MORE CIRCULARITY
LESS CARBON
-25% BY 2025

THE CARBON FOOTPRINT OF WASTE

CROSS ANALYSIS OF THE SECOND COHORT

ODENSE ▪ IRELAND ▪ REGION OF NAVARRA

ACR+

ZERO WASTE SCOTLAND

ACR+ is an international network of cities and regions sharing the aim of promoting a sustainable resource management and accelerating the transition towards a circular economy on their territories and beyond.

Circular economy calling for cooperation between all actors, ACR+ is open to other key players in the field of material resource management such as NGOs, academic institutions, consultancy or private organisations.

Find out more at www.acrplus.org

Zero Waste Scotland exists to lead Scotland to use products and resources responsibly, focusing on where we can have the greatest impact on climate change.

Using evidence and insight, our goal is to inform policy, and motivate individuals and businesses to embrace the environmental, economic, and social benefits of a circular economy.

We are a not-for-profit environmental organisation, funded by the Scottish Government and European Regional Development Fund.

Find out more at www.zerowastescotland.org.uk/

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EXECUTIVE SUMMARY

The 'More Circularity, Less Carbon' (MCLC) campaign was launched by ACR+ in November 2019 to help its member in addressing the carbon footprint of their waste. ACR+ has partnered with its member Zero Waste Scotland to assess how individual territories can reduce the carbon impact of municipal waste by 25 per cent by 2025.

To do so, Zero Waste Scotland adapted its own carbon assessment tool to develop the Carbon Metric International. It allows the assessment of the carbon footprint linked with material resources by using local waste data: generation, composition, and treatment. The tool assesses the impact linked with waste management, but also the impacts linked with the production and the consumption of the product that became waste. To summarise, the CMI allows the assessment of both direct and indirect emissions of the consumption of material resources and products at local level thanks to local waste data.

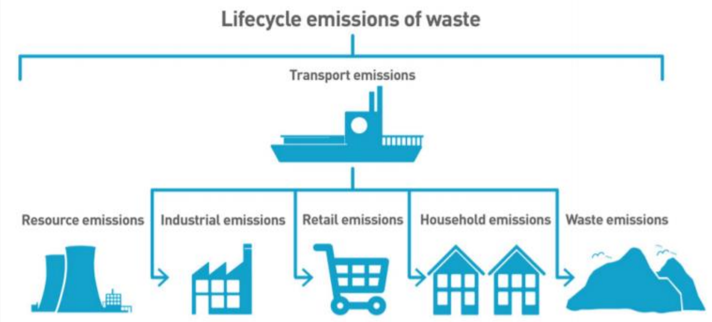

Figure 1: Schematic diagram presenting the lifecycle emissions of waste.

The MCLC campaign consists in different "cohorts", in which three territories collect data and assess their carbon footprint with the assistance of Zero Waste Scotland and ACR+. A first cohort was launched in early 2020, and a second one was launched in 2021. This second cohort includes three territories: the city of Odense in Denmark, the Region of Navarra in Spain, and Ireland.

THE IMPACT OF LOCAL SPECIFICITIES ON WASTE DATA AND CARBON FACTORS

These three territories present quite different data when it comes to waste generation, composition, and treatment. These differences are linked with local specificities, but also the fact that the scope of municipal waste data is slightly different: in Ireland, only household waste is included, when a share of commercial waste is reported in the other two territories. Odense manages quite significant construction and demolition waste, that are for the most part excluded from municipal waste in the other two territories. Finally, beverage packaging waste is partly collected in a deposit-refund system in Denmark, and the associated quantities are not included in the reported data.

There are also important differences regarding waste management. While all three territories present recycling rates around 50%, Ireland and Odense resort mostly to incineration for residual waste whereas Navarra uses landfilling. There are also significant differences regarding the treatment of individual waste fractions.

Participants of cohort 2 could share local data on the composition and recycling routes of key waste fractions, as well as on the waste treatment units in use. This enabled the assessment of local carbon factors, with noticeable discrepancies among the territories. As an illustration, the carbon factor associated with food waste generation is lower in Odense due to a lower presence of protein waste, and the savings enabled by recycling of textile waste are considerably lower in Navarra due to a lower re-use rate.

DIFFERENT CARBON FOOTPRINTS YET SIMILAR MOST CARBON-INTENSIVE FRACTIONS

These discrepancies lead to different carbon footprints. A lower footprint per capita is observed in Odense due to a larger share of waste fractions with a low carbon intensity (such as construction and demolition waste), smaller arising of textile waste (associated with very high carbon intensity), and more significant savings thanks to energy recovery with incineration. In Navarra, the use of landfilling also increases the overall carbon footprint. Yet for the three participants, the emissions linked with the extraction of resources and manufacturing of products that then became municipal waste are significantly higher than the emissions linked with products' end-of-life.

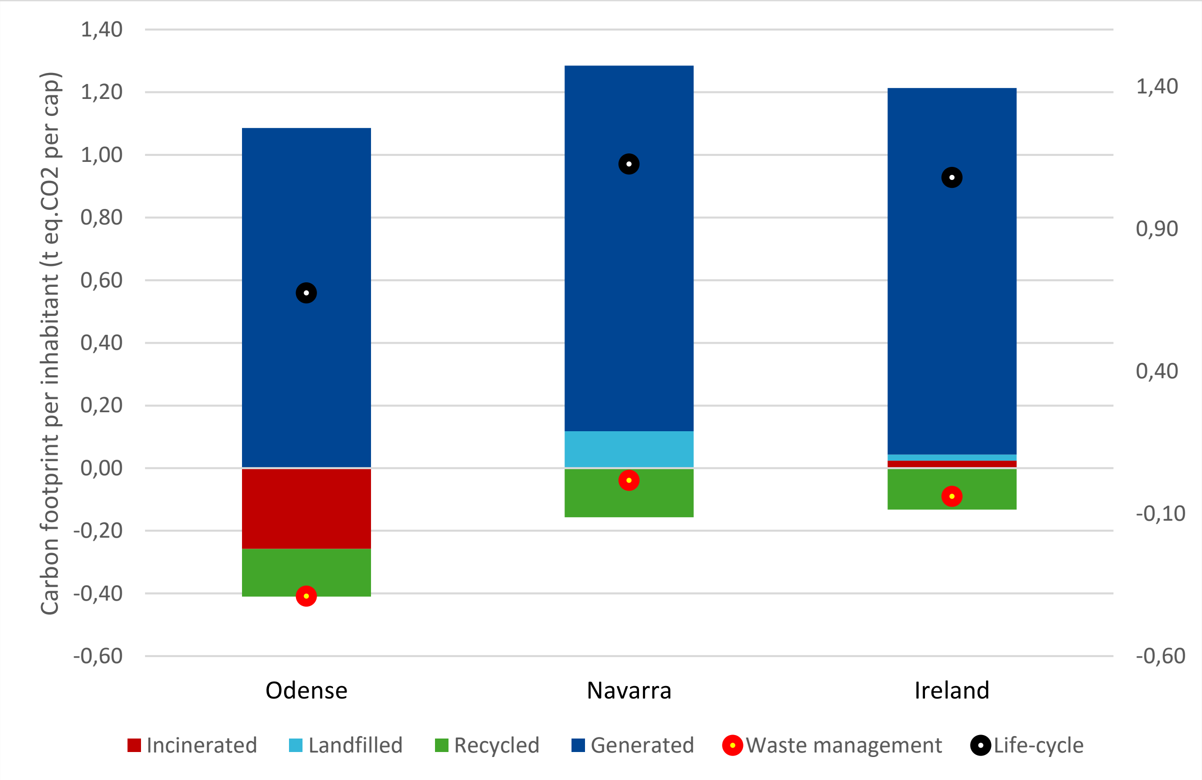

Figure 2: carbon footprint of municipal waste per capita (in t.eqCO2/cap).

Other observations can be made for the three territories:

- The three territories share the same most carbon-intensive fractions: textile, food, and plastic. These were also the key fractions identified for cohort 1. If recycling has a potential to improve their carbon footprint, especially for plastic, prevention represents a much more important potential. This is also true for re-use, especially when applied to textile and WEEE.

- The efficiency of waste treatment plants and their outputs can greatly impact the potential savings: the energy efficiency of incineration and anaerobic digestion plants, the production of heat, or the production of biofertilizer were found to have a strong impact on saved emissions. For energy recovery, it is important to note that the savings also depend on the carbon intensity of the national energy grid.
- The composition of the key waste fractions is a relevant information to identify priorities. For instance, the higher presence of protein waste in Navarra's food waste strongly impacts its carbon footprint and makes it relevant to focus on this specific sub-fraction.

HOW COULD THE THREE TERRITORIES REACH THE TARGET?

Considerable efforts should be put in place to reach the -25% target, which would be only a first step toward carbon neutrality. For all three territories, the model shows that this would require reducing two key target fractions by 30 to 40%, which calls for much more ambitious prevention targets and strategies.

There is little correlation between the tonnages of waste and their carbon footprint, as the most carbon-intensive fractions generally represent a small percentage of municipal waste in weight. This calls for an on-going monitoring of the carbon footprint of waste, a better understanding of waste generation and composition, and more efforts put on prevention and re-use monitoring.

ACR+ 'MORE CIRCULARITY LESS CARBON' CAMPAIGN

The 'More Circularity, Less Carbon' campaign was launched by ACR+ in November 2019, with the objective to help its members to better understand the carbon footprint of material resources (i.e. linked with the production, consumption, and end-of-life of products that became waste), and to identify key circular economy actions and policies to mitigate these carbon emissions.

ACR+ has partnered with its member Zero Waste Scotland to assess how individual territories can reduce the carbon impact of municipal waste among by 25 per cent by 2025.

Zero Waste Scotland's Carbon Metric International (CMI) tool, developed from Scotland's ground-breaking Carbon Metric, enables ACR+ members to measure the carbon impact of their municipal waste, take effective actions to reduce it, and track their progress towards the 2025 target. The first version of the CMI only covers municipal waste, for which most territories have reliable data, but future version will also include commercial and industrial waste.

A first cohort of three territories has been launched in early 2020, followed by a second cohort conducted in 2021. These territories collected waste and carbon-related data, which was then processed by Zero Waste Scotland to assess the current carbon footprint linked with municipal waste. For each territory, a specific report has been published, presenting the main findings from the collected data. These reports are available on the ACR+ website.

This report aims at cross-analysing the results of these data collected during the second cohort to better understand the similarities and differences and identify how these local assessments could be improved to better reflect the different contexts.

ZERO WASTE SCOTLAND'S CARBON METRIC INTERNATIONAL

Zero Waste Scotland has developed a ground-breaking tool in the fight against global climate change. The Carbon Metric (CM) measures the whole-life carbon impacts of Scotland's waste, from resource extraction and manufacturing emissions right through to waste management emissions, regardless of where in the world these impacts occur (Figure 1). The CMI only takes into consideration the non-biogenic emissions, meaning that the emissions related to the natural carbon cycle (e.g. CO_2 emissions linked with the incineration or composting of biomass) are not included.

"The Carbon Metric shows how reducing our waste, and managing what remains in a more sustainable way, is critical to the global fight against climate change."

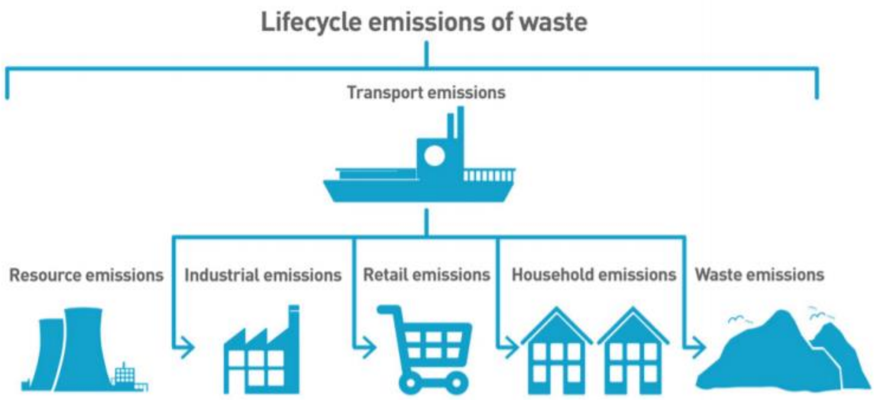

Figure 3 Schematic diagram presenting the lifecycle emissions of waste.

The Carbon Metric has several advantages:

- It provides an accessible way for cities and regions to assess the carbon footprint of waste, being mostly based on local waste data;
- It provides a "consumption-based" approach,
- It also provides an assessment of the embodied emissions that are "wasted" when products become waste, beside the assessment of the emissions generated or saved by waste treatment and recovery.

The Carbon Metric provides policymakers and business leaders with an alternative to weight-based waste measurement, allowing them to identify and focus specifically on those waste materials with the highest carbon impacts and greatest potential carbon savings. Scotland's 33% per capita food waste reduction target is an example of a policy informed by the Carbon Metric[1].

Further details on the Carbon Metric methodology can be found on Zero Waste Scotland's website[2].

USING ZERO WASTE SCOTLAND CMI

In order to support ACR+ in the delivery of the More Circularity, Less Carbon campaign, Zero Waste Scotland upgraded its current Carbon Metric model to enable ACR+ members to run the model using their own waste data based on local waste management practices. Referred to as the Carbon Metric International (CMI), the new tool is built following a modular approach that enables any region to define their own local parameters in order to estimate bespoke and region-specific carbon factors.

The CMI assesses the carbon footprint of waste by multiplying a generated, recycled, incinerated, or landfilled waste quantity of a given waste fraction with an associated carbon factors that consists in an assessment of how much carbon emission is produced or "saved" when one tonne of this given waste fraction is respectively generated, recycled, incinerated, or landfilled.

[1] Scottish Government (2016) Making Things Last
[2] Zero Waste Scotland (2020) Carbon Metric Publications.

To use the CMI, territories must undergo two steps:

- **Collection of waste data**: Identify the quantities of waste generated and break these quantities down into 33 different waste categories defined in accordance with the European Waste Categories[3], as well as detail how these different waste fractions are treated (recycled, incinerated, landfilled, or other);
- **Collect data for carbon factors**: to do so, different possibilities are offered to the ACR+ members, ranging from the collection of key information on a limited number of parameters (for instance the performances of incineration and landfilling, or the composition of several waste fractions), to the collection of detailed data on the composition, the distances for collection and transport and on the treatment/recycling routes. All participants of cohort 2 chose to provide data for the key waste fractions. For the other waste fractions, default values were used.

When it comes to waste data, the main difficulty is to identify data on the composition of mixed fractions such as residual waste or mixed bulky waste, as well as the output of sorting centres (such as materials recovery facilities) where mixed fractions are sorted into single-material streams. For instance, the following figure explains how food waste is reported in the different categories. In this example, food waste is collected separately and sent to composting, where residues are sent to landfill. Besides, residual waste encompasses a share of food waste and is sent partly to incineration, and partly to a mechanical-biological treatment plant (MBT). The MBT process extracts the food waste within residual waste, which is then sent to anaerobic digestion and the digestate produced is recovered.

