

A CATALOGUE OF CIRCULAR CITY ACTIONS AND SOLUTIONS

The Circular City Centre (C3)

DRAFT May 2022



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INTRODUCTION

Cities have a critical role to play in the transition from a linear to a circular economy. They are both centres of consumption and production, and host the systems and policies that govern urban life. Cities have the potential to influence the introduction of circular practices by individuals and business and play a key role in spreading knowledge and information about the circular economy. This guide has been prepared for the European Investment Bank's [Circular City Centre](#) (C3) to help cities accelerate their transition toward circularity. The C3 is a competence and resource centre within the European Investment Bank, which aims to support EU cities in their circular economy transition. This document is a complement to the C3 guide [The 15 Circular Steps for Cities](#), particularly in relation to Step 3 (Collect good examples and learn from the experience of other cities) and Step 4 (Conceptualise circular options for priority sectors and municipal services and assets).

This guide aims primarily at cities that are starting their circular journey, by illustrating how this transition can take place through a range of circular actions and solutions from across Europe. To facilitate navigation, the document is divided into themes reflecting some of the key areas in which circular principles can be adopted. For each theme, the circular link is introduced to provide a rationale for the actions and solutions that later are presented in more detail. As a complement, a number of case studies are presented from cities around Europe. Some of the actions and solutions span multiple themes but have been assigned to one theme to avoid repetition.

The circular city actions and solutions presented in this document are not intended to be an exhaustive list, but rather to highlight particularly relevant, innovative and inspiring examples and cases to illustrate how cities can accelerate their transition to circularity. This is the first edition of this guide, and future editions will include an updated list of actions and case studies. If you have comments and suggestions for additional examples, please contact us at C3@eib.org.









THE CIRCULAR ECONOMY AND CITIES

The circular economy is an economic system where waste in all forms is designed out, goods and materials are used at their highest possible value for as long as possible and natural systems are regenerated. By effectively deploying these strategies, we will ultimately require fewer materials and produce fewer emissions and less waste in meeting societal needs. To reap the benefits of the circular economy, the global economy must transition away from its current linear take-make-use-dispose production and consumption model towards a more circular model.

Cities play a crucial role in the transition to a circular economy. As epicentres of the global economy, they are both engines of innovation and hotspots of consumption, and they host the majority of the world's population and companies. Cities, therefore, are concentrated in their production, consumption, waste generation and greenhouse gas (GHG) emissions. Transforming their business models and material flows to become more circular will have great positive global impact.

In order to become circular, a city must avoid excessive resource consumption, keep resources and products in use as long as possible, and increase the use and utility of all assets, for example by sharing or repurposing them. This will help to minimise wastage in all forms. Most cities are better positioned than countries to make swift decisions, by regulations and incentives, for example, and can play an important role in establishing new circular city functions, infrastructure and services, and supporting circular business models. Cities can, therefore, also be the catalysts, enablers and facilitators for the circular transition, as outlined in the C3 guide [The 15 Circular Steps for Cities](#).

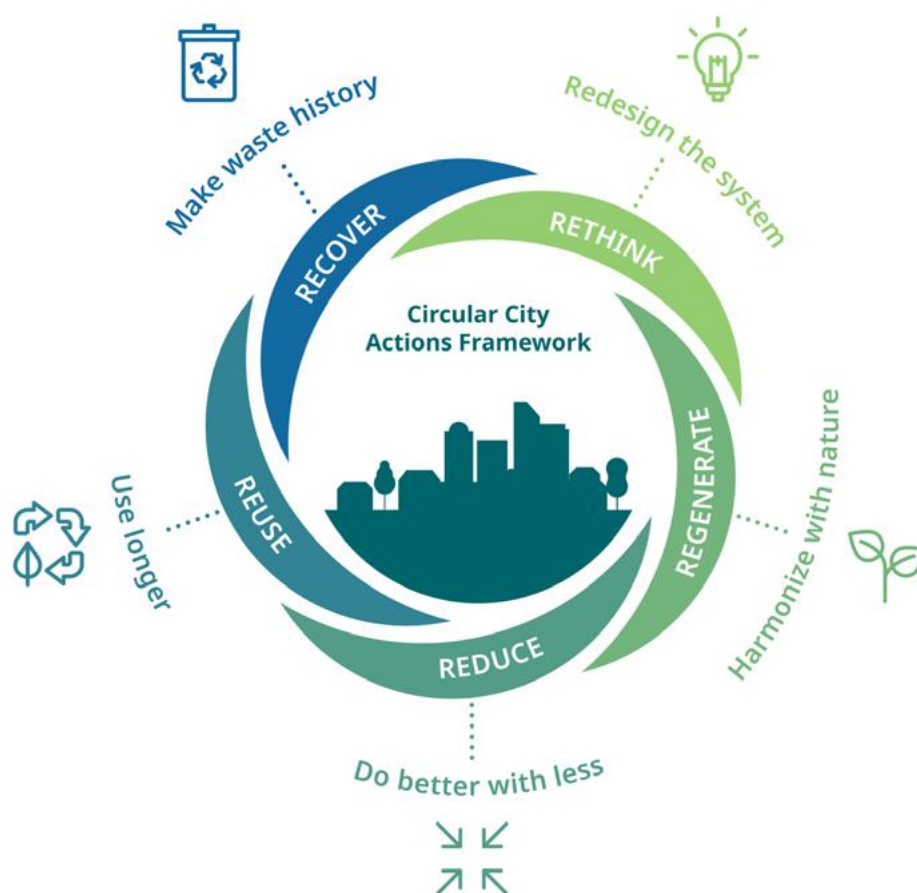
Most of the impact that cities can achieve by going circular is related to the resource-intensive sectors that fuel the majority of urban activities in response to citizens' needs. These sectors are:

