Waste flow and scenario analysis of circular economy solutions and potentials in France and England

Project title: **BLUEPRINT for a Circular Economy**

Project acronym: **BLUEPRINT**

Starting date of project: **April 2020**

Duration: **38 Months**

Funding scheme: **INTERREG France Channel Manche England**

Organisation name of lead contractor for this deliverable: ECO

Version 1	Due date	31/10/2021
	Submission date	08/04/2021
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Dissemination Level

PU	Public	X
CO	Confidential, only for members of the consortium (incl. Channel Services)	

Document history

History			
Version	**Date**	**Author**	**Comment**
0.1	29/04/2021	Rembrandt Koppelaar (ECO), Jessica Clifton (ECO)	Workshops results drafted (now appendix A)
1	29/09/2021	Rembrandt Koppelaar (ECO), Diya Salhab (ECO),	TOC drafted of final report with initial inputs
2	15/10/2021	Rembrandt Koppelaar (ECO), Diya Salhab (ECO)	Draft report of chapter 1 and 2, section 3.1 and the Annexes
3	28/10/2021	Rembrandt Koppelaar (ECO), Diya Salhab (ECO), Natalie Monteiro (ECO)	Improved draft report of chapters 1,2 and 3.
4	03/02/2022	Rembrandt Koppelaar (ECO), Diya Salhab (ECO), Natalie Monteiro (ECO)	2nd draft version of report with all chapters incl. chapter 4 conclusions, executive summary
5	23/02/2022	Rembrandt Koppelaar (ECO), Diya Salhab (ECO), Natalie Monteiro (ECO)	3rd draft version of report with quality improvements & copy-editing
6	31/03/2022	Review carried out by ECC (Hannah-Ramsey Smith, Rosalyn Murphy) and BHCC (Lauren Stabler)	Review before final version
7	08/04/2022	Rembrandt Koppelaar (ECO), Diya Salhab (ECO), Natalie Monteiro (ECO)	Final version for submission

Executive Summary

The BLUEPRINT to a Circular Economy Project is an Interreg-funded project with a total budget of €5.5M, of which €3.8M were contributed by the European Regional Development Fund. Led by Essex County Council, it will help local authorities in France and England to implement a circular economy. Working with local authorities, social enterprises, schools and households, the project will unlock circular economy growth opportunities within the France (Channel) England (FCE) region.

Works carried out: This report provides an overview of activities carried out to build an online library of circular economy solutions that cover activities already underway in the FCE area- France and England, in the shift to a circular economy. The efforts are made to link these activities to potential impacts on waste flows and job creations.

The works carried out from March 2021 to March 2022 led to the following results:

- The development of a mapping approach for circular economy solutions to circularise a range of waste flows, including how to conduct the systematic search for solutions.
- A systematic evaluation of textiles & clothing, packaging, food & garden waste, construction materials, furniture, large & small appliances solutions. Resulting in a mapping of 150 circular economy solutions across the areas of redesign, waste prevention or reduction, reuse or repurpose, repair, recycling and remanufacturing.
- The launch of the online circular economy solutions library on the BLUEPRINT Project website with information about the 150 mapped solutions.
- An assessment of the total waste flows in tonnes in the French and English FCE area across the six product/material streams mentioned above, in terms of current recycling and disposal flows.
- Creation of low-medium-high circular economy scenarios across six circular economy strategies for the six product/material streams, and an assessment on how this can improve the waste flows in terms of reduction and recycling tonnages.
- An assessment on the job creation potential from the advancement of circular economy strategies including reuse, reduce, refill, repair, remanufacturing and recycling.

Key quantitative circular economy waste flows and jobs impact results

- In the French and English FCE areas currently 13.7 and 8.8 million tonnes of waste are generated across the six material/product streams (textiles & clothing; packaging; food & garden waste; construction & demolition waste; furniture; large and small appliances). Out of these 40% and 38% or 5.5 and 3.4 million tonnes are disposed of via landfill or energy from waste incineration in the respective French and English FCE areas including construction materials. If excluding construction materials, the percentage disposed grows to 52% and 51% respectively for the combined 5 product/material streams.

- The circular economy can result in a maximum foreseeable prevention of 3.3 million and 2.5 million tonnes of waste in the French and English FCE area. Primarily as a result of reduce, reuse, repair and refill efforts. The **total amount of waste arisings that go to landfill and incineration for the six material/product streams can be reduced by 34% and 46% in the French and English FCE areas** from concerted circular economy efforts.

- The resulting employment impacts are 14,600 to 42,500 jobs for the English FCE area, and 29,000 to 90,400 jobs for the French FCE area. The range depends on the level of circular economy ambition as set out in the scenarios. The jobs creation impact is substantial when compared against overall jobs in the waste management sector, estimated at 37,200 in the

English FCE area and 9,716 in the French FCE area.[1] Thereby circular economy efforts can **more than double and triple the current number of jobs** in the waste and resources sector in the English and French FCE area, respectively.

Navigation of the report: The report describes the works carried out across six chapters:

- **Chapter 1** provides the context of the works carried out. This includes information about the BLUEPRINT Project and where the waste flow and activity analysis of circular economy solutions fits in. How the interventions needed to achieve a circular economy can be systematically categorised from a product life cycle perspective. And why the mapping of circular economy solutions is relevant from a local authority perspective.
- **Chapter 2** of this report describes the main mapping methodology. How the task was initiated; what approach was taken to identify the solutions; what solutions that have been found; and the progress and current state of the library of circular economy solutions.
- **Chapter 3** of this report provides a series of analyses to gather insights about the transition to the circular economy. First, by looking at the gaps in terms of activities deployed to reach a circular economy based on what type of circular economy solutions are prominent and less prominent or fully absent. The assessment was carried out for both France and England. Second, by looking at the waste flows linked to the established circular economy opportunities, the impact they have, and the possibilities of scaling and operationalising the solutions in local authorities.
- **Chapter 4** describes the methodological approach to develop the circular economy scenarios. It describes what scenarios are; how the scenarios have been generated; and describes the scenario results for each of the six product/material streams that have been evaluated.
- **Chapter 5** provides the combined scenario results for all the six product/material streams together for the French and the English FCE area. This includes the estimated impacts of the low-medium-high ambition scenarios on waste reduction and recycling, and the overall impacts on generated jobs.
- **Chapter 6** describes the main conclusions and next steps for research and the BLUEPRINT Project in this area.

In addition to these chapters there are three Annexes. In Annex A an overview is provided of the results of two workshops with all the BLUEPRINT Project partners that informed the overall methodology developed as described in chapter 2. In Annex B, the listing of circular economy solutions is provided from the systematic analysis and in Annex C an overview of jobs created per 1000 tonnes of product/material waste streams.

[1] The 37,200 jobs figure for England and 9,716 jobs figure for France are based on the Eurostat database from the same dataset with apportionment based on the populations in the Channel Manche French and England areas. The large difference between both numbers are due to differences in the statistical accounting approaches used by the government institutes that provide the data to Eurostat.

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1. Introduction

1.1. What is the BLUEPRINT Project?

The BLUEPRINT to a Circular Economy Project is an Interreg-funded project with a total budget of €5.5M, of which the European Regional Development Fund contributed €3.8M. Led by Essex County Council it will help local authorities move to a circular economy. Working with local authorities, social enterprises, schools and households, the project will unlock circular economy growth opportunities within the France (Channel) England region covering Southern England and Northern France. The project is creating a:

1. new BLUEPRINT Model to enable local authorities to initiate policies, strategies and approaches to transition to a circular economy;
2. local authority management, monitoring and evaluation framework to evaluate performance based around the BLUEPRINT Model;
3. cross-border network of local authorities who complete the BLUEPRINT training programme;
4. social enterprise training scheme to help people to secure jobs in the circular economy sector;
5. online accelerator cluster for social innovation, helping to accelerate the rollout of the social enterprise training scheme;
6. series of behaviour change campaigns (SHIFT pilots), which will encourage 78,000 individuals to increase their recycling rates and reduce waste.

The purpose of the works carried out, as described in this report, is to provide a comprehensive overview of solutions available to shift to a circular economy. These solutions cover the circular economy strategies identified in the next section 1.2. The evaluation was carried out primarily for activities present in England and France in general, and specifically also in the FCE Interreg programme area. This is the coastal area covering South-West, South and South-East England, and Northern France (see Figure 1). The result is a systematic identification of existing circular economy opportunities. The report also provides a macro-level perspective on what circular economy can do in terms of materials and jobs creation for the Channel region. To this end scenarios are made on the aggregate impacts across circular economy strategies on waste flows and jobs.

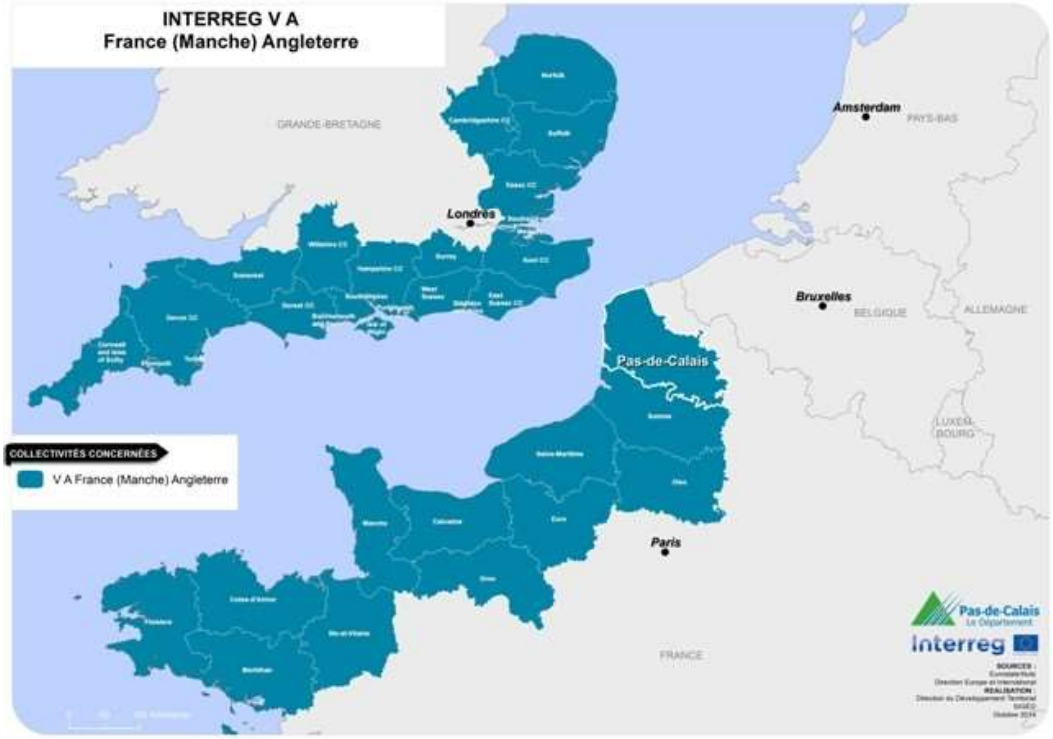

Figure 1. Geographic map of the FCE Interreg area.

The works included two final goals. First, as part of the circular economy solution mapping activity to provide a publicly available source of information: the online Library of circular economy solutions that is made available on the BLUEPRINT Project website. This library is accessible to all and made available in English and French languages. Second, to provide a novel overview of what impacts the circular economy can make in the FCE area, transforming the flows of textiles & clothing, packaging, food & garden waste, construction materials, furniture, large & small appliances. The resulting scenarios provide both, a baseline of the current circularity (or lack thereof) and a perspective on what can potentially be achieved based on concerted efforts from local authorities and other organisations by implementing circular economy solutions.

The report in Chapter 2 describes the identification process of the approaches, from here on referred to as circular economy solutions based on particular strategies. Chapter 2 covers an assessment of which solutions are prominent, less prominent and why, to create an understanding for local authorities of activities that are already happening, and those that are missing. In Chapter 4 a unique quantification is made about the employment's impacts and waste flows of circular economy strategies. Finally, conclusions and potential next steps to refine the research are described in Chapter 5.

1.2. What are circular economy strategies?

The circular economy requires keeping products and materials in use for as long as possible. In contrast, our current economy dominated by single use or short lifespan use products. The take-make-dispose economy that we now live in is heavily reliant on processes that strongly limit material loops due to use of landfilling or energy from waste.

To make the economic shift to a circular economy model interventions are needed at every stage of a product lifecycle to change processes or alter behaviours towards product longevity and circular material loops. Such strategies to achieve a circular economy can work at various levels, such as changing the materials that go into a product, the type of components that a manufacturer chooses, consumer behaviour on how the product is used, and end-of-use or end-of-life opportunities. One systematic approach by which the strategies are captured is the 10R-strategy (Cramer 2018) that identifies different circular economy interventions.

In the context of BLUEPRINT eight different strategies were selected for inclusion in the waste flow and activities assessment of circular economy solutions (Table 1). Each solution can be categorised under one strategy, or in rare cases two strategies. Note that the definitions are identified for products and their materials - yet could be equally adapted to other areas of life, such as spaces with multiple products or the buildings that consist of components.

Table 1. Circular economy Strategies used in the waste flow and activity analysis.

Strategy	**Definition**
Redesign	Changing the way the product is made so that it is designed to support or unlock other circular economy strategies, such as reduction (e.g. light weighting), repair and reuse (e.g. improving the ease of disassembly)
Reduce or prevent	Elimination of the need for the product whilst maintaining the quality of the societal services in which the product is used, such as removing the need for product packaging.
Reuse or repurpose	Continued usage of a product by a citizen or company which for a range of reasons is no longer desired to be used by another company or citizen, yet still in a good condition to either be used with its original function or for a new purpose.
Repair	Repair and maintenance of a defective product so that it can continue to be used in its original function.
Refill	Reuse of the container of a product that contains a liquid or solid by collection, cleaning (if applicable) and refilling of the liquid or solid for multiple use cycles.
Recycle	Processing of the many materials in a product to obtain new separated material streams (secondary raw materials). Ideally with very low contaminations to enable closed loop recycling (e.g. from product to recycling to the same new product) or with acceptable contamination to enable open loop recycling (from product to recycling to a different product).
Remanufacture	Recovery and usage of parts in a product at the end of its life in a new product with the same function.

The aim of pursuing interventions across the product life cycle, in the form of circular economy strategies, is to reduce the need for virgin mined or extracted materials. Minimising any waste during the production or consumption of goods, as well as extending the life of products[1]. Since the circular economy includes product life cycle interventions, a circular economy strategy will affect one or more stages of the product lifecycle. The life cycle stages that are impacted are described in table 2 in relation to each of the circular economy strategies.

Table 2. Product life cycle stages at which Circular economy Strategies have an impact

Strategy	Product Life cycle stage	Phase description
Redesign	Acquisition/ Purchase	Affects multiple phases, from the phase where the product is being sold or being bought due to a change in product qualities or composition, to reuse or repurpose due to modularity, or enhanced repair due to easier disassembly.
Reduce or prevent	Use to end-of-use	Affects the usage phase in which the product is being used by reducing the need for the product or associated products (such as packaging).
Reuse or repurpose	Use to end-of-use	Impacts the phase in which the product switches users/ownership to gain a 2nd, 3rd, 4th life from one. For example, a clothing rental model where it goes from one use to another use.
Repair	Use to end-of-use	Changes the phase in which the product is repaired either for continued use or repaired to be resold (e.g. prior to reuse) For example, a social repair organisation which collects and repairs products, or a repair café.
Refill	Collection	Alters the phase in which a product is collected - either by the local authority, a waste management company, or a producer responsibility organisation on behalf of the original producers – as it is redirected to a refill process instead of being disposed of. For example, a bulk collection service by the local authority that includes a screening for the quality status of the product to see if it is re-usable for refill purposes.
Replace or substitute	End-of-life	Impacts the point at which the product is collected. With material replacement/substitution it will be possible to pursue other strategies, such as sending it for repair or for recycling.
Recycle	End-of-life	Impacts the point at which the product is collected. It will be possible to recover materials in the product into secondary raw materials, instead of directing it to landfill or energy from waste incineration processes.
Remanufacture	Collection Manufacturing	Alters the phase at which the product is collected or recycled by enabling redirection of the product itself or disassembled parts to a manufacturing facility, as well as the manufacturing product life cycle stage itself.

1.3. What are circular economy solutions for local authorities?

Local authorities have a central role in making the switch to a circular economy. Both from their existing duty to manage municipal waste flows in a region, city or local economy, to the duty to protect the interests of their citizens. In the FCE region of Northern France and Southern England, waste management varies greatly between different local areas to best fit the resources and needs of the region.

In England, each local authority is in charge of municipal waste collection for the residents in their territory. The collection services run either in-house or via a contract with a private company, often including a portion of business and commercial waste. To recycle as much of the waste as possible and dispose of the waste in incineration or landfilling, multiple local authorities work together in a region. To this end in England there are over 70 waste partnerships, county councils, or waste disposal authorities. At both, the collection and waste recycling/disposal levels, local authorities are in charge of reuse and waste prevention programmes. The collection and management of all other waste including construction, most commercial & industrial waste, and hazardous waste are carried out by companies.

In France, regional authorities (departments) are in charge of planning for construction waste management, and regions for household and dangerous waste. Municipalities or intermunicipal cooperation establishments (établissements publics de coopération intercommunale) are in charge of collecting, recycling, incineration and landfilling of household waste, as well as creating reuse and waste prevention programmes for household waste.[2] Local authorities in France are increasingly incentivised by the French government agency for the ecological transition ADEME. The latest official support for the circular economy is the ''Programme Territoire engage transition ecologique - volet Économie Circulaire'' from ADEME. Since 2020 local authorities can undergo a diagnosis and accreditation process to receive an official local authority circular economy label under this programme.

In general, local authorities can benefit from a circular economy as it offers new revenue streams for local businesses, job growth opportunities, and a more sustainable way to manage waste by reducing imports and enabling local resource loops. It is estimated that by adopting a circular economy, half a million jobs in Great Britain could be created by 2030.[3] Similarly, in France, it is estimated that 300,000 jobs could be created by adopting a set of policies in transitioning to a circular economy.[4]

The first output of the activity is the library of circular economy solutions. It will be relevant for local authorities to gain inspiration, to replicate solutions which are successful elsewhere, or facilitate companies that deploy new solutions in their journey to a circular economy. It provides a detailed overview of what is already happening on the ground in England and France for a wide range of product/material streams. Note that these solutions are not usually widespread, and they are often only implemented in one or only a few local authorities.

The solution sheet is in a sense an entry point for more information. Each solution in the library includes a link to the solution provider's website, so that local authorities can contact the solution owners. It also includes a starting point to replicate the solutions. A recycling, waste prevention or circular economy officer in a local authority can, with this resource, quickly learn about relevant initiatives. Useful for internal evaluation to see if the solution can be replicated or attracted within the territory. The solutions can be screened via the library for discussions within the local authority team and for cross local authority learning. The screening can then result in the next step such as starting a procurement process, to replicate the solution as part of an internal local authority activity, or in a facilitatory role with local businesses or communities through meetings, workshops, or via providing SME circular economy funding, or other forms of engagement.

The second output of the activity are the scenarios made for six different material streams is relevant for local authorities to envision what a circular economy would look like. These scenarios go beyond business-as-usual strategies that include only recycling and also look at the seven other circular economy strategies (Table 1). The impacts of these strategies are identified in terms of waste prevention, improved cycling via reuse, refill, repair and thus longer lifespan, and recycling. Thereby presenting routes for replication and scaling of the opportunities in both countries, and the FCE area in particular, to stimulate sustainable and inclusive local economic growth and jobs. They provide a starting point for discussion on what is possible within a strategic context, especially for areas of waste

prevention, reuse and repair where councils already have deployed some activities and where they have direct influence.

2. Methodology for circular economy solutions

2.1. How the mapping effort was carried out

The agreed approach for the circular economy solutions library taken by the project partners has deliberately been kept broad in terms of solutions. Covering interventions carried out by businesses and other organisations that can be either technologies, training, or behavioural campaigns that use one or more circular economy strategy. This is because the circular economy as described in section 1.2. affects every single step in the life cycle of a product, and thereby nearly all aspects of organisation's and individuals' economic activity. Equally a broad approach was selected in terms of product/material streams.

The mapping effort started with two sequential workshops in April 2021. The detailed results of the survey workshop are described in Annex A for the 7 questions asked in the workshops, with a synthesis provided in this section. In the workshops partners discussed and set the goals for this task and decided upon the scope of the circular economy solutions mapping work. It was decided that the aim was to map and make available more than 150 solutions during the course of the project. And to digitise them on the BLUEPRINT website in the format of a searchable library of solutions for widespread uptake of the information. It was also decided that for accessibility the information about each solution should not be longer than one page of information. This so that the library can be used for rapid evaluations by local authority waste, recycling or circular economy officers.

The workshop covered: a scan of what circular economy solutions are; what material flows are relevant to cover from a local authority perspective; what circular economy strategies to look at, what information should be captured in a one-page quick scan format; what visualisations could be helpful to convey information; and first ideas on what information is needed to operationalise/implement a circular economy solution.

The result of the workshop led to decisions on what product/material streams the solutions should cover based on a scoring process including: food and garden waste, textile and clothing, packaging, construction materials, furniture, and small to large electric appliances. It was agreed that bathroom, cosmetic, cleaning, small household items, and tools should be excluded. These product/material streams were chosen based on what councils and project partners saw as more important to address.

The workshop also led to decisions on the scope of solutions to: cover technological solutions, behavioural solutions, and training solutions; focus on solutions that are already in place and have been piloted, demonstrated or scaled as opposed to solutions that are in the conceptual or laboratory or pre-deployment phase; include information on the scale at which the solutions are currently operating; and include information on the product life cycle phase in which they operate.

Based on the information from the workshops (see section A.5) a template that contained the information to capture in a one-page quick-scan of circular economy solutions was designed (Table 3). The template was specifically reviewed by the local authority partners before its use in carrying out the solution scanning. This also allowed to identify circular economy strategies as described in section 1.2.

It was then agreed to follow an evaluation to map out the opportunities in England & France. This translated into deciding on two stages of mapping solutions: the first is an inventory of solutions in a spreadsheet, and the second is a one-page quick scan template as per above to collect the information for the solution. The filled in template is then used to digitalise the solutions and put them live on the website.

For the first step, a spreadsheet shown in Figure 2 that would present quick-scans of the solutions was created. These quick-scans present an overview of the solution, and each BLUEPRINT team member filled in the information of the solutions they identified.

Figure 2. Screenshot of a the quick-scan spreadsheet with the solutions listing

To allocate work amongst all the partners, each member focuses on a speciality area, leading to the following division of works:

- **ESITC**: construction sector solutions
- **PECT**: textile solutions
- **UniLaSalle**: food and garden and organic waste
- **EcoWise**: everything else including complementary construction sector, textile and food and garden solutions.

The three local authority partners were also asked to provide information on solutions within their geographies, with specific attention to:

- **ECC**: Households and schools
- **KCC**: Local authority mapping of KCC existing efforts
- **B&HCC**: Construction sector, behaviour change, waste prevention, reuse and recycling

In addition, B&HCC carried out a dedicated effort to identify many circular economy solutions that are being undertaken within their area. The list of B&HCC solutions is provided in Annex D. These were specially sent through and screened by the council.

After the identification of solutions in the spreadsheet (Figure 2) a collective effort to identify solutions and collect the relevant information was carried out using the one-page template (Figure 4). The partners that worked on this effort included ESITC collecting the information for 4 solutions, PECT 24 solutions, UniLaSalle 11 solutions, ECC 4 solutions, and EcoWise 107 solutions. To keep track of which material stream had more or less solutions, and which circular economy strategy was more or less common amongst the solutions, the following overview table was also created and regularly updated (Figure 3):

Total		Reuse or repurpose	Repair	Redesign	Remanufacture	Refill	Recycle	Reduce or prevent
30	Textiles/clothing	17	6	1	0	0	3	3
39	Packaging	9	0	0	1	16	10	3
28	Food and garden	6	0	3	0	0	6	13
15	Construction Materi	12	0	1	0	0	2	0
19	Furniture	10	4	1	3	0	1	0
15	Large and small appl	5	6	0	0	0	4	0
	Total	59	16	6	4	16	26	19

Figure 3. Count of the solution's based on circular economy strategies and material type

For the second step, the one-page template was filled to standardize the digitalisation of the solutions on the BLUEPRINT website (see Figure 4 for a filled in example). The section "What's involved" closely aligns with the purpose of helping councils operationalise the solutions as well as the job opportunities that could arise from implementing the solution. The section gives a quick overview of the resources, technology (such as machinery or digital tools), and people needed to run the solution, as well as the steps to follow for implementation. The approach in filling in the solution was to follow what public information is available, and to tag where there is missing information.

As a final step the one-page template is translated into the website format of the solution (see Figure 5 and the following link). For the images listed on the website, permission to use the picture is asked from the solution provider, and any picture that contains people will have had a consent form signed for. Any

solution that has not received permission to use the photo from the owner will have stock images used instead so as to maintain the visual aspect of each solution.