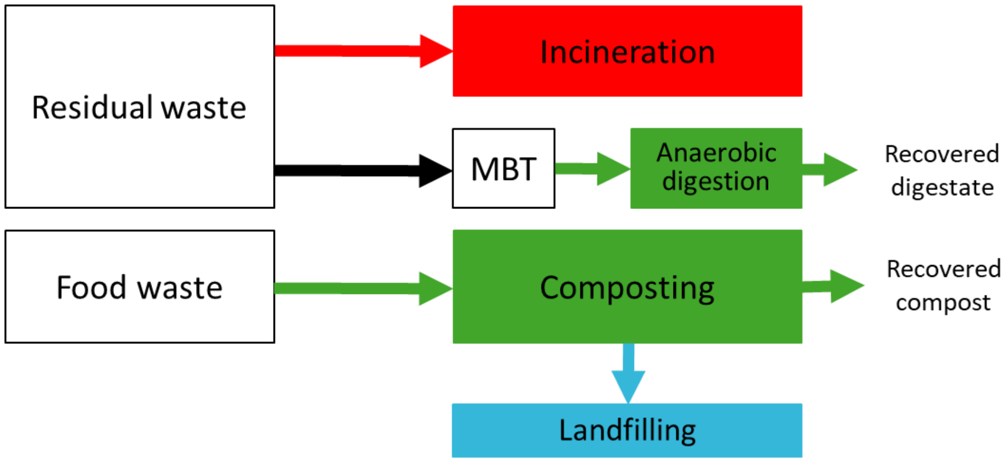

Figure 4: a theoretical food waste management system used to illustrate the reporting of food waste quantities in the CMI.

In this case, the reporting of food waste has to be done in the following way:

- Incinerated quantities: it is assessed by the share of food waste in residual waste sent to incineration, estimated thanks to a composition analysis of residual waste.
- Recycled quantities: it is assessed as the sum of the quantities of organic matter sorted in the MBT and sent to anaerobic digestion and the quantities of source-separated food waste sent to composting, minus the impurities sent to landfilling. If the digestate produced by the anaerobic digestion plant is not recovered (e.g., due to quality

[3] Eurostat, 2013, Manual on waste statistics (available here)

issues), then the associated quantities of organic matter should not be reported as being recycled.

- Landfilled quantities: it is assessed as the quantities discarded from composting unit and sent to landfilling.

It is important to note that the level of details provided by the MCLC participants might differ, as the availability of data is quite heterogeneous among territories. The main sources of uncertainties are the following ones:

- The available information on the composition of mixed fractions: composition analyses are generally available for residual waste, but little data might be available for mixed bulky waste collected on the kerbside, or mixed fractions collected in civic amenity sites.
- Several undifferentiated fractions: composition analyses generally encompass undifferentiated fractions that cannot be distributed among the 33 waste categories used by the CMI: fine elements, combustible waste, etc. These fractions have to be reported as "generic" categories such as "household waste and similar", or "undifferentiated materials".
- The contamination rates of sorted fractions: the level of details available on the composition and the destination of sorted fractions is different from one participant to another. Local contamination rates might not be available, nor the actual recycling routes of the sorted materials.

For the assessment of carbon factors, priority is given to local, then regional, then national data. For instance, the composition of textile waste (e.g. by type of fabrics) is rarely available at municipal level, while the performances and outputs of a local incineration plant are generally well-known. Participants tried to provide data reflecting their local situation as much as possible. Whether the presented data are assessed according to local values or with default values will be explained in the following analyses.

Limits of the approach

As the CMI is based on life cycle assessment methods, it inherits the limitation of environmental tools built using the same principle, in particular the impact of data availability on the model output[4]. The results provided by the CMI is very dependent on the quality of the data reported by different regions. Some limitations linked with data availability have been mentioned above.

Besides, only waste that was "captured" by the "documented" waste services (e.g., the municipal waste service, or the quantities reported by EPR organisations) is included. Any other quantities (e.g., illegally managed, composted at home, or managed by other players such as charity organisations) might not be reported, meaning that the impact associated with their management is not included, but more importantly, the footprint of the associated products is not taken into consideration. In the case of a territory where significant quantities of food waste are managed at home and not reported (such as food waste disposed down the sink), it will result in underestimated quantities of food waste, which might bear a significant footprint and could include a significant potential for carbon mitigation (e.g., with the

[4] Salemdeeb, R. et al., (2021) A pragmatic and industry-oriented framework for data quality assessment of environmental footprint tools. Resour. Environ. Sustain. 3, 100019, 10.1016/j.resenv.2021.100019

reduction of food wastage). For WEEE, illegal management is believed to concern about 60% of the generated quantities in Europe[5], which means that local quantities can also be underestimated. Besides, the quantities collected by retailers might not be available at local level. It is therefore advisable to lead complementary research on possible unreported quantities for the most carbon-intensive fractions.

CROSS ANALYSIS OF THE MCLC SECOND COHORT

The second cohort was launched in early 2021, and brought together three territories and members of ACR+:

- **Odense** is the third-largest city in Denmark. It has a population of 202,348 and is the main city of the island of Funen. The data were provided by Odense Renovation, the company managing municipal waste for the city of Odense.
- **Navarra** (Navarre) is one of the Spanish Regions and a geographically diverse region in Northern Spain encompassing 272 municipalities. It had a population of 654,214 in 2019[6], and half of the inhabitants live in the metropolitan area of its capital, Pamplona.
- **The Republic of Ireland** occupies most of the island of Ireland, off the coast of England and Wales. The population of Ireland in 2019 was estimated to be nearly 5 million inhabitants**.** The data was collected by ACR+ members: Eastern Midlands Waste Region and Southern Waste Region, two of the three regional authorities in charge of waste management.

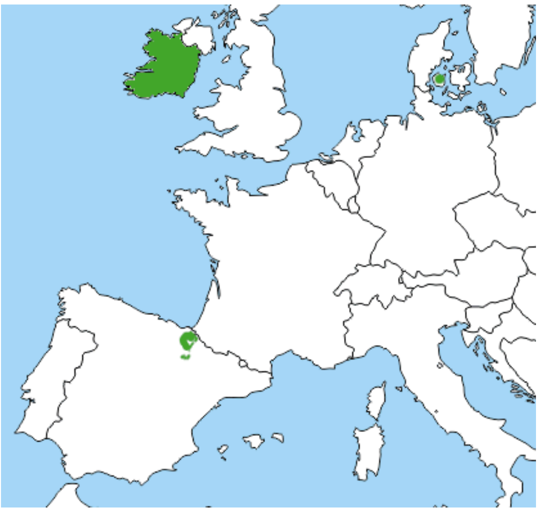

Figure 5 Geographical location of the three territories: Odense, Navarra, and Ireland.

These territories are quite different when it comes to their typology and status: a city, a region, and a whole country.

Before comparing the carbon footprints, a short presentation of the data on waste generation and treatment in the three territories is proposed. The point of these comparisons is not necessarily to explain differences in waste generation and management performances, or to compare the efficiency of the different waste strategies, but rather to understand how these differences impact the respective carbon footprints.

WASTE GENERATION IN THE THREE TERRITORIES

Waste generation refers to the production of waste, regardless of how it is collected: for instance, food waste generation is assessed by adding the separately collected quantities of food waste and the quantities of food waste collected with residual waste. The composition of generated waste is based on the data on the composition of the different waste streams.

[5] CWIT project: https://www.cwitproject.eu/

[6] Personal communications (ACR+ partners in Navarra)

For mixed fractions, data are mostly obtained thanks to composition analyses or, in case of streams that are sorted after collection, with data on the output of sorting facilities. It must be noted that the composition of all waste streams is not necessarily available or might include uncertainties. As mentioned previously, it is not always possible to report specific fractions within the 33 categories used by the CMI. Some of the quantities are reported as mixed/undifferentiated fractions (such as sorting residues, mixed bulky waste, etc.) and default values are used to assess their composition.

Although the scope of this second cohort was household waste, the exact scope covered by the data differs from one participant to the other:

- **Odense**: the reported data mostly includes household waste, but also non-household waste (e.g. commercial waste) collected in the civic amenity sites. The quantities generated are quite high: 690 kg/cap, which can be explained by specific non-household waste fractions such as construction and demolition waste or soil, as well as a significant share of garden waste. Besides, most beverage packaging waste is collected via a national deposit-refund system and the associated quantities (about 8.9 kg/cap/year) are not included.
- **Navarra**: the reported data includes household waste and a share of commercial waste assimilated to household waste. It represents 434 kg/cap.
- **Ireland**: the data only includes waste generated by household, and no "assimilated" commercial waste. It represents 319 kg/cap.

The composition of generated waste is quite different among the three territories, as presented in the following graph:

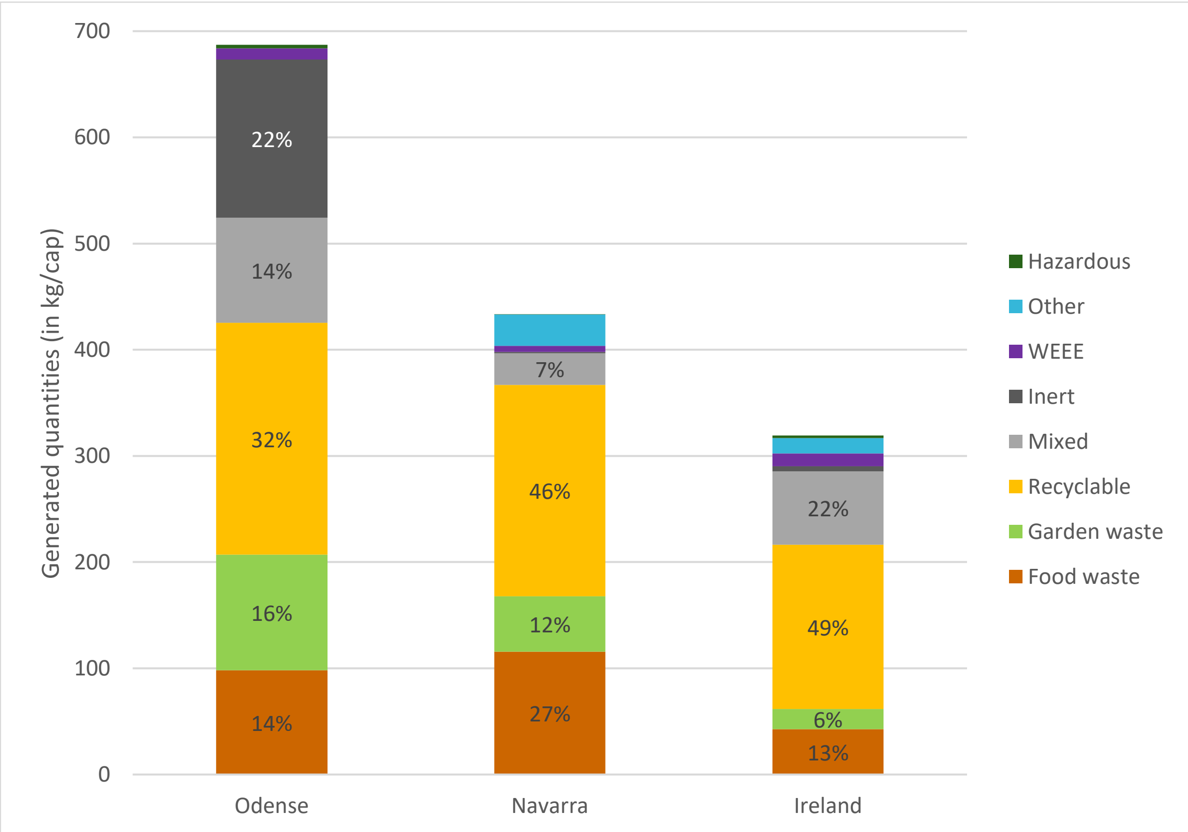

Figure 6: Composition of waste generated in the three territories (in kg/cap). The percentages indicate the share of each waste fraction compared to the total waste generation.

The differences between the quantities of waste generated can be explained by various reasons:

- **Commercial waste** is not included in the data for Ireland, as mentioned above, while it is likely to represent about 20 to 30% of the reported quantities in the other territories. In Odense, quantities of commercial waste collected in civic amenity site are included, which might explain the significant share of inert waste.
- **Inert waste** quantities are quite different from one territory to another, which might reflect the different management systems for construction and demolition waste (CDW). CDW can be partly or fully managed by private companies, and some territories might not consider construction and demolition waste as household waste or put strict limits on the quantities of inert waste that can be brought by inhabitants to civic amenity sites. On the other hand, it represents more than 20% of municipal waste collected in Odense.
- **Bio-waste** quantities per capita are more significant in Navarra, and quite lower in Ireland, which might reflect the share of commercial waste included, different consumption patterns, or the fact that home composting is more developed. Significant differences can also be observed for garden waste; this might be connected with the effective network of civic amenity sites in Odense that captures comparatively more quantities than in the other territories, where home composting might be more developed.

Significant differences can also be observed for **dry recyclable** waste fractions, as highlighted by the following graph:

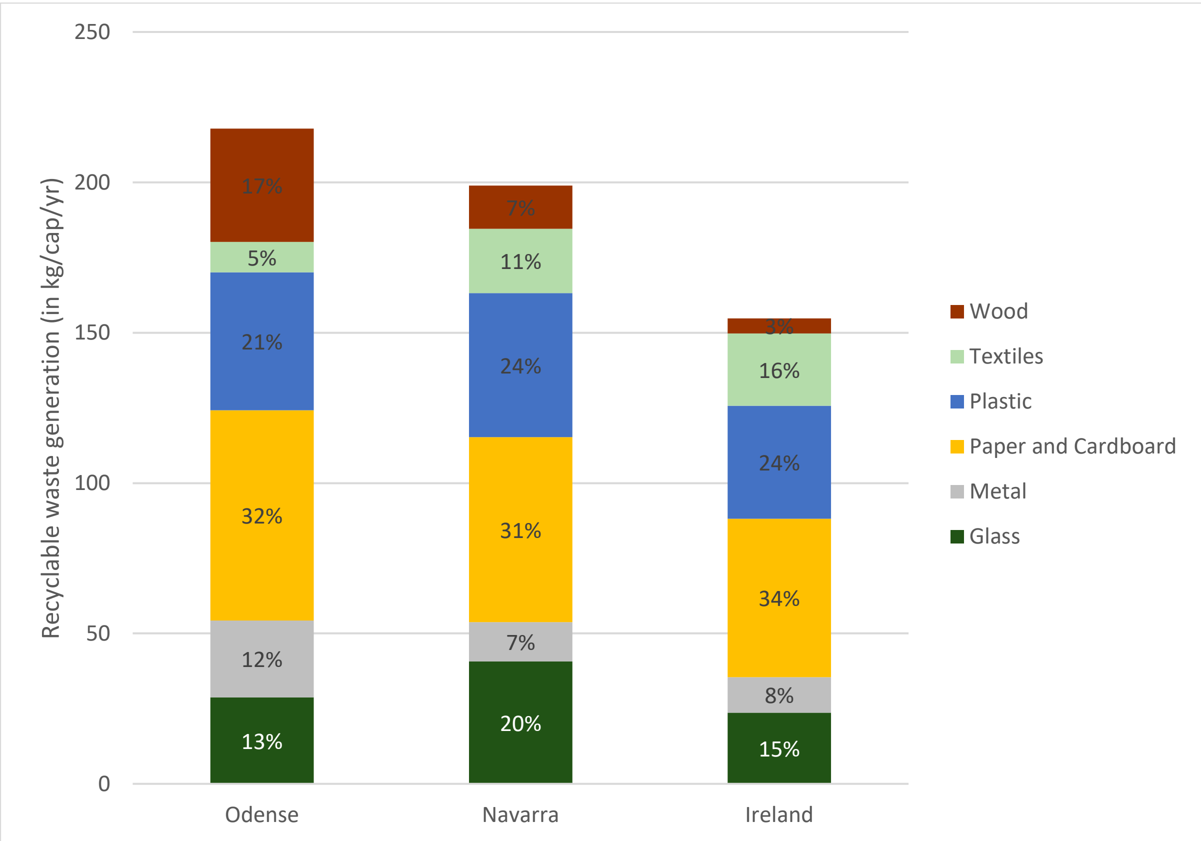

Figure 7: Generated quantities of dry recyclable materials in the three territories (in kg/cap). The percentage indicates the share of each material fraction.

