



NWE plastic waste inventory

Regional analysis for TRANSFORM-CE partners: Assessment of all 4 regions to identify flows of plastic waste streams and recycling

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This report gives an overview of the regional waste streams containing single use plastics in the project regions and provides clarity over the potential supply of single use plastic waste for the TRANSFORM-CE demonstration plants.

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1. Introduction

The European Union manufactures millions of plastic products each year, however, only a fraction of these are made using recycled plastic. Even more surprising, half of the plastic waste collected for recycling is exported outside the EU for processing. The EU plastics industry is thereby losing valuable potential raw materials at a time when demand is increasing. In recognition of this, as well as the possible environmental and social benefits, TRANSFORM-CE brings together four North West European countries (Belgium, Germany, the Netherlands and the United Kingdom) to develop innovative solutions for recycling these materials into new products for a circular economy. TRANSFORM-CE is using two innovative technologies to create new products from single use plastic waste – additive manufacturing (AM) and intrusion-extrusion moulding (IEM). To support this, an R&D Centre (UK) and Prototyping Unit (BE) have been set up to develop and scale the production of recycled filaments for AM, whilst an Intrusion-Extrusion Moulding Facility, the Green Plastic Factory has been established in the NL to expand the range of products manufactured using IEM. By scaling technology, TRANSFORM-CE will develop and demonstrate circular economy business models and stimulate new secondary material markets across North-West Europe for re-manufacturing, demonstrating that municipal waste plastic can be re-purposed and revalued.

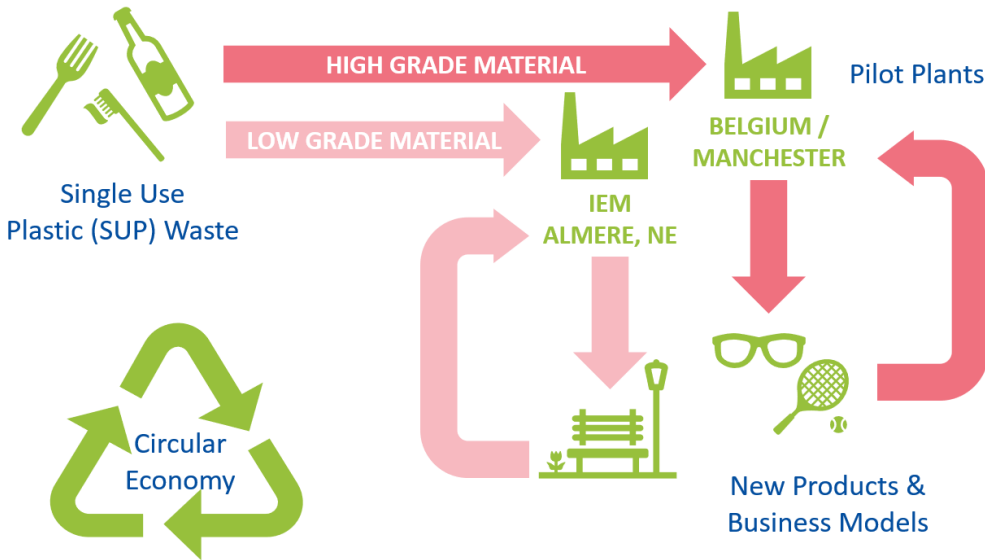


Figure 1: TRANSFORM-CE infographic

This deliverable aims to assess each region’s plastic waste streams and recycling quotes to provide clarity to the availability of plastic waste for the TRANSFORM-CE demonstration plants and the long term uptake through scaling of the technologies.

2. Executive summary

To give an overview of the regional waste streams containing single use plastics and to provide clarity over the potential supply of single use plastic waste for the TRANSFORM-CE demonstration plants, relevant waste streams were assessed in the project regions.

Being the main source of plastic waste in North-West-Europe, about 6.6 Mt of plastic packaging are put into the market in the four TRANSFORM-CE partner countries every year, with LDPE (2 Mt/a), PP (1,4 Mt/a), PET (1,3 Mt/a) and HDPE (1,3 Mt/a) as the most important polymers used for plastic packing.

In total, 9.5 Mt of plastic waste were identified in the selected waste streams, of which currently 63 %, or about 6 Mt, are not intended for material recycling, and thus available as a potential input for the TRANSFORM-CE demonstration plants.

Table 1: plastic waste not intended for recycling in the TRANSFORM-CE partner countries

national plastic waste available for pilot plants
[kt/a]

Waste stream	Germany	Netherlands	Belgium	England
residual	906	197	201	1,356
commercial residual	247			1,930
packaging	964	89	26	
packaging commercial	?		70	
deposit return	-	-		
total	2,117	285	298	3,286

3. Plastic consumption for packaging

The directive 94/62/EC on packaging and packaging waste sets recycling targets for packaging and requires EU member states to set up a system to return, reuse and recover used packaging from the consumer. The TRANSFORM-CE partner countries, Germany, Netherlands, Belgium and the UK delegate this legal obligation to the producers and importers of packaging through the setting of Extended Producer Responsibility Schemes (EPS). To ensure the effectiveness of the schemes, the market for packaging is monitored closely.