-  Built environment
-  Consumer goods
-  Food
-  Manufacturing
-  Mobility & logistics
-  Tourism & leisure
-  Waste & material management
-  Water & wastewater management

THE CIRCULAR CITY ACTIONS FRAMEWORK

A circular city promotes the transition from a linear to a circular economy in an integrated way across the urban space and multiple city functions, and in collaboration with its people, businesses and research community. The Circular City Actions Framework¹ (CCAF), developed by Circle Economy in collaboration with ICLEI, the Ellen MacArthur Foundation (EMF) and Metabolic, educates cities on an holistic approach to the circular economy—an approach that goes beyond just recycling. The CCAF can be used by local governments and city-based circular economy practitioners at any stage of the circular economy transition. The framework is structured into five complementary "R" strategies:

- Rethink: Redesign systems to lay the foundation for circular activities and enable the circular transition.
- Regenerate: Harmonise with nature by promoting infrastructure, production systems, material types and sourcing that allows natural ecosystems to thrive.
- Reduce: Do more with less by using and supporting infrastructure, processes and products that are designed to minimise material, water and energy use and waste generation from production to end of use.
- Reuse: Use longer and more often by extending and intensifying the use of existing materials, products, spaces and infrastructure.
- Recover: Eliminate waste by maximising the recovery of resources at the end-of-use phase so that they can be reintroduced into production processes.



The Circular City Action Framework by [ICLEI Circulars](#)

CIRCULAR CITY ACTIONS AND SOLUTIONS

As inspiration for cities starting or progressing in their circular economy transition, this document presents various circular economy actions and solutions, accompanied by case studies, in eight sectors with high circular potential.

The table below presents a long-list of circular actions and solutions that cities can consider, some of which are presented in more detail in this guide. Each action

is classified in relation to the [Circular City Action Framework \(CCAF\)](#), which is further described in this document. Page numbers are also provided to help readers to find more information on topics of interest.

SECTORS	CIRCULAR ACTIONS	CCAF CATEGORY	BUDGET	PAGE
Built environment	Remediation of brownfield sites for urban redevelopment/ regeneration	REDUCE / REUSE	Med	-
	Make the best use of existing buildings and infrastructure	REDUCE / REUSE	Low - Med	11
	Disassembly, selective deconstruction and demolition of buildings and infrastructure	REUSE	Low - Med	12
	Green and circular districts based on circular principles	RETHINK	Low - Med	-
	Circular public procurement for new buildings and infrastructure	RETHINK	Med - High	13
	Procurement of Products-as-a-service (PaaS), circular leasing/rental models in buildings	REDUCE	Low	-
Consumer Goods	Public advertising to support circular behavior	RETHINK	Low	15
	Circular public procurement for goods and related services	RETHINK	Low	15
	Product sharing platforms, centres (e.g. tools, garden machinery)	REDUCE	Low	-
	Circular centres, shops and malls for repair, restoration and resale of consumer goods	REUSE	Low	16

