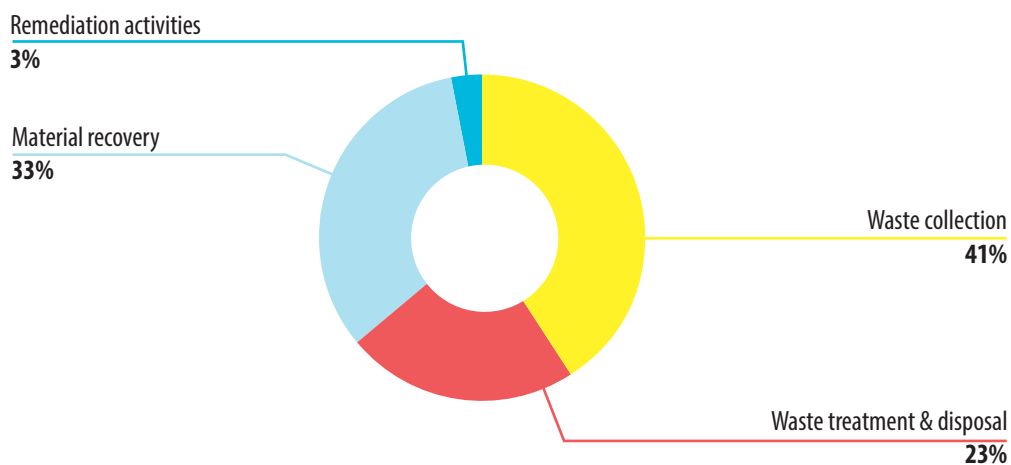
5.3 Private ownership and market concentration

According to Eurostat, in 2018, there were about 47,700 waste operators (public and private) in the then EU28 with a combined annual turnover of €184 billion. Waste collection accounts for the highest share of this turnover (41%), followed by materials recovery (33%), and waste treatment and disposal (23%) (Figure 14).

Yet, the waste market is not so diverse and fragmented as it appears, with increasing market concentration and regional monopolisation taking place. The vast majority of waste operators (99.7%) are micro-companies and small and medium enterprises (SMEs). A few large operators dominate the market with the 16 biggest private companies accounting for 40% of total revenue. And of these 16, five are key multinational players (Veolia, Suez, Remondis, FCC and Alba) (Dri 2018, Salvetti 2020), with Veolia and Suez clearly dominating the market (see Figure 15).

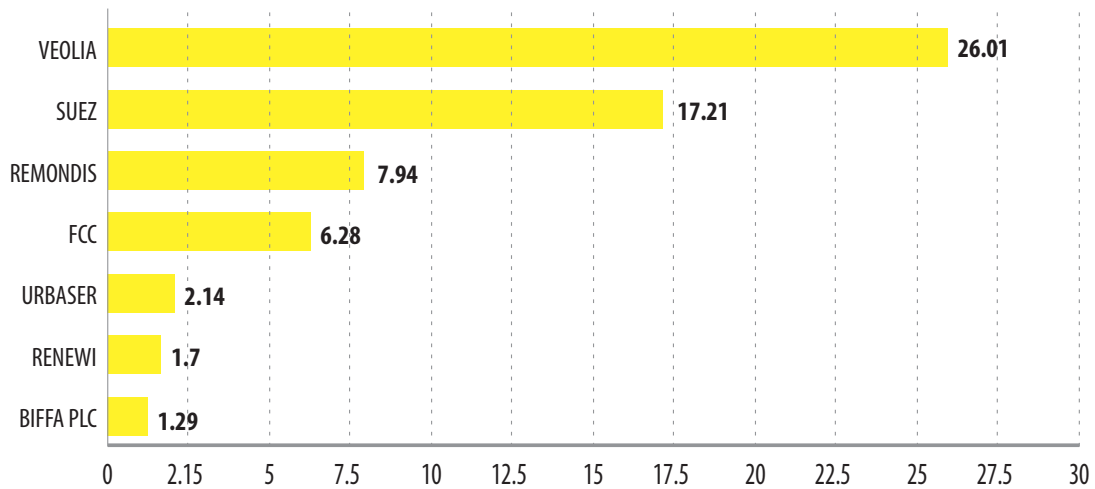
This market concentration will further intensify with the merger of Veolia and Suez which was agreed by the companies in May 2021 (Veolia, 2021a) and approved by the European Commission in December 2021 (Veolia, 2021b). While significantly smaller than Veolia and Suez, Remondis and FCC are still key players especially in certain regions – Remondis in Germany and FCC in Spain and Central and Eastern Europe.

Figure 14: Composition of waste operators' turnover (2018)



Source: Eurostat 2018

Figure 15: Revenue of selected major waste management companies in Europe 2019/20
(Revenue in billion euros)



Source: Statista.

5.4 Dominant companies

5.4.1 Veolia Environment

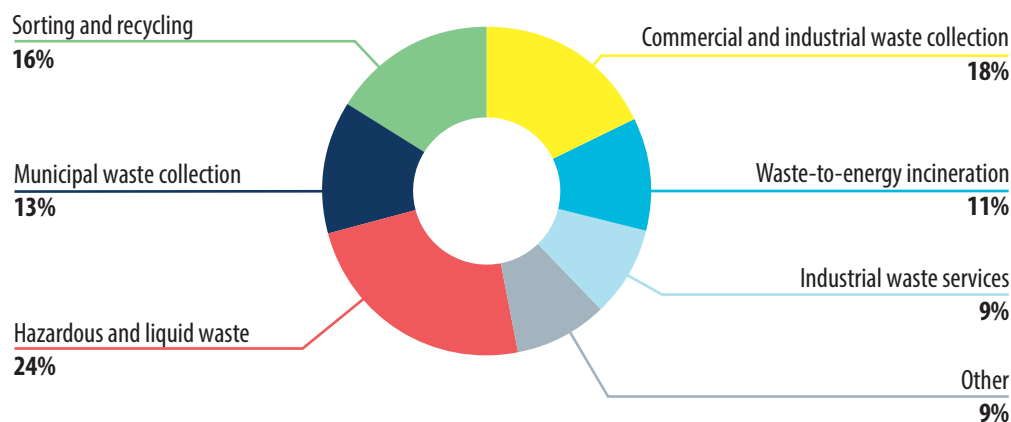
Veolia is a French multinational company with over 470 subsidiaries operating in the waste, water and energy sectors. Nearly 40% of its net sales come from waste management with around 40% from water services and just over 20% from energy services (Market Screener, 2022a). The geographical breakdown of sales shows over 20% in France, over 38% in the rest of Europe and 40% in the rest of the world. Veolia recently expanded in China, Latin America (in particular Argentina and Columbia) and also Northern Africa (in particular Morocco) (Veolia, 2020a).