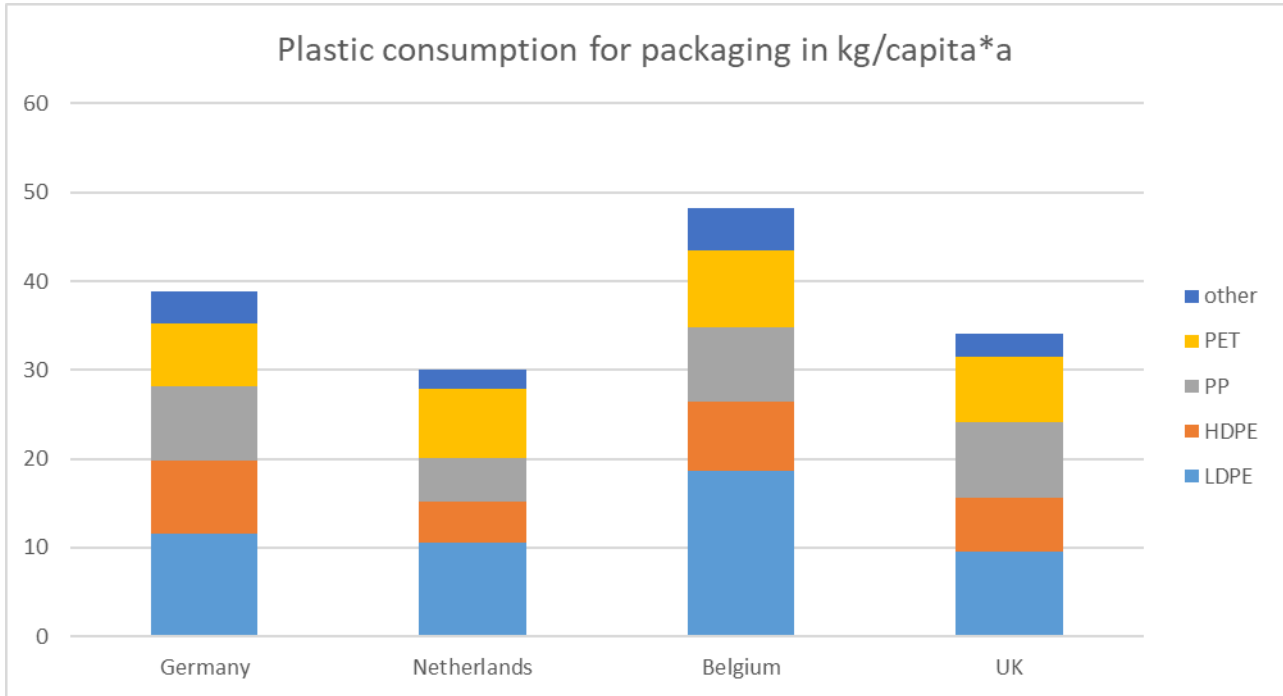


Figure 2: Plastic consumption for packaging in Germany (Conversio Market & Strategy GmbH 2020), the Netherlands (Snijder und Nusselder 2019), Belgium (essencia 2019) and the UK (Valpak 2020)

The most important polymers for packaging are low density polyethylene (LDPE, e.g. used for films and bags) and high density polyethylene (HDPE, e.g. food packaging, crates), polypropylene (PP, e.g. food packaging, bottle caps) and polyethylene terephthalate (PET, e.g. bottles). Each of them has a higher market share than all other polymers combined. Belgium has the highest consumption of plastic packaging of 48.3 kilogram per capita, the Netherlands have the lowest consumption with 30 kg/capita.

Table 2: Plastic consumption for packaging in kt in Germany (Conversio Market & Strategy GmbH, 2020), the Netherlands (Snijder & Nusselder, 2019), Belgium (essencia, 2019) and the UK (Valpak, 2020)

Plastic consumption for packaging in kt					
	Germany	Netherlands	Belgium	UK	total
LDPE	966	183	212	637	1,998
HDPE	679	81	90	415	1,264
PP	696	86	94	563	1,440
PET	585	136	99	502	1,321
other	295	37	54	174	560
total	3,220	523	549	2,290	6,582

In total, about 6.6 Mt of plastic packaging are put into the market in the four TRANSFORM-CE partner countries every year. With 2 Mt/a, LDPE is the most important polymer for packaging, followed by PP (1,4 Mt/a), PET (1,3 Mt/a) and HDPE (1,3 Mt/a). All other polymers used for packaging add up to 0.6 Mt/a.

4. Plastic waste streams

In the former work package, WP D.T1.1.1 Statistical Harmonisation, plastic waste streams rich in single use plastics in the four TRANSFORM-CE partner countries were identified. Plastic content as well as the composition of the plastic fractions found in the respective waste streams are described in the following. Depending on the availability of data, the quantities were taken from national and regional waste statistics. Since composition analysis are usually only available on a national level, the quantities of the waste fractions were extrapolated to the regional level.

In this report, plastic waste that is currently not intended for material recycling is considered as “available for TRANSFORM-CE pilot plants”. The reason for this is, that a main objective of TRANSFORM-CE is the diversion of plastic waste from landfills or waste to energy plants to a higher-value material utilisation. That does not mean that the TRANSFORM-CE demonstration plants are only using this kind of plastic waste, especially the AM-demonstration plants are also using input material that would probably not be discarded in a landfill or incinerated when not used in TRANSFORM-CE.

4.1 Rhineland-Palatinate / Germany

Germany has implemented the Waste Framework Directive of the EU. To increase recycling rates, Germany focuses on source separation of different waste flows at household and commercial level. The German Circular Economy law (German: Kreislaufwirtschaftsgesetz, KrWG) obligates to collect, process and dispose of different types of waste separately and specifically requests the separate collection of the following waste types: organic, paper, metals, plastics and glass. For C&I waste this is being reinforced by the Commercial Waste Ordinance (German: Gewerbeabfallverordnung, GewAbfV), which obligates companies to increase source separation of waste or (if not possible) sort the commingled waste flows.

The partner region for TRANSFORM-CE is the federal state of Rhineland-Palatinate with 4.3 million inhabitants on an area of 19.900 km².



Figure 3: Partner region Germany

4.1.1 Residual waste

Residual waste is supposed to contain only waste fractions that are not collected separately in another waste flow, such as hygiene products. In reality, false throws of plastic, paper and organic waste are also included. It is usually collected at the kerbside in black bins.

In Germany, companies are obligated to entrust household-like commercial waste to the public waste management authority. Thus, the residual waste in Germany also comprises household like commercial waste. Partly, this household like commercial waste is recorded in a separate waste stream.

In Rhineland Palatinate, 592 kt of residual waste and 72.5 kt of separately collected household like commercial waste were generated in 2019 (Landesamt für Umwelt 2021), all over Germany, the figure was about 13.5 Mt residual waste and 3.7 Mt of separately collected household like commercial waste (Umweltbundesamt 2021). According to the German Federal Office for Environment, (Dr. Dornbusch, et al. 2020), the residual waste consists of the following fractions:

Table 3: residual waste fractions in Germany 2018 ((Dr. Dornbusch, et al. 2020))

Waste fraction	weight per cent [%]	waste per capita [kg/(capita*a)]	total amount RLP [t]	total amount Germany [t]
waste paper	5.2	8.7	30,600	723,800
glass	4.6	7.7	27,000	640,300
metals	2.0	3.4	11,800	278,400
plastics packaging	4.0	6.7	23,500	556,800
plastics non packaging	2.7	4.5	15,900	375,900
compounds	4.3	7.2	25,300	598,600
textiles	3.5	5.9	20,600	487,200
wood/cork	1.3	2.2	7,600	181,000
organics	39.3	65.9	231,100	5,470,600
pollutants	0.5	0.8	2,900	69,600
hygiene	13.5	22.6	79,400	1,879,200
inert materials	3.9	6.5	22,900	542,900
other waste	8.9	14.9	52,300	1,238,900
fine fraction (0 - 10 mm)	6.3	10.6	37,000	877,000
total	100	167.7	588,000	13,920,000

6.7 % of the residual waste fraction is plastic, of which about 60 % is packaging waste. In total, about 40 kt of plastic waste in Rhineland-Palatinate or 930 kt of plastic waste in Germany are disposed in the residual waste and are not recycled today.