The end result is as envisioned, all the solutions on the website will be available in French and English and can be filtered by solution type (including Recycle, Refill, Remanufacture, Reduce/Prevent, Repair, Reuse/Repurpose) and by location.

Table 3. One-page template for circular economy solution quick-scan

Name of solution:	
Description of solution **Practical example(s) where it has been implemented with location(s)**	
Pictures	
Targeted product/material	**Scale of solution******
Circular economy strategy *	**Potential circular economy impact**
What makes this solution special?	
Involved actors in setting up and running the solution	
Behavioural change targeted with the solution	
Resources needed	**Implementation effort**
Technology needed ***	**Availability / access to solution**
Weblink: **Contact information:**	

*Categories can include reduce, redesign, reuse, repair, refill, refurbishment, remanufacturing, recycling.

***Describe if the solution requires special machinery or equipment

****Describe an estimate if it is a physical space of the footfall of people frequenting the location, if it is a resident oriented solution the number of residents, or if it is a technology / product solution the minimum tonnage of material or units of product needed to implement the solution (like 1 tonne per year, 10 tonnes, 100 tonnes, 1000 tonnes, 10000 tonnes etc., or 100 units, 1000 units, 10000 units of products per year).

Name of the solution: Les Biens en Commun

Solution: Library of things for flats	**Owner: Les Biens en Commun**	**Circular Economy Strategy: Reuse of appliances**
10-20 word summary:	A mini library of things for small electrical appliances.	
Description:	A mini library of things operating from lockers installed at the entrance of a flat block. Residents can rent small electrical appliances at a low cost for a set period of time. The service also includes the maintenance, repair and addition/removal of appliances according to demand. Users register on an online portal, reserve an item and collect it using a QR code. The lockers have a digital interface that allows for collection and return.	
Location:	The project is currently being piloted in student accommodation in Lyon, France. The organisers will look to roll this out to other flats and their residents	
Scale:	There is currently one locker with 23 compartments of different sizes.The project aims to serve 25 residences — not limited to student housing — by the end of 2022.	
Potential Circular Economy Impact: *Can include why this solution is special + any behavioural change that is targeted*	This solution enables residents to access typically expensive appliances at a low cost. Sharing items also removes the need to buy new appliances, thereby reducing the footprint of the building and its residents. The scheme also includes repair and maintenance, ensuring items are not thrown away if they break.	
Pictures		
		
What's involved?		
People:	Installation crew; software engineers; maintenance and repair people.	
Resources:	Smart locker; electrical appliances to rent; space in the flat blog.	
Technology:	Smart locker; user interface; software layers	
Implementation:	15 days for smart locker evaluation, procurement and installation; eight days for troubleshooting maintenance and repair; five days to evaluate effectiveness; 50 days to integrate software layers.	
More information (website):	Les Biens en Commun Website	

Figure 4. Screenshot of a filled one-page template for the Library of Circular economy Solutions

Figure 5. Example of a circular economy solution in the library on the BLUEPRINT website

2.2. Summary of coverage of circular economy solutions

The list of circular economy solutions has reached 150 solutions (see Annex B). From those solutions, a majority are related to packaging, textile, and food and garden-related waste. The repartition of solutions across material/product stream is as follow:

- 39 solutions target packaging-related waste
- 30 solutions target textile-related waste
- 29 solutions target garden and food-related waste
- 20 solutions target furniture-related waste
- 15 solutions target construction-related waste
- 15 solutions target large and small appliances- related waste
- 2 solutions target “other” waste such as household waste and plastic from toys

In terms of circular economy strategy, the list of solutions contain (including “other” solutions):

- 60 solutions that use reuse or repurpose strategies
- 28 solutions that use recycle strategies
- 16 solutions that use repair strategies
- 16 solutions that use refill strategies
- 20 solutions that use reduce or prevent strategies
- 6 solutions that use redesign strategies
- 4 solutions that use remanufacture strategies

The solutions were also classified by their nature. Behavioural solutions raise awareness and provides tools or material to encourage citizens to change their behaviour towards a certain type of waste/wasteful activity. Technology-based solutions use technical tools, software, or machinery to repair, recycle, reuse, remanufacture, or redesign a certain type of waste. Training-based solutions are training, workshops, classes, or certifications taught concerning a certain type of waste. The quick-scans cover the following:

- 79 technology-based solutions
- 66 awareness & behaviour change-based solutions
- 4 training-based solutions
- 1 technology & behaviour change-based solution

Between France, the United Kingdom and the rest of the world, the solutions were distributed in the following way:

- 85 solutions take place in England
- 55 solutions take place in France
- 1 solution takes place both in France and England
- 8 solutions take place in other countries

It is important to note that, while most solution in England and France have been invented in the respective countries, a minority of the solutions were created in other countries and applied in France and England. Some of the solutions are also available via online website, yet not necessarily limited to a UK or France-based audience. However, these solutions given their origin in England or France would still be counted respectively.

2.3. Final output: library of circular economy solutions

At the time of writing of the report around 60 solutions are live on the BLUEPRINT website. Whilst the information for a majority of the 150 solutions have been collected, it has been decided to release them in batches on the BLUEPRINT website to maximise communications and interest in the library of solutions. As opposed to, first collecting all the solutions information and to place them all at once online. The gradual release of solution information is expected to improve the uptake and interest in the library as it grows, with recurring visits over time. A sequence has been decided for release based on the material stream, as shown in Figure 6 below. Thereby, every month 15 or more additional solutions will be made available that provide inspiration for interventions to circularise particular product/material waste streams.

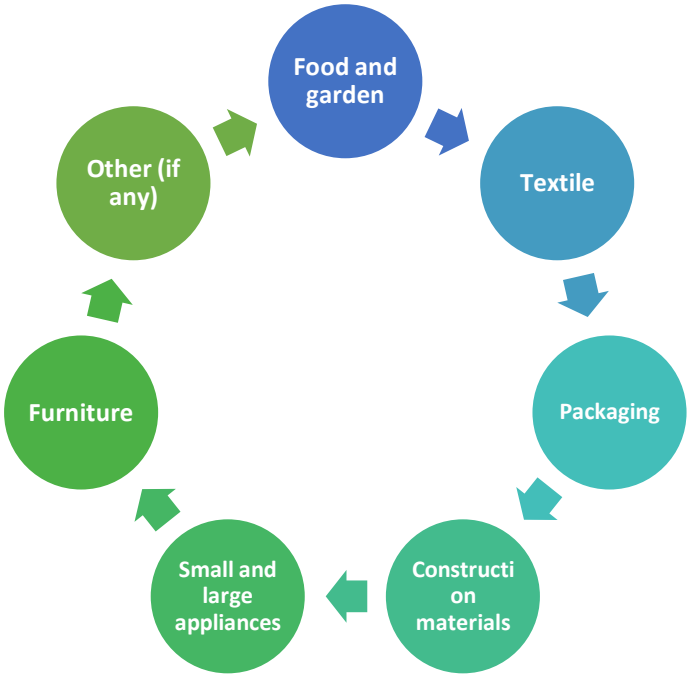

Figure 6. Approach to releasing the circular economy solutions online by topic in sequence.

The library of circular economy solutions will be delivered via the BLUEPRINT website. At the rate of release 60 of the current solutions are set to be live on the website by January 2022 and 150 by July 2022. Beyond the website they will also be showcased on social media and in BLUEPRINT communications such as presentations as part of the BLUEPRINT Circular Economy roadshow.

The solutions will also inform the guidance report to a circular economy to be delivered as part of the BLUEPRINT Project under Task 1.3. This effort includes looking at the operationalisation of circular economy solutions from technical, financial and social perspectives, considering the perspectives from the project partners as described in section A.7 on information needed for operationalisation.

3. Results for circular economy solutions

3.1. Missing circular economy strategies for different materials/products

The mapping of circular economy solutions established that some circular economy strategies are very clearly linked to one or a few products and their materials (Table 4). While some of these products to circular economy strategy associations are naturally non-existent for some product types, for example refill strategies for clothes or furniture, others are likely due to certain technological limitations, economic conditions, or a gap in the solutions pursued for particular products. For example, the absence of remanufacturing efforts for large and small appliances due to limited manufacturing facilities of these in England and France, or limited regulatory requirements and incentives for the recycling of materials in furniture.

Table 4. 150 Circular economy solutions materials and associated strategies

	Reuse or repurpose	Repair	Redesign	Remanufacture	Refill	Recycle	Reduce or prevent	Total
Textiles/ Clothing	*17*	*6*	*1*	*0*	*0*	*3*	*3*	**30**
Packaging	*9*	*0*	*0*	*1*	*16*	*10*	*3*	**39**
Food and garden	*6*	*0*	*3*	*0*	*0*	*7*	*13*	**29**
Construction Materials	*12*	*0*	*1*	*0*	*0*	*2*	*0*	**15**
Furniture	*10*	*4*	*1*	*3*	*0*	*2*	*0*	**20**
Large and small appliances	*5*	*6*	*0*	*0*	*0*	*4*	*0*	**15**
Other	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**2**
Total	**59**	**16**	**6**	**4**	**16**	**28**	**19**	**150**

The absence of circular economy solutions was further analysed qualitatively for each product and associated material streams. The purpose is to gain some insights as to why certain solutions are not yet being pursued and what their likely barriers are. The approach used involved looking at potential challenges associated with low availability of solutions in a particular circular economy strategy, with insights established from circular economy experts in EcoWise combined with a literature review. To ensure high quality the evaluation was peer-reviewed by specific product and material stream experts of the project university partners (e.g. UniLaSalle, NEOMA, ESITC). The insights from the project partners are summarised below in Table 5. The purpose of this evaluation is to form initial insights that can subsequently translated into governmental policy or industry level recommendations for solving these barriers.

It is important to note that the list of 150 solutions found is comprehensive yet not exhaustive as they were limited by the available time. This means that some of the challenges and barriers are potentially

already being addressed. Yet2, they still reflect the wider material streams' waste management and prevention limitations at the level of the current linear economy that is in the initial stages in the transformation to a circular economy.

Table 5. Types of solutions available or lacking, and the challenge behind those

Product stream	Type of solutions	Identified challenges	Barriers to solve these challenges
Textiles/ Clothing	**Recycling**: low number of solutions	Textiles and clothing are usually composed of a mix of fibres. This hybrid of fibres makes it hard to be separated during the recycling process, and mechanical recycling methods tend to break the fibres themselves. In addition, the chemical dyes in the textiles need to be removed during the recycling process, however this process causes the textile quality to degrade. This means that current recycling options are more limited to turning textiles into a lower grade material such as material for building insulation and stuffing. This open loop recycling process has limited positive impact in terms of waste, carbon, and water savings.[5]	Lack of investments and trials of fibre-to-fibre recycling technologies, making the current recycled fibre market not competitive.[6] Limited possibilities to produce clothes using single fibre material due to the affordability and versatility of mixed synthetic materials.[7]
	Reduce or prevent: low number of solutions	Clothes ownership and disposability is on the rise in high income countries. There is a high need to encourage consumers to buy less disposable clothing, and to address the issue of "psychological obsolescence" where clothes aren't worn anymore when considered out of fashion. The responsibility is equally on manufacturers and policy makers to address the approach in producing high volumes of low-quality clothing that get worn out quickly.	For manufacturers: Lack of incentive and support for clothing designed to last. For consumers: limited access to high quality clothing due to their high prices.[2]
	Repair: high number of solutions	A lot of repair services exist for clothes; however, it is a costly service that is not affordable to most. Due to the vast amount of cheap clothes available, it becomes easy to discard torn or broken clothes instead of repairing them.	Lack of technical ability and skills within households to repair clothes, as well as the lack of incentive for producers and manufacturers to use high quality material.[8]
Packaging	**Reuse or repurpose**: high number of solutions	Many solutions exist to reuse packaging, however only few target the shift to long-term reusable packaging across specific sectors that need to systematically eliminate and reduce packaging-related waste. For example, packaging used in the transportation and postage of goods, such as cardboard boxes	Long term re-usable packaging technologies are costly to develop and there are limited incentives beyond environmental gains.
	Refill: high number of solutions	Many refill options exist for food packaging, such as zero waste stores and refill zones in some supermarkets. The challenge to those solutions is making them accessible and upscaling them for easy-access to everyone. A large difference on their implementation can be found between France and England due to much stronger regulatory laws in France requiring refill solutions in supermarkets, whereas in England such initiatives are industry led and voluntary.	Lack of integrated solutions in many supermarkets and lack of partnerships with existing food brands in supermarkets to offer a package-free option to everyone. Here is an example of an integrated solution that has been implemented in some supermarkets across France and the UK.
	Recycle:	Many solutions have been developed to recycle hard-to-recycle plastics and single-use packaging. However, it remains a challenge to have these solutions available for	Lack of homogeneity in the composition of packaging, and lack of ability to understand the many different types of plastics from a

	high number of solutions	the diversity of packaging that exists. These solutions are usually implemented for specific companies/products.	sorting and recycling perspective, making it difficult to upscale solutions at present.
	Reduce or prevent: low number of solutions	While the reduce or prevent strategy for packaging only has three solutions, it is not representative of the availabilities of solutions as an increasing number of brands sell their products package-free or package-limited (especially in the case of beauty products and household cleaning products), however these solutions also fit under refill solutions. Behavioural campaigns that encourage dry-recycling (such as the Blue Bin Recycling League in Oxford) were classified as part of recycling strategies even though they can be classified in both strategies. However, given that packaging waste is still not decreasing based on quantitative estimates (such as from Valpak in England), preventative measures to reduce packaging waste are still not working at a systematic economic scale.	Limited common industry strategy targets on the absolute reduction of packaging used, and lack of economic incentives to implement measures to this end.
Food & Garden	**Reduce or prevent:** high number of solutions	Most solutions from this material stream use a "reduce or prevent" strategy. These mostly cover solutions that deal with food surplus from supermarkets and the hospitality sector. Many of these solutions either transform unsellable or surplus fruit and vegetable into sellable products, or resell surplus food for cheaper, or redirect foods to people who would otherwise not have access to food. There is, however, a gap in the solutions available to prevent the overbuying and overproduction of food.	Lack of awareness of businesses and household on the amount of food waste they generate.[9] Limited translation of overall national food waste reduction targets (Courtauld conference) to local business and local authority targets. Limited scaling efforts of the many solutions that are available
	Reuse or repurpose: medium no of solutions	Reuse or repurpose and redesign solutions cover the repurposing of food surplus or waste into other food products, or the design of eyewear or other fashion items out of food waste residue streams. However, these solutions are reliant on small scale, creative and expensive technologies.	Lack of investment to develop technologies that transform food waste into other material products. This is because food and garden waste are putrescible so reuse and repurposing solutions are difficult or might be unsanitary, making these solutions less favoured by waste management experts.
	Recycle: medium number of solutions	Recycling solutions are common for food and garden waste. These consist of composting schemes, workshops, or collection services for businesses, families, or residents of a council. The challenge associated to those is making composting and food waste collection accessible and user friendly for more people.	Lack of awareness and incentives on sorting food waste and on-site composting possibilities. Lack of consistency in food collections from municipalities in England.[10] Limited works on the user design aspects of composting and food waste collection services.
Construction materials	**Redesign:** low number of solutions	More solutions are needed that cover waste prevention measures in the construction sector. For example, by enabling digital building and product passports to reduce supplier purchasing errors, or by designing disassembly for easy reuse of building components. This is currently a challenge as it is more costly and time consuming to carefully deconstruct buildings, than to carry out demolition type practices. Another major obstacle of in the field of construction in the circular economy is the lack of standardised guidelines, therefore of insurability of the building.	Lack of incentive to design for deconstruction instead of building demolition. Technology barriers on the digitalisation of information on building components between suppliers and construction contractors. Lack of incentives due to time delay between implementing circular economy solutions for new buildings and their effect on waste management up to half a century later.[11] It is also challenging to standardise redesign guidelines to make deconstruction easier and cheaper as each

			building is usually unique and will have different requirements.
	Recycling: low number of solutions	Recycling construction waste is challenging. Reverse logistics of large tonnages of Construction & Demolition Waste (CD&W) form a cost barrier with limited availability of on-site recycling technologies. The separation process of materials is still not mature enough, and there are recycling barriers due to hazardous or polluted materials in legacy buildings.	Uncompetitive pricing and lack of trust in the quality of secondary materials. The lack of information on the composition of materials used in existing buildings. Insufficiently mature technologies for sorting and on-site recycling.
	Reuse or repurpose high number of solutions	Almost all the solutions for construction materials are based on the reuse and repurpose strategy. These include platforms to sell leftover or used building material to be reused for a discounted price. And solutions that transform leftover construction materials such as wood, for example, into furniture.	No significant barrier for this strategy has been established
Large and small appliances	**Reuse or repurpose** high number of solutions	Reuse services include repairing and reselling second-hand small to large appliances. Reuse options also include sharing services of electric appliances. Many of the sharing services rely, on residents' willingness to share and trust in the service.	Businesses that sell used appliances have difficulty of accessing sufficient volumes of good used appliances for economic scaling of the model. There is a deep-rooted consumer habit of ownership.[12] Difficulty to access sufficient volumes of used appliances could be due to the fact that local authorities have limited capacity to recover appliances. For example, very few authorities are equipped with a space for reuse meaning the appliances are sent by default to be recycled.
	Repair: high number of solutions	Repair services are common for small and large electric appliances, yet many appliances can only be repaired to a limited extent. The disassembly of appliances requires substantial expertise, with many appliances requiring dismantling (breaking of composite or glued components) instead of disassembly to get to the broken parts, and some parts are tricky to repair or even designed to be unrepairable Some spare parts are also difficult to find.	Components of appliances are not all repairable, however the European right to repair law should make it easier for appliances covered under the law, such as washing machines and dishwashers, to be repaired more easily.
	Redesign and Remanufacture lack of solutions	Even though there is widely available literature on how to design long lasting and repairable products, few companies are making these products available.	Little attention has been given to circular product design practices by supply chains and business models.[13]
	Recycle: low number of solutions	Challenge as some small appliances contain substances that are now banned under substance regulations such as REACH and RoHS in European countries.[14]	Not enough trials and investment into other recycling alternative that can also tackle the persistent organic pollutants.
	Reduce or prevent low number of solutions	A lot of repair solutions encompass reduce or prevent strategies as repairing an appliance aims to prevent it being discarded. A challenge of that is, however, the lack of awareness on repair options and ways to prevent overbuying or discarding small or large appliances inappropriately. Premature obsolescence is an issue as some products have built-in defects designed to prematurely end a product's life.	Lack of clear communication from the manufacturer on lifespan, repairability, and ways to dispose of their appliances.

Furniture	**Reuse or repurpose** high number of solutions	Many solutions offer options for reuse and exchange of used furniture. However, it remains a challenge to encourage people to buy second-hand when a lot of new furniture can be found cheaply.	Poor awareness of the availability and benefits of second-hand furniture options.[15]
	Repair: medium number of solutions	Beyond the available solutions from the quick-scans, many solutions and services exist for the repair of broken furniture. However, repair remains a costly option for both manufacturers and people.	Lack of economy incentive to make repair viable.[16]
	Redesign: low number of solutions	Products are not designed for durability as assembly and disassembly are not thought about during design.	Lack of mandatory eco-design requirements.[17]
	Remanufacture: low number of solutions	Refurbishment of furniture is widely possible in France and England, however the number of solutions available in the quick-scans does not reflect this. Many re-upholstering and restoration options exist but need to be more widely accessible. Remanufacturing options are still limited. For example, IKEA only recently introduced a return option for used IKEA furniture.	The high cost of reverse logistics for remanufacturing and complications for citizens to transport furniture back to the point of sales.
	Recycle: Low number of solutions	As many furniture items are not made from primarily wood or metal but consist of many different materials including plastics, and they are not designed to enable disassembly into different material streams, there is a large challenge to enable their recycling. In addition, furniture contains many hazardous compounds such as, flame retardants (now prohibited), making it more difficult to recycle the materials as it increases the cost of recycling to prevent accumulation of these chemicals in circular economy loops.	Limited incentives for the reverse logistics of furniture in recycling streams, and challenges in the separating of parts into homogeneous material type streams. Lack of information on how to remove hazardous components of some furniture.
	Reduce or prevent: Low number of solutions	Consumers do not have guidance on the lifespan of furniture and the approach to maintain and repair furniture. As a consequence, they are incentivised to buy furniture that have a short lifespan.	Move away to cheap materials to produce cheap furniture. Lack of transparency from the producer on lifespan and ways to repair, maintain and dispose of furniture

3.2. Comparisons between England and France of the solutions

The quantitative difference between the products and their material streams addressed in England versus France were identified (Table 6). The values were weighted in percentages to enable comparisons between France and England. The majority of listed solutions for England cover textiles/clothing and packaging, while most found solutions in France are for construction materials, packaging and food and garden. A further breakdown can be found in Figure 7 for France and Figure 8 for England on the next pages.

The comparison between France and England gives an impression of the relative situation. It does not mean that from a circular economy perspective a particular product and associated material stream is being neglected. But that it has less emphasis and interest of organisations in making these streams circular between the two countries. Particularly poignant is the lack of solutions on construction materials in England, which signals a lack of circular economy construction industry efforts.

*Table 6. Difference of solutions between material streams between France and England**

	Number of solutions from France	Number of solutions from England	Percentage of solutions in France	Percentage of solutions in England
Textiles/clothing	8	21	15%	24%
Packaging	10	28	19%	32%
Food and garden	10	16	19%	18%
Construction Materials	14	1	26%	1%
Furniture	7	13	13%	15%
Large and small appliances	5	9	9%	10%
Total	55	88	100%	100%

*The total number of solutions across England and France does not add up to 150 due to some solutions in the listing having been established outside of England and France, and one solution in France considered as “other” in terms of material stream

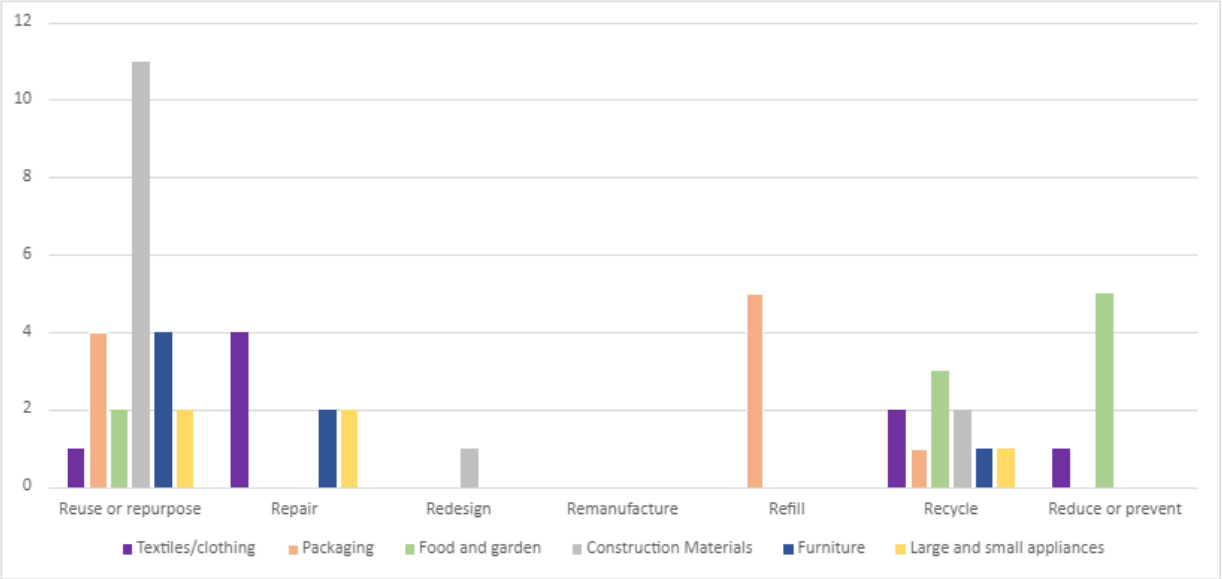

Figure 7. Material type and associated circular economy strategies for French solutions

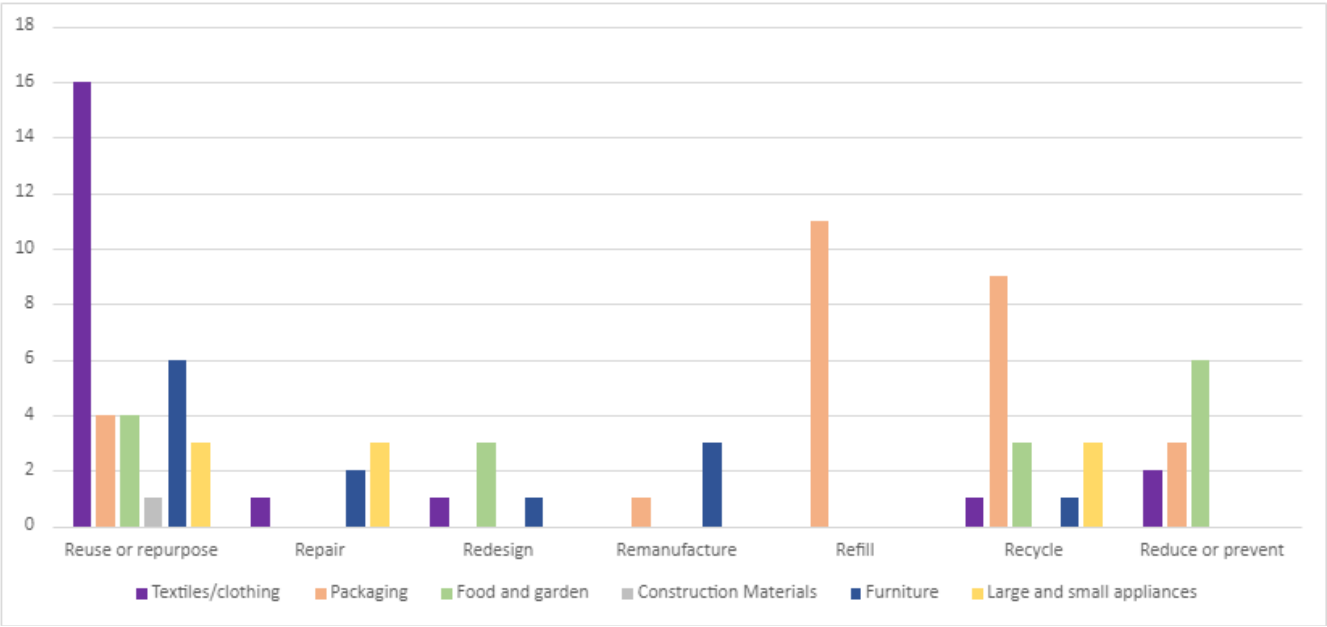

Figure 8. Material type and associated circular economy strategies for English solutions

4. Methodology for circular economy scenarios

The circular economy solutions assessed in the previous sections all change the need for virgin materials extraction and processing. Less mining and manufacturing products from new materials would be needed and more materials can come from closed loop recycling. Existing products would be kept in the loop longer through repair or remanufacture and a portion of virgin materials would no longer be needed by eliminating single use packaging.