The quantities reported in the graph above include both recyclable waste collected door-to-door or in bring banks (such as paper and packaging waste) and recyclable waste collected with bulky waste and in civic amenity sites.

Significant differences can be observed for different fractions, which might reflect different consumption patterns, but also different collection systems, and different scopes. As mentioned above, the quantities reported in Ireland do not include commercial waste, which might explain why the generated quantities are lower for most material fractions. On the opposite, the fact that commercial waste (and possible construction and demolition waste) is collected in civic amenity sites in Odense might explain the higher quantities of wood and metal. The fact that part of the packaging waste is Odense is captured by the national deposit refund system also impacts the differences. For instance, about 4.4 kg/cap of glass waste was collected by the DRS in 2018.

There is also a significant difference with the generated quantities of textile waste between Odense (with 10 kg/cap collected) and the other territories (that collect around 20 kg/cap). Whether this is due to difference in consumption patterns or the fact that some of the textile waste is collected by other collection schemes, for which the collected quantities are not reported, is unknown.

Waste management in the three territories

The three territories have implemented different waste management strategies, and the distribution of treatment routes reflects the different scopes of municipal waste mentioned above. The different treated quantities can be seen on the following graph:

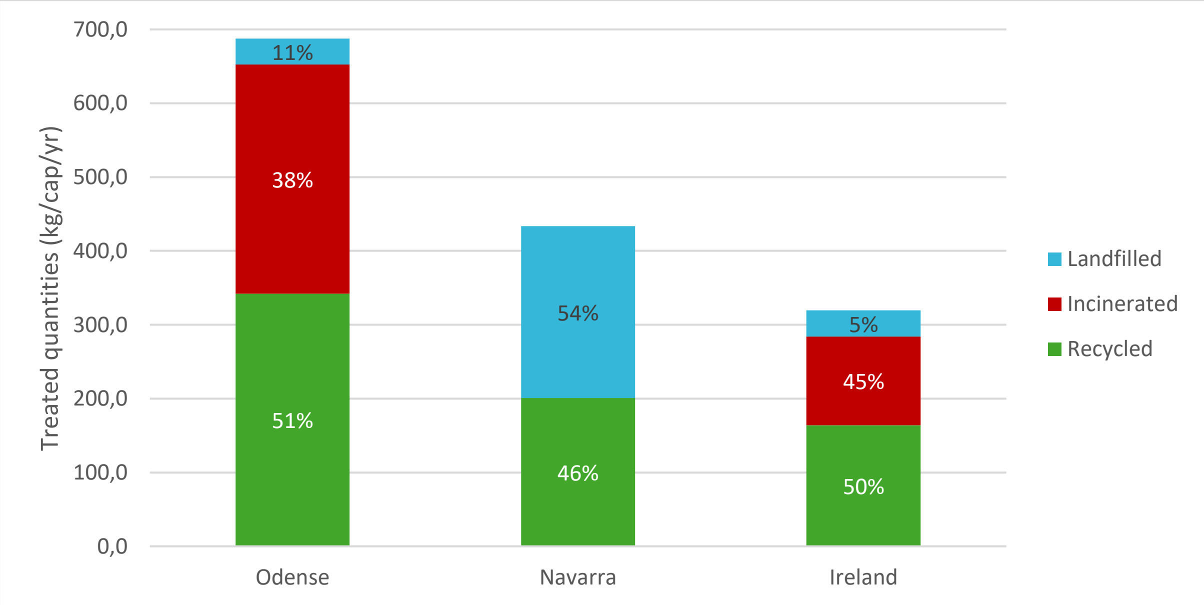

Figure 8: Municipal waste by treatment method in the three territories (in kg/cap).

All three territories present rather high recycling rates, ranging from 46% to 51%. It is important to note that re-use is included in recycling figures, but no detailed data on quantities sent to re-use was collected. The main difference comes from the use of landfilling, which is quite marginal in Ireland and in Odense, and quite widespread in Navarra where there is no incineration of municipal waste.

The main treatment routes for key waste fractions are presented below:

Table 1: Treatment routes for key waste streams in the three territories.

Waste stream	Territory	Treatment route
Residual waste	**Odense**	All residual waste is sent to incineration with energy recovery, where heat and electricity are produced. The net efficiency of the incinerator is 97% for heat and 11% for electricity
	Navarra	56% of residual waste is sent to three different landfilling sites. In one of them, most of the biogas is recovered as electricity, while the rest is sent to mechanical biological treatment followed by anaerobic digestion. The digestate is then sent to disposal.
	Ireland	79% of residual waste is sent to waste to energy. The rest is sent to landfilling sites, where biogas is recovered as electricity
Food waste	**Odense**	Food waste collection is still marginal in 2018, and 15% of impurities has been reported. Food waste is sent to anaerobic digestion, where methane is recovered as biomethane, and the digestate is used as soil conditioner
	Navarra	About 80% of the separately collected food waste is sent to composting, while the rest is sent to anaerobic digestion, producing electricity, heat, and liquid and solid soil conditioner. About 25,000 tonnes of food waste are selectively collected, while about 7,000 tonnes are composted through home- or community composting.
	Ireland	About 60% of the sorted food waste is sent to composting, while the rest is sent to anaerobic digestion, producing electricity, heat, and bio-fertiliser. Organic waste collected on kerbside includes 56% of garden waste, 28% of food waste, 4% of paper, 6% of fine elements, and 6% of impurities (including plastic, textiles, and nappies).
Paper and cardboard waste	**Odense**	77% of the paper and cardboard waste selectively collected is collected via a kerbside collection, 23% is collected in civic amenity sites. The kerbside collection includes 3.5% impurities. About one third of the generated paper and cardboard waste is collected within residual waste and mixed combustible waste in civic amenity sites sent to incineration, and the rest is selectively collected and recycled.
	Navarra	Navarra operates a dedicated collection service of paper and cardboard using street bins. This service includes commercial waste collected door-to-door in city centres.
	Ireland	Paper and cardboard waste is collected with plastic and metal packaging as "mixed dry recycling".
Packaging waste / Mixed dry recycling	**Odense**	Metal packaging is collected with glass packaging. Plastic packaging is collected in civic amenity sites. A deposit refund system also collects beverage packaging, the associated quantities are not included here.
	Navarra	Plastic, metal, and Tetra Pak are collected in a commingled stream and sent to a sorting centre, with a reject rate of about 20%.
	Ireland	The different fractions are sorted in mechanical sorting centres. The contamination rate of co-mingled dry recyclable waste ranges from 15 to 30%
Glass packaging waste	**Odense**	One third of glass waste is collected in bring banks while the rest is collected in civic amenity sites. About 10% of the selectively collected glass is sent to landfilling. For the rest, 68% of glass waste (i.e., packaging glass) is sent to close-loop recycling ("bottle-to-bottle"), and 32% (i.e., flat glass) to open-loop recycling

	Navarra	All collected quantities are sent to close-loop ("bottle-to-bottle") recycling. The contamination amounts to 2%.
	Ireland	In 2019, 93% of the collected glass packaging waste was sent to close-loop ("bottle-to-bottle") recycling, while the rest is sent to open-loop recycling and recovered as aggregate substitute. The contamination amounts to 2%.
Re-use	**Odense**	20% of the selectively collected textile is sent to re-use, 50% to recycling, and 30% to incineration. Bricks is one of the selectively collected streams of construction and demolition waste, with 60% of it being sent to re-use as bricks, and 40% being recycled as road filling.
	Navarra	About 1,000 tonnes of waste is prepared for re-use: mostly furniture, clothes, EEE, and various household objects.
	Ireland	Textile waste is collected via different collection schemes (bring banks, donations in charity shops, door-to-door and/or on-demand collection, take back schemes by retailers). Textile waste management is mostly managed by charity organisation and textile recycling companies. About 7,000 tonnes of textiles collected by Irish charity shops are sold as second-hand products, while the rest is sent as rags to textile recyclers. Most textiles collected for recycling by commercial recyclers are exported. About 50% of the generated textile waste is sent to incineration, and 13% to landfilling.

Differences can also be observed for the different waste fractions. The destination of biowaste is presented on the following graph:

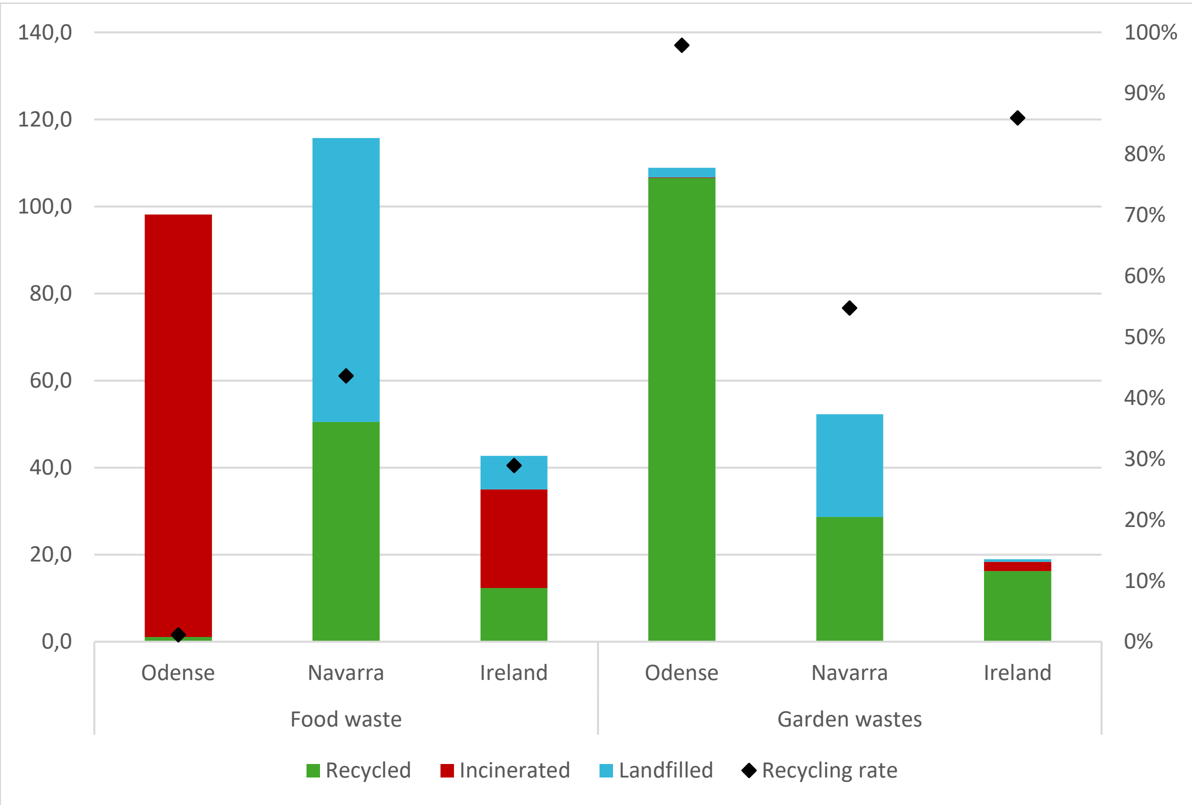

Figure 9: Final destination of food waste and garden waste in the three territories (in kg/cap).

As mentioned above, there are significant differences regarding the management of food waste. Food waste collection is at pilot stage in Odense, whereas it is much more developed in Navarra. On the contrary, most garden waste is recycled in Odense and Ireland, whereas about half of it is landfilled in Navarra. As mentioned in Table 1, composting is dominant in Navarra and in Ireland, where respectively 80% and 60% of the separately collected quantities are recovered.

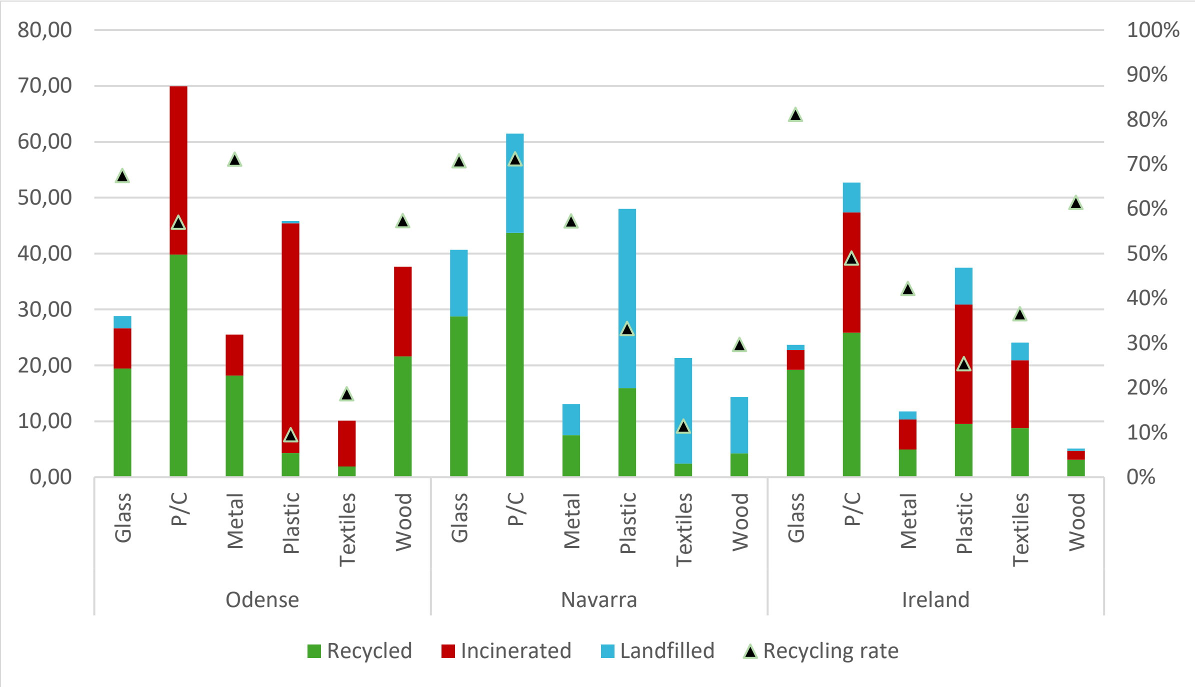

Figure 10: Destination of the main material fractions collected in the three territories (in kg/cap), and recycling rates for each material fraction (in %).

Recycling rates are quite similar for the different waste fractions: all territories present good recycling rates for glass, average ones for paper and cardboard, and low performances for plastic waste. Textile re-use and recycling is higher in Ireland and lower in Navarra.

Carbon factors

The assessment of the carbon footprint for the different waste fractions is done using "carbon factors". These carbon factors enable to assess the carbon emission associated with the generation, recycling, incineration, or landfilling of one tonne of waste for each waste fraction. To assess these waste fractions, specific data are collected from the participating territories, focusing on the actual composition of each fraction, the recycling routes used for the different fractions, or the performances of the waste treatment units. When these data were not available at local or regional level, default values were used: in most cases, Zero Waste Scotland used its own carbon factors.