Assuming a similar composition in the separately collected household like commercial waste streams, another 5 kt of plastic waste in Rhineland-Palatinate or 220 kt of plastic waste in Germany are disposed without material recovery.

The largest share of the plastics fractions in residual waste consists of rigid packaging with 33 % and packaging films with 24 %. About 15 % are garbage bags and plastic bags.

plastics fraction in residual waste [t/a]

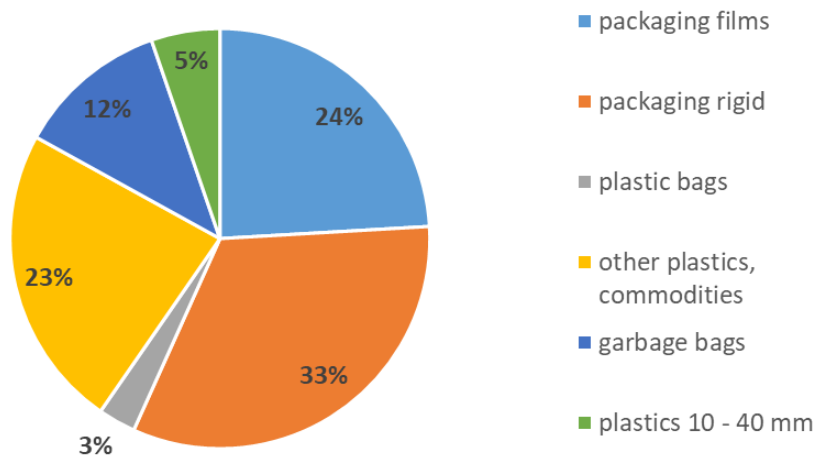


Figure 4: Plastic fractions in residual waste in Germany (Dr. Dornbusch, et al. 2020)

Sorting tests residual waste:

In Germany, a high caloric fraction is often sorted out of the residual waste and incinerated in waste-to-energy plants. This Refuse Derived Fuel (RDF) is known to contain high amounts of plastic waste. The TRANSFORM-CE sub partners of the district Rhein-Lahn-Kreis are testing further treatment options of the RDF fraction, instead of directly incinerating the waste fraction. For that, TOMRA Sorting GmbH carried out a sorting test with the RDF fraction (32 % of the original quantity of residual waste), which resulted in a mixed plastics fraction (9 % of the original quantity of residual waste) after the first step and a PE and PP fraction (5 % of the original quantity of residual waste) after a second sorting. The resulting fraction will be delivered to the Green Plastic Factory in Almere, Netherlands for IEM tests at the TRANSFORM-CE pilot plant.

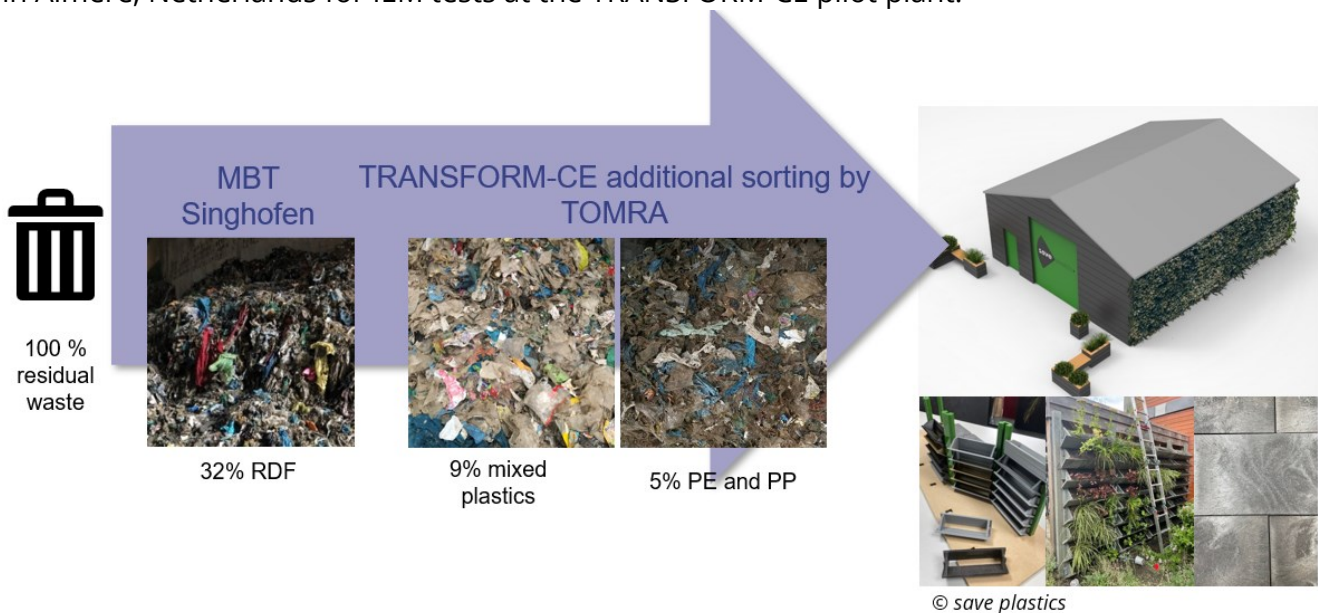


Figure 5: Sorting test RDF fraction Rhein-Lahn-Kreis

4.1.2 Packaging waste

Packaging waste made of plastic, metals and composite materials is supposed to be discarded via kerbside collection using yellow light-weight bags or alternatively in some cities yellow waste bins. The packaging waste in Germany also includes parts of Commerce and Industry (C&I) packaging waste, since the waste disposal fee is part of the licensing fee for packaging. Thus, it is economically attractive for companies to dispose their packaging waste via the packaging waste collection free of charge.

In Germany, the packaging waste contains the following fractions (ifeu - Institut für Energie- und Umweltforschung Heidelberg GmbH 2021).