The merger with Suez was completed early in 2022. The company has recorded several years of growth with record results in the first half of 2021 (due to the merger with Suez). Its net income (overall profit) was US\$ 458 million in 2021, a 320% increase on the previous year (data from Orbis). The result was mainly due to increased profits from energy, following a particularly cold winter and energy price rises, and from waste management as a result of higher recovery in industrial waste collection, good recycled material trends and an increase in treatment activity with higher landfill volumes (+4.6%) (Veolia 2020a).

Veolia is active in the entire waste management system, operating municipal waste collection (13% of revenue), commercial and industrial waste collection (18%) waste-to-energy incineration (11%), industrial waste services (9%), hazardous and liquid waste (24%) and sorting and recycling (16%) (see Figure 16).

Veolia expects to double the size of its plastic recycling business (VEOLIA, 2020b). It is a key player in the waste-to-energy (WtE) sector, in which it has been active since the 1960s (VEOLIA, 2022a). In France, Veolia operates 45 incineration plants, accounting for nearly 40% of the country's WtE incineration (VEOLIA, 2022b) while in the UK the company is contributing significantly to the increase in WtE, operating 10 plants that take around 2.3 million tonnes of waste (Jowett, 2021).

Figure 16: Distribution of Veolia's waste segment revenue in FY 2020, by activity



Source: Statista

Box 6: Sheffield: Veolia and the incineration of recyclable waste

In Sheffield in North East England, Veolia runs waste collection as well as the WtE incinerator. In 2017 the GMB union revealed that the company had been diverting recyclable household waste to its WtE incinerator. This resulted in increased pollution, prevented the city from meeting its recycling targets and meant that workers missed out on the bonuses they would have received if recycling targets had been met. In the same year, the council voted for an early end to its 35-year contract with Veolia for household waste collection and the operation of an WtE plant, agreed in 2001 and due to expire in 2036 (Holmes, 2017) However, threats of a very high compensation claim by Veolia prevented the remunicipalisation (Cole, 2017)

Veolia operates more than 90 WtE facilities worldwide (VEOLIA, 2022a) often pioneering with WtE facilities in entire regions. However, WtE is not always welcomed by residents and workers. In Tarago, Australia Veolia proposed to open an AUD \$600 million plant but met with resistance from civil society groups and the local council (Thrower, 2021) In Mexico, Veolia was commissioned in 2017 to build and operate the first WtE plant in Latin America (VEOLIA, 2017) with a contract worth 80.6bn pesos (US\$4.2bn) over 30 years (Bnamericas, 2018). However, protests by citizens and informal waste recyclers, who saw their livelihoods threatened in 2018 led to the contract being reverted (Environmental Justice Atlas, 2019).

Veolia's takeover of Suez marks a significant increase of market concentration with the new company having a combined revenue of around €37 billion. The two French multinational companies had

already dominated the global private water and waste management market for years and pushed for more privatisations on a global scale. This merger and hence the increased market power of Veolia was only made possible through the support of the French president Emmanuel Macron (PSI, 2022).

Veolia already owned 29.9% of Suez having bought that stake from Engie in 2020. It was not an easy merger but one that followed a public and legal battle, with Suez resisting the take-over (Keohane, 2021).

According to the merger press release, taking over Suez is in Veolia's "strategic" plan to become a global champion in waste management, in particular with activities in the United Kingdom, Spain, the United States, Latin America and Australia (Veolia and Suez 29 June 2021).

In 2020 Suez's revenue for recycling and recovery was €7.26 billion, with more than €6 billion of this generated in Europe (Tiseo, 2022). Revenues increased in 2021 as a result of higher prices for recyclables (EUWID, 2021b). The company was operating 55 waste-to-energy (WtE) incinerators across the world, so the combined company now runs 150 WtE plants globally.

To meet the demands of the competition authorities, Veolia had to sell part of the company which went to a consortium of financial institutions including Meridiam, Global Infrastructure Partners and the Caisse des dépôts et consignations, which have no real experience in the water and waste sector (PSI, 2022).

5.4.2 Remondis

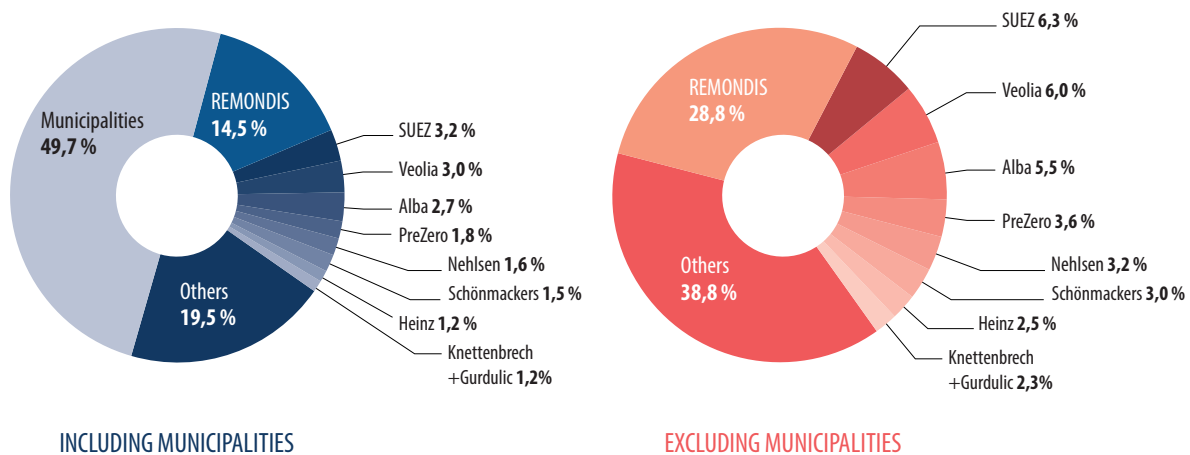
Remondis is a leading waste management company in Germany and Denmark and its main activities cover collection of household and industrial waste, recycling and transport of waste as well as waste treatment (waste incineration and waste to energy). The company is a fully-owned subsidiary of the Rethmann Group, which in turn is owned by the billionaire Rethmann family.