For the second cohort, the data collection for the assessment of local carbon factors was simplified by Zero Waste Scotland and ACR+ thanks to the feedback of the first cohort. Templates were prepared to narrow down the collection of information to the most important parameters (i.e. the ones that are likely to have the most significant impact on the total carbon footprint, or for which local specificities might play a stronger role) and more flexibility was given as to the format of the data. All three territories provided such data, allowing the calculation of local carbon factors for many different waste fractions, thus making the assessment more accurate than for cohort 1.

Carbon factors are either positive or negative. When positive, it means that greenhouse gases are generated by the process. When negative, it means that emissions are “avoided” or “saved”. For instance, recycling glass and using recycled glass waste to produce new bottles prevents the extraction of virgin materials and reduce the energy needed by the production process, thus generating less emission than the production of bottles with virgin materials. These emissions saved are higher than the ones generated by the transport and processing of glass waste, making the carbon factor for recycling glass negative.

Carbon factors can greatly differ from one territory to another, depending on the composition of the waste fraction (for instance the presence of meat in food waste will lead to a higher carbon impact for food waste generation), the performance of the treatment unit (for instance the energy efficiency of an incineration unit), or the actual recycling route (for instance, bottle-to-bottle recycling leads to higher benefits than open-loop recycling for glass waste). Other parameters also impact carbon factors: for instance, the energy mix in one given territory will impact the emission saved when producing electricity or heat. This means that producing electricity out of waste in a territory where electricity production is very carbon intensive (e.g. with power plants running on coal) will yield higher benefit than in a territory where energy is less carbon intensive. This also means that carbon factors are likely to evolve over time: for instance, the positive impact of waste-to-energy will decrease if the energy mix is progressively decarbonised.

The carbon factors used for the three territories are comparable for the most part, especially because default values were used for the waste fractions with low carbon intensity. However, for specific waste fractions, significant differences can be observed.

The following graph shows the values of carbon factors measuring the impact of waste generation and waste recycling for different waste fractions:

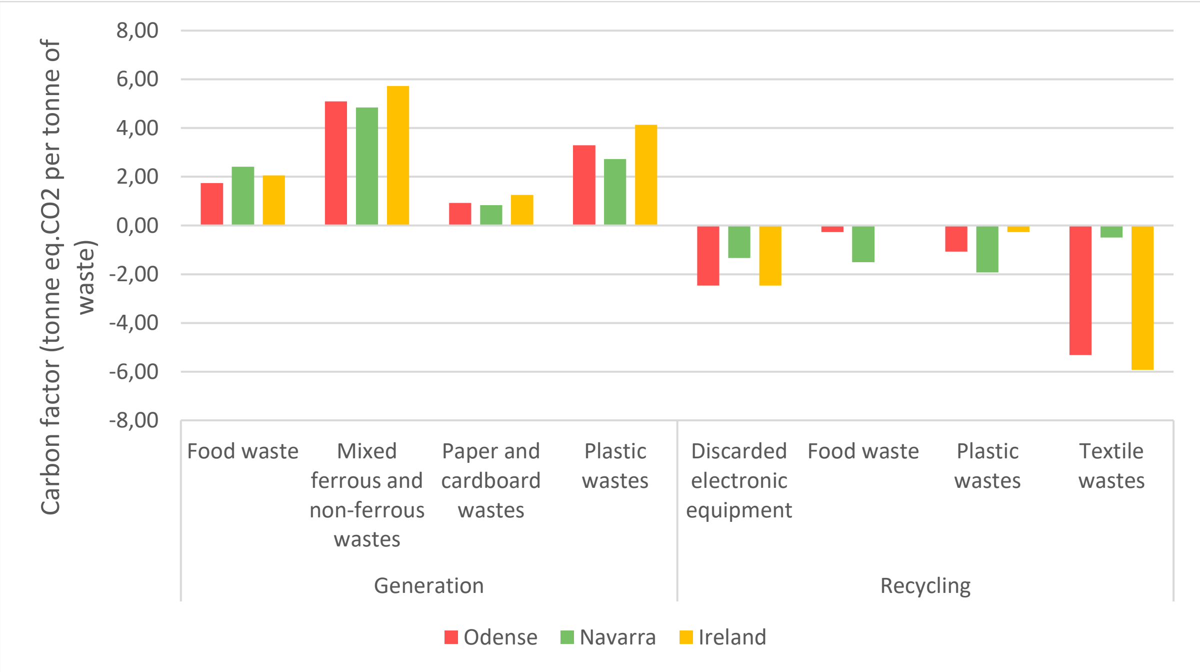

Figure 11: Carbon factors assessed for the generation and recycling of different waste fractions in the 3 territories (in t eqCO2/t of waste).

The different values for "waste generation" are mostly linked with the actual composition of the waste fraction, specific products having a higher embodied impact (such as protein for food waste). For "recycling", differences are likely to be due to the different valorisation routes underwent by waste in the different territories (e.g. re-use vs. recycling). This is notably the case for WEEE ("discarded electronic equipment"), whose reported re-use rate is lower in Navarra than in the other two territories.

More details will be given on key waste fractions such as food waste and plastic waste in the following sections of the report.

Overall carbon impact

The carbon impact of municipal waste per inhabitant is presented on the following graph:

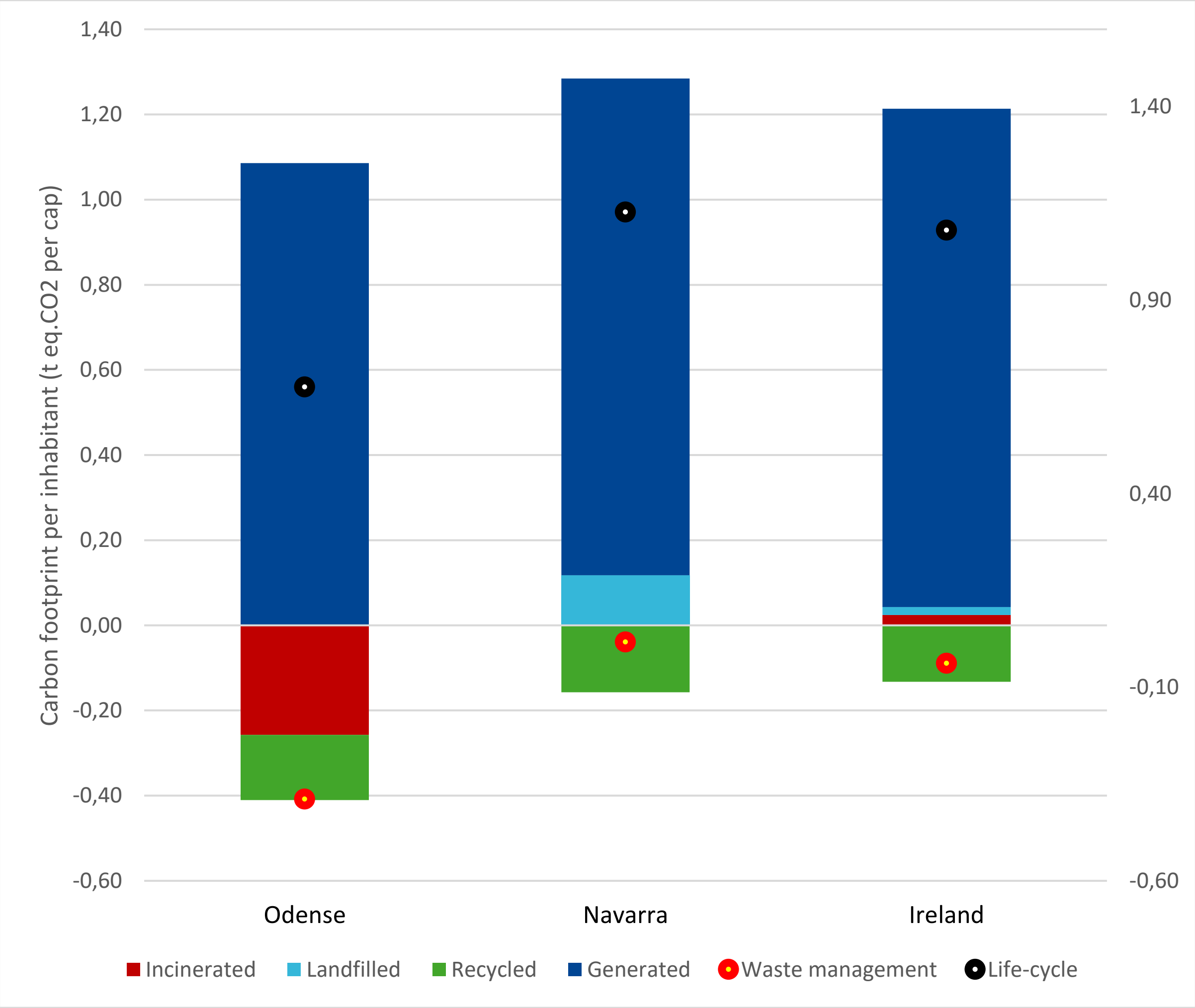

Figure 12: Carbon footprint per capita linked with waste generated and managed in the three territories (in t CO2eq per cap.)

In the figure above, the "generated" category refers to the impact linked with the production and consumption of products that became the waste reported by the three territories. For instance, the "generated" impact for food waste represent the carbon impact associated with the farming, transformation, and transport of food and food products that then became food waste. The impact of consumption is not included in the model.

For all three territories, the impact of waste management (including the emissions generated or avoided by recycling, incineration, and landfilling) is carbon-neutral or even carbon negative, meaning that either the emissions generated are offset by the emissions avoided thanks to waste recycling and recovery, or even that the avoided emissions are significantly higher than the generated ones.

In all three territories, recycling leads to negative emissions, which reflects the fact that the recycling of waste leads to the saving of carbon emissions, e.g., by generating secondary raw materials substituted to raw materials that are more carbon intensive. It is interesting to note that the emissions avoided per inhabitant are quite comparable in all three territories, reflecting the similar recycling performances.

Incineration leads to different impact; while it generates emissions in Ireland, it enables significant savings in Odense. This is due to different reasons: firstly, the incineration plant in Odense mostly produces heat with a high efficiency, which leads to comparatively more important savings than in Ireland, where incineration plants mostly generate electricity and present a lower efficiency. Moreover, the composition of the waste sent to incineration is different: plastic waste represents 18% of the incinerated waste in Ireland vs. 13% in Odense, and textiles represent 10% in Ireland and only 3% in Odense. The incineration of both plastic and textile wastes generates carbon emissions, especially for plastic waste. On the other hand, food waste and household waste represent 60% of the incinerated waste in Odense, and only 28% in Ireland, and the incineration of these fractions leads to avoided emissions due to the fact that biogenic emissions are not included in the model.

Landfilling is quite limited in Ireland and Odense; thus its impact is negligible. In Navarra, it does represent a significant impact. 75% of the impact of landfilling in Navarra can be attributed to only four fractions: food waste, paper and cardboard waste, sanitary textiles, and garden waste.

The main similarity among the three territories is the impact of “generation” (the so-called “embodied impacts”), which is the most significant contributor in all the territories, making the total carbon footprint of waste positive despite the savings achieved with waste management. Even in Odense, the saving achieved by recycling and incineration only offsets less than 40% of the embodied impact of waste. These embodied impacts are quite comparable, representing between 1.07 and 1.17 t eq.CO_2/cap.

Overall, the impacts of the extraction of resources and the production of goods that became municipal waste are very significant compared to the impact of their end-of-life.

Carbon impact per waste fraction

For all three territories, the waste fractions that are the main contributors to the carbon footprints are quite similar: textile, biowaste, mixed/undifferentiated fractions, plastic, and paper/cardboard, as shown on the following graph:

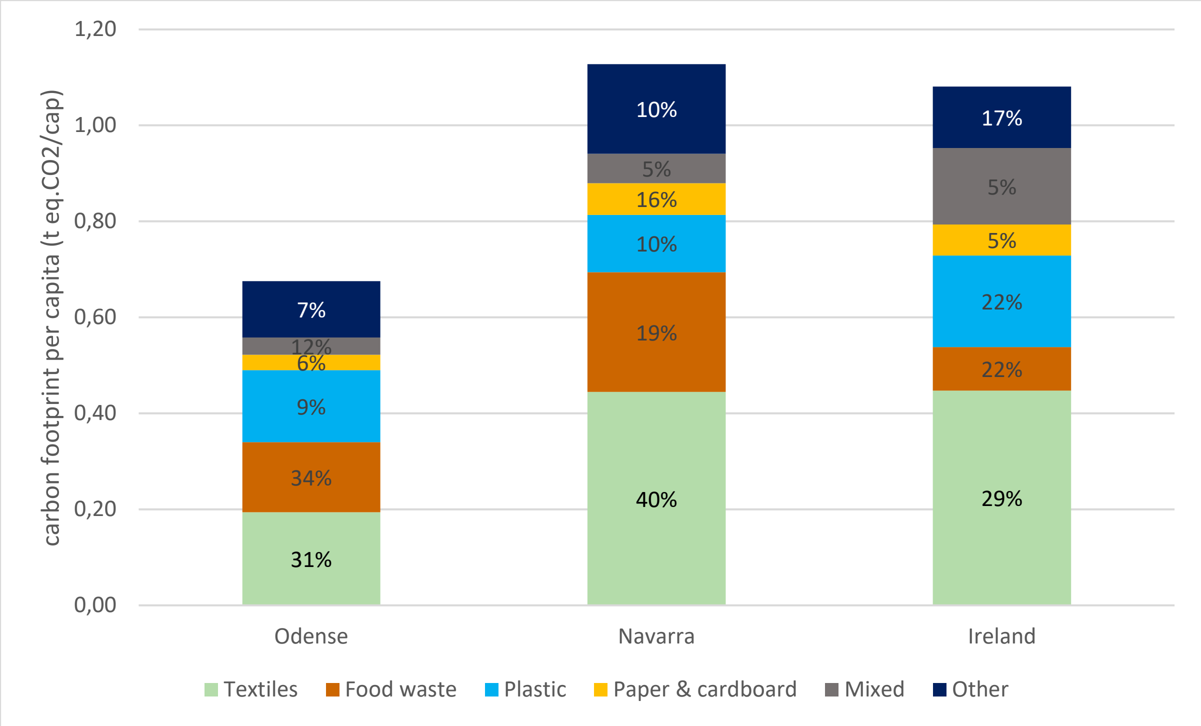

Figure 13: Carbon footprint per capita for the different waste fractions in the three territories.

Textile waste represents between 29 and 40% of the regional carbon footprints, while food waste's contribution ranges from 19 to 34% (reflecting the share of food waste in municipal waste). The relative contribution differs from one territory to another. These key waste fractions will be analysed in more detail in the following parts.