Table 4: Packaging waste in RLP/Germany in 2019

Waste fraction	weight per cent [%]	waste per capita [kg/(capita*a)]	total amount RLP [t]	total amount Germany [t]
PE	3.5%	1.2	4,900	193,600
PP	7.0%	2.4	9,700	387,200
EPS	2.5%	0.9	3,500	138,300
PET	1.5%	0.5	2,100	83,000
ABS	3.5%	1.2	4,900	193,600
films LDPE	18.0%	6.1	25,000	995,800
films PP	6.0%	2.0	8,300	331,900
other plastics	8.0%	2.7	11,100	442,600
non plastic packaging product residues misthrow	50%	17.0	69,400	2,766,000
total	100%	34.0	138,900	5,532,000

About 50 % the packaging waste is made of plastic, of which 58,5 % was recycled in 2019 (Stiftung Zentrale Stelle Verpackungsregister 2020). 40 % are not recycled out of economic reasons, or because of contamination or other reasons. In total, about 29 kt of plastic packaging waste in Rhineland-Palatinate or 1.1 Mt of plastic packaging waste in Germany are disposed without material recovery.

Transport and secondary packaging are, at least in part, captioned in a separate waste stream. This waste stream consists of about 8 % plastic materials. Unfortunately, there is no specific data regarding recycling of the plastic fraction. Since this waste stream is not much contaminated, a high recycling rate can be assumed.

Table 5: Transport and secondary packaging in RLP/Germany 2019

Waste fraction	weight per cent [%]	waste per capita [kg/(capita*a)]	total amount RLP [t]	total amount Germany [t]
glass	0.1%	0.1	269	214,000
paper and cardboard	55%	37.2	151,845	2,946,100
metals	2%	1.7	6,745	48,800
plastics	8%	5.3	21,793	329,900
wood	14%	9.7	39,594	526,100
compound	0.5%	0.4	1,473	58,100
not sorted by type	19%	13.0	53,235	608,800
contaminated waste	0.2%	0.1	506	13,200
total	100%	67.4	275,460	4,745,000

In total, about 330 kt of plastic waste are captured in this waste stream in Germany in 2019.

4.1.3 Deposit return / bottles

In Germany, about 467,000 tons of PET bottles (net share PET) were disposed via the deposit return system and other disposal routes. More than 94 % of the PET bottles were recycled in 2019. The missing 6 % are due to sorting losses when disposed of in packaging waste or due to incineration when disposed of in residual waste. 38 % of the recycled PET is used for producing new PET bottles, although more than 90 % of all recycled bottles are suitable for bottle-to-bottle recycling (Gesellschaft für Verpackungsmarktforschung mbH 2020).

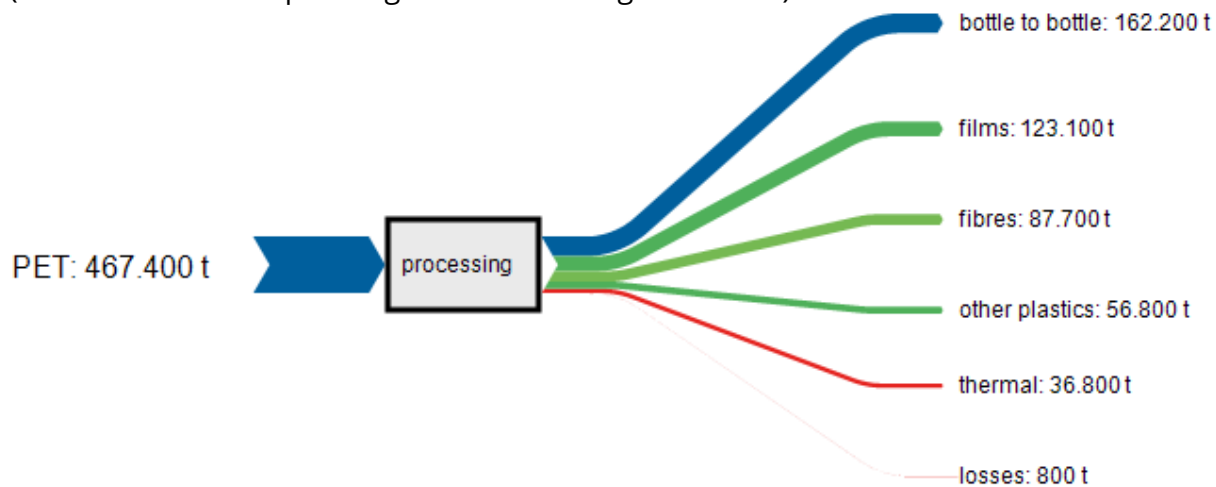


Figure 6: Recycling of PET fraction in deposit return Germany, own image

4.1.4 Summary Germany

Table 6: Overview of plastic waste in Germany

Plastic content of waste streams	Plastic content [%]	Plastic content [kg/(capita*a)]	plastic content RLP [t]	Plastic content Germany [t]	Material recycling plastic fraction [%]	Potential for pilot plants RLP [t]	Potential for pilot plants Germany [t]
residual	6,7	10,9	39.700	906.200	-	39.700	906.200
commercial residual	6,7	3,0	4.900	247.400	-	4.900	247.400
packaging	45,8	15,7	64.100	2.445.700	~ 60	25.300	963.600
secondary packaging	6,5	4,1	16.800	349.200	unknown	unknown	unknown
deposit return	~ 90	5,6	23.000	467.400	94,0	-	-
total		39,3	148.500	4.415.900		69.900	2.117.200

In total, 4.4 Mt of plastic waste were identified in Germany for the year 2018. In Rhineland-Palatinate, 149 kt of plastic waste were disposed via the mentioned waste streams, of which at least 70 kt were not intended for recycling. In Germany, more than 2.1 Mt of plastic waste were not intended for recycling and thus are available as a potential input for the TRANSFORM-CE demonstration plants.

4.2 Flevoland and Utrecht / the Netherlands

In the Netherlands, the Environmental Protection Act states that municipalities are responsible for collecting and processing household waste. As municipalities can choose their own preferred collection system for household waste, there are many different types of systems in place.

The national VANG policy (VANG is translated “from waste to resource”) sets ambitious targets for the reduction of residual waste and waste separation. To meet these targets, municipalities introduced a high service for waste separation and a low service for residual waste, accompanied by the introduction of a price incentive to separate waste.