The relationship between the solutions and how they impact the economy, in terms of which circular economy strategy they fall under, was summarised in section 3.1. A detailed table of the categorisation for each solution is available in annex B. The approach in the BLUEPRINT Project includes an evaluation of the macro-economy wide impacts of such circular economy solutions. However, to understand the larger scale economic relevance of each solution, an assessment on the waste arisings and job creations would be needed for each of the 150 solutions scanned. This could then be used to see the economy wide impact if the solution would be scaled at national level or in the case of BLUEPRINT in the French (Channel) England (FCE) area (Figure 1). For example, if 30% of people would utilise refill solutions for beverages from very low numbers today, how would that impact the need for single use beverage cans and what would be the impacts on net job changes in switching from single use beverage cans to refill solutions?

It was found not to be workable within the timeframe of the BLUEPRINT Project to establish this direct link for each circular economy solution. It would require interviews and collaborations with each of the 150 solution providers in addition to an estimate or quantitative mini-model on the jobs and waste flow impacts for each solution. The work to develop such a quantitative circular economy solutions database is beyond the scope of the project. Based on previous experience of the authors in energy pathways modelling projects in the UK, this requires a project on its own with a modelling effort.

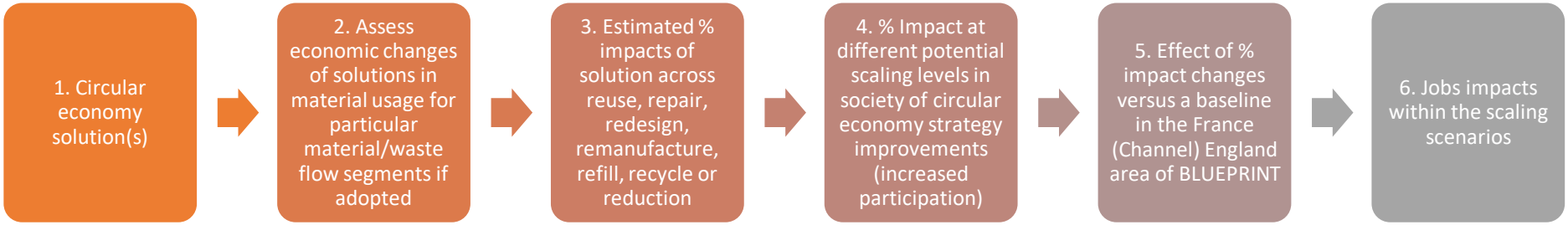

Figure 9. Overview of macro-economic impact assessment steps

As a workable solution, to establish economy wide impacts, a scenario-based approach was developed instead and present here. This approach is decoupled here from individual circular economy solutions. It can be coupled at a later point to a circular economy solutions database, once developed, as mentioned prior. This means that from the steps in Figure 9 only steps 4, 5 and 6 are carried out under a 'what-if' basis for a circular economy strategy at large. For example, if we can increase refill solutions to 30% what would be the impacts on societal material flows. This would be without the constraints of assessing which specific solutions could result in this 30% increase.

Scenarios are to this end developed for each of the six main material/waste streams covered in the circular economy solutions mapping: textiles & clothing, packaging, food & garden, construction materials, furniture, and large & small appliances. And impacts are evaluated for the seven main circular economy strategies: reuse or repurpose, repair, redesign, remanufacture/refurbishment, refill, recycle, and reduction or prevention (Table 1).

4.1. What are circular economy scenarios?

A circular economy scenario in this report is made per material/waste stream. It consists of an examination of the current baseline situation in terms of circular economy strategies. An initial picture is made of how much of the stream is recycled, reused, repaired and so on. Subsequently, an estimate is made of what improvement potential is possible in low, medium and high ambition futures. Resulting in three levels of scenarios. The degree of improvements is set by looking at what is reasonable maximum improvement in the foreseeable future in the best of worlds. From this maximum it can be deduced what would be achievable given low, medium and high ambitions, assuming that the maximum is not achievable for the time being.

The resulting scenarios are not forecasts but are normative scenarios to look at potential futures. They give direction to what is potentially possible with ambition and effort and form a platform for discussion. Discussion on what can be achieved, what the ambition should be for, and how to achieve it. Such scenarios are used first and foremost to demonstrate the potential of change, in this case for achieving a circular economy. To form narratives that can lead to societally informed discussions for change. And secondly to inform the direction of policy and legislation following these societal discussions.

Another key context is that scenarios are inherently dependent on assumptions. For example, we could assume that for packaging 30% is the maximum portion that is refillable. To know whether this assumption is reasonable we would need to know a few things. We need to have an idea of how much packaging that is in circulation contains liquids in the first place. And how much of this is longer use cosmetic or food packaging as opposed to single use beverage packaging. In other words, to segment out the packaging in circulation into different types of use. After this we need to establish how much of the particular segment – multi-use liquids packaging – is replaceable with a range of refill systems.

An assumption is not a single static figure as it highly depends on the current legislative, technological and societal landscape. People may not be initially used to refill. Technologies and logistic systems to return and clean and provide may need to improve. Legislations may be in place or not. In France supermarkets are by 2030 required to provide 20% of their floorspace with refill systems. In England such legislations have not yet been introduced. The development of these assumptions is therefore an iterative process in itself. It is never fully finalised as assumptions need adjustments. And this forms a point of discussion among experts. To this end where scenario development is more established, such as in the energy sector, assumptions are revisited every year with new scenarios, such as those done by the International Energy Agency in its World Energy Outlook. There is no equivalent institution or Circular Economy Outlook, however. Very little work has been done in general on creating circular economy scenarios in general. This is why the scenarios presented in the next sections fill a key gap in circular economy work and are a key contribution to furthering thinking on the circular economy.

4.2. Circular economy scenario for textiles & clothing

Overview. Historically prominent circular economy efforts for textiles & clothing include the handover clothing from one generation to the other, within or between families, and to local second-hand resales. And the repair of clothes when they tear or are worn out to improve their lifespan. The reduced cost of making clothing due to industrialisation, paired with the rise of fast fashion since the 1950s has gone against this trend. Whereas in the past clothing would be mended until it was no longer mendable, today clothing is discarded well before the end of its life. Clothing has become a disposable good. Today it is estimated that clothes have a lifetime of only 2 to 3 years.[18] Circular economy efforts of clothing reuse and repair are far less prominent than they used to be.

The main circular economy systems in place for clothes in France and England are donation points on the streets and second-hand clothing shops where people can bring and donate their old clothes. And to a lesser extent collection from local authorities. After donation at a donation point, clothes are brought to a sorting facility where they are sorted by hand into 120 to 200 grades of types of clothing and qualities.[19] Re-usable clothing quality goes mostly to international markets in the global south to appear in second-hand shops or sellers, and to a lesser extent to national markets in England or France.[20] Where the clothing goes depends on the brand, colours, and fibre types. Grades that are not re-usable because they are too worn or not in demand are divided into recyclable and non-recyclable grades. Recycling today is carried out by shredding or pulling the fibres from the clothes. In some cases, this can provide for new yarn from which clothes can be made, but in the majority of cases this provides for a mixed set of fibres or felt that can be compressed for textile fillings. For example, in France old jeans are at very large scale recycled in this manner into insulation materials for homes. Non-recyclable grades are either landfilled or go to an Energy from Waste incinerator. Therefore there is almost no closed loop clothing recycling in the world today, and open-recycling efforts are dominant.

The applicable circular economy strategies for textiles and clothing are reuse/repurpose, repair, recycle and reduce. Scenarios for these circular economy strategies were made as follows:

1. The baseline circular economy impact on the share of total clothing in circulation, in the French and English context, is shown in Table 7.
2. The estimated maximum achievable progress in the foreseeable future is shown in Table 8.
3. A visual comparison between the current (1) and maximum foreseeable future (2) flows is shown in Figure 10.
4. To create the low-medium-high ambition scenarios, the distance between (1) and (2) is portioned into three levels of improvements. Indicating different ambition levels to go from the current baseline towards the future achievable maximum. Defined in the final Table 9 and used for the FCE scenario calculations.

In terms of other circular economy strategies, remanufacture and refurbishment as well as refill are not applicable for textiles and clothing. Redesign is highly relevant for making clothes easier to repair and easier to recycle, yet this is difficult to quantify. In the scenarios redesign is thus assumed to be necessary to unlock higher ambition scenarios as shown in Table 9.

Table 7. current circular economy performance for clothing & textiles in England and France

Circular Economy Strategy		**Share of total clothing in circulation**	**Source of information**
Clothing & textiles that **are locally purchased from virgin materials (**excludes exported clothes and open loop recycling)		85%	Calculated by subtracting the circular economy loops from 100%. Excludes exported clothes and open loop recycling that turns clothing into insulation or other non-clothing materials, and reduction from reducing fast fashion.
Clothing & textile **reuse**	Direct reuse via handovers to friends and family	4%	Guesstimate from the authors in absence of existing data.
	Peer to peer reuse sales via APPs like vinted	2%	Guesstimate from the authors in absence of existing data. Based on an assumed 3% of clothes offered for peer-to-peer sales and a resulting 2% of actual sales.
	Reuse sales via local 2nd hand stores and sellers	3%	Based on 48% of clothes estimated to be donated for sorting, combined with estimate from le Relais a French donation and sorting organisation of 6% local reuse sales and 55% exports. Excludes insights in how many clothes are actually sold and likely an overestimate.
	Reuse sales via exports (unknown how much ends up as actual reuse)	**26%**	
Clothing & textile **repair**	Share of clothes repaired with their lifespan extended preventing new purchases	1%	Guesstimate from the authors in absence of existing data
Clothing & textile **recycling**	**Closed loop recycling** - share of clothes recycled into new yarn and clothing	<1%	Guesstimate from the authors in absence of existing data.
	Open loop recycling - Share of clothes recycled into insulation materials or other purposes.	**17%**	Based on 48% of clothes estimated to be donated for sorting, combined with estimate from le Relais a French donation and sorting organisation of 36% recycling. Recycled provides for new insulation materials & cleaning cloths.
Clothing & textile **prevention** (less purchasing/ownership)	Share of clothes that are reduced from circulation by reducing fast fashion. Through overall less ownership as people buy more in line with actual needs	**<1%**	Guesstimate from the authors in absence of existing data. Based on an estimate of the number of people who actively are following a wear only what you need, and wear what you have clothing lifestyle.
	Share of clothes that are rented instead of owned and associated increase in usage of a particular piece of clothing (reduced disused clothing in people's homes).	4%	Guesstimate from the authors in absence of existing data. Estimated share of population that rents clothes multiplied by the proportion of clothes used and disused that are rented.

Table 8. Maximum performance of circular economy strategies for clothing & textiles in England and France

Circular Economy Strategy		Share of total clothing in circulation	Source of information
Clothing & textiles that **are locally purchased from virgin materials (**excludes exported clothes and open loop recycling)		21%	Calculated by subtracting the circular economy loops from 100%. Excludes exported clothes and open loop recycling that turns clothing into insulation or other non-clothing materials, and reduction from reducing fast fashion.
Clothing & textile **reuse**	Direct reuse via handovers to friends and family	5%	Author's assumption that only a minor improvement is likely from 4% to 5%
	Peer to peer reuse sales via APPs like vinted	7%	Author's assumption of a maximum quadrupling to 10% clothes acquired via peer to peer on offer of which 7% are sold and 3% remain unsold and go into recycling loops.
	Reuse sales via local 2nd hand stores and sellers	21%	Based on an assumed 70% of clothing being donated at end-of-use of which 30% are prepared for local reuse, and 30% are exported.
	Reuse sales via exports (unknown how much ends up as actual reuse)	21%	
Clothing & textile **repair**	Share of clothes repaired with their lifespan extended preventing new purchases	5%	Author's assumption that there will be a five-fold maximum expansion of estimated current repair rates across all clothing
Clothing & textile **recycling**	**Closed loop recycling** - share of clothes recycled into new yarn and clothing	14%	Estimate based on assumed 70% of clothing being donated at end-of-use of which 36% ends up in recycling, plus an additional 3% from unsold reuse sales. And of this about half of clothing that goes into recycling loops in the future can be closed loop based on improvements in recycling technologies
	Open loop recycling - Share of clothes recycled into insulation materials or other purposes.	14%	
Clothing & textile **prevention** (less purchasing/ownership)	Share of clothes that are reduced from circulation by reducing fast fashion. Through overall less ownership as people buy more in line with actual needs	3%	Guesstimate from the authors of an estimate of the number of people who actively are following a wear only what you need, and wear what you have clothing lifestyle.
	Share of clothes that are rented instead of owned and associated increase in usage of a particular piece of clothing (reduced disused clothing in people's homes).	15%	Guesstimate from the authors in absence of existing data. Estimated share of population that rents clothes multiplied by the proportion of clothes used and disused that are rented.

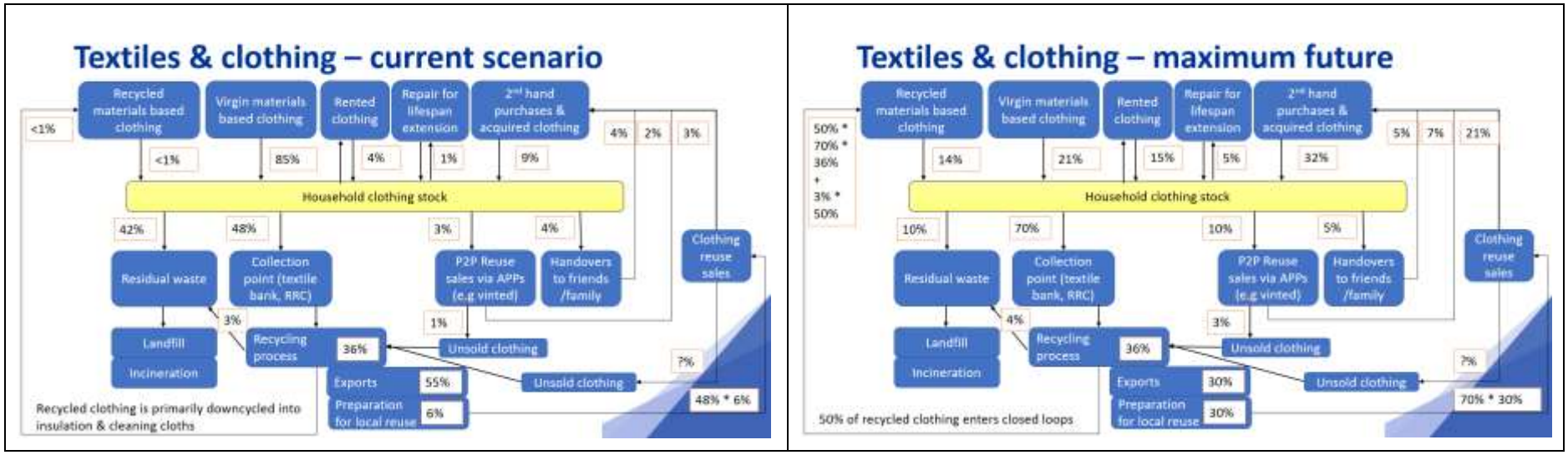

Figure 10. Baseline for clothing (left) vs achievable maximum future (right).

Table 9. Estimated scenario impacts for textiles & clothing

		Reuse or repurpose	Repair	Redesign	Remanufacture	Refill	Recycling (closed loop)	Reduce or prevent
Product stream	**Impact type** / **Impact levels**	Waste stream % reduction	Waste stream % reduction	**Unlocks high scenarios across strategies**	Waste stream % reduction	Packaging reduction %	Local Disposal % reduction and recycling increase	Total product/material stream % reduction
Textiles & clothing	Low	6.00%	1.00%				3.00%	3.00%
	Medium	12.00%	2.00%				6.00%	6.00%
	High	18.00%	3.00%	Unlocked			9.00%	9.00%

4.3. Circular economy scenario for packaging

Overview. Packaging can be split into three main usage categories:

- **Logistics packaging**, historically packaging for logistics did not exist beyond the use of cloth bags for transporting goods. The 19th century saw the introduction of paper and cardboard packaging including commercial card boxes, commercial paper bags and corrugated cardboard. Around 1900 corrugated paperboard replaced wooden crates and boxes and cardboard became the standard for logistics, as it still is today. Next to boxes logistics packaging includes void filling to reduce damage in transported goods. This is a relatively recent invention from the 1960s. Today void filling covers different options such as kraft paper, air filled plastics, and plastics 'packaging peanuts.
- **Food & beverage packaging** was primarily glass, paper and cardboard based until the mid-20th century when aluminium and plastic PET became dominant for beverages. Since a very wide range of plastics has become dominant for all food items.
    - In the 1930s tin-plated steel beverage cans were invented which were advanced to modern aluminium beverage can in the 1960s. The introduction of plastic PET bottles began in the 1980s before which glass was dominant.
    - Food snacks, breakfast cereal packaging, and similar, was at first packaged in cardboard boxes with wax paper bags in the 1900s until the 1960s. At that point plastic bags for the snacking market were introduced and by the 1980s these were the dominant standard.[21]
    - The widespread use of modified atmosphere packaging with plastics lidding film for meat was introduced in the 1970s.[22] The first Tetrapaks were manufactured in the 1950s, microwavable plastic trays were developed in the 1980s, and the first salad-in-a-bag packaging in the 1990s.[23] The 2000s saw the introduction of biodegradable packaging made from Polylactic Acid (PLA) a corn-based polymer.
- **Non-food items packaging**, similarly as other packaging at first non-food items were packaged in cardboard or paper wrapping or boxes. The first introduction of plastics came from cellophane wrapping in the 1910s and 1920s. The standard plastic bag was invented in the 1950s as well as shrink-wrap. Bubble wrap plastics were invented in the 1960s. Items like shampoo or other liquids used to be packaged in glass bottles until the rise of plastic bottles in the 1970s and 1980s. Clamshell plastic packaging was invented in the 1980s. Today these items are dominantly packaged in plastics.

At present it is only partially possible to distinguish between these three categories from materials use perspective. Especially for plastics there is an overlap in use across the three categories. For example, we can thus speak of plastics packaging use for logistics, plastics packaging use for food & beverage, and plastics packaging use for non-food items. Only in case of aluminium a predominant use for beverage cans is observed, and thus aluminium packaging can be wholly attributed to food & beverage packaging.

The circular economy strategies that can be discerned among packaging depend on the type of usage category. Refill applies to food & beverage packaging, whereas reuse, recycle and reduce applies to all the categories. Remanufacture, repair, and refurbishment are less applicable for packaging, they could be for long-lasting re-usable packaging, yet this is not evaluated here. Redesign is highly relevant for packaging easier to recycle and to improve the re-usability. In the scenarios redesign is thus assumed to be necessary to unlock higher ambition scenarios for recycling and reuse as shown in Table 12.

Scenarios for these circular economy strategies of packaging were made as follows:

1. The baseline circular economy impact on the share of packaging in circulation, in the French and English context, is shown in Table 10.

2. The estimated maximum achievable progress in the foreseeable future is shown in Table 11.
3. A visual comparison between the current (1) and maximum foreseeable future (2) flows is shown in Figure 11.
4. To create the low-medium-high ambition scenarios, the distance between (1) and (2) is portioned into three levels of improvements. Indicating different ambition levels to go from the current baseline towards the future achievable maximum. Defined in the final Table 12 and used for the FCE scenario calculations.

Table 10. Current performance of circular economy strategies for packaging in England and France

Circular Economy Strategy		**Share of total packaging in circulation**	**Source of information**
Newly manufactured packaging that is **purchased from virgin materials (**excludes exported clothes and open loop recycling)		61%	Calculated by subtracting the circular economy loops from 100%. Excludes open-loop recycling.
Packaging **reuse**	Packaging **take-back** and **reuse services**	3%	Guesstimate from the authors in absence of existing data.
	Packaging direct user refill (e.g. zero waste shops)	2%	Guesstimate from the authors in absence of existing data.
Packaging **recycling**	**Closed loop recycling** - share of packaging recycled into new packaging	34%	To be updated
	Open loop recycling - Share of packaging recycled into other purpose products	<1%	To be updated. Drink cartons are typically downcycled and there are also losses in paper & card recycling
Packaging **prevention** (less purchasing/ownership)	Prevention from shifting from single-use packaging to multi-use packaging systems with reuse services.	<1%	Guesstimate from the authors in absence of existing data.
	Prevention from using less packaging without replacement via light weighting and unnecessary packaging removal.	5%	Guesstimate from the authors in absence of existing data.

Table 11. Maximum performance of circular economy strategies for packaging in England and France

Circular Economy Strategy		**Share of total packaging in circulation**	**Source of information**
Newly manufactured packaging that is **purchased from virgin materials (**excludes exported clothes and open loop recycling)		25%	Calculated by subtracting the circular economy loops from 100%. Excludes open-loop recycling.
Packaging **reuse**	Packaging **take-back** and **reuse services**	27%	Guesstimate from the authors in absence of existing data.
	Packaging direct user **refill** (e.g. zero waste shops)	6%	Guesstimate from the authors in absence of existing data.
Packaging **recycling**	**Closed loop recycling** - share of packaging recycled into new packaging	42%	To be updated
	Open loop recycling - Share of packaging recycled into other purpose products	**<1%**	To be updated. Drink cartons are typically downcycled and there are also losses in paper & card recycling
Packaging **prevention** (less purchasing/ownership)	Prevention from shifting from single-use packaging to multi-use packaging systems with reuse services.	**10%**	Guesstimate from the authors in absence of existing data.
	Prevention from using less packaging without replacement via light weighting and unnecessary packaging removal.	10%	Guesstimate from the authors in absence of existing data.

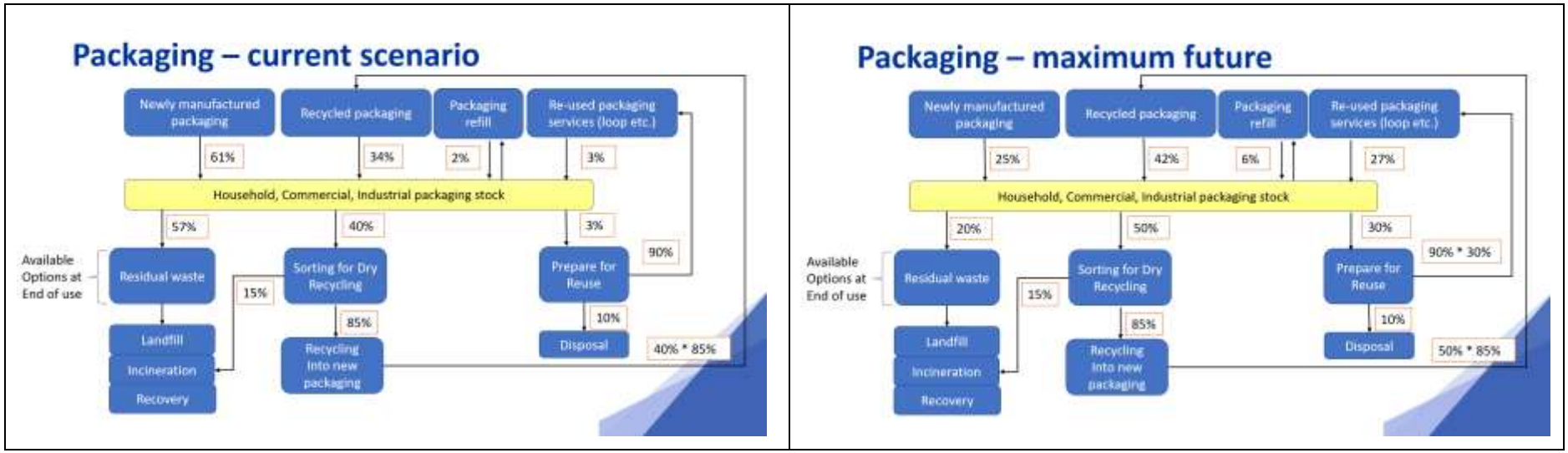

Figure 11. Baseline for packaging (left) vs achievable maximum future (right).