Carbon footprint per tonne of waste

Comparing the carbon footprint per tonne of waste generated also gives interesting insight on the impact of waste management as well as on how local specificities can play a role on the total footprint. The overall carbon footprint per tonne of municipal waste generated for the three territories is presented below:

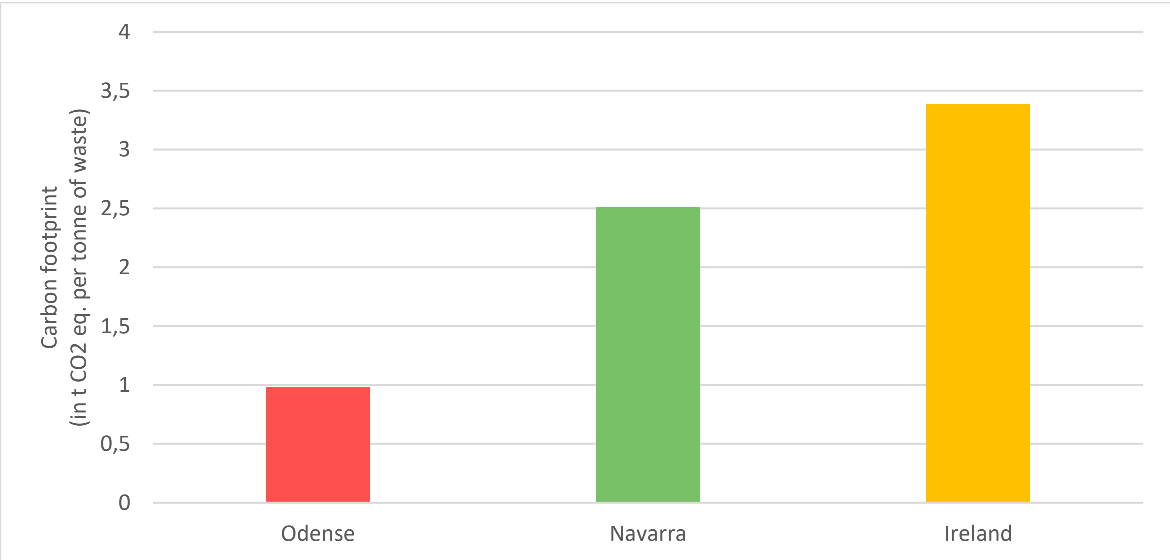

Figure 14: Carbon footprint per tonne of waste in t CO2 eq.CO2 eq. per tonne.

The footprint per tonne of waste is very different from one territory to another. This can be mostly explained by the different scopes used for municipal waste: for instance, Odense presents comparatively lower quantities of textile waste that is very carbon-intensive, but also very large share of inert waste, garden waste, or wood waste, that have a very low carbon footprint. On the contrary, Ireland includes almost no inert waste and little garden waste but presents high proportion of plastic and textile waste comparatively to the other territories. Besides, Odense manages to offset comparatively more carbon emissions thanks to recycling and incineration compared to the other two territories.

There are differences regarding the carbon footprint per tonne for the key waste fractions, as presented in the following graph:

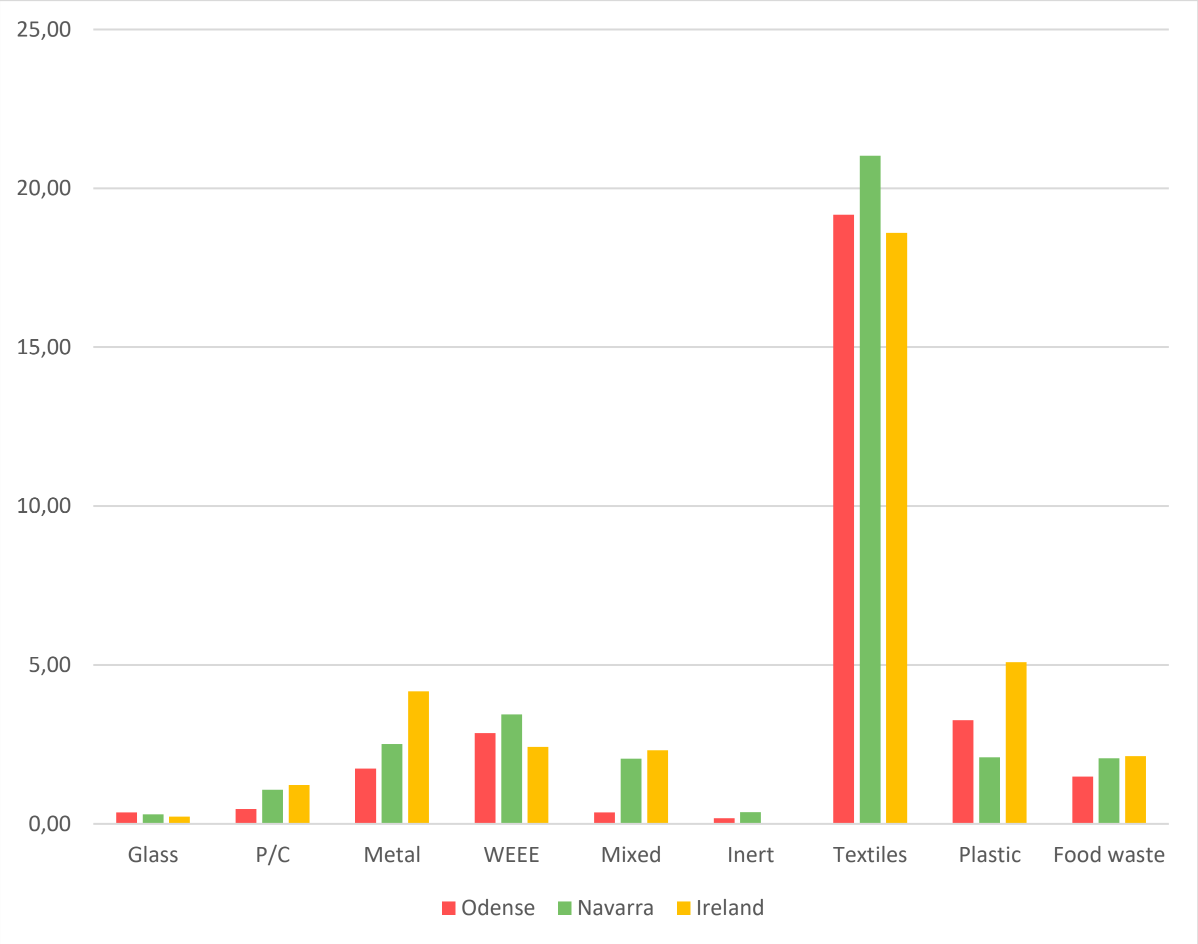

Figure 15: Carbon footprint per tonne of waste for key fractions (in t CO2 eq. per tonne of waste).

These differences are likely to be connected to the composition, and the way they are managed. Quite significant differences can be observed for metal, mixed fractions, and plastic waste. These differences will be explored in the following parts.

Comparison of the carbon footprint for several fractions

As presented above, the footprint of the different waste fractions can greatly differ from one territory to another. The three “priority” fractions (textiles, plastic, and food waste) will be analysed in the next section. A quick overview of waste fractions with significant differences is given in this section.

The following graph shows the carbon footprint per capita in the three territories, for various waste fractions:

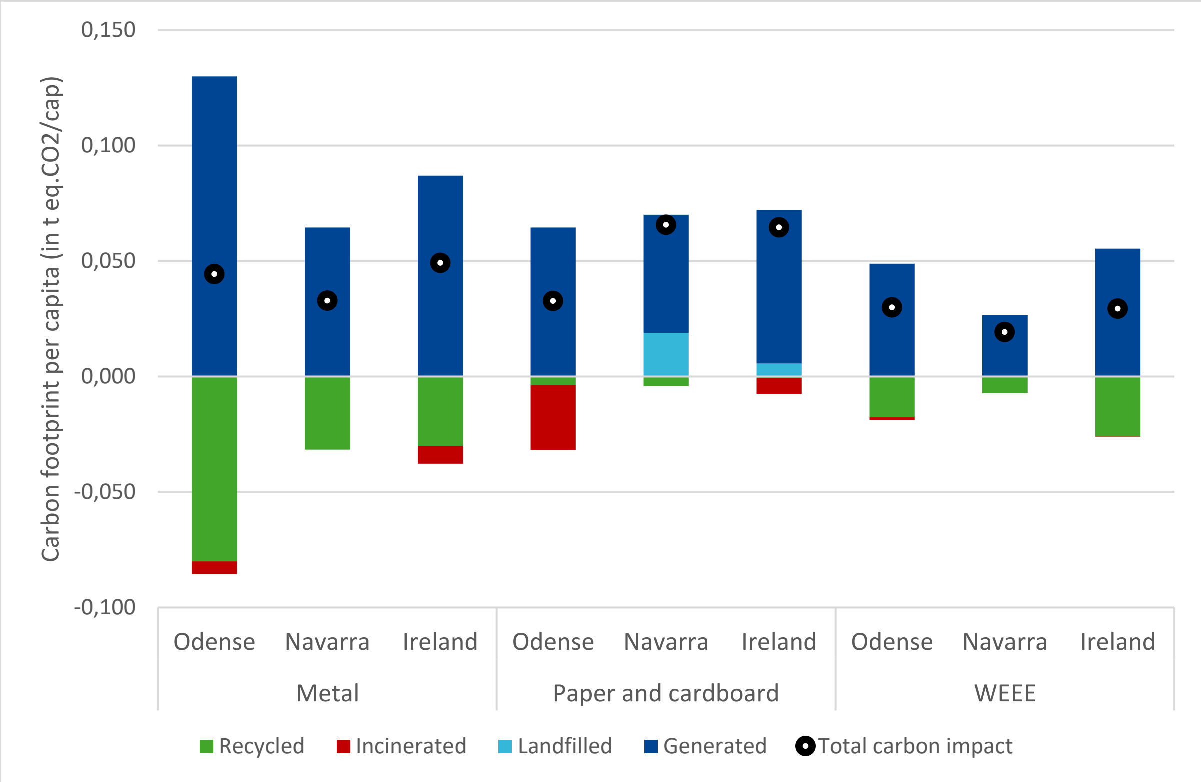

Figure 16: Carbon footprint per capita for different waste fraction (t eq.CO2 per capita).

These carbon footprint per capita can be put in parallel with the carbon footprint per tonne of waste:

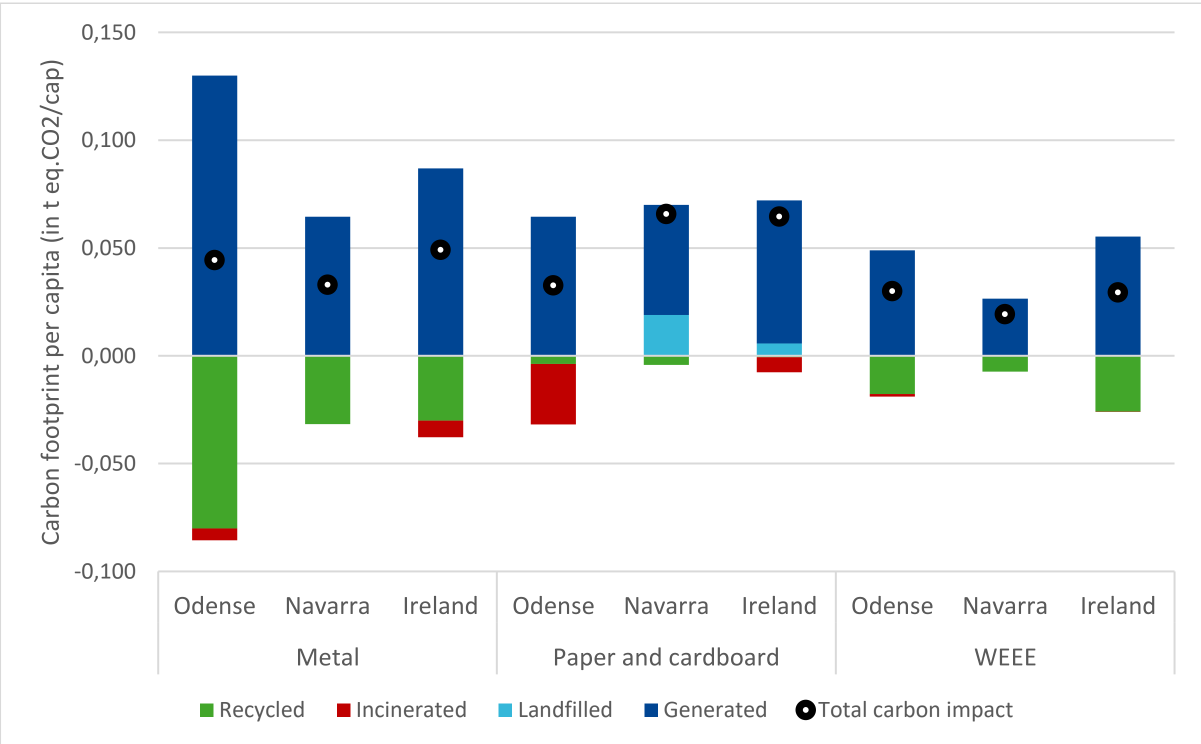

Figure 17: Carbon footprint per tonne of waste for different waste fraction (t eq.CO2 per tonne).

For metal waste, the higher carbon footprints per tonne in Ireland are associated with a higher proportion of non-ferrous metal that presents a higher carbon footprint, but whose recycling also offsets comparatively more carbon emissions than ferrous metal recycling. Odense's larger carbon emissions are associated with the more important quantities of metal waste generated by inhabitant, and the more significant savings are due to its higher recycling rate.

When it comes to paper and cardboard, the carbon factors are quite similar across the three territories. However, Odense presents very significant savings thanks to incineration, that can be associated with the high calorific value of paper and cardboard and the high energy efficiency of its incineration plant.

As mentioned previously, the lower carbon factors for WEEE recycling in Navarra is due to the fact that the re-use rate reported by Navarra is relatively low (about 2%) when Odense and Ireland used the CMI's default value, which is higher. Indeed, re-use is included under "recycling" in the CMI, and the savings associated with re-use are considerably higher compared to the one associated with material recycling of WEEE.

Focus on priority fractions

As specified above, the three territories present the same specific priority fractions: textile waste, food waste, and plastic waste.

Textiles

The reported quantities of textile waste are quite different from one territory to another, as presented on the graph below:

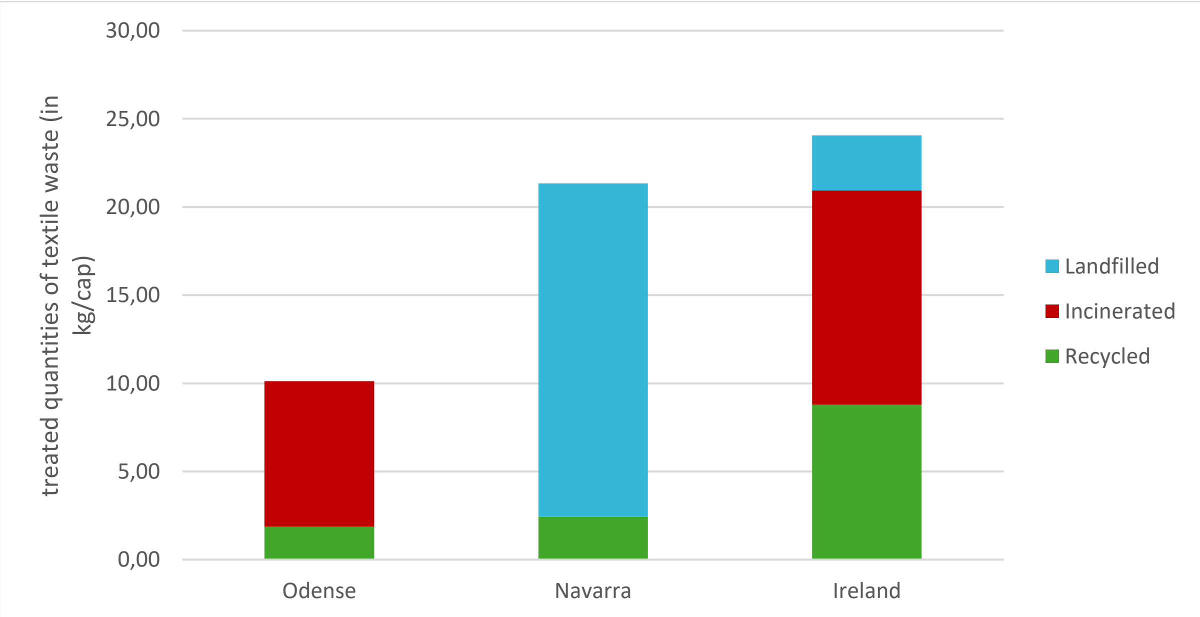

Figure 18: Treated quantities of textile waste in kg/cap.