The partner regions for TRANSFORM-CE are the province off Flevoland together with the city of Utrecht, with 1.75 million inhabitants on an area of 3,800 km².



4.2.1 Residual waste

According to the National Waste Management Plan (LAP3), residual waste (*Restafval*) is a mixture of components of household waste, that differ by nature and composition and arises after sub-flows, such as organic waste, paper / cardboard, glass, etc. are kept separate and be collected / disposed of separately.

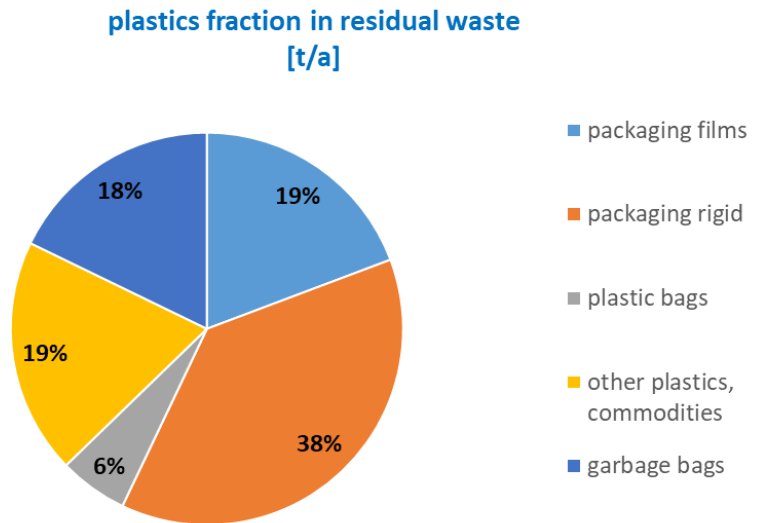
As reported by the Directorate-General for Public Works and Water Management, (Rijkswaterstaat 2021), the residual waste consists of the following fractions:

Table 7: residual waste fractions in the Netherlands, composition is three years average over 2018 - 2020 (Rijkswaterstaat 2021)

Waste fraction	weight per cent [%]	waste per capita [kg/(capita*a)]	total amount Nederland [t]
waste paper	19.0	32.4	565,800
glass	5.0	8.6	148,900
metals	3.9	6.6	116,100
plastics packaging	9.0	15.4	268,000
plastics non packaging	3.0	5.1	89,300
textiles	5.6	9.6	166,800
wood/cork	2.2	3.8	65,500
organics	31.0	52.9	923,200
hygiene	7.9	13.5	235,300
inert materials	3.5	6.0	104,200
other waste	10.0	17.1	297,800
total	100	170.8	2,978,000

About 12 % of the residual waste fraction is plastic, more than half of which is packaging waste. In total, about 36 kt of plastic waste in Flevoland and Utrecht or 357 kt of plastic waste in the Netherlands are disposed in the residual waste.

Figure 7: plastics fraction in residual waste in the Netherlands (Rijkswaterstaat 2021)



4.2.2 Packaging waste

The Netherlands have adopted the European Packaging Waste Directive. Companies that market packaged products in the Netherlands pay a tax on their packaging to the Packaging Waste Fund (Afvalfonds Verpakkingen). With these taxes, Afvalfonds Verpakkingen compensate municipalities and waste companies for the costs incurred for collecting, sorting, transport and marketing of sorted plastics.

Packaging Waste is collected in the PMD (Plastic, Metal and Drinking Cartons) waste stream. Some regions are switching to a PMD+ waste stream, in which non packaging plastic is also allowed to dispose of. The composition of the packaging waste is based on figures for the city of Almere, and extrapolated to the partner region and the Netherlands.

Table 8: Composition of packaging waste in the Netherlands 2018

Waste fraction	weight per cent [%]	waste per capita [kg/(capita*a)]	total amount Flevoland + Utrecht [t]	total amount Netherlands [t]
Alu	2%	0,5	900	8.200
Tinplate	6%	1,4	2.500	22.600
PP	5%	1,3	2.200	20.000
Films	10%	2,3	4.100	37.000
PE	3%	0,7	1.300	11.400
PET	10%	2,5	4.500	40.000
Mix plastics	20%	4,8	8.600	76.600
carton for beverage	8%	1,9	3.400	30.000
Misthrow	36%	8,8	15.600	139.300
total	100%	24,2	43.100	385.000

4.2.3 Deposit return

in the Netherlands, approx. 620 million bottles larger than 0.75 litres were sold in 2017. With a return rate of 95 %, 23,560 tons of PET were collected via the deposit return system. Since July 2021, the deposit system also includes bottles from 0.1 to 0.75 litres. Assuming a return rate of 80 % of 900 million bottles, another 18,000 tons of PET are now collected per year (Bergsma, Warringa und Schep 2017).

4.2.4 Summary Netherlands

Table 9: Overview plastic waste and recycling quotes in the Netherlands

Plastic content of waste streams	plastic content [%]	plastic content [kg/(capita*a)]	total amount Flevoland + Utrecht [t]	total amount Netherlands [t]	Material recycling plastic fraction [%]	Potential for pilot plants Netherlands [t]	Potential for pilot plants Flevoland & Utrecht [t]
residual waste	12	20,5	36.400	357.300	45	20.000	196.500
packaging waste	48	11,6	20.700	185.000	52	9.900	88.800
deposit return	100	2,4	4.200	41.600	100	-	-
total		34,5	61.300	583.900		29.900	285.300

In total, 602 kt of plastic waste were identified in the Netherlands for the year 2018. In Flevoland and Utrecht, 36 kt of plastic waste were disposed via residual waste, of which 31 kt were not intended for recycling. In the Netherlands, about 69 kt of plastic packaging waste were sorted out of the residual waste stream (Kerstens und Blanksma 2019)¹, which means that 288 kt out of 350 kt of plastic waste in the respective waste stream were not intended for recycling and thus are available as a potential input for the TRANSFORM-CE demonstration plants. With a recycling quote of 52 % for plastic packaging (Eurostat 2022), another 97,425 tons of packaging waste were not recycled in 2018. It should be mentioned, that the recycling quotes reported in the IRPC activity report 2019 are related to the quantities of plastic packaging brought into the market by the members of the EPR Scheme. For the present report, these recycling quotes have been adjusted to the captured plastic packaging waste

¹ Sorting capacity for 1.7 Mt residual waste, 9 % of this plastic packaging waste with of 40 to 50 % sorted out of the waste stream

4.3 Wallonia / Belgium

Belgium has also implemented the Waste Framework Directive of the EU.