Table 12. Estimated circular economy scenarios impacts for packaging

		Reuse or repurpose	**Repair**	**Redesign**	**Remanufacture**	**Refill**	**Recycling (closed loop)**	**Reduce or prevent**
Product stream	**Impact type** / **Impact levels**	Waste stream % reduction	Waste stream % reduction	**Unlocks high scenarios across strategies**	Waste stream % reduction	Packaging reduction %	Local Disposal % reduction and recycling increase	Total product/material stream % reduction
Packaging	Low	6.00%				1.00%	2.00%	5.00%
	Medium	12.00%				2.00%	4.00%	10.00%
	High	18.00%		Unlocked		3.00%	6.00%	15.00%

4.4. Circular economy scenario for food & garden

Overview – In today's world food and garden waste is widespread, resulting in a key waste stream with significant environmental impacts. A transition towards a circular economy for food & garden waste covers two main strategies:

- **Food waste prevention** results in significant decrease in resource pressure on energy and water needs and associated carbon emissions. Promoting a change in consumer behaviour can cause a shift towards a more circular economy..In 2018, a report published by a UK based charity, Waste Resources Action Programme (WRAP) states that around 9.5 million tonnes of food waste are produced in the UK. Of these an estimated 6.4 million tonnes could have been eaten.[24] According to the Association Nationale des Industries Alimentaires (ANIA) around 10 million tonnes of food is wasted every year in France.[25] Since 2012, France has implemented various initiatives and policies to combat the food waste problem. For example, the Waste Management Enforcement Law was introduced in 2012, to regulate the amount of organic waste sent to landfills, making it necessary to recycle for private companies producing more than 120 tons of organic waste.[26]

- **Organics recycling** for agriculture plays an important role in food production. Industrialisation of agriculture has made production of food more efficient but has moved agriculture away from natural cycles and towards artificial fertilisers in terms of provisioning of nutrients. The recycling of organics in food waste can partially counter this trend by closing local food to agricultural loops via composting and digestate based fertilisers from anaerobic digestion of food waste. However, at present the majority share of food waste is incinerated generating energy from waste, or put into landfill instead of used for composting, anaerobic digestion, or animal feed. WRAP estimated that in 2018 19% of the total food waste generated in the UK is anaerobically digested or composted. A total of 41% of food waste is incinerated and 30% goes into landfill, with only 10% redistributed or used as animal feed.[27] In France, a report commissioned by the Bio-based Industries Consortium (BIC) indicated that the majority of organic waste, an estimated 33% is incinerated, 23% goes to landfill and 16% composted or anaerobically digested.[28] Closing the loop by eliminating the need for incineration of food waste is a key element in fostering healthy agricultural systems and a circular economy.

The deployment of the circular economy for food also can yield substantial financial benefits. Both from cost savings from reducing losses and from increased profits by using what would otherwise be disposed of. The applicable circular economy strategies for food & garden are waste prevention and recycling. Assumptions for these circular economy strategies were made as follows:

1. The baseline circular economy impact on the share of total food in circulation, in the French and English context, is shown in Table 13.
2. The estimated maximum achievable in the foreseeable future is shown in Table 14.
3. A visual comparison between the current (1) and maximum foreseeable future (2) flows is shown in Figure 12.
4. To create the low-medium-high ambition scenarios, the distance between (1) and (2) is portioned into three levels of improvements. Indicating different ambition levels to go from the current baseline towards the future achievable maximum. Defined in the final Table 15 and used for the FCE scenario calculations.

Remanufacture, refill and refurbishment are not applicable for food & garden waste streams. Although repurposing of food waste for making non-food products can be applicable in some specific scenarios, it is not considered here.

Table 13. Current circular economy performance for food & garden waste in England and France

Circular Economy Strategy		**Share of total food & garden in circulation**	**Source of information**
Newly purchased food		97%	Calculated by subtracting the leftover food distribution from a 100% newly purchased food share.
Food **prevention** (Less purchasing resulting in less waste generated)	Recovery of food for distribution prior to becoming food waste	3%	Guesstimate from the authors in absence of existing data. An estimated 3% of leftover food is recovered before it becomes food waste.
	Prevented food waste through behavioural change in food processing and in households	10%	Guesstimate from the authors in absence of existing data
Food and garden **recycling**	Prepare for conversion to other products	2%	Guesstimate from the authors in absence of existing data
	Home or community composting	3%	Guesstimate from the authors in absence of existing data
	Industrial recovery for AD or composting resulting in fertiliser and compost.	34%	Guesstimate from the authors in absence of existing data based on 40% of food recovered for AD or composting, of which 85% is recycled into organic streams.

Table 14. Maximum circular economy performance in the future for food & garden waste in England and France

Circular Economy Strategy		**Share of total food & garden in circulation**	**Source of information**
Newly purchased food		94%	Calculated by subtracting the leftover food distribution from a 100% newly purchased food share.
Food **prevention** (Less purchasing resulting in less waste generated)	Recovery of food for distribution prior to becoming food waste	6%	Guesstimate from the authors in absence of existing data. An estimated 3% of leftover food is recovered before it becomes food waste.
	Prevented food waste through behavioural change in food processing and in households	50%	Guesstimate from the authors in absence of existing data
Food and garden **recycling**	Prepare for conversion to other products	4%	Guesstimate from the authors in absence of existing data
	Home or community composting	20%	Guesstimate from the authors in absence of existing data
	Industrial recovery for AD or composting resulting in fertiliser and compost.	51%	Guesstimate from the authors in absence of existing data based on 40% of food recovered for AD or composting, of which 85% is recycled into organic streams.

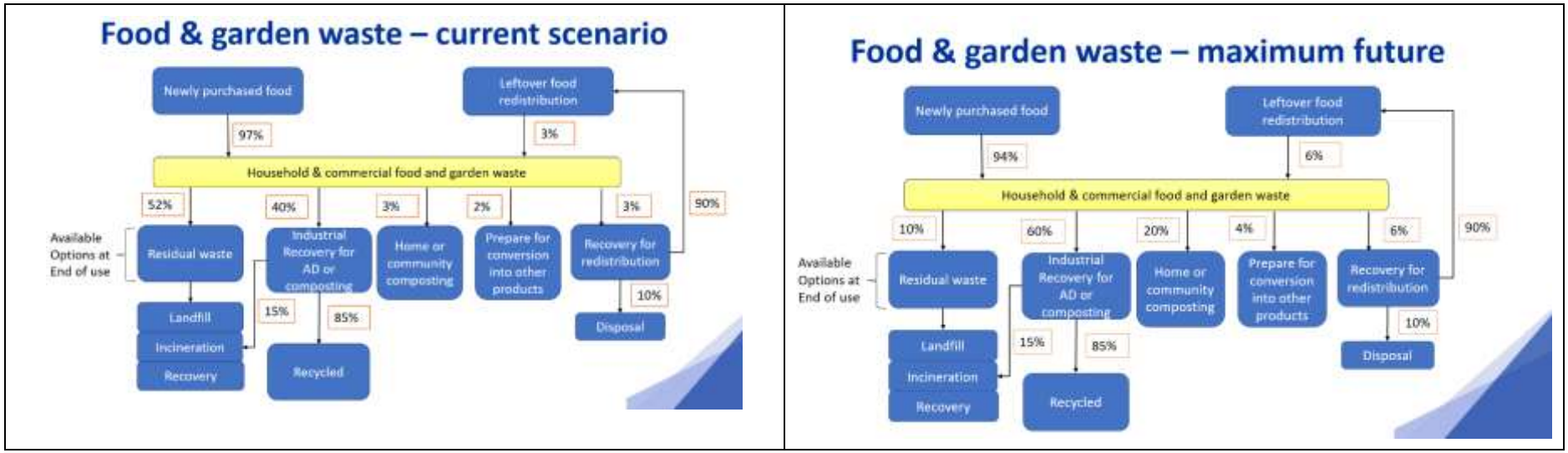

Figure 12. Baseline for food and garden (left) vs achievable maximum future (right).

Table 15. Estimated circular economy scenarios impact for food & garden waste

		Reuse or repurpose	**Repair**	**Redesign**	**Remanufacture**	**Refill**	**Recycling**	**Reduce or prevent**
Product stream	**Impact type** **Impact levels**	Waste stream % reduction	Waste stream % reduction	**Unlocks high scenarios across strategies**	Waste stream % reduction	Packaging reduction %	Local Disposal % reduction and recycling increase	Total product/material stream % reduction
Food & Garden	Low	1%					9%	10%
	Medium	2%					18%	20%
	High	3%					27%	30%

4.5. Circular economy scenario for construction materials

Overview – Today we are seeing the reinvention of a circular economy for buildings after this model was abandoned in the 20th century. In general, three main circular economy strategies have historically been deployed for construction materials:

- **Direct reuse** was very common in most cities in the 18th and 19th century. When a building was torn down public announcements were made for deconstruction, to create a local market for available building components. Demolition contractors would be interested to pay for being able to sell construction materials. This lasted until the common use of dynamite, hydraulic jackhammers, bulldozers and other mechanical means which made destroying buildings more destructive, mechanical and cheaper. The need for speed of demolishing also played a role due to faster real estate construction pressures from increasing population growth since the 19th century.[29]

- **Recycling of materials** varied depending on local resource availability such as for clays. In cities with limited means to acquire materials in direct vicinities, such as London, there was a thriving market for recycled brick inputs. So-called dust-yards saw recovery of coal ashes combined with soil substituted partially for clay needs for brick production in the 19th century for example.[30] Manual separation of collected materials was mostly carried out under hazardous circumstances and done by women, children and older men. And phased out in the 20th century over increasing health concerns and the rise of women's rights.

- **Building repair in terms** of renovations for continued longer lifespan and use is a circular economy strategy that survived from earlier times primarily applied to heritage and special class buildings.

Today the main circular economy strategies deployed and being advanced in the construction sector relate to **waste prevention**, **recycling and reuse of materials**. In terms of waste prevention an estimated 10% to 30% of construction components become waste during the construction process based on older estimates.[31] To reduce this waste substantial efforts have gone into making a route map for zero avoidable waste in the UK construction sector.[32]

For recycling and reuse, key is the recovery of building materials on the construction site with sorting and processing, and the associated linkage to building sites in a region or country. Comprehensive figures on the successes of these strategies are difficult to obtain. A key challenge is the overall accounting of circular economy in the construction sector.

The commonly used indicator is the recovery rate of construction and demolition waste. The value is estimated at the latest available year 2018 at 98% for the United Kingdom and 73% for France in the Eurostat database.[33] This is defined as the 'ratio of construction and demolition waste, which is prepared for reuse, recycled or subject to material recovery, including through backfilling operations, divided by the construction and demolition waste treated as defined in Regulation (EC) No 2150/2002 on waste statistics. Thereby lumping together reuse, recycling and backfilling on-site. Especially the inclusion of backfilling creates a convoluted picture. This means that soil that is removed during construction on-site and is replaced with unspecified filling materials from construction is counted as recovery.

More specific are the figures on treatment of waste-by-waste category, which splits out recovery to backfilling, and recovery to recycling. Based on the Eurostat figures for 2018, for Construction & Demolition Waste (C&DW):

- A total of 60 million tonnes for England and 49 million tonnes for France was recycled and backfilled.
  - Of these 0.5 million tonnes of this is backfilled in England and a larger 4.5 million tonnes in France.
  - And 59.5 million tonnes are recycled in England and 44.8 million tonnes in France.
- A total of 1.5 million tonnes of C&DW in England and 18.5 million tonnes of C&DW in France was landfilled.

Note that these Eurostat figures are not consistent with the national values. Especially in France where there is more consistently evaluated data. For example, 5 million tonnes of C&DW are generated in France alone. It is estimated that out of these 73% of inert construction waste is recovered of which 18% is recycled and 55% is backfilled. Similarly, figures received for England from the waste data interrogator database operated by the Environment Agency by the authors provide for a 78% recycling figures including backfilling.

Whilst the majority of C&DW is recycled this is primarily into low-grade recovery applications. Typical low-value applications include the crushing into aggregates of recovered construction and demolition waste and using the aggregates into pipe bedding or subbase and base road and highway constructions. This has led to the sourcing of 29% of aggregates in the UK and around 8% in France from recycled materials.[34] No figures are available on how much goes into high-grade recovery for re-utilisation of the materials back into building components. Recycling efforts in the construction sector thus primarily relate to open loop recycling (from buildings to roads) instead of closed loop (buildings to buildings).

On top of these background figures scenarios for these circular economy strategies for construction materials were made as follows:

1. The baseline circular economy impact on the share of construction materials in circulation, in the French and English context, is shown in Table 16.
2. The estimated maximum achievable progress in the foreseeable future is shown in Table 17.
3. A visual comparison between the current (1) and maximum foreseeable future (2) flows is shown in Figure 13.
4. To create the low-medium-high ambition scenarios, the distance between (1) and (2) is portioned into three levels of improvements. Indicating different ambition levels to go from the current baseline towards the future achievable maximum. Defined in the final Table 18 and used for the FCE scenario calculations.

Note that in the scenarios a distinction is made between **new and existing infrastructure & building stock**. Here the approach is primarily to look at the circularity of the **existing stock and infrastructure**, and to look at how circular like for like type replacement can be made via reuse and recycling, and the impact of waste prevention in this process. Narrowing down in the scenario to **how circular can the existing stock and infrastructure become**. This in contrast to looking at the circularity of new additions and growth to the building stock due to population and wealth growth.

The simplification is made for a few reasons. First, due to the lack of disaggregate data for the construction sector in terms of construction and demolition waste and its origin and destination (e.g. new buildings, new road infrastructure, new landscaping efforts). This also makes it impossible to split the flows into low-grade and high-grade applications adequately. Second, the very high share of new material inputs relative to recycling supply despite very high recovery rates. For example, in the UK for 2017 there was an estimated use of 176 million tonnes of primary aggregates vs 72 million tonnes of recycled and secondary sources supplied.[35] This indicates that far more infrastructure is developed than broken down to provide material supply.

Table 16. Current circular economy performance for the existing infrastructure and building stock in England and France

Circular Economy Strategy		Share of materials circulated as inputs/outputs for the **existing infrastructure & building stock**	**Source of information**
Existing infrastructure and building stock sustained by **use of virgin materials**		55%	Calculated by subtracting the circular economy loops from 100%. Includes open-loop recycling.
Construction material **reuse**	**Recovery** and **reuse**	<1%	Guesstimate from the authors in absence of existing data.
Construction material **recycling**	**Closed loop recycling** - share of construction material recycled via high-recovery applications	5%	Estimated based on an average 70% recovery figure including backfilling from England and France, of which 45% processed for recycling and 25% backfilling. The recycling value is multiplied by 10% going to closed loop recycling and 87% to open loop recycling, and 3% to landfilling based on a guesstimate from the authors in absence of existing data.
	Open loop recycling - Share of construction material recycled into low-recovery applications	39%	
Avoidable **construction waste prevention**	Prevention from **reducing the arisings of waste** during the construction process	<5%	Guesstimate from the authors in absence of existing data.

Table 17. Maximum circular economy performance for the existing infrastructure and building stock in England and France

Circular Economy Strategy		Share of materials circulated as inputs/outputs for the **existing infrastructure & building stock**	**Source of information**
Existing infrastructure and building stock sustained by **use of virgin materials**		6%	Calculated by subtracting the circular economy loops from 100%. Includes open-loop recycling.
Construction material **reuse**	**Recovery** and **reuse**	20%	Guesstimate from the authors in absence of existing data.
Construction material **recycling**	**Closed loop recycling** - share of construction material recycled via high-recovery applications	38%	Estimated based on an average 92% recovery figure from England and France multiplied by 10% going to closed loop recycling based on a guesstimate from the authors in absence of existing data.
	Open loop recycling - Share of construction material recycled into low-recovery applications	36%	Estimated based on an average 92% recovery figure from England and France multiplied by 87% going to closed loop recycling based on a guesstimate from the authors in absence of existing data.
Avoidable **construction waste prevention**	Prevention from **reducing the arisings of waste** during the construction process	10%	Guesstimate from the authors in absence of existing data.

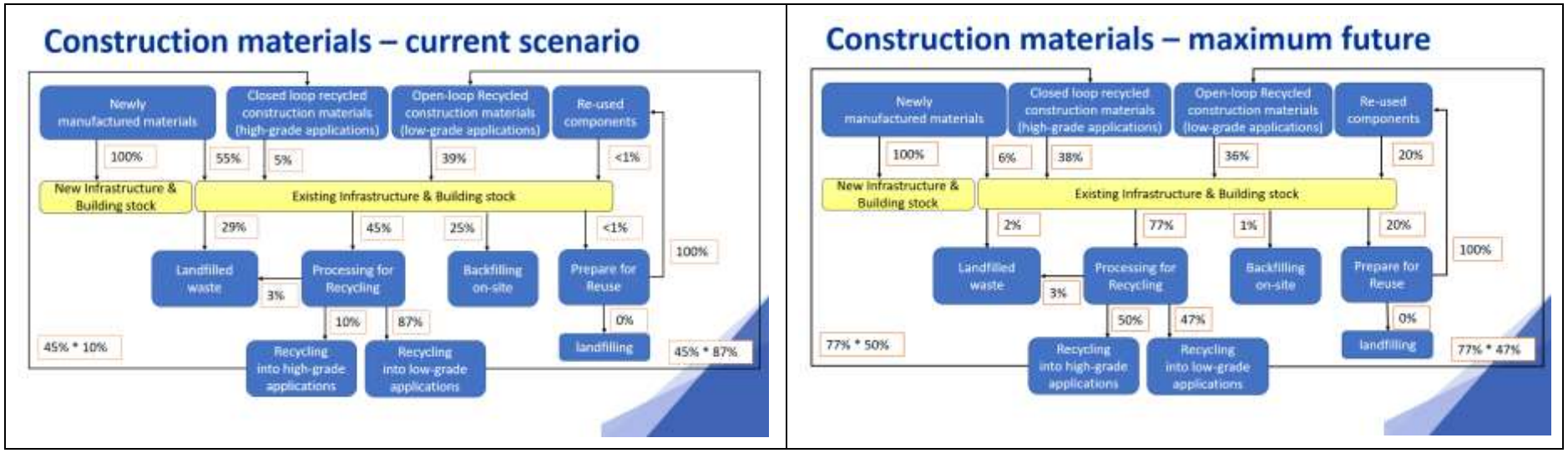

Figure 13. Baseline for construction materials (left) vs achievable maximum future (right).

Table 18. Estimated circular economy scenarios impacts for construction materials

		Reuse or repurpose	Repair	Redesign	Remanufacture	Refill	Recycling*	Reduce or prevent
Product stream	**Impact type** / **Impact levels**	Waste stream % reduction	Waste stream % reduction	**Unlocks high scenarios across strategies**	Waste stream % reduction	Reduction %	Local Disposal % reduction and recycling change	Total product/material stream % reduction
Construction materials	Low	5.00%					1.25%	2.50%
	Medium	10.00%					2.50%	5.00%
	High	15.00%		Unlocked			3.75%	7.50%

*Values include all recycling and backfilling due to the lumping of these practices in current recovery and recycling figures

4.6. Circular economy scenario for furniture

Overview – Furniture is an essential part of daily life, and accounts for a large number of resources consumed. Historically the demand for furniture has risen resulting in greater material use, so has the need to transition from linear economy to a circular one. The take, make and dispose culture has created an unsustainable model. Modern furniture waste typically consists of a wide range of materials such as wood chipboard, medium density fibreboard, metal and aluminium, plastic and different textiles and even in some cases electric appliances (e.g., motorised beds).

The main circular economy strategy for furniture in place today relates to reuse of furniture in second-hand shops and reuse initiatives. In contrast, recycling of furniture is quite uncommon today. Furniture that is not repaired and reused today ends up in landfill or is incinerated because of limited systems and economics of recycling.[36] According to the 2021 'Waste Prevention Programme for England' around 670,000 tonnes of furniture is sent to landfill annually[37], although potentially 50% of it is still reusable.[3] In France, an estimated 2.2 million tonnes of furniture were sold in 2016 yet only around 32,000 tonnes of furniture are reused, with the majority incinerated or sent to landfill.[38]

Low recycling rates occur because the processes for sorting and processing of furniture in different material streams are not yet available at commercial scale. As furniture is composed of various recyclable and non-recyclable materials, it requires significant time, effort and skills to obtain separate material streams. The ECOBULK 2017-2021 research project evaluated the possibilities for pre-treatment of bulky waste, including furniture.[39] This demonstrated that with a set of pre-treatment processes including shredding, screening and manual and near-infrared sorting, different material streams can be provided from furniture. These streams include fibre, film, wood, different plastics, metals, fines and residues. Paving the way for a recycling industry for furniture that is no longer re-usable. The vision of ECOBULK is that in addition to traditional Material Recovery facilities (MRF's) for items like glass, paper & card, metals and plastics, also bulky waste MRF's linked to closed loop recycling become a commonality.

Lifespan extension of furniture via better design that improves repairability is a key circular economy strategy for furniture. Poorly designed furniture can be a major issue as it would break down quicker requiring it to be replaced more frequently. Smart designs can also result in minimising manufacturing waste, and the use of surplus wood and materials in the creation of another product. As such, every aspect within the furniture industry has the potential to become more circular, this includes the design, supply and manufacturing processes.

These practices are strengthened by increasing involvement of furniture manufacturers in the full lifecycle of the product. Increasingly, furniture businesses are exploring the circular economy to deploy innovative uses of unwanted or old furniture items. For example, IKEA has started to offer a pay-back service for its own old furniture when returned to the store. Key to these developments is legislation of Extended Producer Responsibility schemes (ERP) where furniture manufacturers and/or brand owners become legally responsible for what happens to furniture at the end of their life. In France, an ERP scheme for furniture was introduced in 2012.[40] The scheme is operated by Valdelia - https://www.valdelia.org/ - who takes care of oversight across France for furniture take-back collections, reuse and recycling. In the UK a proposal for Extended Producer Responsibility (EPR) for bulky waste (essentially furniture and furnishings) is under consultation and will potentially be introduced by the end of 2025.

[3] Matt Mace, "Britons throw away more than 300,000 tonnes of reusable furniture every year", Edie, 2015, https://www.edie.net/news/5/RSA-urge-manufacturers-to-embrace-circular-economy-for-furniture/ (last accessed 24 March 2022)

Applicable circular economy strategies for furniture include reuse, repair, recycle and reduce. Assumptions for these circular economy strategies were made as follows:

1. The baseline circular economy impact on the share of total furniture in circulation, in the French and English context, is shown in Table 19.
2. The estimated maximum achievable in the foreseeable future is shown in Table 20. A visual comparison between the current (1) and maximum foreseeable future (2) flows is shown in Figure 14.
3. To create the low-medium-high ambition scenarios, the distance between (1) and (2) is portioned into three levels of improvements. Indicating different ambition levels to go from the current baseline towards the future achievable maximum. Defined in Table 21 and used for the FCE scenario calculations.

Refill as a circular economy strategy is not applicable to furniture. Remanufacture and redesign are outside of the scope of this study. Redesign is highly relevant to improve repair and re-usability. In the scenarios, redesign is thus assumed to be necessary to unlock higher ambition scenarios repair and reuse.