SECTORS	CIRCULAR ACTIONS	CCAF CATEGORY	BUDGET	PAGE
Food	Rescue and redistribution of food surplus	REUSE	Low	-
	Regenerative urban and peri-urban farming	REGENERATE	Low	18
	Circular public procurement of food products and services	RETHINK	Low	19
	Rescue and redistribution of food surplus	REUSE	Low	20
Manufacturing	Circular innovation hubs/incubators	REDUCE	Low - Med	22
	Networking platforms/digital tools enabling circular strategies and business models	REDUCE	Low	-
	Investment platforms for circular projects / businesses (city as a co-investor)	REDUCE	Med - High	-
	Eco-industrial/circular parks with local value loops	REUSE	Low	23
Mobility & logistics	Compact city planning and development to reduce transport needs and facilitate shared solutions	RETHINK	Med - High	25
	Shared or low-carbon mobility and logistic systems and platforms	REDUCE	Low - High	26
	Refurbishment/technological conversion of rolling stock	REDUCE	Low - Med	-
	Reuse and recycling of vehicles or components	REDUCE	Low - Med	27
Tourism & leisure	Socially responsible sharing platforms	REUSE	Low	29
	Reusable products and containers	REUSE	Low	30

SECTORS	CIRCULAR ACTIONS	CCAF CATEGORY	BUDGET	PAGE
Waste & material management	Expanded/improved separate collection of recyclable materials	RECOVER	Med - High	32
	Expanded/improved separate collection of bio-waste	RECOVER	Low - Med	33
	Civic amenity/recycling centres	RECOVER	Low - Med	-
	Material Recovery Facilities (MRF) / sorting facilities for separately collected recyclable materials	RECOVER	Med - High	34
	Construction and demolition waste reuse and recycling	RECOVER	Med - High	35
	Composting and anaerobic digestion of bio-waste	RECOVER	Med - High	36
	Urban biorefineries for food/feed/chemicals recovery	RECOVER	Med - High	-
Water & wastewater management	Grey water reuse systems	REUSE	Med	38
	Recovery of nutrients and chemicals from wastewater and sludge	RECOVER	Med	39

Budget - Low: <5m, Med: 5- 20m, High: >20m



BUILT ENVIRONMENT

All cities contain a combination of buildings and infrastructure that provide for human needs such as shelter, water, energy and mobility. Although the urban built environment represents a relatively small fraction of our land-use, the impacts are far-reaching: biodiversity loss, resource depletion, waste generation, GHG emissions and environmental pollution. This sector is highly resource-intensive, and unlike many others, the incoming material flows accumulate within the city in vast magnitudes over time in the form of long-lasting buildings and infrastructure.

In a circular city, the processes of designing, building, maintaining, refurbishing and replacing buildings and infrastructure ensure that they are designed in a modular and flexible manner that can be adapted to changing needs over their useful life. Assets, components and materials are maintained and reused at their highest value for as long as possible. Additionally, all materials used are non-toxic or regenerative, components are easily repairable and reusable, and energy and water are used efficiently.

The following sections present a number of examples of circular built environment actions and solutions from cities around the world. You can read more about a [circular built environment](#) on the Circular City Funding Guide website.

MAKE THE BEST USE OF EXISTING BUILDINGS AND INFRASTRUCTURE

The demolition of old buildings and construction of new buildings require vast quantities of heavy materials, and significant amounts of energy and water. Where possible, it is preferable to renovate and refurbish an existing building in a circular manner rather than demolishing it to build a new one. Additionally, underutilised and vacant buildings and spaces represent an enormous untapped value, which could be leveraged to finance investments in other areas and revitalise neighbourhoods. This could include 'meanwhile use' or 'intermittent use' of buildings, which involves making temporarily empty spaces, properties and land available for use as work spaces, pop-up cafes, shops, and more. Such projects help to rethink the design of the surrounding urban space, creating attractive, safe and user-friendly areas, thus revitalising neighbourhood economies and encouraging local retail networks.

Local governments—along with multidisciplinary teams of finance, human resources, technology, and corporate real estate stakeholders—can identify idle or underutilised spaces and determine their value, and then consider this in relation to current and future requirements of their citizens (for example, shortage of affordable housing or cultural spaces). Measures to address the underuse of buildings and spaces could include flexible zoning plans, economic disincentives for new greenfield developments in favour of refurbishing and manufacturing, as well as piloting projects with public vacant buildings.