While Remondis is still the biggest player in the collection of lightweight packaging and waste glass in Germany, it has lost many municipal contracts due to remunicipalisation (Weghmann 2021). The company's 2019 annual review states:

'The market situation in 2020 is expected to continue to be tough with great price pressures, where there has also been a tendency for municipalities to insource waste collection. Price is still the decisive parameter, but also with a focus on quality and the environment – especially with regard to public tenders for municipal household waste collection. The company expects a reduced turnover in 2020 as a result of the termination of several municipal household waste contracts.'
(Deloitte 2019)

This is significant, as there was a trend towards the privatisation of waste collection in Germany from the middle of the 1980s, which has now been reversed (see section 5.1). For cost and environmental reasons municipalities have increasingly started to take waste collection back in-house, especially after contract expiry (Weghmann 2021). Since 2003, the market share of municipalities has increased by almost a third while the share of the three largest private waste companies in Germany (Remondis, Alba and Suez) fell by 10 percent. Currently, half of the municipal waste collection in Germany is operated in-house by municipalities (Weghmann 2021).

Figure 17: Market share of waste operators in Germany



Data: Remondis

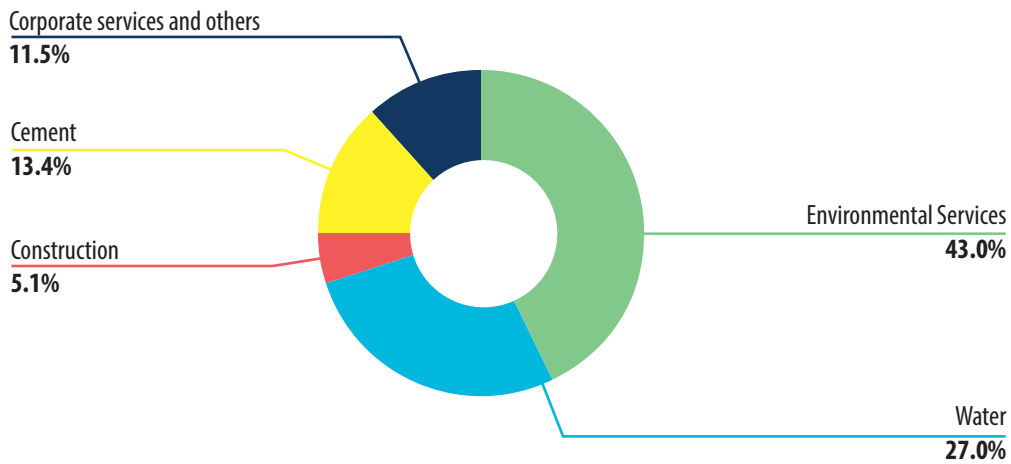
Remondis is also active in waste-to-energy (WtE) with a dedicated subsidiary, Remondis Thermische Abfallverwertung GmbH, indicating that it aims to expand this area of its business. The German WtE sector is almost fully privatised (86% of the WtE plants are in private ownership, 9% are PPPs and only 5% are in public ownership), but Remondis is not the only major player, competing with multinational energy companies, such as Vattenfall and EEW. Remondis is looking abroad for WtE opportunities and was planning to build and operate an incinerator in Australia but pulled out of the contract in early 2022 (Queensland Government, 2022).

5.4.3 Fomento de Construcciones y Contratas (FCC)

The FCC Group claims to be the largest waste management company in Spain and Central and South-Eastern Europe (FCC Environment, 2022a). Its main business segments include waste management (in particular street cleaning, maintenance of urban parks and gardens, industrial waste management, waste treatment and recycling) as well as construction and water management. Waste management accounts for over 46% of its sales (Market Screener, 2022b). FCC's operations are concentrated in Europe but it operates in 30 countries including in Northern Africa, the Middle East, America and Latin America (FCC Environment, 2022b). It's expansion plans include water and wastewater services in the Middle East and North Africa and waste management (environmental) services in America. Over half FCC's income is generated in Spain but operations in Austria, Czech Republic, Slovakia, Hungary, Poland, Romania and Serbia account for nearly 30% of income (FCC Environment, 2019a).

FCC is owned by the Mexican billionaire Carlo Slim and his family. In 2021 the group made a net profit of €580.1 million, more than double that of the previous year. Most of its operating profits (70%) come from waste (environmental services) and water management (see figure 18). The rest is made in infrastructure construction and management and the production of associated materials, along with real estate, where it has plans to expand (FCC Environment, 2022c).

Figure 18: FCC’s EBITDA (gross operating profit) by business segment

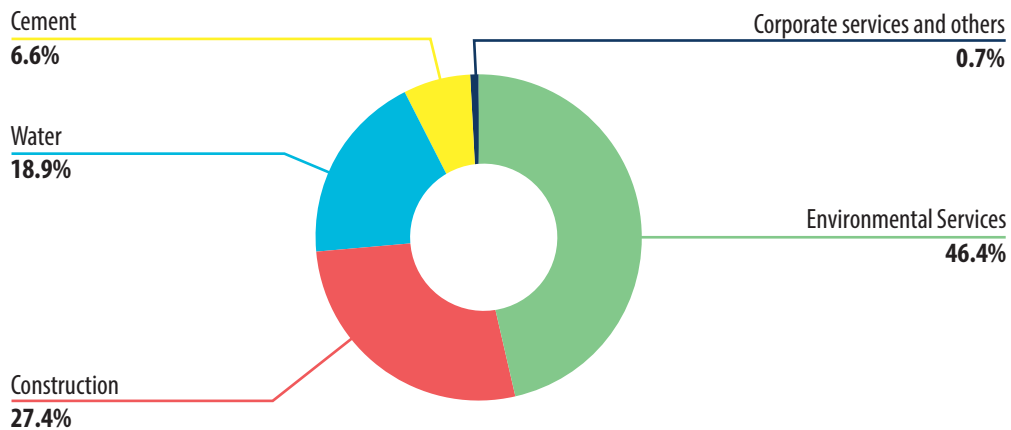


Source: FCC annual report 2020

FCC expanded its operations in the US in 2021, buying Premier Waste Services, a company specialising in tertiary waste collection in Dallas, for \$34 million (Toto, 2022) and winning a 10-year, €110m municipal solid waste collection contract in Wellington, Florida (with a possible five-year extension) (FCC Environment, 2021a). It also won an eight-year residential and commercial solid waste collection contract in Hillsborough County (with a possible extension for four years) with a value of €230m (FCC Environment, 2021b).