Waste management in Belgium falls under the responsibility of three regions: Brussels Capital Region, Flanders and Wallonia, where waste management planning and statistical reporting are undertaken by three separate entities. Each region has their own waste prevention programme.

Household waste collection is performed by a series of intercommunal companies. For the collection of packaging waste, non profit associations are responsible to enforce extended producer responsibility.

The partner region for TRANSFORM-CE is Wallonia, with 3.6 million inhabitants on an area of 16.900 km².



4.3.1 Residual waste

According to the 27/06/1996 Walloon decree, residual waste is waste material that is not collected separately and would not be recycled, and thus will undergo energetic valorisation.

In Belgium, household waste collection is performed by a series of intercommunal companies. In Wallonia, 64,000 tons of plastic and all over Belgium more than 200,000 tons were disposed in the residual waste (RDC Environment SA 2019)².

4.3.2 Packaging waste

In Belgium, the non-for-profit association Fost Plus is responsible for the collection and recycling of household packaging waste in all regions. Fost Plus has a triple role of raising public awareness for efficient sorting, coordinating involved parties (municipalities, waste intercommunal companies, collection companies and sorting centres) and funding collecting, sorting and recycling activities.

Packaging waste made of plastic, metals and composite materials, kerbside collection using yellow light-weight bags or alternatively in some cities yellow waste bins

According to Fost Plus, the packaging waste in Belgium consist of the following fractions:

² 17,7 kg plastic per capita for Wallonia, extrapolated to the whole of Belgium

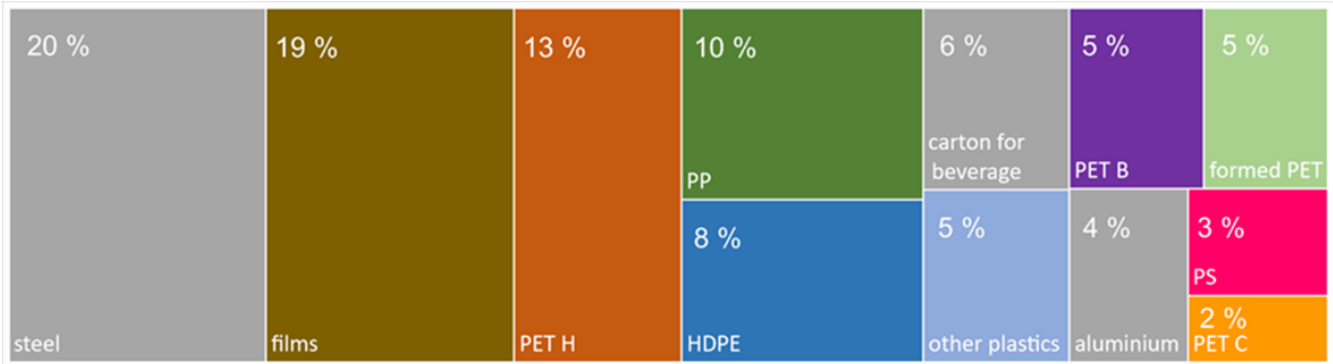


Figure 8: Fractions in packaging waste in Belgium 2019 (FostPlus 2019), image by Olivier Talon

In Belgium, about 70 % of the packaging waste is made of plastic. With 25 %, the different forms of PET³ are the biggest fraction, since today there is no deposit return system in place.

Table 10: Packaging waste in Wallonia/Belgium in 2018

Composition of packaging waste	weight per cent [%]	waste per capita [kg/(capita*a)]	total amount Wallonia [t]	total amount Belgium [t]
steel	20%	3,0	11.200	33.900
films	19%	2,8	10.700	32.200
PET H	13%	1,9	7.300	22.000
PET B	5%	0,7	2.800	8.500
PET C	2%	0,3	1.100	3.400
formed PET	5%	0,7	2.800	8.500
PP	10%	1,5	5.600	17.000
HDPE	8%	1,2	4.500	13.600
carton for beverage	6%	0,9	3.400	10.200
PS	3%	0,4	1.700	5.100
other plastics	5%	0,7	2.800	8.500
Alu	4%	0,6	2.200	6.800
total	100%	14,9	56.100	169.500

In Wallonia, every inhabitant generates 15.4 kg of packaging waste, slightly more than the average of 14.9 kg / capita for the whole of Belgium (Interregional Packaging Commission (IRPC) 2019). For commercial and industrial packaging, Valipac is the accredited organisation responsible for collection and recycling of the packaging waste. In 2019, more than 116 kt of plastic were collected via commercial and industrial plastic packaging waste (Valipac 2020), most of it plastic films (70 %).

³ PET H: uncoloured bottles; PET B: blue bottles; PET C: coloured bottles; PET T: formed packaging / trays

Table 11: Plastic fractions in commercial and industrial packaging waste in Wallonia/Belgium in 2019

Waste fraction	weight per cent [%]	waste per capita [kg/(capita*a)]	total amount Wallonia [t]	total amount Belgium [t]
plastic film	70%	6,0	15.500	68.200
rigid plastic	28%	4,0	6.200	45.800
expanded PS	2%	0,2	400	2.500
total	100%	10,2	22.100	116.500

4.3.3 Summary Belgium

Table 12: Overview plastic waste and recycling in Belgium 2019

Plastic content of waste streams	plastic content [%]	plastic content [kg/(capita*a)]	total amount Wallonia [t]	total amount Belgium [t]	Material recycling plastic fraction [%]	Potential for pilot plants [t]	Potential for pilot plants [t]
residual waste	12,8	17,7	64.500	201.400	-	64.500	201.400
packaging waste	70,0	10,4	39.300	118.600	78	8.700	26.300
packaging waste commercial		10,2	22.100	116.500	40	13.300	70.200
total		38,4	125.900	436.500		86.500	297.900

In total, 437 kt of plastic waste were identified in Belgium for the year 2018. In Wallonia, 65 kt of plastic waste disposed via residual waste, which was not intended for recycling. Given the current recycling rates (Interregional Packaging Commission (IRPC) 2019) of the two household and commercial packaging waste streams, the global potential input for TRANSFORM-CE demonstration plants could reach 87 kt for Wallonia or 298 kt for Belgium. It should be mentioned, that the recycling quotes reported in the IRPC activity report 2019 are related to the quantities of plastic packaging reported by the members of Valipac and Fost Plus. For the present report, these recycling quotes have been adjusted to the plastic packaging waste captured in the respective waste stream.