Table 19. Current circular economy performance for Furniture in England and France

Circular Economy Strategy		**Share of total furniture in circulation**	**Source of information**
Furniture made from **virgin materials**		71.5%	Calculated by subtracting the circular economy loops from 100%. Excludes open loop recycling that turns furniture into other products, and reduction from reducing fast furniture.
Furniture **reuse**	Second-hand furniture sales (direct)	2%	Guesstimate from the authors in absence of existing data. Value based on 4% going into second-hand sales of which half is sold and the rest going into recycling loops
	Refurbishment sales (direct)	2%	Based on furniture stock, and what happens to furniture through refurbishment and furniture reuse sales
	Reuse sales from collect furniture for recycling	1.5%	Out of estimated furniture that goes into recycling, where 10% is prepared for reuse by local authority, producer responsibility, and 3% is collected for recovery of which half is sold for reuse and half goes go back to recycling
Furniture **repair**	Share of furniture repaired with their lifespan extended preventing new purchases	3%	Guesstimate from the authors in absence of existing data
Furniture **recycling**	**Closed loop recycling** - share of materials recycled into new furniture	21%	Guesstimate from the authors in absence of existing data.
	Open loop recycling – Materials recycling	**?%**	Assumed all recycling in closed loop, more info required
Furniture **prevention** (less purchasing/ownership/less frequent replacement of furniture)	Share of furniture reduced from circulation by reducing fast furniture. Through overall less ownership as people buy more in line with actual needs	**<1%**	Guesstimate from the authors in absence of existing data. How many pieces of furniture that are not used but stored and how many people would buy things only in line with their needs, rather than buy new things more frequently (fast furniture)
	Share of furniture that are reduced from circulation by renting furniture. By increasing the life span through making reuse easier. Overall, less ownership	**2%**	Guesstimate from the authors in absence of existing data. Based on an estimate of the number of people who would rather rent certain items of furniture, rather than own it

Table 20. Maximum circular economy performance in the future for furniture in England and France

Circular Economy Strategy		Share of total furniture in circulation	Source of information
Furniture that is made from virgin materials		21.5%	Calculated by subtracting the circular economy loops from 100%. Excludes open loop recycling that turns furniture into other products, and reduction from reducing fast furniture.
Furniture **reuse**	Second-hand furniture sales (direct)	15%	Guesstimate from the authors in absence of existing data. Value based on 20% going into second-hand sales of which half 5% is unsold and the rest goes back into 2nd hand into recycling loops
	Refurbishment sales (direct)	12%	Guesstimate from the authors in absence of existing data. Value based on 15% refurbishment sales, where by 3% is unsold furniture and the rest goes back into a loop
	Reuse sales from collect furniture for recycling	1.5%	Out of estimated furniture that goes into recycling, where 10% is prepared for reuse by local authority, producer responsibility, and 5% is collected for recovery of which half is sold for reuse and half goes go back to recycling
Furniture **repair**	Share of furniture repaired with their lifespan extended preventing new purchases	10%	Guesstimate from the authors in absence of existing data
Furniture **recycling**	**Closed loop recycling** - share of materials recycled into new furniture	40%	Guesstimate from the authors in absence of existing data.
	Open loop recycling – Materials recycling	**?%**	Assumed all recycling in closed loop, more info required
Furniture **prevention** (Less purchasing/ ownership/ less frequent replacement of furniture)	Share of furniture that are reduced from circulation by reducing fast furniture. Through overall less ownership as people buy more in line with actual needs	**5%**	Guesstimate from the authors in absence of existing data. Increased awareness about fast furniture would mean, increase in number of people buy out of need rather than want.
	Share of furniture that are reduced from circulation by renting furniture. By increasing the life span through making reuse easier. Overall, less ownership	**10%**	Guesstimate from the authors in absence of existing data. Based on an estimate of the number of people who would rather rent certain items of furniture, rather than own it

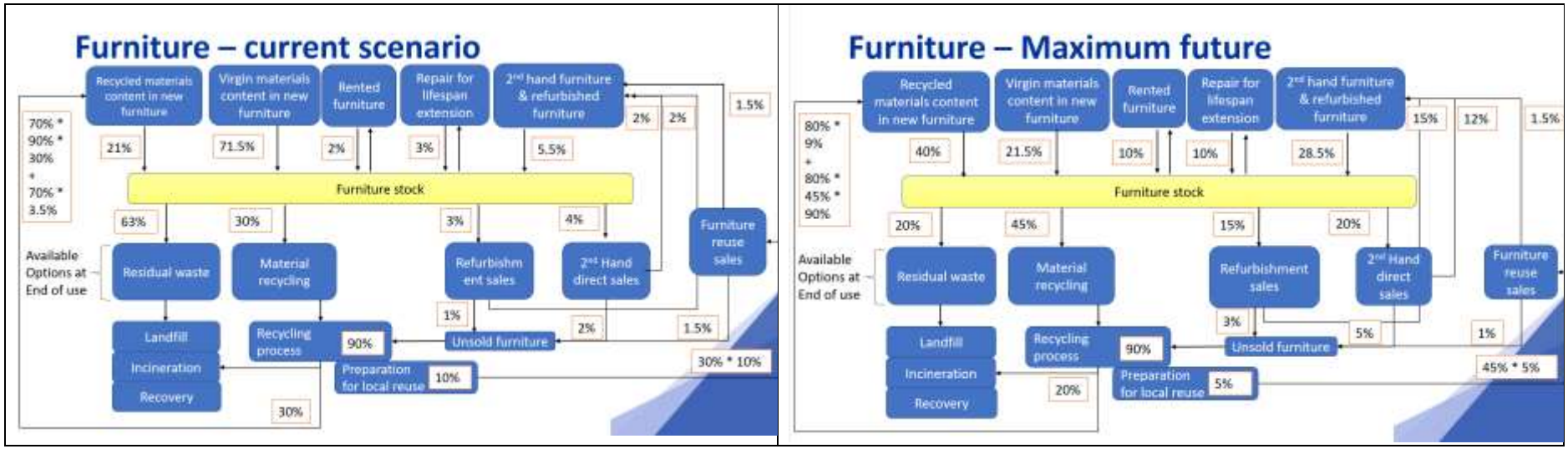

Figure 14. Baseline for furniture (left) vs achievable maximum future (right).

Table 21. Estimated circular economy scenario impacts for furniture

		Reuse or repurpose	Repair	Redesign	Remanufacture	Refill	Recycling (closed loop)	Reduce or prevent
	Impact type	Waste stream % reduction	Waste stream % reduction	**Unlocks high scenarios across strategies**	Waste stream % reduction	Packaging reduction %	Local Disposal % reduction and recycling increase	Total product/material stream % reduction
Product stream	**Impact levels**							
Furniture	Low	3.25%	1.75%		2.50%		4.75%	3.00%
	Medium	6.50%	3.50%		5.00%		9.50%	6.00%
	High	9.75%	5.25%		7.50%		14.25%	9.00%

4.7. Circular economy scenario for large & small appliances

Overview – Large and small appliances manufacturing contain a wide range of materials including copper, aluminium, steel, and plastics, among others. Adopting circular economy principles into the large and small appliance industry would result in products that last longer, are used for longer, and with increasing recovery and recycling at end of life.[41] A survey conducted in the UK in 2019 highlighted that 75% of the respondents preferred to throw away their appliances rather than pay to get them fixed, as it is easier and often cheaper to buy new appliances.[42] A 2021 study conducted by the French Environment and Energy Management Agency estimated that people carry out their own repair effort in only 1 out of 5 electronic devices that break down.[43]

The main five strategies to achieve circularity for large and small appliances include reduce, reuse, repair, remanufacture and recycle:

- **Reduce**, people with higher incomes tend to purchase small appliances as gifts. Especially around commercial shopping holidays, including Christmas and black Friday, millions of appliances are bought that are not necessarily wanted. Many of these end up disused or disposed. Also a large share of people tend to purchase a new model of smartphone when the old one still works well and is quite new because of new features. Circular economy activities under this strategy include campaigns focusing to reduce fast disposal and replacement appliances behaviours.
- **Reuse**, the direct reuse strategy when it comes to appliances implies improved collection channels for appliances and more commonplace checks for reusability than in place today. At present most appliances are not checked for their reuse condition, either at collection or further inspections. Instead they go directly to recycling streams. Local authorities play a key role as they are the main contact point for the first collection stage of residents, either directly or via a company contracted by the local authority. There is a lot to gain by making sure that appliances are inspected for reuse at local authority reuse and recycling centres or similar donation points.
- **Repair,** most appliances require repair before they can be reused. Repair is becoming easier due to legal requirements and legislative initiatives. Both France from EU rules and the UK has implemented 'right to repair' rules. These mandate manufacturers to provide professional repairers access to spare parts and technical information within the next few years.[44] In addition, the French National Assembly Resource in 2020 voted to introduce an index of 'repairability' ratings for appliances (small and large appliances). In doing this the French government has stated the ambition to increase the repair efforts from 40% to 60% of device received by repair network organisations in the next 5 years.[45] Local authorities play a key role by providing access to devices for repair through the collections they manage from residents.
- **Remanufacture,** requires a more intensive process of disassembly at the end of life of appliances to obtain components that can be re-introduced in the manufacturing stream. It is excluded here as local authorities have limited influence over this strategy.
- **Recycling**, the current main circular economy strategy in place for large and small appliances is recycling. An estimated half of the appliances that are collected end up in authorised legal recycling loops. These are approved authorised treatment facilities by the national governments that have strict procedures for the pre-treatment of waste electrical and electronic equipment with minor disassembly and subsequent shredding. Followed by sorting and recycling efforts, as well as incineration of hazardous components. In particular cases the entire device is incinerated due to hazardous components such as persistent organic pollutants. What happens with the other half is not fully known, as these devices are today collected by informal networks often leading to cheap mostly illegal exports to global south countries, or improper in country treatment, with high profits for the collection firm. The reason for the continued persistence of informal collection companies is twofold. First, a lack of regulations, especially in the UK, which means almost anyone can become a waste collector with no proper training and operate in a grey area of the law. Second, residents who put their devices out on the street or donation/collection by an informal network instead of local authority approved channels, due to a lack of information and/or enforcement of proper collections.

The evaluated circular economy strategies for large and small appliances in these scenarios are reduce/prevention, reuse, repair, and recycling. Assumptions for these circular economy strategies were made as follows:

1. The baseline circular economy impact on the share of total large and small appliances in circulation, in the French and English context, is shown in Table 22.
2. The estimated maximum achievable in the foreseeable future is shown in Table 23.
3. A visual comparison between the current (1) and maximum foreseeable future (2) flows is shown in Figure 15.
4. To create the low-medium-high ambition scenarios, the distance between (1) and (2) is portioned into three levels of improvements. Indicating different ambition levels to go from the current baseline towards the future achievable maximum. Defined in the final Table 24 and used for the FCE scenario calculations.

Refill as a circular economy strategy is not applicable to large and small appliances. Remanufacture is not included as it is not directly applicable to local authorities' efforts. Redesign is outside of the scope of this study. Redesign is highly relevant to improve repair and remanufacturing. In the scenarios redesign is thus assumed to be necessary to unlock higher ambition scenarios for repair.

Table 22. Current circular economy performance for appliances in England and France

Circular Economy Strategy		**Share of total large & small appliances in circulation**	**Source of information**
Large and small appliances that is made from virgin materials		62.5%	Calculated by subtracting the circular economy loops from 100%. Excludes open loop recycling that turns large and small appliances into other products
Large & small appliances **reuse**	Second-hand large and small appliances sales (direct)	3%	Guesstimate from the authors in absence of existing data. Value based on 4% going into second-hand sales of which 1% is unsold and the rest going into recycling loops
	Refurbishment sales (direct)	2%	Guesstimate based on 3% going into refurbishment sales of which 1% is unsold and the rest going into second-hand refurbished appliances.
	Reuse sales from collect large and small appliances for recycling	3.5%	An estimated 10% is prepared for reuse of which 4.5% goes to appliance reuse sales, where 1% is unsold and the rest goes into second-hand and refurbished appliances.
Large & small appliances **repair**	Share of appliances repaired with their lifespan extended preventing new purchases	1%	Guesstimate from the authors in absence of existing data
Large & small appliances **recycling**	**Closed loop recycling** - share of materials recycled into new large and small appliances	26%	Guesstimate from the authors in absence of existing data.
	Open loop recycling – Materials recycling	**?%**	Assumed all recycling in closed loop, more info required
Large & small appliances **prevention** (less purchasing/ownership/less frequent replacement)	Share of large and small appliances that are reduced from circulation by reducing their use. Through overall less ownership as people buy more in line with actual needs	**<1%**	Guesstimate from the authors in absence of existing data. How many appliances that are not used but stored. Also includes how many people would buy things only in line with their needs, rather than buy new appliances more frequently
	Share of large and small appliances that are reduced from circulation by renting them. By increasing the life span making reuse easier. Overall, less ownership.	**1%**	Guesstimate from the authors in absence of existing data. Based on an estimate of the number of people who would rather rent appliances, rather than owning it.

Table 23. Maximum circular economy performance in the future for appliances in England and France

Circular Economy Strategy	**Share of total large & small**	**Source of information**

		appliances in circulation	
Large and small appliances that is made from virgin materials		30.6%	Calculated by subtracting the circular economy loops from 100%. Excludes open loop recycling that turns large and small appliances into other products
Large & small appliances **reuse**	Second-hand large and small appliances sales (direct)	4%	Guesstimate from the authors in absence of existing data. Value based on 4% going into second-hand sales of which 1% is unsold and the rest going into recycling loops
	Refurbishment sales (direct)	13%	Guesstimate based on 3% going into refurbishment sales of which 1% is unsold and the rest going into second-hand refurbished appliances.
	Reuse sales from collect large and small appliances for recycling	4.4%	An estimated 10% is prepared for reuse of which 5.4% goes to appliance reuse sales, where 1% is unsold and the rest goes into second-hand and refurbished appliances.
Large & small appliances **repair**	Share of appliances repaired with their lifespan extended preventing new purchases	8%	Guesstimate from the authors in absence of existing data
Large & small appliances **recycling**	**Closed loop recycling** - share of materials recycled into new large and small appliances	38%	Guesstimate from the authors in absence of existing data.
	Open loop recycling – Materials recycling	**?%**	Assumed all recycling in closed loop, more info required
Large & small appliances **prevention** (less purchasing/ownership/less frequent replacement)	Share of large and small appliances that are reduced from circulation by reducing their use. Through overall less ownership as people buy more in line with actual needs	**2%**	Guesstimate from the authors in absence of existing data. How many appliances that are not used but stored. Also includes how many people would buy things only in line with their needs, rather than buy new appliances more frequently
	Share of large and small appliances that are reduced from circulation by renting them. By increasing the life span through making reuse easier. Overall, less ownership	**2%**	Guesstimate from the authors in absence of existing data. Based on an estimate of the number of people who would rather rent appliances, rather than own it

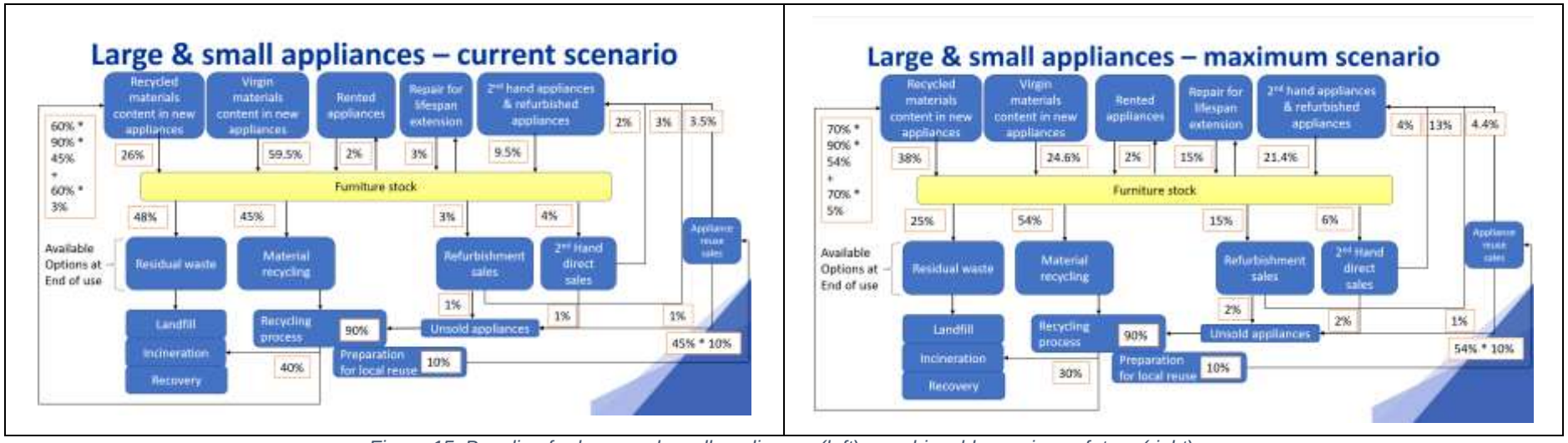

Figure 15. Baseline for large and small appliances (left) vs achievable maximum future (right).

Table 24. Estimated circular economy scenario impacts for large and small appliances

		Reuse or repurpose	Repair	Redesign	Remanufacture	Refill	Recycling (closed loop)	Reduce or prevent
Product stream	**Impact type** / **Impact levels**	Waste stream % reduction	Waste stream % reduction	**Unlocks high scenarios across strategies**	Waste stream % reduction	Packaging reduction %	Local Disposal % reduction and recycling increase	Total product/material stream % reduction
Large & small appliances	Low	0.50%	3.00%		3.00%		3.00%	6.00%
	Medium	1.00%	6.00%		6.00%		6.00%	8.00%
	High	1.50%	9.00%		9.00%		9.00%	12.00%

5. Results for circular economy scenarios

5.1. Circular economy impacts on material flows in the FCE area

The scenarios presented in section 4.2 to 4.7 were integrated to provide for a combined overview of potential waste flow impacts for the FCE regions in England and France. In table 26 the results for England and in table 27 the results for France are presented.

A baseline of total waste flow tonnages and the recycling and disposal routes as first made. To this end for England as a baseline waste tonnage value from local authority collected waste statistics are used from the most recent comprehensive study produced by Eunomia in 2020.[46] The values represent the waste tonnages for the year 2017. Except for construction materials where values are based on the 2020 Waste Data Interrogator of the UK Environment Agency. The values have been adjusted to provide for an estimate of the 23 local authority regions in the FCE area in England. The baseline value estimates included an assessment recycling and disposal routes. For France, the waste tonnage baseline is made from a bottom-up estimate. Values of the amount of waste recycled and disposed in Pas de Calais, Somme, Oise[47], Normandy[48], and Brittany[49] were obtained from regional statistical summaries. The values were aggregated to come to a total estimate for the FCE area in France. This included the creation of baseline values for recycling and disposal routes.

The French FCE area in terms of population at around 9.5 million people is about two thirds that of the English FCE area with around 15 million people. A cross-check of tonnages of products/materials was made between the two areas by dividing the material/product flows by the population (Table 25). This delivers the waste arisings in kg per person per year which can be directly compared. The data shows substantial inconstancies for construction materials, textiles & clothing and furniture. A factor 4.4 more construction material waste in France versus England, a factor 3 more textiles & clothing waste arisings in England than in France, and a factor 2 more furniture waste arisings in France than in England. The main key reason is missing data due to different and more robust data collection methodologies between the countries. In case of construction materials much richer datasets are available in France than in England, which implies that the English data used likely underestimates construction material waste. The findings indicate that more efforts need to be made to improve the quality of collected data for the three material/product streams with significant discrepancies.

Table 25. Data consistency check between the England and French FCE area data.

Categories	England FCE – waste arisings in kg per person per year	France FCE – waste arisings in kg per person per year
Textiles & clothing	24	8
Packaging	121	87
Food and garden	156	105
Construction Materials	273	1,203
Furniture	7	17
Large and small appliances	8	9

After the baseline was made the impacts of different circular economy strategy impacts were estimated. To this end the low-medium-high ambition impact percentages from tables 7 to 24 were taken and applied to the datasets for France and England. Either resulting in a reduction in the waste arisings, such as via prevention or reuse initiatives, or a change in the recycling rate. The impacts of several circular economy strategies, reuse, repair, prevent, and refill are thereby grouped together as a joint impact on reduced waste arisings.

The results of the scenarios for the **English FCE area (Table 26)** include:

- The **total waste current waste arisings across the 6 product/material categories** amount to 8.8 million tonnes, of which 62% is recycled primarily due to high low-recovery recycling rates in construction materials. If construction materials are excluded 48% is recycled.
- The combined potential **reduction in waste arisings** amounts to 19% in the low ambition scenario, 30% in the medium ambition scenario and 46% in the high ambition scenario. The high ambition scenario results in a **decline in disposed waste** sent to landfill and incineration with energy recovery from 3.4 million tonnes to 1.8 million tonnes.
- The **highest circular economy potentials in absolute terms in tonnes** are found for food and garden waste, packaging, and in construction materials. The reason is the higher absolute waste flows in millions of tonnes, combined with larger percentage economy impacts for packaging and food and garden waste.
- The overall **recycling tonnages are estimated to decline** from 5.5 million down to 4.5 million tonnes in the high ambition scenario. The reason are shifts towards reuse, refurbishment, rental, repair, and refill resulting in overall fewer waste arisings for recycling. This is not consistent across the six product/material categories. Recycling tonnages increase in furniture and textiles & clothing vs declines in food & garden, packaging, construction materials and small and large appliances.

The results of the scenarios for the **French FCE area (Table 27)** include:

- The **total waste current waste arisings across the 6 product/material categories** amount to 13.7 million tonnes, of which 60% is recycled primarily due to high low-recovery recycling rates in construction materials. If construction materials are excluded 49% is recycled.
- The combined potential **reduction in waste arisings** amounts to 13% in the low ambition scenario, 23% in the medium ambition scenario and 34% in the high ambition scenario. The high ambition scenario results in a **decline in disposed waste** that are sent to landfill and incineration with energy recovery from 5.5 million tonnes to 3.6 million tonnes.
- The **highest circular economy potentials in absolute terms in tonnes** are also found for food and garden waste, packaging, and in construction materials. The reason is the higher absolute waste flows in millions of tonnes, combined with larger percentage economy impacts for packaging and food and garden waste.
- The overall **recycling tonnages are estimated to decline** from 8.2 million tonnes down to 6.8 million tonnes in the high ambition scenario. The reason are shifts towards reuse, refurbishment, rental, repair, and refill resulting in overall fewer waste arisings for recycling. This is consistent with declines in recycling across all six product/material categories.

*Table 26. Circular economy waste flow impacts for FCE **England** area.*

Product & material stream	FCE area: England Tonnage			Expert estimated macro-impact potential of solutions (tonnage)											
	Total	Recycled	Disposed*	Low				Medium				High			
				Reduced	Recycled	Disposed	% Waste reduction	Reduced	Recycled	Disposed	% Waste reduction	Reduced	Recycled	Disposed	% Waste reduction
Textiles & clothing	**356,090**	**34,424**	**321,667**	35,609	40,596	**279,885**	**-13.0%**	71,218	44,632	**240,240**	**-25.3%**	106,827	46,530	**202,733**	**-37.0%**
Packaging	**1,812,480**	**953,609**	**858,871**	217,498	871,076	**723,907**	**-15.7%**	434,995	902,975	**474,510**	**-44.8%**	652,493	934,875	**225,112**	**-73.8%**
Food and garden	**2,344,312**	**1,212,866**	**1,131,446**	252,014	1,270,790	**821,509**	**-27.4%**	504,027	1,270,790	**569,495**	**-49.7%**	764,832	1,459,097	**120,384**	**-89.4%**
Construction Materials**	**4,088,988**	**3,199,907**	**889,081**	306,674	3,007,193	**775,121**	**-12.8%**	613,348	2,806,812	**668,828**	**-24.8%**	920,022	2,598,764	**570,202**	**-35.9%**
Furniture	**109,384**	**6,446**	**102,938**	11,485	10,419	**87,479**	**-15.0%**	22,971	13,302	**73,112**	**-29.0%**	34,456	15,093	**59,835**	**-41.9%**
Large and small appliances	**125,914**	**78,680**	**47,234**	15,739	72,150	**38,025**	**-19.5%**	26,442	68,126	**31,347**	**-33.6%**	39,663	61,658	**24,593**	**-47.9%**
Total	**8,837,168**	**5,485,932**	**3,351,237**	839,019	5,272,224	**2,725,925**	**-18.7%**	1,673,001	4,830,438	**2,333,729**	**-30.4%**	2,518,293	4,503,430	**1,815,446**	**-45.8%**

*Table 27. Circular economy waste flow impacts for FCE **France** area*

Product & material stream	FCE area: France Tonnage			Expert estimated macro-impact potential of solutions (tonnage)											
	Total	Recycled	Disposed*	Low				Medium				High			
				Reduced	Recycled	Disposed	% Waste reduction	Reduced	Recycled	Disposed	% Waste reduction	Reduced	Recycled	Disposed	% Waste reduction
Textiles & clothing	**73,489**	36,696	**36,793**	7,349	35,011	**31,129**	**-15.4%**	14,698	32,884	**25,907**	**-29.6%**	22,047	30,317	**21,125**	**-42.6%**
Packaging	**864,845**	508,039	**356,806**	103,781	462,296	**298,768**	**-16.3%**	207,563	412,401	**244,881**	**-31.4%**	311,344	358,355	**195,146**	**-45.3%**
Food and garden	**1,050,036**	459,213	**590,823**	112,879	494,192	**442,965**	**-25.0%**	225,758	434,667	**389,611**	**-34.1%**	342,574	436,738	**270,724**	**-54.2%**
Construction Materials**	**11,432,898**	7,103,053	**4,329,845**	857,467	6,702,517	**3,872,914**	**-10.6%**	1,714,935	6,280,544	**3,437,419**	**-20.6%**	2,572,402	5,837,135	**3,023,361**	**-30.2%**
Furniture	**161,294**	76,643	**84,651**	16,936	75,452	**68,906**	**-18.6%**	33,872	72,653	**54,769**	**-35.3%**	50,808	68,245	**42,242**	**-50.1%**
Large and small appliances	**87,703**	29,288	**58,415**	10,963	27,929	**48,811**	**-16.4%**	18,418	27,295	**41,991**	**-28.1%**	27,626	25,469	**34,607**	**-40.8%**
Total	**13,670,265**	8,212,932	**5,457,333**	1,109,375	7,797,397	**4,763,493**	**-12.7%**	2,215,242	7,260,444	**4,194,578**	**-23.1%**	3,326,801	6,756,258	**3,587,205**	**-34.3%**

*Landfilled, exported or incinerated in an Energy from Waste incinerator.
**Values for construction materials recycling include backfilling due to a lack of accounting that enables to split recycling and backfilling into two different data categories.