This might be due to the exact scope of textile waste, or due to unreported fractions (e.g. part of the textiles might be collected by local players that do not report data, such as charity organisations). As observed above, capture and recycling rates are quite low in Odense and Navarra. Ireland presents a quite higher recycling rate. All territories reported that a small proportion of the sorted textiles is re-used, these quantities being reported in the recycled quantities. In general, the three territories report uncertainties on the final treatment of textile waste, and re-use represent between 6% of the generated quantities in Navarra and around 20% in Odense and Ireland.

According to the ECAP project[7], clothing and household textiles waste generation can vary from one country to another, the available figures showing quantities ranging from 9 to about 27 kg/cap/yr, even though there are uncertainties about the comparability of the presented data. The data reported above are within these figures, even if it seems challenging to clearly identify the reasons behind the significant differences. According to the European Environment Agency, the average generation per capita is around 15 kg[8].

The carbon footprint per capita for textile waste is presented below:

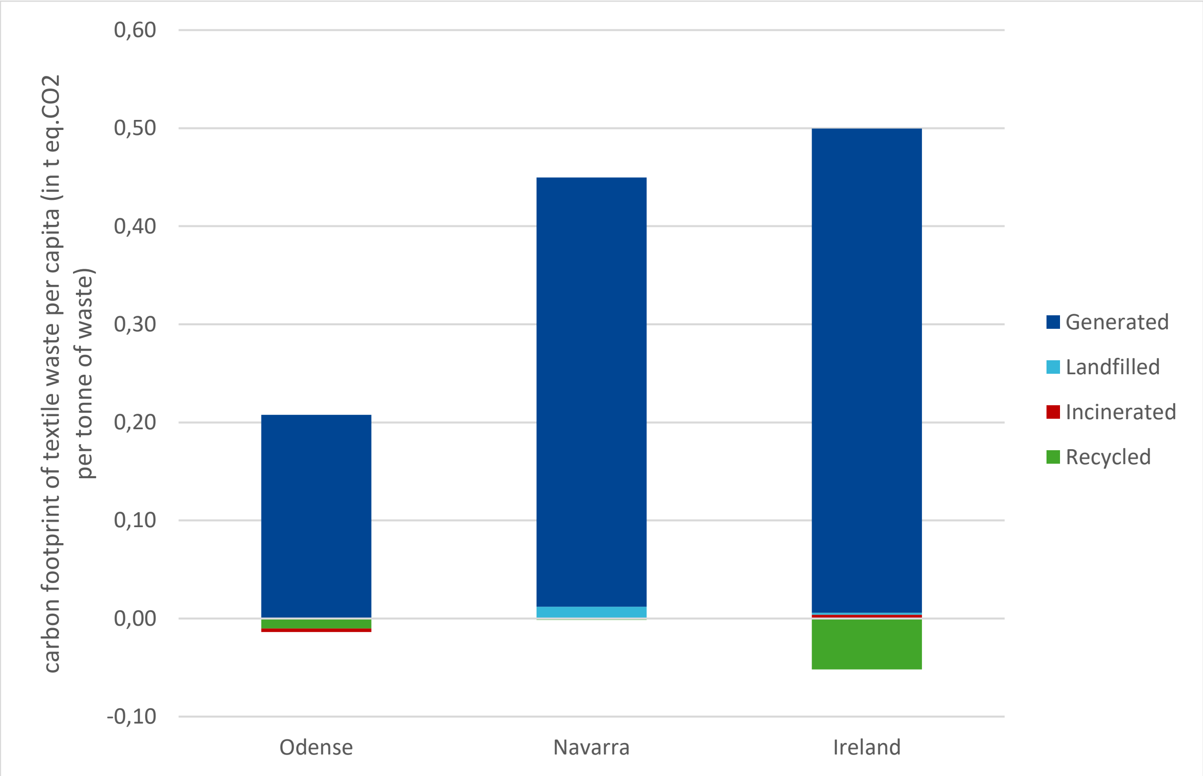

Figure 19: Carbon footprint per inhabitant for textile waste (in t CO2 eq. per cap).

The main impact comes from the production of textile products, while its incineration and landfilling have little to no impact. Recycling enables some saving, yet it is very limited compared to the total footprint. Re-use has much more potential, which explains why the emissions offset in Ireland and Odense are comparatively more important than in Navarra.

No detailed data on the composition of textile waste was available at the level of the different participants. Therefore, the CMI's default values were used for all three territories. The information available at national level for Spain presented similarities with these default values. Compositions used for textile are presented on the following graph:

[7] ECAP (2018), Used Textile Collection in European Cities
[8] EEA (2022), Textiles and the environment: the role of design in Europe's circular economy

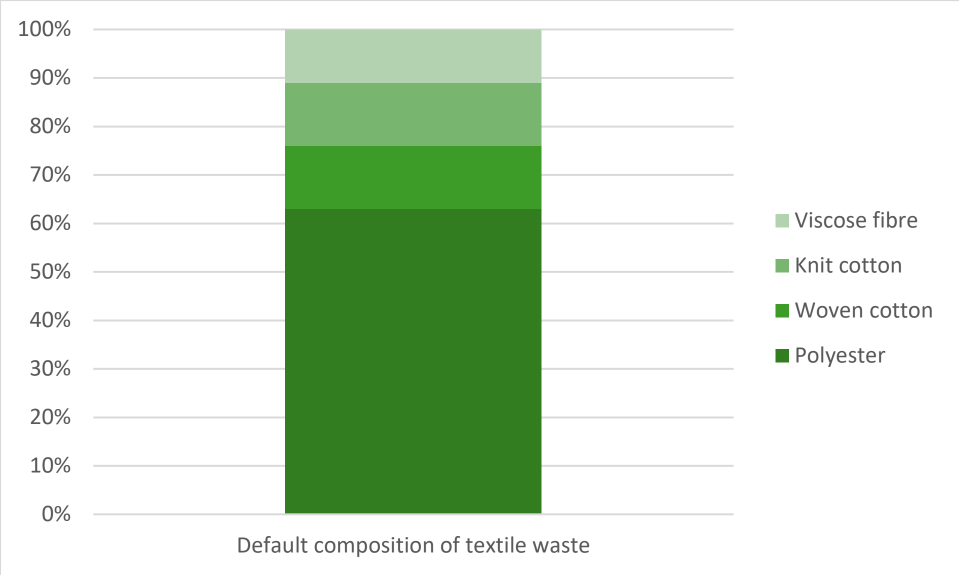

Figure 20: composition of the textile fraction (in %).

The carbon impacts of the different sub-fractions are indicated on the following graph. As mentioned above, the impact of sub-fractions is quite similar from one territory to another:

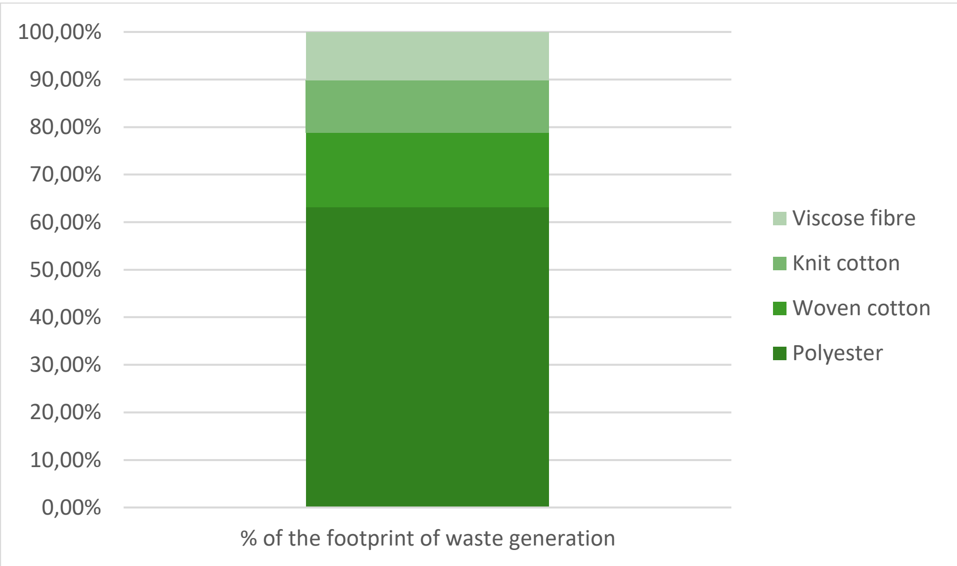

Figure 21: contribution of subfractions for the impact of textile waste generation.

The carbon intensities of the different textiles are not significantly different; thus the distribution of carbon impact reflects the composition of textile waste. The main impact comes from the generation of polyester, which is mostly due to the fact that it is the most important fraction in terms of tonnes.

The carbon footprint of clothing is quite different from one product to another[9]. It seems that the extraction of resource (e.g. cotton cultivation), the manufacture of clothing, and the use phase (especially the washing of clothes) are the most impactful steps of the life cycle of clothing[10]. As mentioned above, the impact of consumption is not included in the CMI model.

[9] https://www.bilans-ges.ademe.fr/documentation/UPLOAD_DOC_FR/index.htm?coton_-synthetique_-autre.htm

[10] Rana et al., 2015, *Carbon Footprint of Textile and Clothing Products*

According to the ECAP report mentioned above, there is about 60% of reusable textiles in a typical load of separately collected used textiles, meaning a potential of 50-60% of reusable textile in selectively collected textile. While there is no information on the re-use potential of unsorted textile, we might assume that reaching a 25% re-use rate for all textile waste could be achieved. The impact of increasing sorting rates to 50% and re-using 50% of the separated textile waste, leading to a 25% re-use rate for generated textiles, can be seen below:

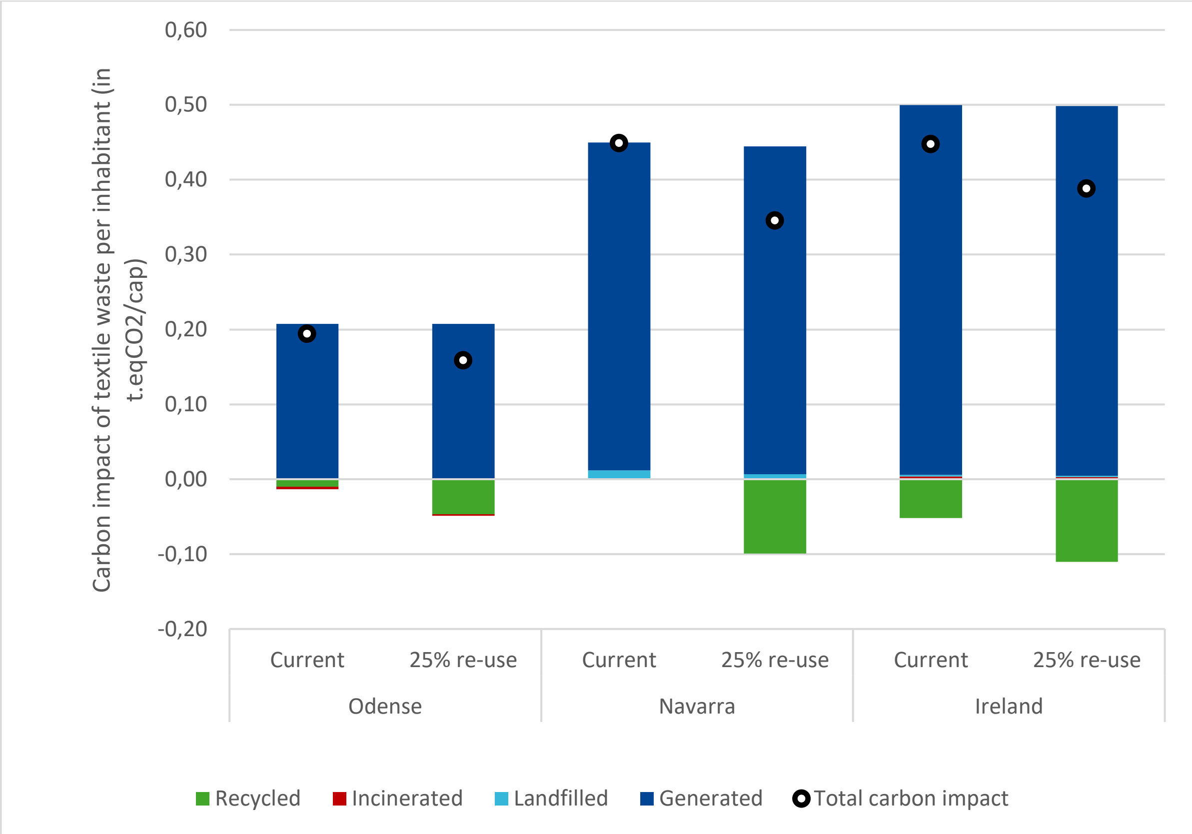

Figure 22: carbon footprint of textile waste in the current situation and with a 25% re-use rate (in t.eqCO2/cap).

Increasing re-use does have a significant impact on the total carbon footprint of textile waste, with a reduction ranging from -13% in Ireland to -23% in Navarra. The potential reductions reflect the current level of re-use in the different territories. This also shows the importance of defining actions and instruments addressing the production of textile products, including the uptake of recycled textiles.

Several actions can be undertaken at local level to mitigate the carbon footprint of the production and use phases: facilitate the creation of short-term clothing rental, promote more durable clothes, promote repair, and increase collection for re-use and re-use shops[11]. The Sustainable Clothing Action Plan implemented in the UK, whose actions led to a decrease of textiles' carbon footprint of more than 21% between 2012 and 2020, recognises that "in-country use of pre-owned clothing" is one of the actions with the most potential for carbon emission mitigation of textile products[12]. Other actions, such as the uptake of recycled polyester or organic cotton, are also regarded as very impactful.

[11] Ellen MacArthur Foundation, 2017, *A new textiles economy: Redesigning fashion's future*
[12] WRAP (2021), SCAP 2020 – Final report

Food waste

As presented previously, food waste generation is quite different for the three territories, with Ireland presenting quite lower generated quantities compared to the other two territories

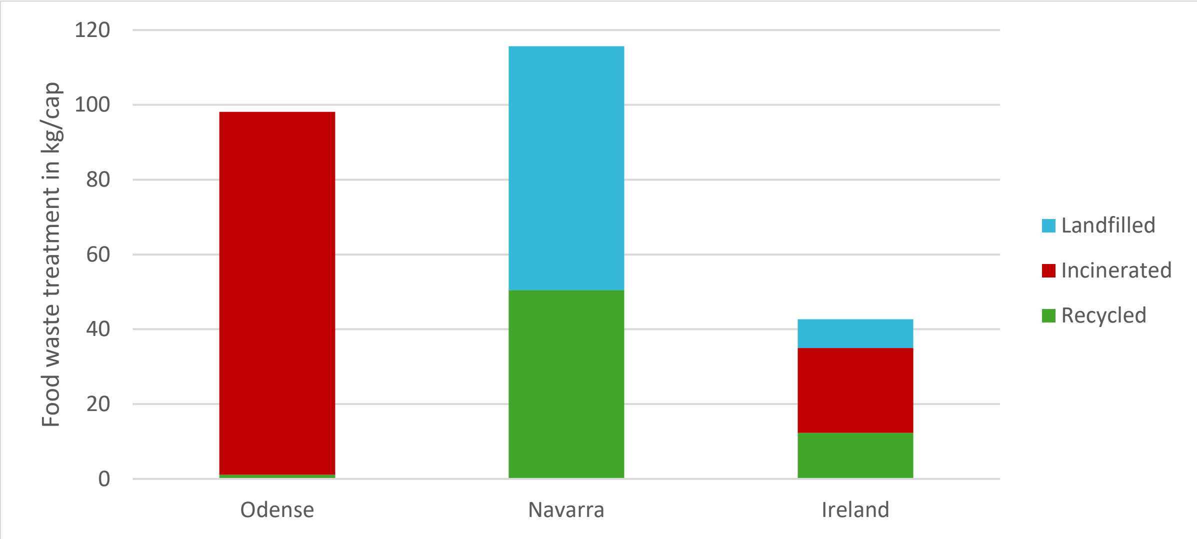

Figure 23: Food waste treatment in the three territories (in kg/cap/yr).