4.4 Greater Manchester / United Kingdom

In the UK, the Department for Environment Food & Rural Affairs (Defra) is responsible for setting waste and recycling policy, most of which is from the EU waste directives. Local authorities are responsible for household and business waste collection services, waste disposal, enforcing waste legislation, and encouraging good waste management in their areas. In England and Wales, 376 Waste collection authorities are charged with the collection of municipal waste.

All collection systems require residents to separate their recyclables from their residual waste and place each in a designated container (box, bin or sack) and to present the container for collection on the specified collection day.

The partner region for TRANSFORM-CE is Greater Manchester, with 2.8 million inhabitants on an area of 1.200 km².



4.4.1 Residual waste

Waste from Households (WfH) was introduced for statistical purposes by Defra in 2014. WfH includes waste from:

- Regular household collection
- Civic amenity sites
- 'Bulky waste'
- 'Other household waste'

and excludes waste from:

- Street cleaning/sweeping
- Gully emptying
- Separately collected healthcare waste
- Soil, Rubble, Plasterboard & Asbestos waste

In Greater Manchester, 660,000 tons of WfH generated in 2017, all over England, the figure was about 13.1 Mt WfH (WRAP 2019). According to the Waste and Resources Action Programme, (WRAP 2019), the residual waste consists of the following fractions:

Table 13: Household residual waste in England 2017

Waste fraction household waste	weight per cent [%]	waste per capita [kg/(capita*a)]	total amount Greater Manchester [t]	total amount England [t]
Food Waste	29,3%	68,8	193.500	3.852.100
Garden & other organix	8,1%	19,0	53.600	1.066.353
Paper & Card	12,6%	29,6	83.300	1.656.896
Glass	2,9%	6,9	19.300	384.066
Metals	3,0%	7,1	19.900	396.368
Dense Plastic	7,3%	17,0	47.900	952.631
Plastic Films	5,7%	13,4	37.800	752.317
Textiles	7,6%	17,7	49.900	992.597
WEEE	1,2%	2,8	8.000	159.219
Hazardous	0,5%	1,2	3.500	69.056
Wood	1,4%	3,4	9.500	188.487
Misc	20,3%	47,6	134.000	2.666.737
total	100,0%	234,7	660.200	13.136.827

About 7.3 % of the residual waste fraction consists of dense, plastic, another 5.7% consist of plastic films. In total, about 86 kt tons of plastic waste in Greater Manchester or 1.7 Mt of plastic waste in England are disposed in the residual waste.

The largest share of the plastics fraction in residual waste consists of packaging film with 25 % and other dense plastic non packaging with 22 %. Bottles make up about 10 % of the plastic waste.

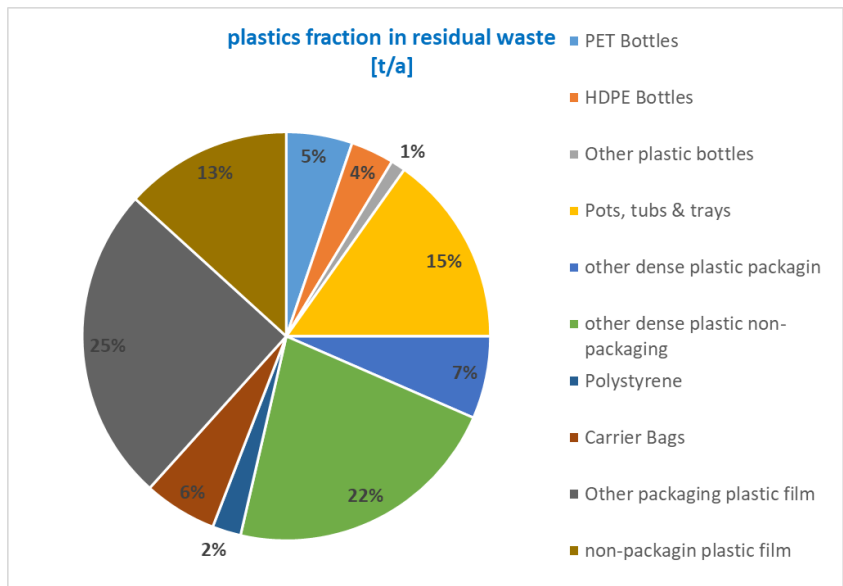


Figure 9: Plastic fractions in household residual waste in England

4.4.2 Commercial residual waste

Commercial and Industrial residual waste, mainly manufacturing and service industries, most of it collected by local authorities.

In Greater Manchester, 600 kt of commercial municipal waste were generated in 2017, all over England, the figure was about 11.9 Mt (WRAP, 2019). According to the Waste and Resources Action Programme, (WRAP, 2019), the residual waste consists of the following fractions:

Table 14: Commercial municipal residual waste England 2017

Waste fraction commercial municipal residual waste	weight per cent [%]	waste per capita [kg/(capita*a)]	total amount Greater Manchester [t]	total amount England [t]
Food Waste	24,5	52,3	147.100	2.928.375
Garden & other organix	1,6	3,5	9.700	193.961
Paper & Card	30,4	64,8	182.300	3.628.256
Glass	2,3	4,9	13.700	272.420
Metals	4,1	8,7	24.400	485.353
Dense Plastic	8,5	18,1	50.900	1.012.689
Plastic Films	10,9	23,2	65.400	1.300.873
Textiles	3,2	6,8	19.100	379.767
WEEE	0,9	1,9	5.500	108.796
Hazardous	0,4	0,8	2.400	47.346
Wood	3,2	6,9	19.500	388.038
Misc	10,0	21,4	60.200	1.199.109
total	100	213,4	600.200	11.944.983

About 8.5 % of the commercial residual waste fraction consist of dense, plastic, another 10.9 % consist of plastic films. In total, about 116 kt of plastic waste in Greater Manchester or 2.3 Mt of plastic waste in England are disposed in the commercial residual waste.

The largest share of the plastics fraction in residual waste consists of packaging film with 37 % and non packaging plastic film with 16 %.