In Europe, FCC Environment Austria was awarded the five-year, €33m municipal waste treatment and transport contract by the West Tyrol Waste Treatment Association, commencing in January 2022, (with a possible extension for 5 years). The group also won further street collection contracts in Barcelona and Madrid and in Valladolid a joint venture led by FCC Medio Ambiente won the 11-year contract for the design, development, and operation of the Valladolid Household Waste Treatment and Disposal Centre worth more than €110m (FCC Environment, 2022c).

Figure 19: FCC Revenue by activity



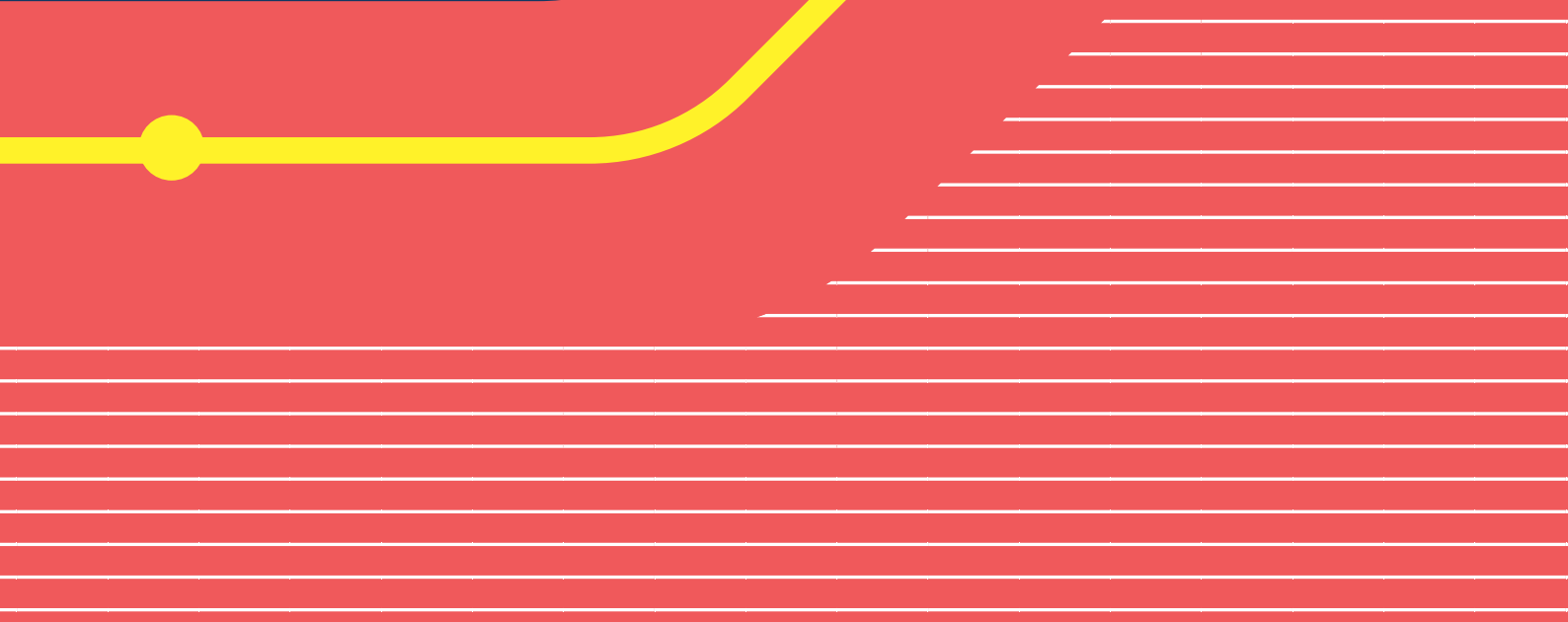
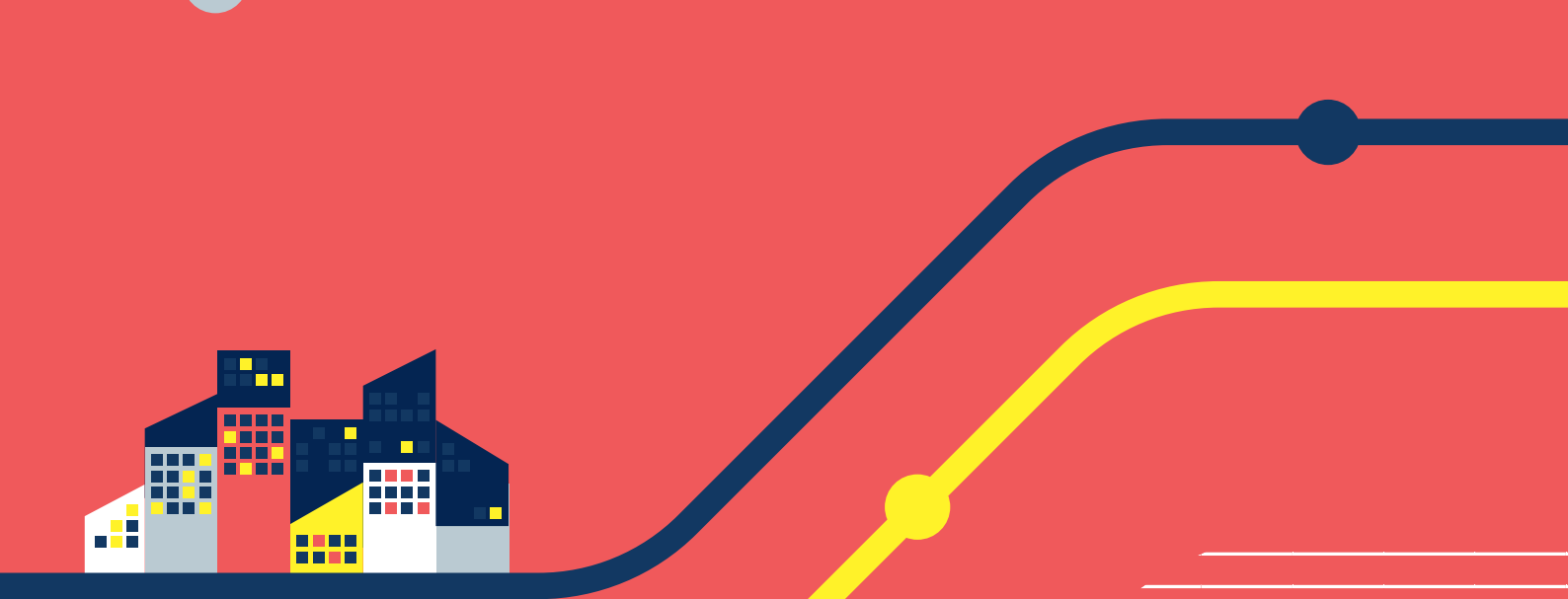
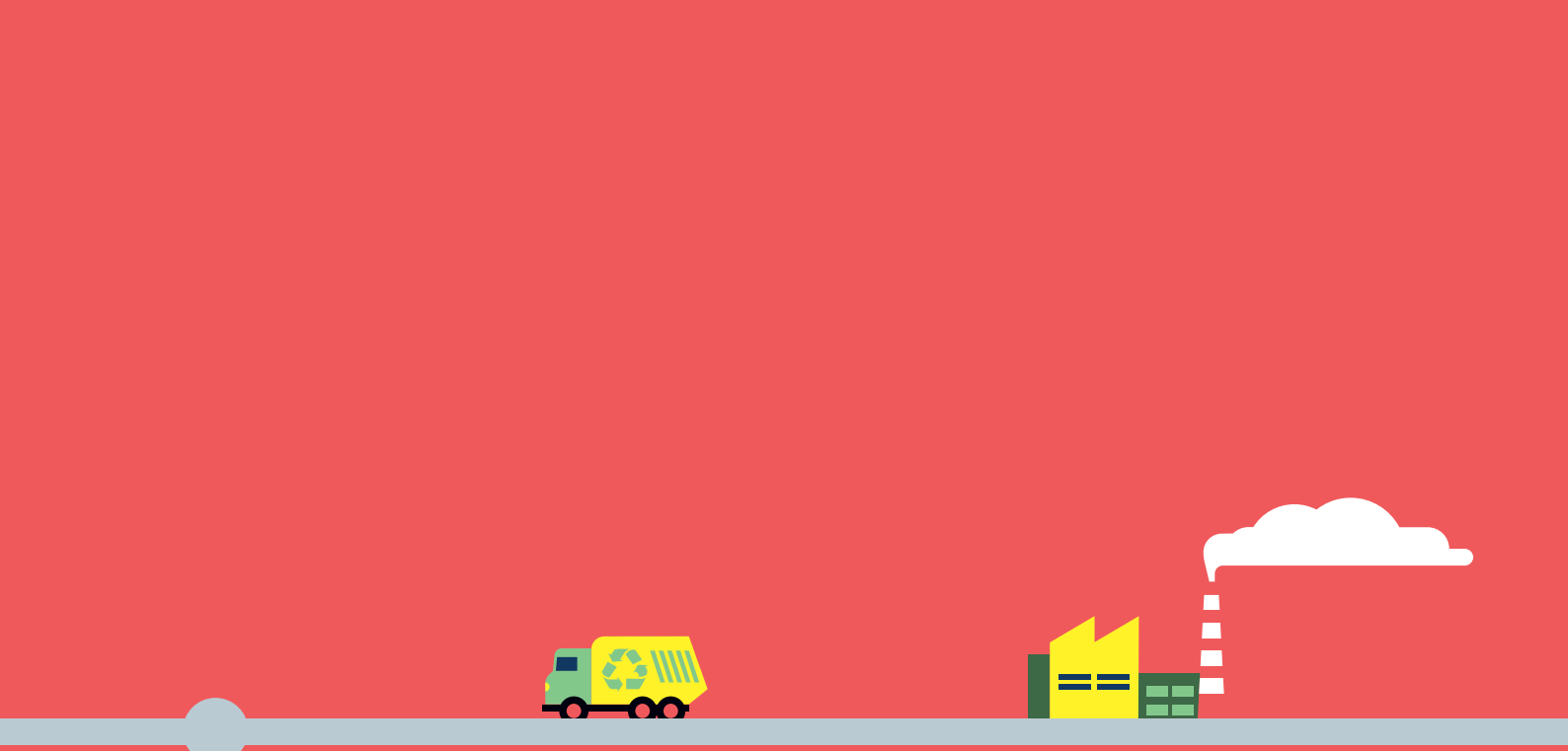
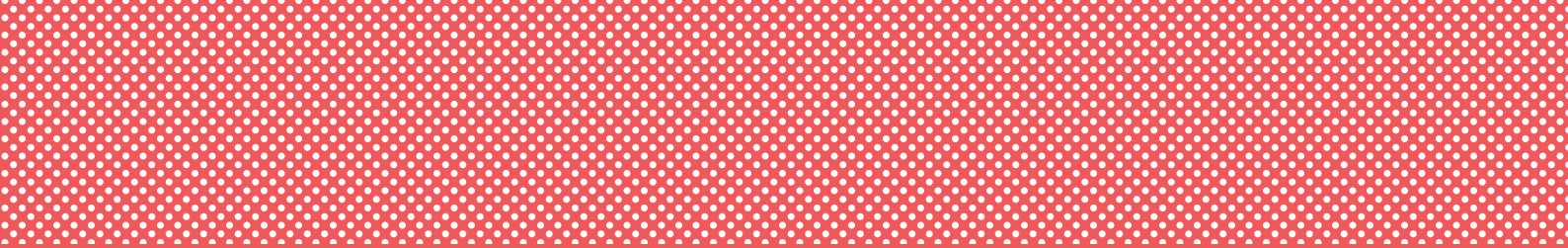
Source: FCC annual review 2019a