5.2. Jobs impacts of the circular economy solutions in the FCE area

The circular economy allows for a shift from linear waste management activities to circular activities including reuse, repair, recycling. The job impacts of circular economy strategies have previously been estimated based on the number of jobs per tonne of product or waste flow. For example, repair jobs per tonne of product repaired. This approach is also adopted in this study, as it provides a comparable approach to existing studies, and because it is easy to apply to the waste flow scenarios as presented in section 4.8. The underlying circular economy strategy impacts for reuse, repair, remanufacture, refill, recycle and reduce is estimated in terms of tonnes of waste flowing through these approaches and their resulting impacts of waste prevented or recycled. The estimate for redesign job impacts was excluded as it was not possible to obtain good insights in this strategy for this study.

The applied job values in number of jobs were estimated per 1000 tonnes of waste/product flows per strategy. Specific values can be found in Appendix D. In general, circular economy strategies that are higher up on the waste hierarchy involve more job opportunities than those lower on the waste hierarchy. In case of recycling, for example, job impacts across product/material streams range from 3 to 30 jobs per 1000 tonnes recycled. In contrast, for reuse, job impacts range from 15 to 100 jobs per 1000 tonnes reused. This is why a shift to a more circular economy has substantial impacts on the number of jobs created within a region.

After applying this analysis, the job impacts can be easily read from tables 28 and 29 for the English and French FCE area respectively. Both for individual circular economy strategies and the total job gains across low-medium-high impact scenarios. There are substantial job gains for all circular economy strategies except recycling. This is because if there is a substantial increase in reuse, repair, remanufacture, reduce and refill, there is an overall decrease in the waste flow and thereby in absolute terms less recycling. Even if the total share of recycling would increase. And absolute flow reductions mean less jobs overall.

The specific results of the analysis for the **English FCE** area include:

- **Total:** across all six material/product streams the total circular economy jobs potential is estimated at 14,600 to 42,500 jobs.
  - **Reuse activities**: enhancing reuse activities can result in 11,800 to 35,400 new jobs. Primarily in construction materials reuse and by setting up packaging reuse systems for non-refillable packaging.
  - **Waste prevention activities**: The jobs creation potential lies between 1,800 and 5,400 jobs. Primarily from preventing packaging, food and garden and construction materials streams.
  - **Repair activities**: a total potential of 1,660 to 5,000 jobs is estimated. Primarily from the repair of large and small appliances and textiles & clothing product streams.
  - **Refill activities**: packaging refill activities for liquids can provide for 270 to 820 jobs.
- **Recycling activities**: the jobs in the recycling sector are expected to shrink by between 1320 and 5370 jobs. The reason is a reduced absolute flow of recycling due to significant growth in reuse, waste prevention, repair and refill. The largest share of this decline comes from construction and the second largest from packaging.
- **Total job creation potential excluding the construction sector**: the circular economy job creation potential when excluding the construction sector is estimated at 6,200 to 16,900 jobs.
- The job creation potential is significant **within the context of the current number of jobs in waste management**. A total of 125,000 people are employed in waste management across the entire UK based on the last available figures for 2018.[50] Based on the respective population of the UK vs

the FCE England area, this would imply a total of 37,200 jobs in waste management in FCE England. Therefore, the scenarios for circular economy **could more than double the current number of jobs.**

The specific results of the analysis for the **French FCE** area include:

- **Total:** across all six material/product streams the total circular economy jobs potential is estimated at 29,000 to 90,400 jobs.
  - **Reuse activities**: enhancing reuse activities can result in 27,000 to 81,000 new jobs. Primarily in construction materials reuse and to a lesser extent by setting up packaging reuse systems for non-refillable packaging.
  - **Waste prevention activities**: The jobs creation potential lies between 1,800 and 9,700 jobs. Primarily from preventing construction materials, food and garden and packaging streams.
  - **Repair activities**: a total potential of 960 to 2,870 jobs is estimated. Primarily from the repair of large and small appliances and textiles & clothing product streams.
  - **Refill activities**: packaging refill activities for liquids can provide for 130 to 390 jobs.
- **Recycling activities**: the jobs in the recycling sector are expected to shrink by between 1340 and 4970 jobs. The reason is a reduced absolute flow of recycling due to significant growth in reuse, waste prevention, repair and refill. The largest share of this decline comes from construction and the second largest from packaging.
- **Total job creation potential excluding the construction sector**: the circular economy job creation potential when excluding the construction sector is estimated at 3,330 to 9,220 jobs.
- The job creation potential is significant **within the context of the current number of jobs in waste management**. A total of 65,470 people are employed in waste management across France based on the last available figures for 2018.[51] Based on the respective population of France vs **the FCE France area, this would imply a total of 9,720 jobs in waste management in FCE France.** Therefore, the high ambition scenarios for circular economy **could also more than triple the current number of jobs.**

*Table 28. Circular economy job creation potential for FCE **England** area*

Product & material stream	Expert estimated macro-impact jobs potential of solutions (tonnage)							
	Reuse or repurpose	Repair	Redesign	Remanufacture	Refill	Recycle (incl. Sorting)	Reduce or prevent	Total
Low ambition scenario								
Textiles & clothing	599	713				105	43	1,460
Packaging	1,632				272	-413	363	1,854
Food and garden	106					290	938	1,334
Construction Materials	9,201					-579	409	9,031
Furniture	189	192		206		40	14	641
Large and small appliances	63	756		227		-196	31	881
Medium ambition scenario								
Textiles & clothing	1,197	1,425				174	86	2,882
Packaging	3,263				544	-869	725	3,663
Food and garden	211					-476	1,876	1,611
Construction Materials	18,401					-1,180	818	18,039
Furniture	377	383		411		69	27	1,267
Large and small appliances	126	1,511		454		-317	41	1,815
High ambition scenario								
Textiles & clothing	1,795	2,137				206	129	4,267
Packaging	4,894				816	-1,369	1,088	5,429
Food and garden	370					-557	2,814	2,627
Construction Materials	27,601					-1,804	1,227	27,024
Furniture	566	575		616		87	40	1,884
Large and small appliances	189	2,267		680		-511	61	2,686
Combined scenario total across six product/material streams								
Low ambition	11,790	1,661		433	272	-753	1,798	**15,201**
Medium ambition	23,575	3,319		865	544	-2,599	3,573	**29,277**
High ambition	35,415	4,979		1,296	816	-3,948	5,359	**43,917**

*Table 29. Circular economy job creation potential for FCE **France** area*

Product & material stream	Expert estimated macro-impact jobs potential of solutions (tonnage)							
	Reuse or repurpose	Repair	Redesign	Remanufacture	Refill	Recycle (incl. Sorting)	Reduce or prevent	Total

Low ambition scenario								
Textiles & clothing	124	147				-29	9	251
Packaging	779				130	-229	173	852
Food and garden	48					-175	421	644
Construction Materials	25,725					-1,202	1,144	25,667
Furniture	279	283		303		-12	20	872
Large and small appliances	44	527		158		-14	22	710
Medium ambition scenario								
Textiles & clothing	247	294				-65	18	494
Packaging	1,557				260	-479	348	1,684
Food and garden	95					-123	841	813
Construction Materials	51,449					-2,468	2,287	51,268
Furniture	556	565		605		-40	39	1,725
Large and small appliances	88	1,053		316		-60	29	1,426
High ambition scenario								
Textiles & clothing	371	441				-109	27	730
Packaging	2,336				390	-749	519	2,496
Food and garden	166					-113	1,261	1,314
Construction Materials	77,173					-3,798	7,783	81,158
Furniture	834	847		908		84	59	2,564
Large and small appliances	132	1,579		474		-115	43	2,113
Combined scenario total across six product/material streams								
Low ambition	26,998	957	N/A	461	130	-1,338	1,789	**28,997**
Medium ambition	53,992	1,912	N/A	921	260	-3,235	3,560	**57,410**
High ambition	81,012	2,867	N/A	1,382	390	-4,968	9,692	**90,375**

6. Conclusions and next steps

6.1. Conclusions

The circular economy seeks to shift from a linear disposal model to a reduce, reuse, repair and recycling model of products and waste. To achieve this a large number of new innovative societal solutions are needed to transform every stage of a products lifecycle. To change processes or alter behaviours that can keep products in the loop for longer and ensure that materials are reused and recycled to the highest extent possible.

The efforts described in this report started in chapter 2 with **creating a scan of new innovative solutions** that are already being deployed in France and England. A scan of **150 such solutions was made across six material/product streams**: packaging, textiles & clothing, garden and food waste, furniture, construction materials, and large and small appliances. The solutions have been summarised and are **available on the project BLUEPRINT website** (www.projectblueprint.eu) **in an online circular economy solutions library**. It was established in chapter 3 that **the dominant focus across the 150 solutions is on reuse, recycling and waste prevention**. Solutions that focus solely on repair, refill, redesign and remanufacturing are less common. It was also established **that solutions focusing on construction materials circular economy are much more present in France**, with very few solutions established in England.

The efforts continued with the creation of circular economy waste flow and jobs potential scenarios across the six materials streams. The scenarios **in chapter 4 provide for key reading to understand the current state of circular economy,** including insights in the prominence of particular circular economy strategies. For example, whilst reuse is very prominent in textiles & clothing in both England and France, recycling is only deployed at larger scales in France and consists primarily of down-cycling into insulation & cleaning cloths. In contrast, for construction materials recycling into low-value aggregates is dominant but reuse is virtually non-existent.

The combination of all scenarios shows the very large impact of the circular economy in the Interreg FCE area. The area covers territories in Northern France with around 9.5 million people, and in South-west, South and South-East England with around 15 million people. In the French and English FCE areas currently 13.7 and 8.8 million tonnes of waste is generated across the six material/product streams. Out of these 40% and 38% or 5.5 and 3.4 million tonnes are disposed of via landfill or energy from waste incineration in the respective French and English FCE areas including construction materials. If excluding construction materials, the % disposed grows to 52% and 51% respectively for the combined 5 product/material streams.

The circular economy can result in a maximum foreseeable prevention of 2.5 million tonnes of waste in the French and English FCE area. Primarily as a result of reduce, reuse, repair and refill efforts. The **total amount of waste arisings that go to landfill and incineration can be reduced by 34% and 46% in the French and English FCE areas** from concerted circular economy efforts. The resulting jobs impacts are 14,600 to 42,500 jobs for the English FCE area, and 29,000 to 90,400 jobs for the French FCE area. The range depends on the level of circular economy ambition as set out in the scenarios. The jobs creation impact is substantial when compared against overall jobs in the waste management sector, estimated at 37,200 in the English FCE area and 9,716 in the French FCE area. Thereby circular economy efforts can **more than double and triple the current number of jobs** in the waste and resources sector in the English and French FCE area, respectively.

The jobs creation potential varies substantially between different circular economy strategies and material/product streams. Whilst **reuse activities** have the largest jobs potential this is primarily in construction materials and non-refillable packaging. In contrast, **waste prevention** jobs potentials are found mostly in packaging, food & garden and construction materials. **Repair activities** jobs are mostly in large & small appliances and textiles & clothing efforts. The scenarios also established that a large shift in the waste hierarchy will lead to **a reduction in jobs in recycling**, despite significant increases in recycling rates. This is because of reduced waste arising associated with reduce, reuse, repair, and refill resulting in an absolute decline in the materials that go to recycling.

6.2. Next steps

The waste flow and job scenarios in sections 3.3 and 3.4 provide for an indicative assessment of the scaling of circular economy solutions. Solutions as exemplified in the 150 evaluated solutions that were mapped. To the author's awareness this is a first such an assessment that links the deployment of circular economy strategies directly to waste flows **and** jobs at a macro systems level. Previous assessments have focused on overarching circular economy gains for jobs, without relating these to waste flows or individual strategies. As stated in the section further work would be needed to create more direct links between solutions and circular economy strategies and their impacts. In order to assess which of the 150 or more solutions would sort the greatest impacts in terms of either circularising waste flows, or jobs creation. Or both by developing a more refined database of specific job and waste flow data per solution through monitoring and evaluation of each solution carried out by or with the solution providers.

The realisation of the scenarios are highly dependent on the replication and scaling of existing solutions, which in turn also depend on reducing the overall circular economy strategy barriers (see Table 5 in section 3.1). Replicating and scaling requires further initiation, capacity and capability building, facilitation and investment. To enable replication from one organisation to another, and by enabling growth of existing companies/organisations circular economy activities within and across borders. From a local authority perspective there are four potential routes we describe for replication and scaling of circular economy solutions:

- **Direct procurement**, where the local authority initiates and contractually procures a specific circular economy solution for implementation from a 3rd party. The on-going operations can either be sustained by the 3rd party, or by the local authority, depending on the procurement associated ownership model.
- **Internal delivery**, where the local authority takes care of the initiation, implementation, ownership and on-going operations for a circular economy solution
- **Facilitation**, where the local authority provides expertise to enable others to initiate, implement and operate a circular economy solution, such as through workshops or training programmes or small seed or grant funding, or a mix thereof.
- **Financial funds,** where the local authority sets up a general fund for one-off or on-going funding of social enterprises, charities and SME's for developing circular economy solutions in a region. Here organisations apply based on particular circular economy strategies (such as for repair, reuse or waste prevention) and/or associated waste streams that they are focused on.

The approaches that local authorities can take to replicate and scale circular economy solutions will be further evaluated in two other BLUEPRINT tasks:

- The to be delivered circular economy analysis report of the FCE area, that will look at how sustainable and inclusive growth opportunities can be initiated for the FCE area, based on circular economy solutions and the transition to a circular economy.
- The to be delivered guidance report for local authorities, which will include technical, economic and financial assessment of a selected number of circular economy solutions, relative to landfill and energy from waste incineration approaches.

In the latter report special attention will be paid to guidance for local authorities on the operationalisation of the circular economy solutions. For example, by identification of what changes a council needs to make in collection and access to waste to unlock particular circular economy solutions. These initiatives will support local authorities in France and England to take further leadership in replication and scalability activities. The two reports will become available by the end of 2022 and early 2023, respectively.

Annex A – Circular economy Solutions workshop results

A.1 Q1: what do you think of when you think of circular economy solutions?

The question was open ended to provide consortium partners the ability to conceptualise what thoughts come up when thinking about circular economy solutions with as little direction as possible. The responses were analysed, and an adjective was added at the start to categorise and cluster the responses in relation to circular economy Strategies and other relevant aspects of the Circular economy. In total 38 different aspects of circular economy were given as part of the question. The answers were clustered in two groups:

- Responses relating to circular economy strategies that say something about the type of solutions.
- Responses relating to societal, social and environmental values that say something about the requirements in conceiving of and operationalising the solutions.

The summary of responses of what consortium partners think of in relation to the Circular economy is**:**

> **Closing loops, designing better products and materials, better use of existing products, spaces and skills, reducing consumption and harmful materials, longer product lifespan, improved business models for product longevity, regeneration/upcycling, reuse and second-hand, repair and popularise repair, recycling and waste management.**

The summary of responses of what consortium partners think of should be considered when looking at circular economy solution is**:**

> **Agency of stakeholders and their alignment working with or towards circular economy solutions, thinking creatively when looking at solutions, strengthening community initiatives and engagement, making use of information and awareness channels, taking care of the environment by ensuring friendly end-of-life treatment of materials/products, taking care that the solutions are an investment for the future, making sure they are economically viable/can be scaled by being business centred, enable shifts in worldviews, help to retain the value of resources and materials, and can be linked to trainings and broader strategies.**

The detailed listing of responses relating to circular economy strategies included:

- **Closed loops** - Opportunities for waste to be put back into the loop.
- **Design** - Designing products (from electronics to buildings) to use more sustainable materials or reduce the number of new materials used.
- **Design** - smart design solutions
- **Design** - designing materials that are long lasting and environmentally friendly.
- **Sharing** - Sharing/second-hand economy for products, to redistribute old items which would otherwise go to landfill or recycling.
- **Better use** - and better ways of using things - including space, skills and knowledge.
- **Leasing** - leasing business models rather than purchase.
- **Reduce** - reducing the number of harmful materials used.
- **Reduce and longer life** - All approaches that reduce the need for producing things and where longevity is built into the production of anything that is newly made.
- **Regenerate/upcycle** - and regeneration projects - such as Repair Shops.
- **Reuse** - Opportunities that facilitate reusing materials rather than throwing away.
- **Reuse** - Reuse
- **Reuse** - Second-hand opportunities
- **Reuse & repair** - Ways to make the transition to a circular economy possible for example supporting the development of repair and reuse places.
- **Repair & reuse** - Something that makes a shift of mindset towards repair and reuse easy and the first choice - this is applicable to people, businesses, local authorities, anyone really.
- **Repair** - Repair
- **Repair** - Mandatory repairing prior throwing away

- **Repair** - To make repairable, have a second life as something else after use, and for disassembly.
- **Recycling -** Recycling waste streams
- **Recycling** - ways to deal with 'hard to recycle' items
- **Recycle** - Recycling projects - such as second-hand furniture stores or production of new items from existing resources e.g. candles produced from recycled glass
- **Zero waste** - Using waste to create new products
- **Waste management** - Also waste management projects - such as managing food waste.

Responses relating to societal, social and environmental values:

- **Agency** - Alignment of agency
- **Creativity -** Creative solutions
- **Community** - Community initiatives and engagement
- **Communications** - Information and awareness channels
- **Environment** - While using and re-using them, they will have an end life and should be designed to be destroyed in an environmentally friendly way.
- **Environment** - Respect for the environment
- **Environment** - Sustainable consumption
- **Future** - Investment for the future
- **Innovation** - innovation;
- **Investment** - Business centred solution
- **Paradigms** - Worldview shift
- **Resource value** - A circular economy solution recognises the retained value of a resource that would be typically regarded as waste and seeks to ensure that value is captured and re-utilised through reuse, re-purposing, etc, etc
- **Strategies** - Top-down and bottom-up and Middle-Out strategy
- **Trainings** - Training solutions, particularly for elected officials, to integrate this concept into public orders or territorial development choices

Responses relating to specific solutions:

- **Biosphere** - Bio Polymers

A.2 Q2: How important is this product sector for BLUEPRINT, when looking at circular solutions?

The question was formed to gain insights in the relative importance of different sectors and products to find solutions for. Participants were asked to score a total of eight sectors from 1 (low) to 5 (high) in terms of importance. Selected sectors included packaging, building/construction materials, large and small appliances, textiles/clothing, food and garden, bathroom/cosmetics/cleaning, and small household items and tools. The results shown in Figure 15 show that Packaging, Construction/building materials, large and small appliances, and textiles/clothing are the most important from the BLUEPRINT consortium perspective to focus on for Circular economy Solutions.

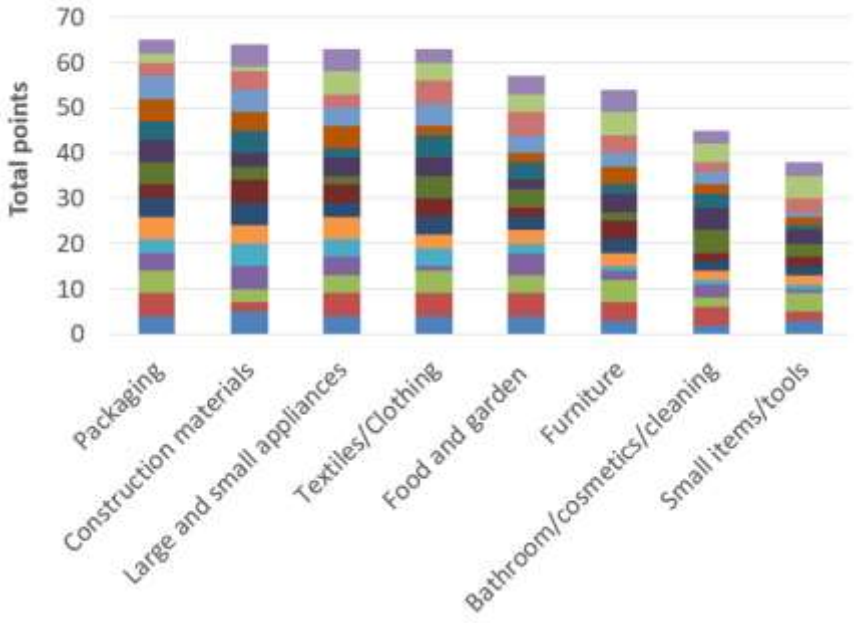

Figure 16. Cumulative scoring of 16 participants at the workshop between 8 product sectors
The maximum score is 80 and the minimum score is 0.

A.3 Q3: what type of circular economy solutions would you like BLUEPRINT to look at?

The question was an open-ended question where the respondents could provide for up to three answers. The aim is to further refine what solutions to look at from both a circular economy strategy as well as approach or method perspective. A summary is provided in table 30 with an added categorisation.

Table 30. Overview of circular economy solution types to look at under BLUEPRINT

Category	**Type of solutions**
Reduce	Reduction of waste
Reuse	Materials reuse, Product reuse matching, Repair/reuse communities, extension of product life
Repair	Right to repair guidance
Design	Regeneration ideas, circular design, design for longevity
Sharing	leasing/renting models, sharing platforms for construction, my waste your resources, second-hand networks
Awareness and behavioural change	Teach CE to residents, Community initiatives, behavioural change, sustainable behaviour
Products/materials	Construction, textiles, electrical devices, plastics, building materials, common household items
Construction	Construction materials, durable construction, sharing platforms for construction
Bulk waste	manage bulk waste
Trainings	Innovative approaches, social enterprises, training for public authorities
Links/enablers	Link with the maritime, resources and associated business models, networks that allow individuals to exchange ''good practices''

A.4 Q4: How important do you see the following category of solutions for BLUEPRINT?

The question was formed to gain insights in the relative importance of different circular economy strategies (the 10Rs as described in section 1.3). Participants were asked to score a total of eight sectors from 1 (low) to 5 (high) in terms of importance. Selected Rs to rank included reduce, reuse, repair, refill, replace, recycle, and remanufacture. The results shown in Figure 17 show that Reduce (or eliminate), Reuse, and repair and refurbishment should receive the highest priorities within the BUEPRINT Circular economy solutions efforts.

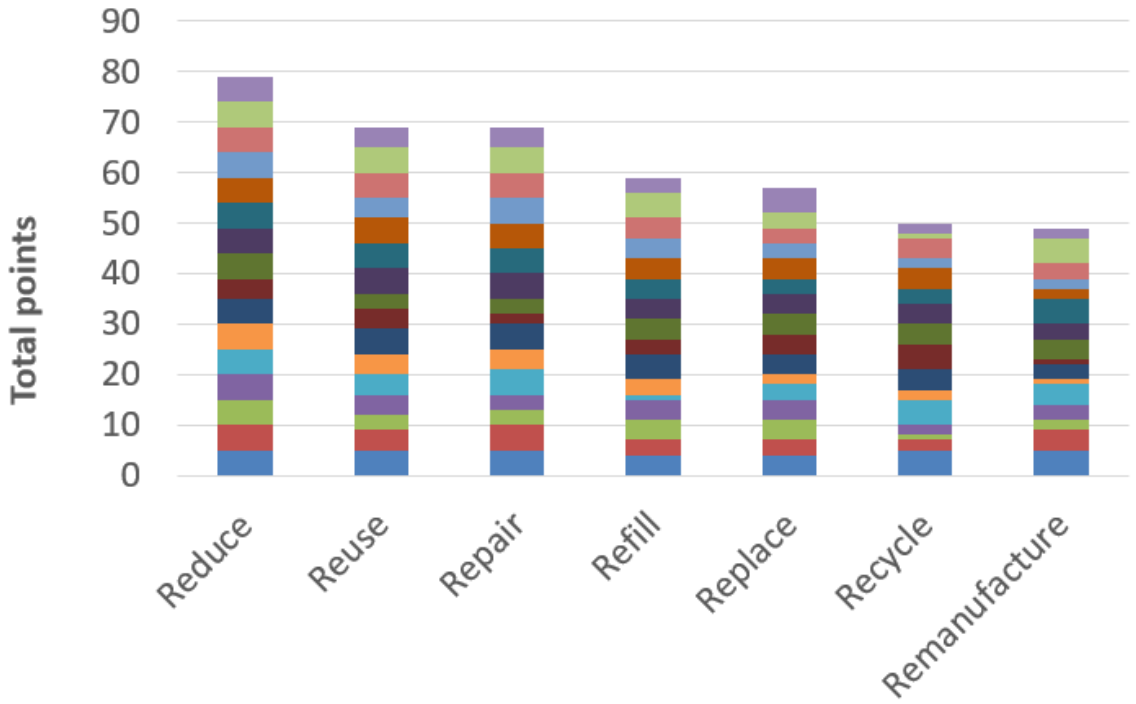

Figure 17. Cumulative scoring of 16 participants among between 7 circular economy strategies
The maximum score is 80 and the minimum score is 0.