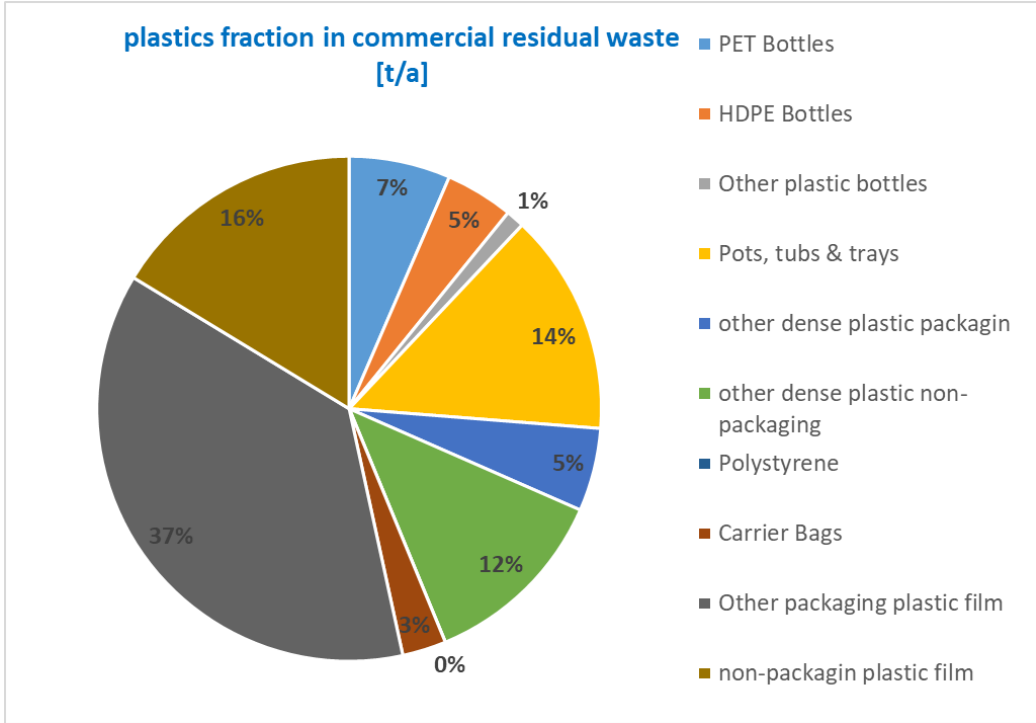


Figure 10: Plastic fractions in commercial residual waste in England

4.4.3 Commercial plastic waste

Another 2,284,353 tons of commercial plastic waste were separately collected for recycling purposes in 2017 in England (WRAP 2019). (

4.5 Summary England

Table 15: Overview plastic waste in England

Waste stream	weight per cent [%]	waste per capita [kg/(capita*a)]	total amount Greater Manchester [t]	total amount England [t]	Material recycling [%]	Potential for pilot plants [t]	Potential for pilot plants [t]
household waste	13.0	30.5	85,665	1,704,948	20.5	68,123	1,355,816
commercial waste	19.4	41.3	116,245	2,313,562	16.6	96,959	1,929,731
seperately collected commercial plastic waste	100.0	20.6		2,284,353	100.0	-	-
total		92.4	201,910	6,302,863		165,082	3,285,547

In total, 6.3 Mt of plastic waste were identified in England for the year 2017. About 2.3 Mt of which were commercial plastic waste, separately collected for recycling. In Greater Manchester, 201,910 tons of plastic waste were disposed via residual waste, of which more than 165,000 tons were not intended for recycling. For England, more than 4 Mt of plastic waste were disposed via residual waste in 2017, of which about 3.2 Mt were not intended for recycling and thus are available as a potential input for the TRANSFORM-CE demonstration plants⁴.

⁴ Recycling quotes according to (WRAP 2019)

5. Summary and Outlook

In total, more than 9.4 Mt (cf. Table 16)of plastic waste were identified in the respective waste streams, of which almost 6 Mt (c.f. Table 17) are not intended for landfill and incineration.

Table 16: National plastic waste streams

national plastic waste streams					
[kt/a]					
Waste stream	Germany	Netherlands	Belgium	UK	total
residual	906	357	201	1.705	3.170
commercial residual	247			2.314	2.561
packaging	2.446	185	119		2.749
packaging commercial	349		117		466
deposit return	467	42			509
total	4.416	584	437	4.019	9.455

Table 17: Plastic waste available for pilot plants

national plastic waste available for pilot plants					
[kt/a]					
Waste stream	Germany	Netherlands	Belgium	England	total
residual	906	197	201	1.356	2.660
commercial residual	247			1.930	2.177
packaging	964	89	26		1.079
packaging commercial	unknown		70		70
deposit return	-	-			-
total	2.117	285	298	3.286	5.986

In a following report, scenarios will be developed to predict future plastic waste occurrence in the respective waste streams throughout the TRANSFORM-CE partner countries.

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About the project

The problems associated with plastic waste and in particular its adverse impacts on the environment are gaining importance and attention in politics, economics, science and the media. Although plastic is widely used and millions of plastic products are manufactured each year, only 30% of total plastic waste is collected for recycling. Since demand for plastic is expected to increase in the coming years, whilst resources are further depleted, it is important to utilise plastic waste in a resourceful way.

TRANSFORM-CE aims to convert single-use plastic waste into valuable new products. The project intends to divert an estimated 2,580 tonnes of plastic between 2020 and 2023. Two innovative technologies – intrusion-extrusion moulding (IEM) and additive manufacturing (AM) – will be used to turn plastic waste into recycled feedstock and new products. To support this, an R&D Centre (UK) and Prototyping Unit (BE) have been set up to develop and scale the production of recycled filaments for AM, whilst an Intrusion-Extrusion Moulding Facility, the Green Plastic Factory, has been established in the NL to expand the range of products manufactured using IEM.

Moreover, the project will help to increase the adoption of technology and uptake of recycled feedstock by businesses. This will be promoted through research into the current and future supply of single-use plastic waste from municipal sources, technical information on the materials and recycling processes, and circular business models. In-depth support will also be provided to a range of businesses across North-West Europe, whilst the insights generated through TRANSFORM-CE will be consolidated into an EU Plastic Circular Economy Roadmap to provide wider businesses with the 'know-how' necessary to replicate and up-scale the developed solutions.

Lead partner organisation

Manchester Metropolitan University

Partner organisations

Materia Nova

Social Environmental and Economic Solutions (SOENECS)
Ltd

Gemeente Almere

Save Plastics

Technische Universiteit Delft

Hogeschool Utrecht

Hochschule Trier Umwelt-Campus Birkenfeld Institut für
angewandtes Stoffstrommanagement (IfaS)

bCircular GmbH

Countries

UK | BE | NL | DE

Timeline

2019-2023