CASE STUDY

Rotterdam — Repurposing waterpark into a circular innovation hub

In the city of Rotterdam, a disused waterpark has been repurposed into a new business hub, while maintaining a large proportion of the original elements to give the space a unique character and a minimal ecological footprint. The location, called BlueCity, is home to a budding ecosystem of inspiring circular economy initiatives and hosts a flexible office space and a café.

[Read more online](#)

CASE STUDY

Barcelona — Opening underutilised urban sites for community use

Barcelona City Council is driving the BUIITS Plan (Empty Urban Spaces with Territorial and Social Involvement) to provide temporary social and community use for some of the municipally owned land sites that are currently underutilised. For instance, civil society has given purpose to empty spaces in the form of community gardens, meeting spaces and even bicycle parking.

[Read more online](#)

DISASSEMBLY, SELECTIVE DECONSTRUCTION AND DEMOLITION OF BUILDINGS AND INFRASTRUCTURE

Buildings and infrastructures often include many types of components and materials used in ways that make disassembly or repurposing very difficult. This can be solved by integrating circular concepts over the entire lifecycle of buildings and infrastructures. Flexible and modular design facilitates repurposing in response to changing needs over the life of a building and supports lifetime extension as modular constructions are often easier to renovate. Design for disassembly (DfD) enables deconstruction instead of demolition at the end of life and recovery of high value components and materials such as doors, flooring, windows and other elements before demolition. Selective demolition, finally, allows to retain the structural integrity of the building and refurbishing for new uses. These practices not only increase the material reused and value recovered at the end-of-life of buildings, but are often labour-intensive, creating more jobs than conventional demolition. As such, they can spur local innovation and industry, contribute to preserving local character and heritage of buildings, while reducing landfill costs and limiting the need for virgin and often carbon-intensive materials.

City governments can promote the adoption of these practices by providing appropriate guidance on flexible and modular design, design for disassembly and selective demolition, and including these principles in their procurement guidelines. They can also foster the uptake of such practices through end-of-life standards and regulation. Additionally, they can undertake a cost-benefit analysis of deconstruction, building material reuse and DfD in the city compared to demolition and new build. This type of analysis can encourage circular approaches and help cities set targets for construction and demolition waste minimisation as well as plans for material reuse and standardised designs for modularity and disassembly. Finally, cities can create enabling conditions for the upscaling of such solutions by supporting digital tools, such as material passports and Building Information Modelling (BIM).

For these strategies to be successful, the city must take an active role in building awareness by demonstrating the effectiveness of circular approaches in city owned buildings. It is also important to involve relevant stakeholders in the planning and implementation of building deconstruction and disassembly.

CASE STUDY

Venlo — Municipality leading the circular built environment

The municipality of Venlo, the Netherlands, has commissioned its new city hall to be built according to cradle-to-cradle (C2C) standards. This means that all base materials can be fully reused without losing value. In the design phase, a significant focus was placed on stakeholder involvement. The C2C design provides multiple health and economic benefits, allowing material recovery and disassembly, as the materials can be sold back to manufacturers through a 'buy and buy-back' scheme.

[Read more online](#)

CASE STUDY

Porto — Materialbase Porto's material bank for heritage materials

To promote and safeguard materials and components that exemplify the character of Porto's built environment, the city has established a material bank. The Materialbase collects tiles, signs and other compone building components from degraded or soon to be demolished buildings. Not just for conservation, these materials are then available to building owners free of charge for use in renovation projects.

[Read more online](#)

CASE STUDY

Kongsvinger — The O-House made from reclaimed materials

The O-House is a modular youth home based on recycled wood that can be moved around in six municipalities in the Kongsvinger region to demonstrate the potential to reclaim and repurpose local construction materials. It is the first building project in the region that is circular by design and that aims to use demolition materials as construction material-sourced from a local barn.

[Read more online](#)

CIRCULAR PUBLIC PROCUREMENT FOR NEW BUILDINGS AND INFRASTRUCTURE

Cities can directly support the transition towards a circular economy and emission reduction targets by leading by example through their public procurement activities. This is especially true regarding the built environment, as cities manage a sizable portfolio of buildings and infrastructure. Through procurement, local governments can help to develop the market for circular products and services, including circular materials as well as product-as-a-service or leasing models for building components (such as flooring, elevators and lighting). They can also manage the existing and future building stock in a way that contributes to closed energy and material loops within supply chains, whilst minimising—and ideally avoiding—GHG emissions across the entire life-cycle of procured construction materials and activities.