FCC says it is committed to the circular economy but it is involved waste-to-energy (WtE) initiatives which cannot be classified as part of the circular economy (see section 2.2). Its FCC Medio Ambiente subsidiary focuses on WtE projects as well as research on recycling. In 2019, FCC owned and operated 10 WtE facilities in Europe, mainly in Spain but also in the UK (FCC Environment, 2019b), Austria and Slovakia (FCC Environment, 2022d). The company aims to expand its WtE activities while it also operates several recycling plants in Europe (FCC Environment, 2019b).

5.4.4 Prezero

Another emerging player, particularly in recycling, is Prezero, a subsidiary of Germany's Schwarz group which also owns major retailers, such as Lidl and Kaufland. In 2021 Prezero tripled its turnover to €2.1bn and currently has 11 subsidiaries active in waste management (information from Orbis). In July 2021, it bought Cespa from Ferrovial for €1.1bn, a company that is involved in waste collection, processing and recycling in Spain and Portugal (EUWID, 2021c). Prezero also acquired some of Suez's assets and this should be reflected in the next annual report with annual turnover forecast to reach €3bn.

The Schwarz Group has been active in the German waste management market since 2009, via its subsidiary Greencycle set up to manage recyclable from the group's supermarket chains. It then took over Toensmeier in 2018, which was at the time Germany's fifth biggest waste management company (EUWID, 2018). In 2019 the company changed its name to Prezero and is expected to play a major role in Europe's waste management market in the future.



6. Key points and policy recommendations

The Circular Economy and the environment

- Waste prevention is the top priority of the waste hierarchy, which is the foundation of Europe's waste management strategy. Yet, effective policies and legislation are lacking to increase waste avoidance. To really tackle the waste problem Europe's growth agenda needs to be challenged. To reduce waste, production and consumption need to go down. Increasing the sharing economy and avoiding of packaging could be important first steps.

This also raises the question of the extent to which current levels of production and consumption are sustainable.

- There is a danger of overcapacity in Europe's waste-to-energy (WtE) incineration and there may be an incentive to maintain rather than reduce the supply of waste where WtE incinerators require minimum quantities of waste to operate. Some countries in Europe with a developed WtE sector have become dependent on waste imports and it is worrying that it is recyclable waste that is often incinerated in these plants.
- Improved waste collection is necessary to decrease the contamination of waste and thereby improve its recyclability.

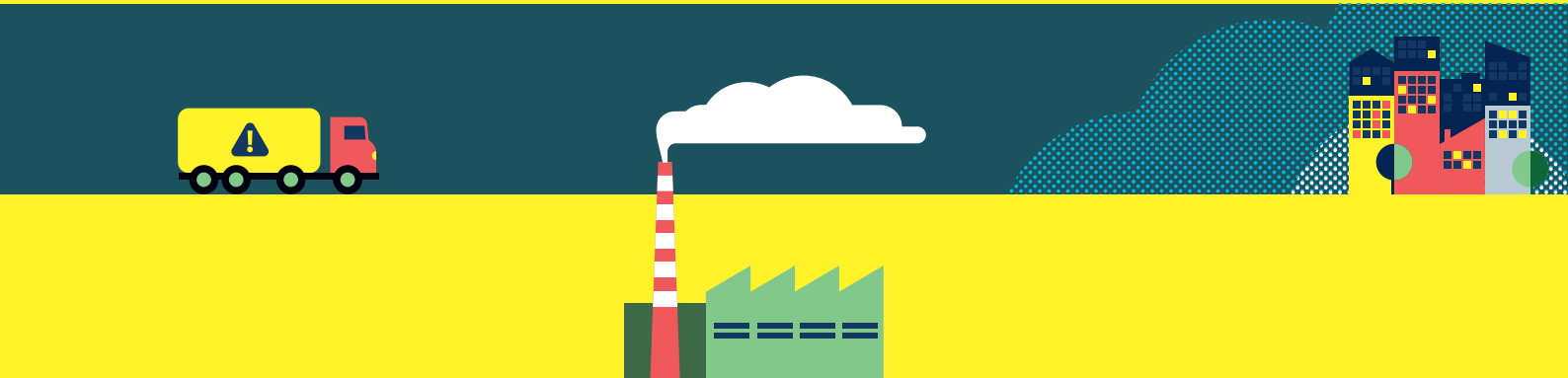
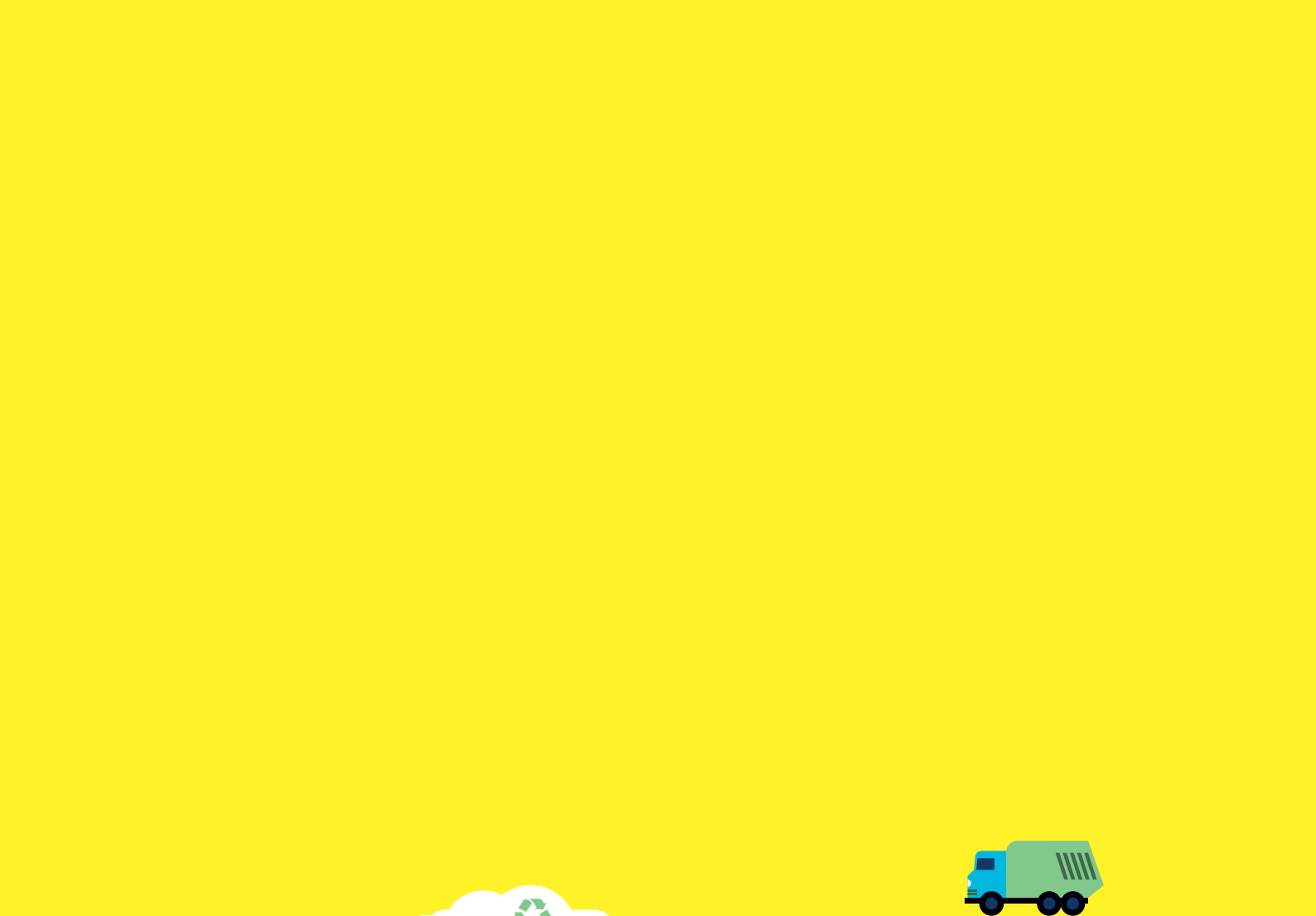
Public and private ownership