A.5 Q5: what information should we capture about a circular economy solution?

The question was open ended and up to eight different answers could be provided by the participants. The aim was to understand what information would be helpful to inspire and obtain a first understanding of the solution and how it can help, before diving deeper. The answers are displayed in Table 31 below based on a categorisation into six areas: operational, social, environmental, economy, other, and technical.

Table 31. Overview of potential information to capture for a circular economy solution

Operational	**Social**	**Environment**	**Economy**	**Other**
Description of solution / current activity	Behavioural change needed to enable solution	Impact - environmental	Current customer base	Future plans/vision
Target product / linked waste origin and information on type / items targeted	Benefits – wider society / Positive outcome action	How it reduces waste	Current budget	Potential circular economy impact
Target audience / the actors involved (to network)	How it promotes reuse/sharing	Environmental benefits	Investment need / investment requirement / costs to implement / investment level	Solutions elsewhere / location
Case studies / practical examples / Best Practice	How it links to sustainable tourism		Savings provided to households / cost of waste to households	example of leaders in CE
Popularity	How it links to a sharing economy		Energy costs	How it joins up in CE strategy/visions
Effort required / implementation experience / Ease of actions	How it encourages others or links to encouragement		Person cost / need	Reason for that particular solution over others / relative to others
Skills levels needed / Skill required	Links to repair shops		Economic benefits	Augmented reality
Technological complexity / Technology required / technology needed			Related business models to adopt this solution	**Technical**
Legislative constraints			Adaptation to new themes, functionality economy	Materials which are used / bio-resources involved / Different grade plastics
Scale/ replicability / scale of solution / how to replicate it				Links to existing systems (reverse waste collection, resource)
Availability of solution / Accessibility to solution				Links to existing systems (reverse waste collection, resource)
Contact if applicable				

A.6 Q6: What visuals/pictures would be helpful to understand the circular economy solutions?

The purpose of the question is to gain idea for visual displays of circular economy solutions that can be used both for the one-page quick scans and for more detailed evaluations, as well as potentially for other activities within BLUEPRINT. A total of 40 idea were generated as summarised in table 32 based on categorisations of concepts and visualisation types.

Table 32. overview of concepts and visualisation options for circular economy solutions

Concepts		Visualisation type	
Example of solution	Material broken down	Process flow charts / flow charts of process	Graphic illustration
CE vs recycle	CE vs linear	System diagrams	Mind mapping / interconnected mind-map
CO2 waste reduction impact	Sea	Photo from case study	Infographic / Infographics
Circle	Tree	Spider web diagram	Map with similar projects
How the 'loop' is closed	Material recycle journey x2	Before/after charts / before and after	Cartoon/comic scenarios
Solutions in use	Volume - equivalent	Product lifecycle diagram	Positive images
Resource opportunity	Solution impact on society	Diagrams	
Recovery steps / cycle	Impact / hierarchy ranking		
Reusable items x2	Comparisons eco vs traditional		
Step by step	Pollution		

A.7 Q7: What information is needed to operationalise/implement a circular economy solution?

The aim for BLUEPRINT is that a select number of the circular economy solutions will be evaluated in detail to assess how they can be operationalised. As part of this effort a methodology will be developed for the assessment of circular economy solutions from a local authority perspective that provides for hopefully as hands-on as possible set of steps to go from solution idea to realisation. To this end the consortium partners were asked what information is needed to operationalise/implement a circular economy solution. A total of 57 different ideas were provided that have been categorised into six groupings: baseline information, economic information, operational requirements information, impacts assessment information, planning and deployment information, and additional success factors information, as shown below.

The aim from this initial brainstorming is to come to a select sub-set as part of the methodology. Then provide for a data evaluation, processing and output to a circular economy solution assessment based on a series of templates that will be developed. This should provide for a streamlined approach for local authorities to carry out these assessments. The process to move forward on this is shown in Figure 18 at a high-level.

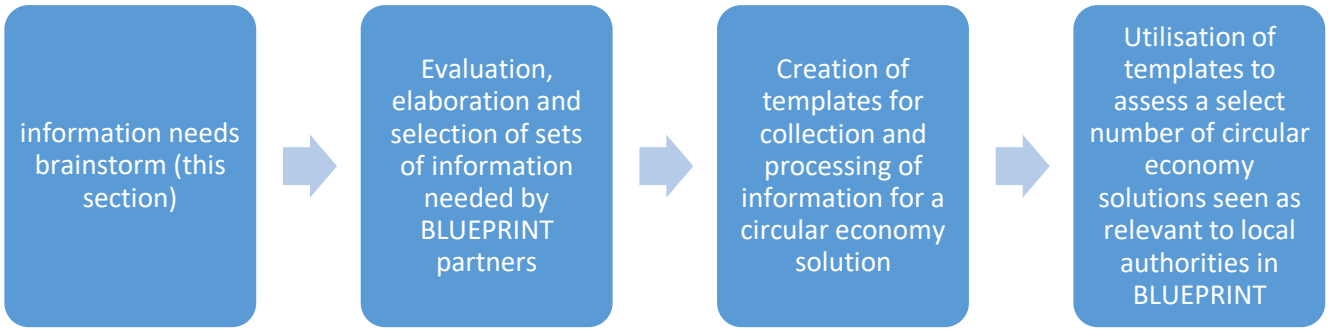

Figure 18 Step by step process to come to a circular economy solution assessment methodology

Baseline information:

- Case study examples showing how the solution can work and what is needed in order for it to be replicated. Perhaps videos showing work undertaken and process involved - 'before' and 'after' scenarios.
- A circular solution that is actually needed;
- Target audience
- The advantages of this new solution over traditional solutions
- Current snapshot of local ecosystem
- Which areas do we target,
- How do we capture whether it has worked,
- Data/information for targeted actions/solutions
- Overall benefits of the solution

Economic information:

- A business plan that incorporates things like; on the material side: volume of material arising; issues around seasonality; collection and processing challenges; associated costs to collect/process;
- financial forecasting in terms of costs and income;

- (financial/expertise/mentors);
- Cost and resource analysis;
- financial costs of circular solution;
- cost and

Operational requirements information:

- resources needed (buildings, equipment, people, energy);
- skills/training requirements;
- overview of possible support available for start ups;
- identification of space to deliver operation;
- existence and availability of local manufacturers;
- access to waste material at scale;
- availability of collection;
- storage and transportation to facilitate solution;
- what avenues are there to get information out / how do we get the information out.

Impacts assessment information:

- Equalities Impact Assessment.
- inclusivity/EqIA
- carbon cost of circular solution;
- co-benefits of solutions i.e. job creation;
- impact on local economy;
- impact to local environment and community.

Planning and deployment information:

- Target to achieve
- Review against existing policies / Current policy and practice guidelines
- Develop information for procurement brief
- Ability to engage with the sector
- Interest and buy-in from sector
- Length of time of implementation of the solution
- Detail of actors and their roles across solution stages. Who does what, when and how. Including info on costs, responsibilities, actions, benefits... / a clear action plan
- Identification of team which will implement / a list of people that need to be involved.
- Resources needed / Clear signposting to resources / Where resources can be sourced
- Risk assessment
- Legal implications
- Communications needed / Communication plan
- Lessons learnt after deployment / what has worked well elsewhere that can be replicated
- Information of how to act on the proposed solution
- How many residents / accesses to residents

Additional success factors information:

- Economic and social interest
- Support and help available
- Buy in/support from local councils

Annex B – overview of the list of circular economy Solutions

Table 33. Overview of mapped circular economy solutions

Ref.	Solution Organisation	Material Stream	Circular economy Strategy	Approach	Product Life Cycle	Location	Weblink	Notes
1	Neolithe	Construction Materials	Recycle	Technology	EoL	France	https://neolithe.fr/	Treatment by fossilization of household waste residues, construction residues and industrial waste that would otherwise be incinerated or landfilled. The new fossilized product can be used as construction aggregate and prevent the extraction of virgin raw material.
2	Enviromate	Construction Materials	Reuse or repurpose	Awareness & Behaviour Change	Reuse	United Kingdom	https://www.enviromate.co.uk/	Platform to buy and sell leftover building materials
3	Minéka	Construction Materials	Reuse or repurpose	Awareness & Behaviour Change	Reuse	France	https://mineka.fr/	Collection of unused/unsold construction material from construction companies and selling it to any individual/industry
4	Maximum	Construction Materials	Reuse or repurpose	Technology	End-of-life	France	https://www.maximum.paris/pages/maximum	Uses industrial surplus and waste to make furniture
5	Du Dechet au Design by API'UP	Construction Materials	Reuse or repurpose	Technology	End-of-life	France	https://apiup40.wixsite.com/accueil	Upcycling of used/disposed wood and transforming it into wooden furniture
6	La Matière	Construction Materials	Reuse or repurpose	Awareness & Behaviour Change	End-of-life	Périgny France	https://www.lm-lr.com/nos-activites/magasin-des-matieres/	Reselling of construction material, disassembled furniture - to access this service you have to join the organisation (30 euro membership)
7	Atelier Extramuros	Construction Materials	Reuse or repurpose	Technology	End-of-life	France	https://www.atelier-extramuros.com/	Furniture making from discarded wood
8	Crown Workspace	Furniture	Repair	Technology	Repair	Across the United Kingdom	https://crownworkspace.com/uk/sustainable-workplace-solutions/renew-centre/	The company remanufactures, refurbishes and repairs office furniture.
9	La Rênoverie	Furniture	Repair	Awareness & Behaviour Change	Repair	Ambérieu-en-Bugey France	https://www.larenoverie.fr/	Renew and resell furniture

10	La collecterie	Furniture	Repair	Awareness & Behaviour Change	Repair	Montreuil France	la collecterie – Ressourcerie	Renew and resell furniture
11	Campus Market	Furniture	Reuse or repurpose	Awareness & Behaviour Change	Reuse	Lille and Paris France	https://www.campus-market.com/	Collection of student's furniture once they move out of their accommodation to then sell them again on campus for other students
12	IFIXIT	Furniture	Repair	Awareness & Behaviour Change	Repair	United Kingdom	https://www.ifixit.com/	Online platform with guides to fix furniture
13	Warp it	Furniture	Reuse or repurpose	Awareness & Behaviour Change	Acquisition/Purchase	United Kingdom	https://www.warp-it.co.uk/	Platform to find, give away or loan office furniture
14	Rype Office	Furniture	Remanufacture	Technology	Use to end-of-use	United Kingdom	https://www.rypeoffice.com/	Remanufacture of used office furniture to as-new condition
15	Lighthouse furniture	Furniture	Reuse or repurpose	Awareness & Behaviour Change	End-of-life	United Kingdom	http://www.lighthousefurniture.org/	Selling low-cost used furniture
16	Wayst	Furniture	Recycle	Technology	Collection	United Kingdom	https://www.wayst.co.uk/	Furniture removal company that recycles the items
17	Casala	Furniture	Remanufacture	Technology	End-of-life	United Kingdom	https://www.casala.com/about-casala/	Refurbishment of furniture
18	Envie	Large and small appliances	Repair	Technology	Repair	France	https://www.envie.org/	Envie collects and repairs electrical and electronic equipment (large appliances, small appliances, medical equipment), and can resell them to individuals, professionals and communities.
19	Murfy	Large and small appliances	Repair	Awareness & Behaviour Change	Repair	France	https://murfy.fr/	Online platform that offers help to self-diagnose the issue that the consumer's washing or drying machine might be having. The purpose it to encourage the individual to repair the appliance alone. The platform also offers in house repair service as well as selling second-hand appliances.
20	GSUK	Large and small appliances	Repair	Technology	Repair	Surrey United Kingdom	https://gsuk.eu/	Recover, recycle and reuse solutions for technology products. Their goal is to extend the life of mobile technology products and find new users for them.

21	Envie	Large and small appliances	Repair	Technology	Repair	Pays de la Loire Franc	https://www.enviеanjou.com/	Repair and resell of small and large electronic appliances
22	iFIXIT	Large and small appliances	Repair	Awareness & Behaviour Change	Repair	United Kingdom	https://www.ifixit.com/Guide	Online platform with guides to fix small electronic appliances
23	CCL (North)	Large and small appliances	Recycle	Technology	End-of-life	United Kingdom	https://www.cclnorth.com/	IT recycling and refurbishment as well as WEEE recycling
24	Zack	Large and small appliances	Reuse or repurpose	Technology	Collection	France	https://entreprises.zack.eco/	Collection of electric appliances from industries and reselling or recycling them
25	Wiser Recycling	Large and small appliances	Recycle	Technology	End-of-life	United Kingdom	https://www.wiserrecycling.co.uk/	Storage, collection, reuse, recycling and disposal services for all types of WEEE
26	Repair Cafe	Large and small appliances	Repair	Awareness & Behaviour Change	Repair	United Kingdom	https://www.repaircafe.org/en/	Meetings where material and tools are provided to repair appliances
27	POCACITO project (Milan)	Food and garden	Reduce or prevent	Awareness & Behaviour Change	EoL	Italy	https://pocacito.eu/sites/default/files/FoodWasteRecycling_Milan.pdf	Door-to-door collection of food waste in special biodegradable bags and transferred to anaerobic reactors to generate biogas and compost. The operator delivers to household adequate equipment (bins), biodegradable bags and information brochures. Collection with non-compacting methane/biodiesel powered trucks.
28	Bristol Waste	Food and garden	Recycle	Awareness & Behaviour Change	Collection	Somerset United Kingdom	https://bristolwastecompany.co.uk/slim-my-waste-feed-my-face/	
29	Brighton & Hove Food Partnership	Food and garden	Reduce or prevent	Awareness & Behaviour Change	End-of-life	Brighton United Kingdom	https://bhfood.org.uk/directory-hub/community-composting/	
30	The Wonky Food Company	Food and garden	Reduce or prevent	Technology	Distribution	Oxford United Kingdom	https://www.wonkyfoodco.com/home	Work with farmers, suppliers and retailers to collect their imperfect and surplus fruit & veg and turn it into other products (such as relish)

31	Seachips	Food and garden	Reuse or repurpose	Technology	End-of-life	United Kingdom	https://www.sea-chips.com/	The company makes crisps from salmon skin offcuts that would otherwise go to waste as fishmongers usually throw the skin away.
32	CelluComp	Food and garden	Reuse or repurpose	Technology	End-of-life	Scotland United Kingdom	https://www.cellucomp.com/	Developed Curran®, a material developed from the extraction of nanocellulose fibres of root vegetables, primarily from sugar beet pulp, which is a by-product of the sugar industry. The material can then be used for numerous applications, such as paints and coatings, inks, personal care, home care, paper, food, concrete, drilling fluids, composites.
33	Friendly Frenchy	Food and garden	Reuse or repurpose	Technology	End-of-life	Brittany and Morbihan France	https://www.friendlyfrenchy.fr/fr/	Company that transforms seashells, vegetable oils, grape seeds, and shells from the food industry that would otherwise go to waste into sunglasses
34	Regal	Food and garden	Reduce or prevent	Training	Use to end-of-use	Normandy France	https://www.regal-normandie.fr/	A network bringing together the regional stakeholders in the food chain to meet, cooperate, act in the aim of addressing the issue of food waste. The community aims to track and support food wastage in the food service industry, engage the wider community, and promote best practices to the region of Normandie.
35	Somerset Waste Partnership	Food and garden	Recycle	Technology	End-of-life	Somerset United Kingdom	https://www.somersetwaste.gov.uk/	Collection service for garden waste. For a small fee garden waste can be collected fortnightly. The waste is composted and then resold as "soil conditioner".
36	We are cauli	Packaging	Refill	Awareness & Behaviour Change	Reuse	London United Kingdom	https://www.wearecauli.com/	Reusable food boxes for restaurants
37	Aurora Sustainability	Food and garden	Reuse or repurpose	Technology	End-of-life	United Kingdom	https://www.auroracons.org/	Recovery of coffee waste and heat from whisky distilleries to produce and supply dry fresh mushrooms
38	Elvis & Kresse	Textiles/clothing	Reuse or repurpose	Technology	Reuse	Kent United Kingdom	https://www.elvisandkresse.com/	fire hoses into bags + use of kiteboards sails for packaging
39	Seshnotstigma	Textiles/clothing	Reuse or repurpose	Technology	Reuse	Huddersfield United Kingdom	www.ihavesesh.co.uk	old skateboards into jewellery
40	Worn Wear Patagonia	Textiles/clothing	Repair	Technology	Repair	USA	https://wornwear.patagonia.com/	repair, recycle and rebuy scheme for all Patagonia items
41	Finisterre	Textiles/clothing	Repair	Technology	Repair	Cornwall United Kingdom	https://finisterre.com/collections/repairs-lived-loved	for a small fee, have garments repaired

42	Been. London	Textiles/clothing	Reuse or repurpose	Technology		London United Kingdom	https://been.london/	leftover leather trimmings into luxury bags, leftover pineapple leaves and apple peels into vegan leather
43	Waterhaul	Textiles/clothing	Reuse or repurpose	Technology	Reuse	Cornwall United Kingdom	https://waterhaul.co/about/	use ghost fishing nets to make into eyewear
44	Greenstream Flooring CIC	Textiles/clothing	Reuse or repurpose	Technology	Reuse	Wales United Kingdom	https://www.findcarpettiles.co.uk/	
45	Rapanui	Textiles/clothing	Reuse or repurpose	Technology	Reuse	Isle of Wight United Kingdom	https://rapanuiclothing.com/the-journey/	Old products returned to be remade. Using renewable energy to produce clothing.
46	E Leather	Textiles/clothing	Reuse or repurpose	Technology	Reuse	Peterborough United Kingdom	https://www.eleathergroup.com/sustainability/	
47	Sightmode	Textiles/clothing	Reuse or repurpose	Technology	Reuse	Peterborough United Kingdom	https://sightmode.com/products/	
48	Cycle Up	Construction Materials	Reuse or repurpose	Awareness & Behaviour Change	Reuse	France	https://www.cycle-up.fr/	Online marketplace to sell used/excess construction material
49	Agilcare	Construction Materials	Redesign	Technology	Use to end-of-use	France	https://www.agilcare.co/home-page	Construction company that builds using eco-friendly material that can be assembled and dissembled, the buildings generate no waste when they are constructed or dissembled
50	Kings Office Furniture	Furniture	Reuse or repurpose	Awareness & Behaviour Change	Acquisition/Purchase	United Kingdom	https://kingsofficefurniture.co.uk/	Buy used office furniture
51	Committee of Taste	Furniture	Reuse or repurpose	Awareness & Behaviour Change	Acquisition/Purchase	London United Kingdom	https://www.committeeoftaste.com/	Second hand vintage furniture
52	After Noah	Furniture	Remanufacture	Technology	Reuse	London United Kingdom	https://afternoah.com/	Restoration workshops for furniture
53	Ikea circular hub	Furniture	Reuse or repurpose	Awareness & Behavio	Acquisition/Purchase	United Kingdom	https://www.ikea.com/es/en/offers/circular-hub-pub2eab7840	Buy used Ikea or discontinued Ikea furniture

				ur Change				
54	Reyooz	Furniture	Reuse or repurpose	Technology	Collection	United Kingdom	https://www.reyooz.com/	Collection of used furniture and redistribution to small initiatives or community organisations
55	Drab2Fab	Furniture	Redesign	Technology	End-of-life	Peterborough and Northampton United Kingdom	https://www.etsy.com/shop/Drab2FabDesign	Upcycling of old furniture into new ones
56	SHARE Oxford	Large and small appliances	Reuse or repurpose	Awareness & Behaviour Change	Reuse	Oxford United Kingdom	https://shareoxford.org/	Library of Things in Oxford
57	Freegle	Large and small appliances	Reuse or repurpose	Awareness & Behaviour Change	Acquisition/Purchase	United Kingdom	https://www.ilovefreegle.org/	Online platform to acquire any items from other people for free
58	Reboxed	Large and small appliances	Reuse or repurpose	Awareness & Behaviour Change	Use to end-of-use	United Kingdom	https://reboxed.co/	Marketplace for people to sell and buy devices
59	WeeeCharity	Large and small appliances	Recycle	Technology	Collection	United Kingdom	https://weeecharity.co.uk/	Free collection and recycling of WEEE
60	The Naked Shop	Packaging	Refill	Awareness & Behaviour Change	Acquisition/Purchase	France	https://thenakedshop.fr/	package-free grocery store
61	Surrey Recycling	Packaging	Recycle	Awareness & Behaviour Change	End-of-life	Surrey United Kingdom	https://play.google.com/store/apps/details?id=net.recollect.surreycc	App for residents of Surrey to search what items are recyclable or not
62	Refill	Packaging	Refill	Awareness & Behaviour Change	Acquisition/Purchase	United Kingdom	https://www.refill.org.uk/	App that helps the user find places where they can eat drink and shop with less packaging
63	Wastebuser	Packaging	Recycle	Awareness & Behaviour Change	Use to end-of-use	United Kingdom	https://www.wastebuster.co.uk/	Resources to teach kids about waste

64	Surfers Against Sewage	Packaging	Recycle	Awareness & Behaviour Change	Collection	United Kingdom	https://www.sas.org.uk/	Charity that organises beach clean ups in the UK
65	Splosh	Packaging	Refill	Awareness & Behaviour Change	Use to end-of-use	United Kingdom	https://www.splosh.com/	Order refills for cleaning products and soaps and return your refill pouches so they can be upcycles
66	Bower Collective	Packaging	Refill	Awareness & Behaviour Change	Acquisition/Purchase	United Kingdom	https://bowercollective.com/	Refill household products
67	Asda (refill zones)	Packaging	Refill	Awareness & Behaviour Change	Acquisition/Purchase	United Kingdom	https://corporate.asda.com/newsroom/2021/06/16/asda-to-rollout-refill-zones-to-more-stores	The supermarket has partnered with household and food and beverage companies to offer refill zones to customers
68	La fabrik a vrac	Packaging	Refill	Awareness & Behaviour Change	Acquisition/Purchase	France	https://www.lafabrikavrac.fr/	Refill grocery store
69	ecosystem	Large and small appliances	Recycle	Technology	End-of-life	France	https://www.ecosystem.eco/	Recycling for WEEE
70	Flawsome	Food and garden	Reduce or prevent	Technology	Use to end-of-use	United Kingdom	https://flawsomedrinks.com/	Wonky and surplus fruit and vegetables used to make drinks and juices
71	Ty Syml	Food and garden	Redesign	Technology	Reuse	Wales United Kingdom	https://tysyml.com/	Collect waste from various companies (coffee/BSG/wood/paper) and combine with and OC substrate to make interior furniture products/wall panels/packaging.
72	Ananas Anam (Pinatex)	Food and garden	Redesign	Technology	Reuse	London United Kingdom	https://www.ananas-anam.com/	Natural textile (Pinatex) made from waste pineapple leaf fibre
73	Chipsboard	Food and garden	Redesign	Technology	Reuse	Leeds United Kingdom	https://www.chipsboard.com/products	Using Potato waste to make eyewear, buttons etc.
74	Oh Give Me A Break!	Textiles/clothing	Reuse or repurpose	Technology	Reuse	Cornwall United Kingdom	https://ohgivemeabreak.co.uk/	
75	Ahluwalia	Textiles/clothing	Redesign	Technology	End-of-life	United Kingdom	https://ahluwalia.world/	Garments made using surplus and post-consumers fabrics