Food waste recycling is quite limited in all three territories, except in Navarra, where landfilling of food waste is also quite significant. In Odense, most food waste is incinerated with residual waste since food waste separation was only at pilot phase.

The associated carbon footprint is presented on the following graph:

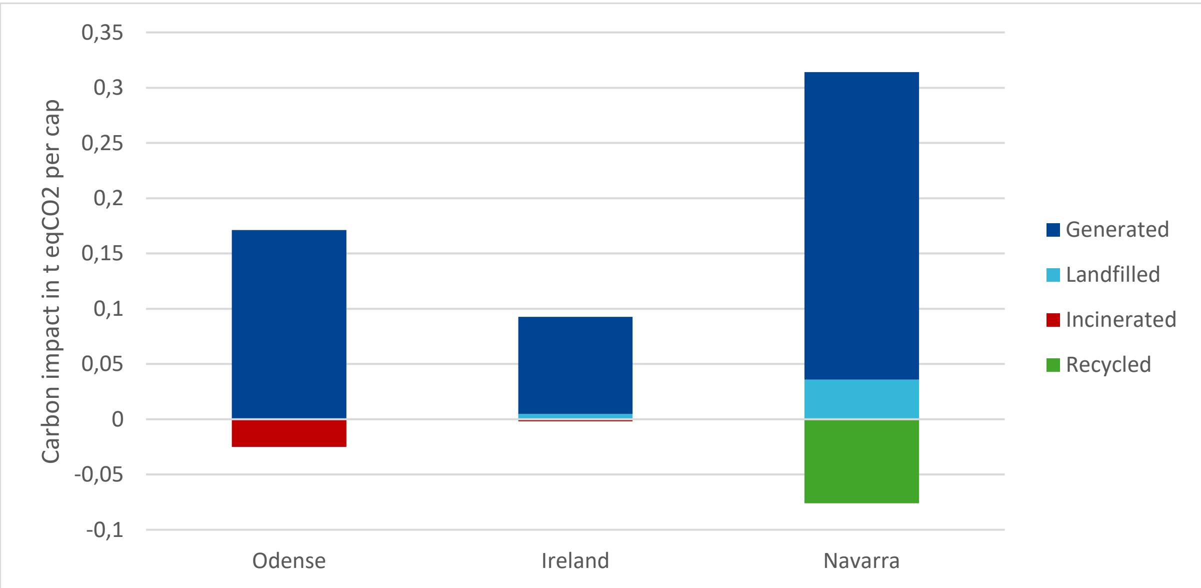

Figure 24: Carbon footprint of food waste (in t CO2 eq. per cap).

The carbon footprints are dominated by the impact of food production, and the current waste management strategies implemented in the three territories have limited impact on it. Both Navarra and Odense achieve noticeable carbon savings, thanks to anaerobic digestion in Navarra and incineration in Odense. In Odense, recycling of food waste leads to slightly higher savings per tonne treated compared to incineration, but the collected quantities are too small to have a significant impact on the overall footprint. The savings achieved for each tonne of waste sent to recycling in Navarra are way more significant than in the other two territories. This can be attributed to the data reported on the anaerobic digestion unit, which indicate a high production of heat and the recovery of part of the digestate as biofertilizer, while it is used as soil conditioner in the other territories. This shows that the use of the output of recovered waste and to what it is substituted has a great importance for carbon savings. Considering the emissions generated by the landfilling of food waste, there is an interesting potential for reducing the carbon footprint of food waste by boosting food waste collection in Navarra.

However, it seems that the main potential for the reduction of the food footprint lies in food waste prevention. Interestingly, local data are available regarding the composition of food waste:

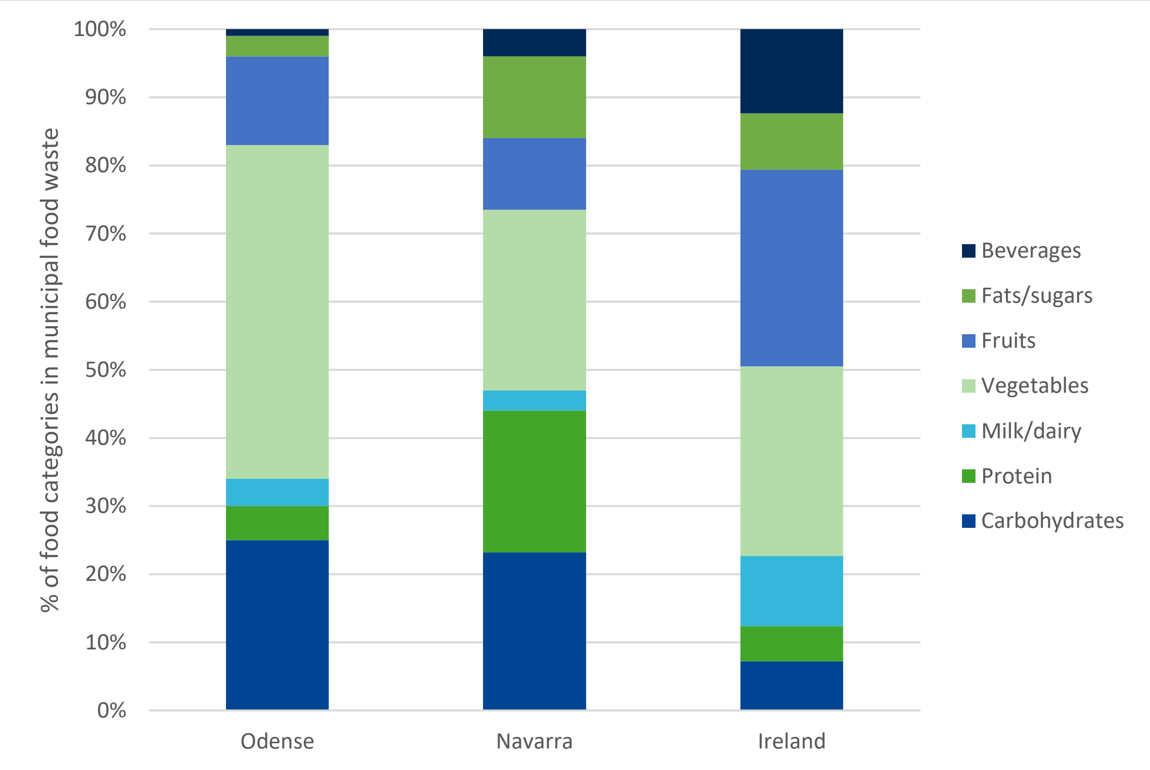

Figure 25: Composition of municipal food waste in the three territories.

The graph indicates very different composition for municipal food waste: for instance, Navarra presents significantly higher quantities of protein waste, whereas in Odense vegetable is a very significant fraction. In Ireland, carbohydrates are significantly lower and fruits quantities are comparably higher. It is unknown if these compositions reflect different consumption patterns, the impact of previous food waste prevention strategies focusing on specific fractions, or different methods for assessing food waste composition. These different compositions have a significant impact on the carbon footprint of food waste generation.

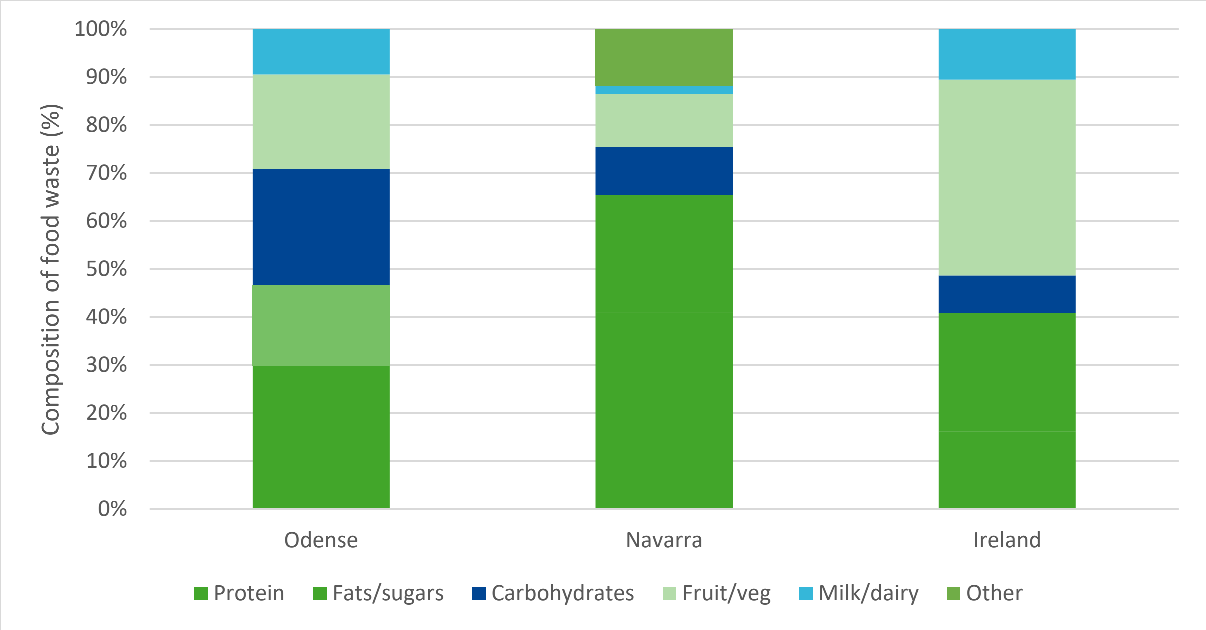

Figure 26: Composition of municipal food waste (in %).

The graph above shows the significant impact of protein waste, which is much more carbon intensive than other food waste fractions. In Navarra, about two third of the impact of food waste generation is linked with proteins. Fruits and vegetables also have a significant impact, especially in Ireland where the quantities wasted are very important.

Agriculture is the most contributing phase when it comes to the carbon footprint of food[13], so reducing the losses (at every step of the value-chain, from production, to transformation, distribution, and consumption) is a priority action to improve the carbon footprint. Several actions can be promoted as local level, such as the promotion of low-carbon diets (e.g. with less meat and processed food, and more legumes[14]), and the reduction of losses (e.g. through awareness raising or the promotion of food donation).

Households are usually an important contributor of food waste among the other steps of the food value chain, and avoidable food waste generally represents around 50% of the total food waste, meaning that there is still much potential to reduce the carbon impact linked with food waste generation by targeting households. This can be achieved through awareness raising campaigns, targeted communication activities aiming at teaching ways to concretely reduce food waste or working with food producers and retailers to improve communication and information on food products[15].

Plastics

The reported quantities of plastic waste are very different from one territory to another, which might be linked to different scopes and data quality. The quantities and treatment methods are presented in the following graph:

[13] Notarnicola et al., 2015, *Environmental impacts of food consumption in Europe*
[14] WWF, 2018, *Vers une alimentation bas carbone, saine et abordable*
[15] ACR+ publication to come

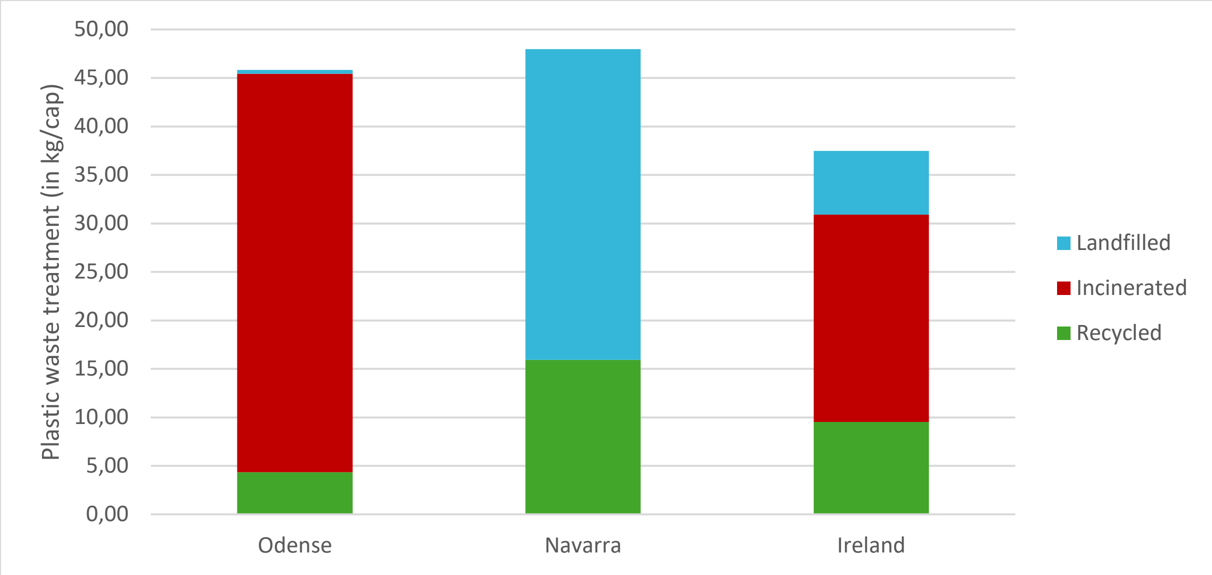

Figure 27: Plastic waste treatment in the three territories (in kg/cap/yr).

The generated quantities per capita are not too different, but the treatment methods are quite different. Recycling rates are quite low in all territories, and most quantities are either incinerated (in Odense and Ireland) or landfilled (in Ireland and Navarra).