- In some countries there is a trend towards publicly run waste collection motivated by cost savings and environmental concerns.
- However, there is increasing private ownership in WtE, with the main corporate players trying to increase their activities in this field. In contrast, Denmark, where WtE is in public ownership, was able to shut down WtE plants as part of its strategy to increase recycling and waste prevention. Other European countries, such as Sweden and Germany, where WtE is largely privatised, will have difficulties to follow suit as they have contractual obligations with the private providers, hence compensation for a loss of profits will need to be paid. Privatising WtE can therefore hamper efforts to increase waste prevention and recycling.
- The case of Slovenia provides an example of a holistic waste management system when waste management is in public ownership and control.

Circular Economy and employment

- There is much debate about the job creation potential of the circular economy, but any optimistic predictions should be considered with caution. Usually, the studies rely on economic modelling that assumes that jobs are created as recycling and repair are more labour intensive than burning or landfilling waste. However, this study has shown that
 - a lot of recycling is taking place abroad;
 - where recycling and sorting plants are being built in Europe they are increasingly relying on AI and robots and while workers are still needed to run the plants, the job creation potential is limited;
 - a lot of the recycling work is carried out in the informal sector which raises questions about the number and quality of jobs being created; and
 - a lot of repair work is based on unpaid labour through volunteering taking advantage of vulnerable groups such as the unemployed and pensioners, which leads to the question if unpaid work can be classified as job creation.
- The working conditions and the health and safety of workers in the circular economy are completely side-lined in EU policy making. Yet, academic research has shown that jobs in the recycling sector tend to be badly paid, labour intensive and often put the health and safety of the workers at risk.
- Employment in waste management is increasing in line with rising quantities of waste and indeed in some countries like Germany there is a shortage in waste workers.
- Increased employment in the sector could contribute towards a more efficient and more frequent system of waste collection that helps increase the recyclability of waste.
- If the EU takes the Circular Economy and with it the waste hierarchy seriously then it needs to increase its efforts in waste prevention. Waste prevention brings no profits – as one cannot sell what is not there. More funding for the creation of jobs in waste prevention is needed, for example through educational programmes and publicly subsidised repair and share services, such as public libraries of things and tools.
- There is no recognition of informal workers in Europe's circular economy policies, as well as a significant research gap as to their numbers and working conditions. The informal nature makes data collection hard, but studies from 2016 estimated that there are around one million informal waste workers in Europe (which is roughly the same as formal recycling workers), who are contributing significantly to Europe's circular economy. Indeed, official circular economy mechanisms, such as the Deposit Refund Schemes (DRS) rely very much on informal work and so it is likely that the number of informal waste workers is increasing, making it all the more important to make this invisible group of workers more visible.

- Automation brings risks and benefits. While it can reduce some safety risks by taking over dirty and dangerous work, it can lead to other problems in relation to isolated work and unsocial hours in automated plants with very few workers.
- Europe needs to expand its localised recycling industry. This will help to avoid being so dependent on exports and will increase recyclability while avoiding the hazards for workers involved in its transport. Long periods of transport (usually via ship) increase the risks of contamination with a negatively impact on recyclability and greater threats to the health of workers.