76	Pantee	Textiles/clothing	Reuse or repurpose	Technology	End-of-life	United Kingdom	https://pantee.co.uk/	Upcycling of unsold t-shirts into underwear
77	Adapta	Textiles/clothing	Reduce or prevent	Awareness & Behaviour Change	End-of-life	France	https://www.adapta-paris.com/	Collects unused textile from luxury textile providers and resells them to designers.
78	Bobines & Combines	Textiles/clothing	Repair	Technology	Repair	France	https://www.bobinesetcombines.fr/fr/	Sewing workshops to repair/make clothes
79	Les Reparations	Textiles/clothing	Repair	Technology	Repair	France	https://www.lesreparables.fr/	Send clothing for repair (for a fee)
80	Love your clothes	Textiles/clothing	Reduce or prevent	Awareness & Behaviour Change	Use to end-of-use	United Kingdom	https://www.loveyourclothes.org.uk/	Platform to learn how to maintain, repair and discard clothe
81	Worn Again Technologies	Textiles/clothing	Recycle	Technology	End-of-life	United Kingdom	https://wornagain.co.uk/	Converts polyester and polycotton blended textiles from non-reusable textile at their end of use, back into circular raw materials
82	Recycle Refashion	Textiles/clothing	Recycle	Technology	End-of-life	France	https://recycle.refashion.fr/	Platform for professionals in the textile/shoes industry and recycling solution providers to connect
83	Chaussettes Orphelines	Textiles/clothing	Recycle	Technology	End-of-life	France	https://chaussettesorphelines.com/	Recycling of socks into thread that is used to make other socks/products
84	Valdelia	Furniture	Recycle	Technology	End-of-life	France	https://www.valdelia.org/	Recycle and reuse service for office furniture
85	Chic Faktory	Furniture	Reuse or repurpose	Awareness & Behaviour Change	Reuse	France	https://www.chicfaktory.com/	Shop for upcycled and second-hand furniture
86	move and rent	Furniture	Reuse or repurpose	Technology	Reuse	France	https://www.moveandrent.com/fr/economie-circulaire	Rental service for furniture
87	Living Packets	Packaging	Reuse or repurpose	Technology	Reuse	France	https://livingpackets.com/	Intelligent, reusable new packaging enabling a truly circular economy, decked out with sensors and systems that streamline shipments and secure transactions.
88	Disco Soupe	Food and garden	Reduce or prevent	Awareness & Behavio	End-of-life	France	http://discosoupe.org/lemouvement/	Food waste reduction programme where people cook together with unsold food surplus

				ur Change				
89	ArtStock	Furniture	Reuse or repurpose	Awareness & Behaviour Change	End-of-life	France	https://www.artstockasso.fr/	
90	Smile Plastics	Packaging	Reuse or repurpose	Technology	Reuse	Wales United Kingdom	https://smile-plastics.com/	Create hand-crafted panels from waste materials
91	Playerlayer	Packaging	Remanufacture	Technology	Reuse	United Kingdom	www.playerlayer.com	plastic bottles, waste coffee grinds into sports equipment
92	Wild Cosmetics	Packaging	Refill	Technology	Reuse	London United Kingdom	https://www.wearewild.com/?utm_source=Google%20CPC&utm_medium=Brand%20CPC&utm_campaign=Google%20Brand%20Cpc&gclid=Cj0KCQjw0K-HBhDDARIsAFJ6UGhmwkXR71P57kONdgBKgDtTia8dB5G9SY4s_2DNg2RRgTbgl3VKXrUaAtNfEALw_wcB	Refillable and compostable deodorants (that actually work)
93	Hubbub and Leeds City Council	Packaging	Recycle	Awareness & Behaviour Change	Collection	Leeds United Kingdom	https://www.hubbub.org.uk/leeds-by-example	
94	Love Essex	Packaging	Reduce or prevent	Awareness & Behaviour Change	Acquisition/Purchase	Essex United Kingdom	https://www.loveessex.org/news-and-ideas/ideas-to-help-reduce-your-plastic/	
95	Recycling Technologies	Packaging	Recycle	Technology	End-of-life	Swindon and London United Kingdom	https://recyclingtechnologies.co.uk/	The technology transforms plastic waste (that are usually not recyclable) into chemical feedstock for plastic production. The machine uses a process called thermal cracking which breaks down the long chains of polymers into shorter chains through the use of heat and in the absence of oxygen.
96	The Refill Barn	Packaging	Refill	Awareness & Behaviour Change	Acquisition/Purchase	Essex United Kingdom	https://therefillbarn.com/home	Refill shop where you can purchase food package free
97	Payote	Packaging	Reuse or repurpose	Technology	Reuse	France	https://www.payote.fr/	Garments made using plastic packaging that has been found in the Mediterranean Sea

98	Versoo	Packaging	Recycle	Technology	End-of-life	Pays de la Loire France	https://versoo.com/	Recycles plastic and paper cups and transforms them into granules that can be used to produce items
99	Vrac en Vert	Packaging	Refill	Awareness & Behaviour Change	Acquisition/Purchase	Saint-Etienne France	www.vracenvert.fr	Package-free grocery store
100	Mintie Lunchbox	Packaging	Refill	Awareness & Behaviour Change	Refill	United Kingdom	https://mintielunchboxes.co.uk/?gclid=EAIaIQobChMIzcDW5LnY8gIVh-vtCh0FuQOeEAAYASAAEgIRePD_BwE	Eco-friendly stainless-steel lunchboxes
101	The English Vine	Packaging	Refill	Awareness & Behaviour Change	Acquisition/Purchase	Chelmsford United Kingdom	https://theenglishvine.co.uk/	Wine refill
102	Faith in Nature	Packaging	Reduce or prevent	Awareness & Behaviour Change	Acquisition/Purchase	United Kingdom	https://faithinnature.co.uk/	Solid shampoo and conditioner (no plastic packaging)
103	Anethicallife	Packaging	Refill	Awareness & Behaviour Change	Acquisition/Purchase	Colchester United Kingdom	https://www.anethicallife.co.uk/	Refill grocery store
104	Smart litter bins in Huntingdongshire	Packaging	Reduce or prevent	Technology	Collection	United Kingdom	https://www.letsrecycle.com/news/latest-news/huntingdon-installs-more-smart-litter-bins/	Sensor-equipped bins to know how filled they are to improve collection service
105	Egbert Taylor Lid	Packaging	Recycle	Technology	End-of-life	London and Brighton United Kingdom	https://egberttaylor.com/products/taylor-spares-accessories/lid-in-lid-t-lock/	Lid for recycling bins and restrictor plates for waste-streams to make it easier to open them and reduce contamination
106	LEGO	Other	Reuse or repurpose	Technology	Reuse	Denmark	https://www.lego.com/en-gb/aboutus/news/2021/june/prototype-lego-brick-recycled-plastic/	
107	Café Planet	Food and garden	Recycle	Technology		United Kingdom		

108	Street Food Box	Packaging	Reuse or repurpose	Technology		United Kingdom	https://www.linkedin.com/company/street-food-box/	
109	woolcool	Packaging	Reuse or repurpose	Technology		United Kingdom	https://www.woolcool.com/pioneers/	
110	Green Wolf	Textiles/clothing	Repair	Technology	Repair	Mont-Blanc France	https://www.green-wolf.fr/	Repair service for outdoor clothing
111	ALKERN	Construction Materials	Reuse or repurpose	Technology	Reuse	France	https://www.alkern.fr/products/pave-coquillage/	Production of draining pavements with shell coproducts
112	Upcyclea	Construction Materials	Reuse or repurpose	Technology and behaviour	EoU and EoL	France USA, Estonia	https://www.upcyclea.com/en/	Cloud platform containing material libraries that connect waste material producers and companies or people that could reuse said waste material based on location and for a discount price.
113	G4DEC les bonnes initiatives	Construction Materials	Recycle	Awareness & Behaviour Change	EoL	France	https://www.g4dec.bzh/sites/default/files/upload/fiches-actions/bonnes-intiatives/bi-gravat_reutilise.png	Guidelines for reuse of excavation and rubble waste
114	Zéro Gâchis	Food and garden	Reduce or prevent	Awareness & Behaviour Change	Distribution	France Belgium, Portugal and Romania	https://zero-gachis.com/fr/carte	First brand of anti-waste in supermarkets. Huge quantities of products fail to find a buyer, yet they are still excellent for consumption. Distributors sell them more and more frequently at reduced prices, but consumers are often not informed of this bargain. This is why Zéro-Gâchis offers its community of responsible consumers, the Zéro-Gâcheurs, to help them with their purchases by informing them when and where to go shopping.
115	Vert le Jardin	Food and garden	Recycle	Awareness & Behaviour Change	EoL	Brittany, France	https://www.vertlejardin.fr/	Association created in 2000 in Brest with the aim of developing and promoting shared gardens and composts. Nowadays it also includes food waste prevention and recovery, biowaste from gardens shredding for compost and mulch and collective farming in shared gardens.
116	Défi Zéro Déchet Vert	Food and garden	Recycle	Training	N/A	Brittany, France	http://www.centremorbihancommunaute.bzh/vivre/dechets-et-environnement/defi-zero-dechet-vert/	15 selected families have private workshops with a team of professionals to use their green waste in their garden. Thus reducing green waste and visits to the recycling centre (less transportation).

117	Excellent Excedents	Food and garden	Reduce or prevent	Awareness & Behaviour Change	Distribution	Île-de-France, France	https://www.excellents-excedents.fr/	Collecting food surpluses from restaurants and catering services in order to provide food to people in need and risk of malnourishment. At the same time, it offers traceability to the donor and recipient of the meals.
118	Nous anti-gaspi	Food and garden	Reduce or prevent	Awareness & Behaviour Change	Distribution	France	https://www.nousantigaspi.com/	Chain of groceries stores offering a second chance to rejected products (physical appearance, old packaging, close or over expiring date) from local farmers, wholesalers, small and large companies (suppliers).
119	PaperWise	Food and garden	Recycle	Technology	EoL	Netherlands (HQ) - outsourced in India	https://paperwise.eu/en/	Using agricultural/green waste to produce high quality paper, office paper-based supplies, packaging, among other products. All of their products are fully recyclable and once they reach their EoL, they can decomposed in anaerobic digesters to generate biogas and compost. HQ in the Netherlands and production takes place in India
120	Keenan Recycling	Food and garden	Reuse or repurpose	Technology	End-of-life	Across the United Kingdom	https://www.keenanrecycling.co.uk/	Provides food waste bins to businesses and collects the waste. The waste can then be recycled organically as compost, transformed into biofuel or shredded.
121	Terra Leo	Food and garden	Recycle	Training	End-of-life	Rouen France	https://www.terraleo.fr/	Workshop given to individuals/businesses that want to compost their organic waste on-site
122	Love Food Hate Waste	Food and garden	Reduce or prevent	Awareness & Behaviour Change	Use to end-of-use	United Kingdom	https://www.lovefoodhatewaste.com/	Platform to raise awareness on food waste and how to prevent it. The website offers tips on how to prevent the food waste as well as recipes to make use of any/all ingredients available in order to avoid waste.
123	The Company Shop Group	Food and garden	Reduce or prevent	Awareness & Behaviour Change	Acquisition/Purchase	United Kingdom	https://www.companyshopgroup.co.uk/	Community Store to buy high quality food, drink and household products from well-known brands at deeply discounted prices. Surplus products are donated by top retailers, manufactures and brands.
124	Atelier Bara'mel	Food and garden	Reuse or repurpose	Awareness & Behaviour Change	Collection	Nantes France	http://www.pays-de-la-loire.developpement-durable.gouv.fr/IMG/pdf/atelier_bara_mel.pdf	Collection of unsold bread from bakeries to dry it and transform it into animal food.
125	Winnow Solutions	Food and garden	Reduce or prevent	Technology	End-of-life	Around the world incl. FR&ENG	https://www.winnowsolutions.com/	Intelligent camera set above the trash, uses AI to identify what the food waste composition is, the Chef can then analyse that to see where to reduce food

126	Too Good to Go	Food and garden	Reduce or prevent	Awareness & Behaviour Change	End-of-life	United Kingdom	https://toogoodtogo.co.uk/en-gb/business	App to buy at a cheap price unsold food from businesses
127	Défi Familles (presque) Z0ero Déchet	Household residual, other	Reduce or prevent	Training	EoL	France	https://www.pays-iroise.bzh/environnement-eau-dechets/dechets/33650-defi-familles-presque-zero-dechet-pays-d-iroise	Selected families are given information via workshops (online now) to reduce their household waste output.
128	Les Biens en Commun	Large and small appliances	Reuse or repurpose	Awareness & Behaviour Change	Reuse	France	https://reservation.lesbiensencommun.com/	Rental of small electric appliances - can be in a large locker in the entrance of a building for residents to use
129	Upcircle	Packaging	Reuse or repurpose	Technology		London United Kingdom	https://upcirclebeauty.com/pages/refill-scheme	repurposed ingredients i.e. coffee grounds from London cafes, all recyclable packaging, refill scheme
130	Packoorang	Packaging	Reuse or repurpose	Technology	Reuse	Norway	https://www.packoorang.com/	
131	Loop	Packaging	Refill	Awareness & Behaviour Change	Use to end-of-use	United Kingdom	https://loopstore.co.uk/	Partnership with a lot of brands to deliver the products in reusable containers. The end user "rents" the container by paying a deposit and once the container is empty the company collects it back to clean it professionally and use it again, the deposit is then returned to the consumer
132	Vegware	Packaging	Recycle	Technology	End-of-life	United Kingdom	https://www.vegware.com/uk-en/	food packaging, coffee cups, and cutlery made out of plant. After disposable they are composted within regular industrial composting facilities.
133	PlastiKetic	Packaging	Reuse or repurpose	Technology	End-of-life	France	http://plastiketic.fr/	Transforming recycled bottles into furniture and decorative items
134	Day by Day	Packaging	Refill	Awareness & Behaviour Change	Acquisition/Purchase	France	https://daybyday-shop.com/	Package-free grocery store
135	Carton plein	Packaging	Reuse or repurpose	Awareness & Behaviour Change	Reuse	France	https://cartonplein.org/	Sells used cardboard boxes for moving and collects used cardboard boxes
136	Compostable Sorting Line by	Packaging	Recycle	Technology	End-of-life	United Kingdom	https://www.paper-round.co.uk/servi	Sorting line for compostable waste such as containers, cutlery, cups

	Paper Round						ce/vegware-compostables	
137	Blue Bin Recycling League	Packaging	Recycle	Awareness & Behaviour Change	End-of-life	Oxford United Kingdom	https://www.oxford.gov.uk/news/article/1561/blue_bin_recycling_league_closes	Mascot, door knocking, student engagement and social media campaign to encourage residents to improve dry recycle rate
138	Pousse Pousse	Packaging	Refill	Awareness & Behaviour Change	Acquisition/Purchase	France	https://pousse-pousse.com/	Refills for household products
139	Recycled Vegan & TuC	Textiles/clothing	Reuse or repurpose	Technology	Reuse	Lincolnshire United Kingdom	https://www.etsy.com/uk/shop/RECYCLEDVEGANandTuC	old inner tubes into various items, life jackets into wallets and fire hoses too
140	Minot Recyclage Textile	Textiles/clothing	Reuse or repurpose	Technology	End-of-life	Pas-de-Calais France	https://www.minot-recycling.fr/accueil-1.html#contenu1	Clothes that can't be sold or reused again will either be repurposed as cleaning cloths for the industrial sector or will be frayed or transformed into fibres. This is then turned into threads or material that can be used as thermal insulation for roofs, floors, green walls, padding for mattresses and cushions
141	Smarter Uniforms	Textiles/clothing	Reduce or prevent	Awareness & Behaviour Change	End-of-life	Brighton United Kingdom	https://smarteruniforms.org/	Buy second-hand school uniforms in Brighton
142	Spruce Carpets	Textiles/clothing	Reuse or repurpose	Technology	End-of-life	United Kingdom	http://sprucecarpets.org.uk/	Reuse and recycle carpets to divert them from landfills and resell them at cheap prices
143	Clothes Swap by Hertfordshire council	Textiles/clothing	Reuse or repurpose	Awareness & Behaviour Change	Reuse	Hertfordshire United Kingdom	https://www.hertfordshire.gov.uk/services/recycling-waste-and-environment/recycling-and-waste/wasteaware-campaigns/textiles/textiles.aspx#clothesswap	Clothes swap event
144	By rotation	Textiles/clothing	Reuse or repurpose	Awareness & Behaviour Change	Reuse	United Kingdom	https://byrotation.com/	Lend and rent designer clothes
145	Sustainable Advantage	Textiles/clothing	Reuse or repurpose	Awareness & Behaviour Change	Collection	United Kingdom	https://www.sustainable-advantage.com/news/fatface/	Collects clothes from FatFace and redistributes them to a drug rehabilitation charity

146	Ambio-n	Textiles/clothing	Reuse or repurpose	Awareness & Behaviour Change	End-of-life	United Kingdom	https://circularsource.ambio-n.com/	Digital marketplace for reusable materials
147	La Textilerie	Textiles/clothing	Repair	Awareness & Behaviour Change	Repair	France	https://www.latextilerie.fr/	Sewing workshops to repair clothes
148	LE RELAIS - Metisse RT	Construction Materials	Reuse or repurpose	Technology	Reuse	France	http://www.isolantmetisse.com/	"Métisse RT insulation is part of a circular economy process. Insulation composed of 85% recycled cotton, 15% polyester binder and 1% core treatment "
149	BIOFIB	Construction Materials	Reuse or repurpose	Technology	Reuse	France	https://www.biofib.com/gamme-biofib-isolation/	Biofib'Isolation designs and manufactures new generation insulation solutions of plant origin.
150	SCALITE	Construction Materials	Reuse or repurpose	Technology	Reuse	France	https://www.scale.vision/fr/notre-histoire	SCALITE® is made from fish scales collected in France from sustainably managed stocks of sardines or salmons. SCALITE® is suited to many applications in interior and decoration from hospitality to retail, to offices and many more.

Annex C – overview of parameters used to calculate job impacts

Table 34. Job impacts per estimated 1000 tonnes of waste per circular economy solution

Parameters for jobs per 1000 tonnes of CE activity							
Category of materials/products	**Reuse or repurpose**	**Repair**	**Redesign**	**Remanufacture**	**Refill**	**Recycle (incl. sorting)**	**Reduce or prevent**
Textiles & clothing	28	200				17	4
Packaging	15				15	5	4
Food and garden	6					5	4
Construction Materials *	45					3	4
Furniture	53	100		75		10	4
Large and small appliances	100	200		60		30	4

*There is high variation in construction materials reuse depending on the material type. The jobs potential for reuse of concrete estimated at 8 jobs per 1000 tonnes is substantially lower than for wood cladding estimated at 300 jobs per 1000 tonnes. An average value was chosen.

Annex D – CE solutions screened and submitted by B&HCC

Ref.	Solution Organisation	nomy	Approach	Product Life Cycle	Location	BLUEPRINT organisation
1						
2	The Wood Store	urpose	Awareness & Behavi	Reuse	Brighton	BHCC
3	MarinaTex	epurpose	Technology	End-of-life	Brighton	BHCC
4	Claire Potter Design	urpose	Awareness & Behavi	End-of-life	Brighton	BHCC
5	Pothole Spotter	revent	Technology	Use to end-of-use	Brighton	BHCC
6	Brighton Bike Share	revent	Technology	Use to end-of-use	Brighton	BHCC
7	Brighton Bike Hub	urpose	Awareness & Behavi	Repair	Brighton	BHCC
8	Cobblers Thumb Containers	urpose	Awareness & Behavi	End-of-life	Brighton	BHCC
9	Ptolemy	urpose	Awareness & Behavi	End-of-life	Brighton	BHCC
10	Passive pod	revent	Technology	Acquistion/Purchase	Brighton	BHCC
11	One Brighton	educe or prev	Technology	Acquistion/Purchase	Brighton	BHCC
12	Korna architects		Technology	Acquistion/Purchase	Brighton	BHCC
13	ghton & Hove Buses - Contactless bus paym	revent	Technology	Acquistion/Purchase	Brighton	BHCC
14	Barclay's Eagle Lab Brighton	revent	Awareness & Behavi	Acquistion/Purchase	Brighton	BHCC
15	The Resource Centre	revent	Awareness & Behavi	Acquistion/Purchase	Brighton	BHCC
16	Kemptown Trading Post	urpose	Awareness & Behavi	Reuse	Brighton	BHCC
17	Made & Mended		Awareness & Behavi	Repair	Brighton	BHCC
18	Magpie/Shabitat Cooperative	urpose	Awareness & Behavi	Reuse	Brighton	BHCC
19	Vacuum repair centre		Awareness & Behavi	Repair	Brighton	BHCC
20	Brighton bike Co-operative		Awareness & Behavi	Repair	Brighton	BHCC
21	City Libraries book and toy lending	urpose	Awareness & Behavi	Reuse	Brighton	BHCC
22	Alma's Alterations		Awareness & Behavi	Repair	Brighton	BHCC
23	Amberoot	revent	Awareness & Behavi	Acquistion/Purchase	London	BHCC
24	Clever with leather		Awareness & Behavi	Repair	Brighton	BHCC
25	Dawsom Denim		CE business model	Use to end-of-use	Brighton	BHCC
26	My mac fixer		Awareness & Behavi	Repair	Brighton	BHCC

27	The zipyard		Awareness & Behavi	Repair	Brighton	BHCC
28	Toy box club		Awareness & Behavi	Use to end-of-use	Brighton	BHCC
29	2 electronic device repair shops		Awareness & Behavi	Repair	Brighton	BHCC
30	3 community repair cafes		Awareness & Behavi	Repair	Brighton	BHCC
31	Entreprenuerial Spark Brighton	revent	Awareness & Behavi	Acquistion/Purchase	Brighton	BHCC
32	g spaces (Spaces - Trafalgar Place, The Skiff,	revent	Awareness & Behavi	Acquistion/Purchase	Brighton	BHCC
33	Aqauponics training and system building	urpose; Rede	Technology	Reuse; End-of-life	West Sussex	BHCC
34	Ruby Moon	urpose	Technology	Reuse	Brighton	BHCC
35	Food Shed	revent	Awareness & Behavi	Acquistion/Purchase	Brighton	BHCC
36	biobased materials for insulation: Brighton		Technology	Reuse	East Sussex	BHCC
37	Bin Cooking Community	revent	Awareness & Behavi	Use to end-of-use	Brighton	BHCC
38	Arka Funerals	urpose	Awareness & Behavi	End-of-life	Brighton	BHCC
39	Food waste audits in schools	revent	Awareness & Behavi	Use to end-of-use	Brighton	BHCC
40	Beau Bottletops	urpose	Awareness & Behavi	Reuse	Brighton	BHCC
41	The Source Bulk Foods Store	revent	Awareness & Behavi	Acquistion/Purchase	Brighton	BHCC
42	Loop Loop		Awareness & Behavi	Acquistion/Purchase	Brighton	BHCC
43	Super Looper CIC	urpose	Awareness & Behavi	Acquistion/Purchase	Brighton	BHCC
44	Barnes & Binns		Awareness & Behavi	Acquistion/Purchase	Brighton	BHCC
45	Franklins Brewing Co	urpose	Technology	Reuse	Brighton	BHCC
46	Paharmacie Coffee Roasters	urpose	Technology	Reuse	Brighton	BHCC
47	Good Things Brewing Co	urpose	Technology	Reuse	Brighton	BHCC
48	Paper Round	urpose	Technology	Reuse	Brighton	BHCC
49	The Green Centre		Awareness & Behavi	Collection	Brighton	BHCC
50	Sharp Smart		Awareness & Behavi	Collection	Brighton	BHCC
51	Old Tree Brewery	urpose	Awareness & Behavi	Reuse	Brighton	BHCC
52	Lovabell	revent	Awareness & Behavi	Acquistion/Purchase	East Sussex	BHCC

53	Brighton Community Workshop Project	revent	Awareness & Behavi	Acquistion/Purchase	Brighton	BHCC
54	Mintie		Awareness & Behavi	Acquistion/Purchase	Brighton	BHCC
55	Leave No Trace Brighton CIC		Awareness & Behavi	Collection	Brighton	BHCC
56	Surplus Food Network	urpose	Awareness & Behavi	Reuse	Brighton	BHCC
57	Silo London	urpose	Awareness & Behavi	Reuse	London	BHCC
58	Hove Tip Shop	urpose	Awareness & Behavi	Reuse	Brighton	BHCC
59	Brighton Waste House	urpose	Technology	Reuse; End-of-life	Brighton	BHCC
60	Olio	urpose	Awareness & Behavi	Reuse	United Kingdom	BHCC
61	Fat Llama	revent	Awareness & Behavi	Use to end-of-use	United Kingdom	BHCC
62	Liftshare	revent	Awareness & Behavi	Use to end-of-use	United Kingdom	BHCC
63	Hiyacar	revent	Technology	Use to end-of-use	United Kingdom	BHCC
64	Cowheels	revent	Awareness & Behavi	Use to end-of-use	United Kingdom	BHCC
65	Enterprise Car Club	revent	Awareness & Behavi	Use to end-of-use	United Kingdom	BHCC
66	Emmaus	urpose	Awareness & Behavi	Reuse	United Kingdom	BHCC
67	Gleening Network	urpose	Awareness & Behavi	Reuse	United Kingdom	BHCC
68	Waste less - save more Sainsburys campaign	revent	Awareness & Behavi	Use to end-of-use	United Kingdom	BHCC
69	TRAID	e or repurpos	Awareness & Behavi	Use to end-of-use	United Kingdom	BHCC
70	TeeMill		Technology	End-of-life	United Kingdom	BHCC
71	Reuse Network	urpose	Awareness & Behavi	Reuse	United Kingdom	BHCC

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