These different treatment modes impact the overall carbon footprint of plastic waste in all three territories:

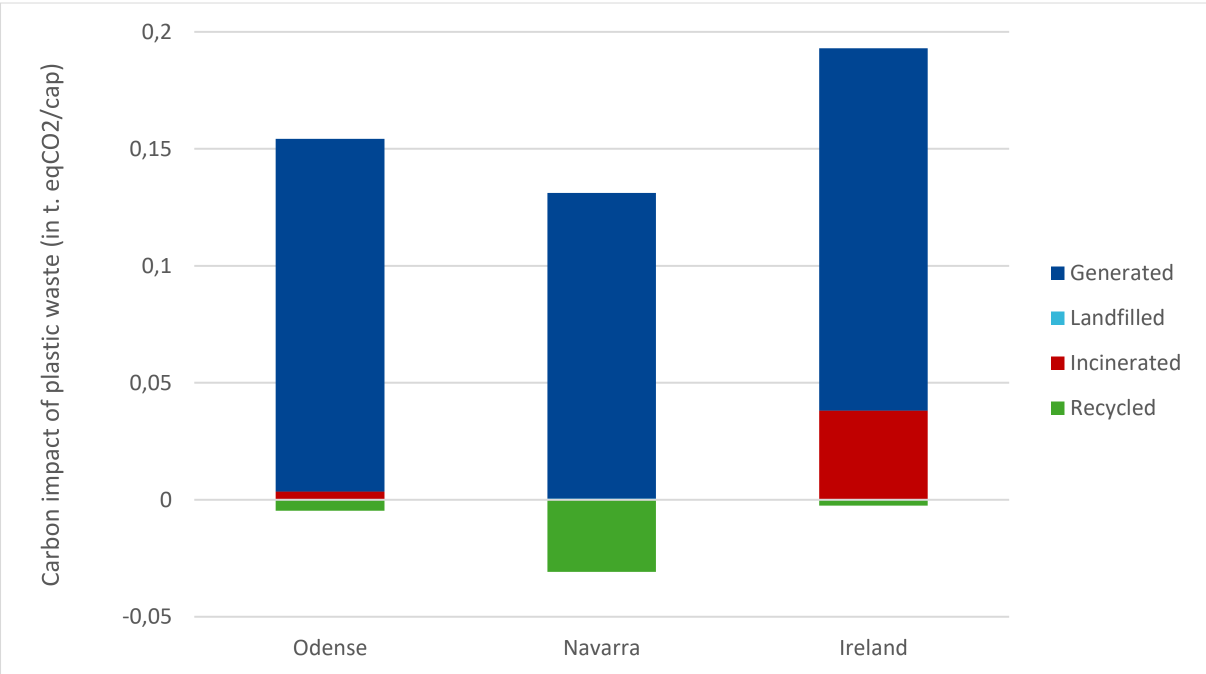

Figure 28: Carbon impact of plastic waste in the three territories (in t.eqCO2/cap).

Treatment systems have a significant impact on carbon emissions: landfilling has a rather limited impact, while recycling allows to achieve quite important savings in Navarra, while its impact is more limited in Ireland and Odense. This reflects the fact that Navarra manages to send comparatively more plastic to recycling, but also that the composition of plastic is different from one territory to another. The fact that the DRS system in Odense captures most

PET, whose associated quantities are not included here, negatively impacts the observed savings. It is interesting to note that incineration has generally a negative or neutral impact. In Odense, and despite the high energy efficiency of the incineration unit, the emissions saved thanks to energy recovery barely offset the emissions linked with plastic waste incineration. In all territories, there is a significant potential for plastic waste recycling.

It is important to note here that local information on the actual recycling routes of the different waste polymers was not collected. Different recycling routes for the same polymer can be associated with different carbon savings, e.g. depending on the virgin materials replaced by the recycled ones. This means that the actual impact of plastic recycling might be different from the figures reported here.

Yet in all territories, the impact associated with the production of plastic products is the most significant one. Plastic waste includes various types of products. Each participant of cohort 2 could propose local or regional data for the composition of the collected plastic waste, presented below:

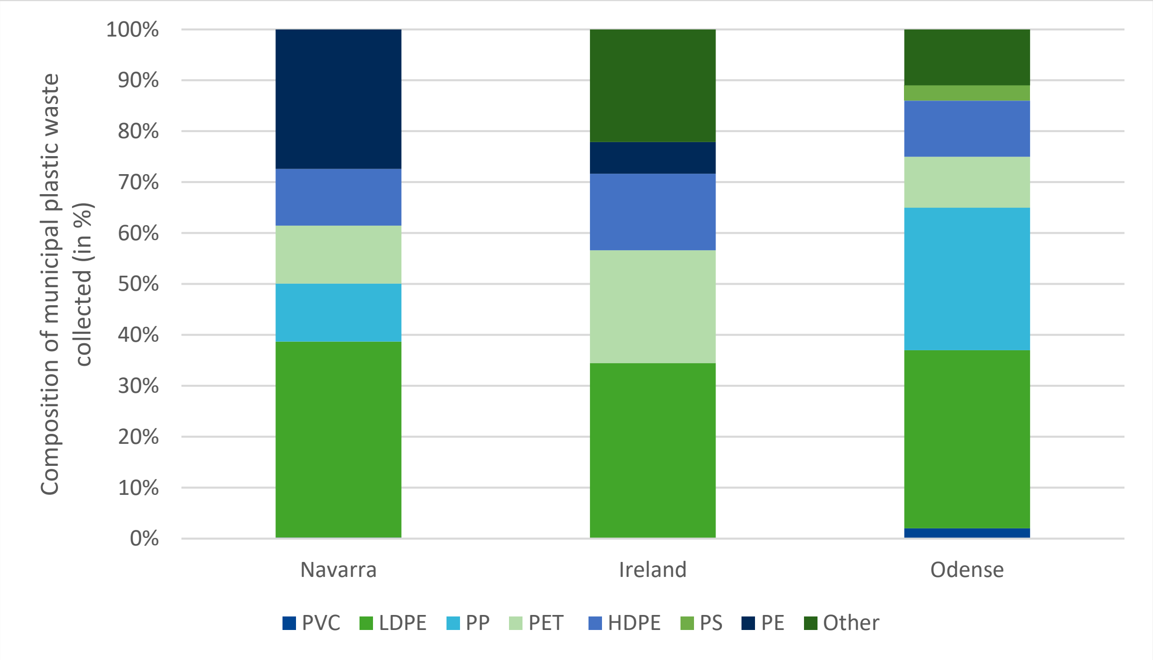

Figure 29: Composition of municipal plastic waste in the three territories.

The graph shows some differences regarding the composition of plastic waste, which might be linked with different consumption patterns, but also uncertainties (e.g. all datasets include an "other" category or some reported "mixed fractions" that had to be distributed among the other categories). Besides, there might be differences on the actual scope of the proposed data: in Odense, PET bottles are collected via the national deposit refund system, whose associated quantities are not reported in the presented data. In addition, whether the composition of plastic waste collected in civic amenity sites (as plastic waste or in mixed fractions) is well documented is not certain.

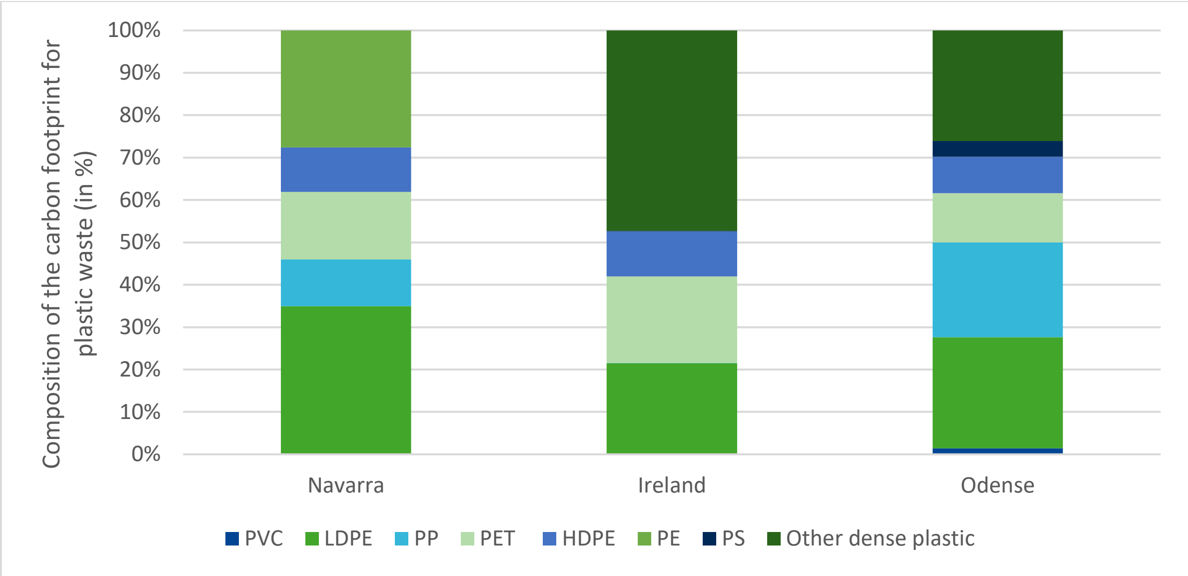

Figure 30: contribution of the different plastic polymers to the carbon footprint of plastic waste in the three territories (in %).

The composition of the carbon footprint reflects the composition of plastic waste. One fraction seems to be comparatively more carbon intensive: "other dense plastic" (for the most part "hard plastic" composed of non-packaging products) which includes Nylon (PA), Acrylonitrile butadiene styrene (ABS), Polycarbonate (PC), and layered or multi-material mixed polymers, among other. However, this composition is the one used by the CMI, and might not reflect the exact composition in each of the territories. This fraction represents about half of the carbon footprint of plastic waste in Ireland, when it only represents 20% of the generated quantities. This waste fraction also tends to explain why the carbon footprint of plastic waste generation is higher in Ireland and lower in Navarra (where little quantities of "other dense plastics" were reported).

All plastic polymers are carbon-intensive materials, and the savings associated with closed-loop recycling are quite significant. However, the generally low capture rates and the losses between waste collection and final recycling tend to limit the observed savings. Important progress could be made if both the quality and quantity of plastic waste could be improved.

SCENARIOS TO REDUCE THE WASTE CARBON FOOTPRINT BY -25%

The participants of cohort 2 were presented different scenarios as how to reduce their waste carbon footprint by -25%. The three territories share almost the same target materials: textile waste, food waste, plastic waste, and paper and cardboard waste. Other waste fractions can also be regarded as target materials: sanitary textiles in Navarra, metal waste in Odense, non-ferrous waste and mixed bulky waste in Ireland.

The key target fractions are summarised in the following table:

Odense	Navarra	Ireland
Textile wastes	Textile wastes	Textile wastes
Plastic wastes	Food waste	Plastic wastes
Food waste	Plastic wastes	Mixed and undifferentiated materials
Mixed ferrous and non-ferrous wastes	Health care and biological wastes	Food waste
Paper and cardboard wastes	Paper and cardboard wastes	Paper and cardboard wastes

Different types of scenarios were proposed to the participants, all of them focusing on reducing waste generation, which is the most effective way to cut down carbon emission.

Of course, reducing all waste generated by 25% (and reducing the associated quantities sent to landfilling, incineration, and recycling) will lead to a decrease of 25% of its carbon footprint. If focusing on their respective target fractions, the three territories must achieve a -30% reduction of generated quantities to reach the -25% reduction of carbon footprint.

It might be more relevant to focus the efforts on priority fractions. If each territory choses to focus on the two most carbon-intensive fractions, the following reduction targets should be set to reach the -25% reduction of carbon emission:

Table 2: targets to reach the -25% target for the waste carbon footprint.

	Ireland		Navarra		Odense	
	Waste fraction	Target	Waste fraction	Target	Waste fraction	Target
Priority fraction 1	Textile wastes	-40%	Textile wastes	-40%	Textile wastes	-40%
Priority fraction 2	Plastic wastes	-30%	Food waste	-30%	Food waste	-30%
Other priority fraction	Mixed and undifferentiated materials Food waste Paper and cardboard wastes	-12%	Plastic wastes Health care and biological wastes Paper and cardboard wastes	-10%	Plastic wastes Health care and biological wastes Paper and cardboard wastes	-10%

Additional measures focusing on waste management could also help to reduce the carbon footprint of waste, to a lesser extent than prevention and re-use actions. For instance, diverting 50% of biowaste (food waste and garden waste) from landfills to recycling in Navarra could lead to a decrease of 50,000 t eq.CO2, out of the 178,000 t required to reach the -25% target. In all three territories, increasing collection and recycling of food, textile, and plastic waste shall contribute to decrease the carbon footprint, yet it is unlikely that recycling alone unlocks the -25% reduction.

The figures presented above show that considerable efforts should be put in place to reach the -25% target, which would be only a first step toward carbon neutrality. If several food waste prevention strategies (such as the "Love Food, Hate Waste" campaign in the UK) are known to have reached such reduction performances, it is unsure how a -40% reduction of textile waste can be achieved. Local and regional authorities might not have the possibility to reach such reduction targets with local policies, and actions targeting production or use of recycled materials must also be considered by the industry or EU/national regulations.

Nonetheless, it shows the importance to give priority to prevention and re-use in local and regional policies. This means setting ambitious targets and a consistent monitoring system allowing to control the progress made and assess the effectiveness of the local strategies. It also shows the importance to align waste management strategies with prevention targets, e.g. when considering the capacity of waste treatment units.

GENERAL CONCLUSIONS

The improvements brought to the data collection process contributed to make the individual carbon footprint more detailed and accurate. The fact that local carbon factors could be assessed for several key waste fractions allowed a better understanding of how local specificities or choices impacted the waste carbon footprint.

It is important to remind that the point of the MCLC campaign is not to compare individual “carbon performances”, considering that the different scopes and situations make such comparisons very challenging. Indeed, specific parameters such as the generated quantities of textile waste significantly impact the overall carbon footprint when they do not necessarily reflect the performance of the municipal waste system. The main objective is more to understand what parameters impact the carbon footprint of municipal waste and what measures can be taken to reduce it.

The cross-analysis does show that local specificities play an important role: different compositions (of textile or food waste), or the level of re-use for key waste fractions such as textile waste have a strong influence on the carbon impact and on the priorities to mitigate it.

This second cohort confirms some of the general observation of the first cohort:

- The impact of the end-of-life is quite limited compared to the impacts linked with the extraction of resources and the manufacturing of products.
- The key waste fractions tend to be the same across the participants: textile waste, food waste, plastic waste.

The possibility to collect better data leads to the following observations:

- The efficiency of waste treatment plants and their outputs can greatly impact the potential savings: the energy efficiency of incineration and anaerobic digestion plants, the production of heat, or the production of biofertilizer were found to have a strong impact on saved emissions. For energy recovery, it is important to note that the savings also depend on the carbon intensity of the national energy grid.
- Re-use has a very significant impact on carbon savings, especially for textiles and WEEE. For both fractions, the potential of re-use seems much more significant than recycling.
- The composition of key waste fractions is a relevant information to identify priorities. For instance, the higher presence of protein waste in Navarra’s food waste strongly impacts its carbon footprint and makes it relevant to focus on this specific sub-fraction.

It is still important to acknowledge the limitations of this cross-analysis, mostly linked with the uncertainties of local data on uncaptured quantities, actual composition of mixed fractions and key waste fractions, and recycling routes used for the different sorted materials.

FOLLOW-UP

Further efforts will be made to further improve data collection, to ease the process for participants and simplify the analysis of results. For instance, the possibility to add new waste categories or to get "re-use" in addition to recycling will be investigated.

ACR+ plans to publish reports focusing more on practical actions that can be implemented by local and regional authorities to prevent key waste fraction. A report focusing on household food waste prevention will be published in September 2022, and a report on textile waste will be proposed by the end of 2022.

New cohorts will be organised, leading to the collection and analysis of more local and regional waste data, along with their carbon footprint. Further cross-analyses will be proposed, possibly leading to a better understanding of how local factors can influence the carbon footprint, and how priorities might change from one place to another.

Another important aspect to bear in mind is that the carbon footprint is only one of the environmental issues addressed by the circular economy. When defining strategies, it can be relevant to take other aspects (such as resource scarcity, air or water pollution, etc.) into consideration.

More information on the campaign, as well as the individual reports presenting the data for each of the three territories are available on the MCLC webpage.

-25%
BY 2025

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