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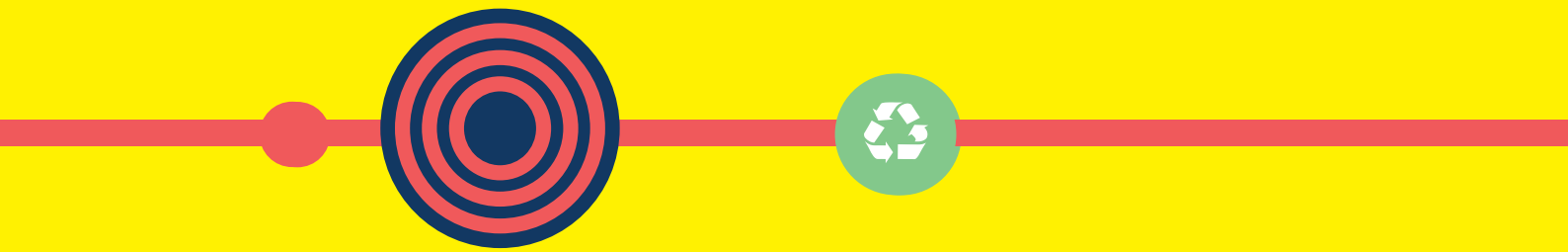
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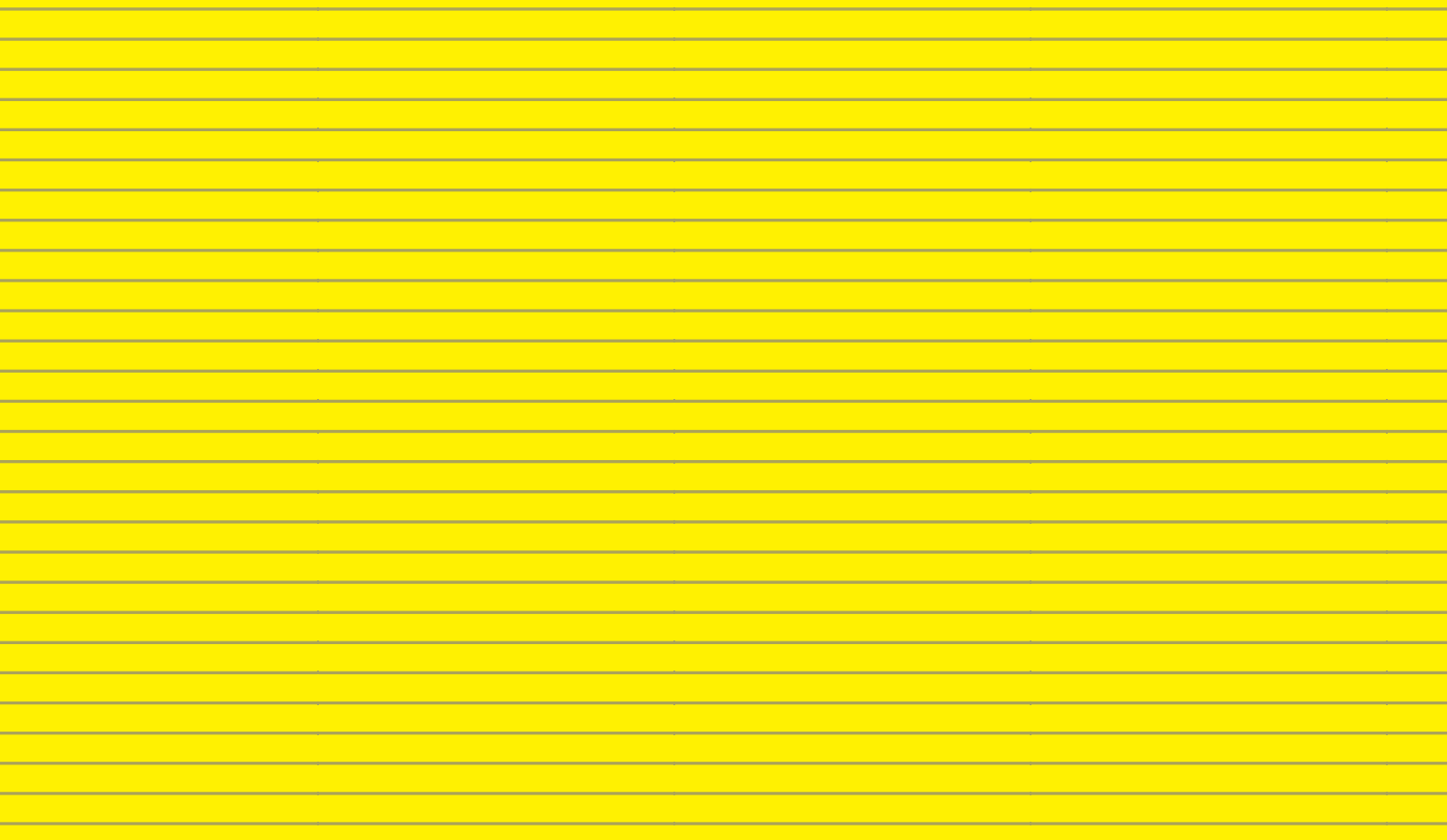
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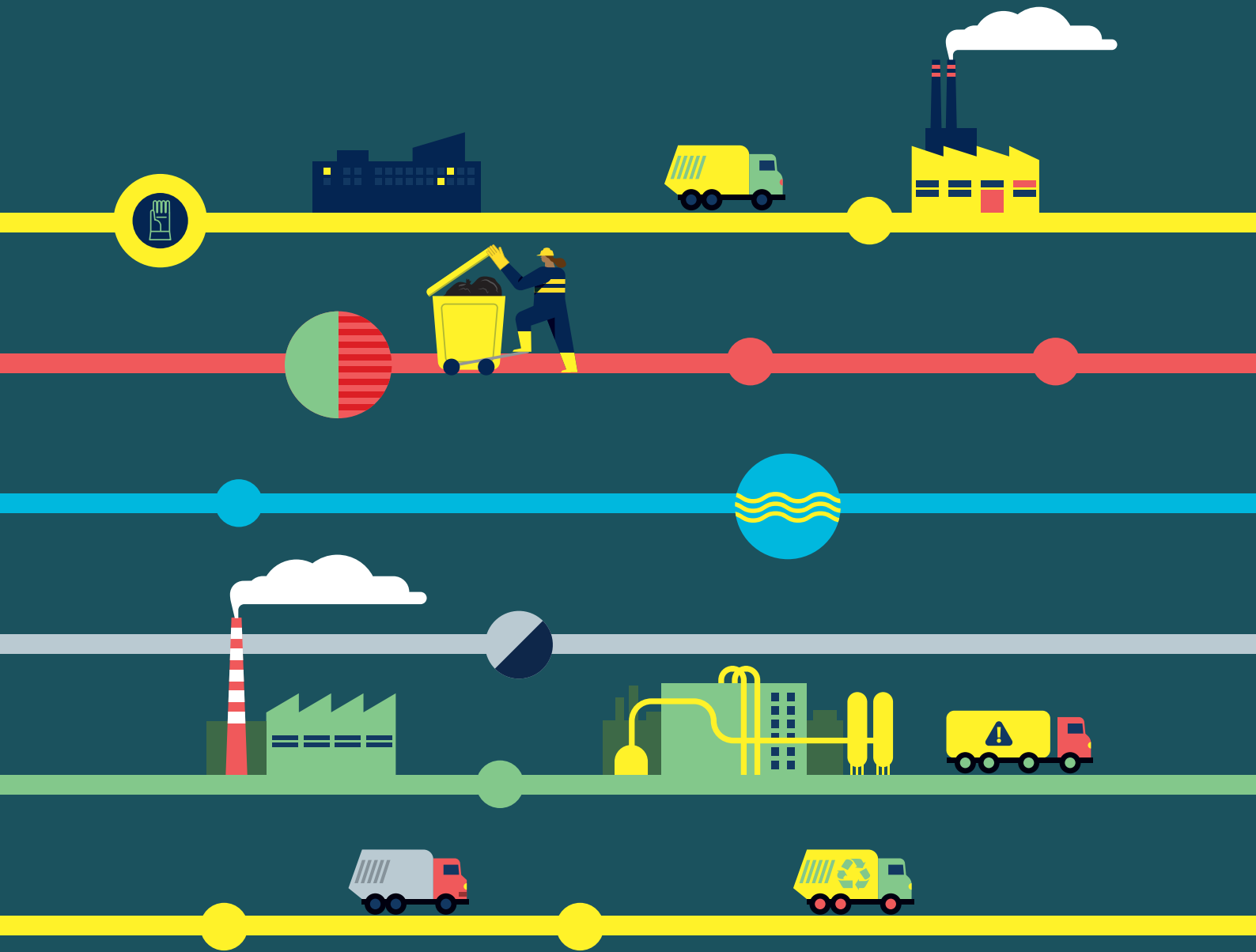
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EPSU is the **European Federation of Public Service Unions**. It is the largest federation of the ETUC and comprises 8 million public service workers from over 250 trade unions across Europe. EPSU organises workers in the energy, water and waste sectors, health and social services and local, regional and central government, in all European countries including the EU's Eastern Neighbourhood. It is the recognised regional organisation of Public Services International (PSI).

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