Local governments have several levers at their disposal: investing in renovation and maintenance work, retrofitting and repurposing (if necessary) existing building stock to avoid new construction, specifying circular criteria in public tenders for the design, construction and management of buildings. These criteria could, for instance, include mandatory requirements for the use of secondary or bio-based materials in new development projects, or specify design for adaptability, deconstruction and reuse. Additionally, the uptake of ‘green contracts’—agreements that require the contractor to develop and implement a site management plan and favour certain types of resources—can also stimulate circular operations by integrating circularity in the legal relationship between building owners, operators and users.

CASE STUDY

Amersfoort — Circular public procurement for construction

The Municipality of Amersfoort, in the Netherlands, is participating in the EU’s Green Deal aimed for 10% circular procurement by 2020. Two large projects have already started: the renovation of the town hall and the construction of the new Amersfoort ring road. Circular purchases by the municipality so far include 98% circular office chairs, furnishing consisting entirely of reused materials, recycled hooks from a hospital, and reception desks made from potato starch and grass.

[Read more online](#)

CASE STUDY

Copenhagen — Source separation and recycling requirements for construction

The City of Copenhagen has developed a strategic document [Sustainability in Construction and Civil Works](#) (2016) which specifies requirements for construction and civil works commissioned or supported by the City. It includes, for example, that in all city projects all materials suitable for recycling must be source-separated and cleaned and that uncontaminated construction rock material must be crushed and reused on site, unless an exception is granted by the Municipal Environmental Protection Department.

[Read more online](#)



CONSUMER GOODS

Consumer goods refer to products that citizens buy and consume to satisfy their daily needs and include a wide range of products such as food, textiles and electronics. The past century has seen the rapid growth of consumerism with a focus on sales rather than sustainability. This has resulted in reduced lifespans of consumer goods, the growth of fast-fashion, the prevalence of single use and disposable items in the name of convenience, and planned obsolescence in consumer electronics. A key source of waste generated by urban residents stems from patterns of unsustainable production and consumption, which lead to many consumer goods being thrown away, often after a short time and before being worn out or broken. This is contributing to a global challenge of unprecedented and unsustainable levels of resource use, waste generation and ecological damage.

A circular consumer goods system is based on the principles of reducing the consumption of such goods, prolonging the lifespan (through strategies such as refurbishment and repair), and facilitating material recovery for end-of-life products to produce new materials that can reduce demand for virgin materials in the manufacturing of new consumer goods.

The following sections present a few examples of actions and solutions to encourage more circular production and consumption of consumer goods. You can read more about [circular consumer goods](#) and [textiles](#) on the Circular City Funding Guide website.

PUBLIC ADVERTISING TO SUPPORT CIRCULAR BEHAVIOUR

In recent decades, the advertising industry has played a significant role in building demand for consumption. By tapping into the psychology of residents, advertising campaigns are designed to build desire for new products and remind people to consume more throughout their daily routines. Many cities generate revenue from selling advertising space in well used public places such as bus stops, trains and squares. For many cities, it has become a part of the urban landscape.

While public advertising may seem ubiquitous, many cities are exercising a degree of control over what is advertised and where to protect the public interest. For example, some cities are placing controls on the advertising of junk food to safeguard citizen health, and others have banned the promotion of air travel to reduce demand for emission-intensive holidays. Cities can, instead, use public advertising to promote circular economy initiatives within the city, such as 'libraries of things', second hand stores, repair cafes, or reuse hubs. Alternatively, cities can reduce the number of advertising locations around the city, or even ban public advertising altogether. Old billboards and other advertising sites can be opened up to the community for street art, notice boards or greening.

CASE STUDY

North Somerset — Ban of adverts for high carbon products

North Somerset Council, in the UK, passed a motion in 2021 to introduce a Low Carbon Advertising Policy to reduce the consumption of high carbon products. A preliminary list of high carbon industries includes petrol and diesel car advertising—particularly for the largest and most polluting cars—airline advertising for flights, and fossil fuel companies.

[Read more online](#)

CASE STUDY

Grenoble — Regulating outdoor advertising to reduce excessive consumption

In 2014, Grenoble in France cancelled a contract for 326 outdoor advertisements, including 64 large billboards. In their place, trees were planted and more space was provided for community notice boards. The aim of the intervention was to reduce unnecessary consumption, thereby supporting a shift towards more sustainable lifestyles of residents.

[Read more online](#)

CIRCULAR CENTRES, SHOPS AND MALLS FOR REPAIR, RESTORATION AND RESALE OF CONSUMER GOODS

With the economic drive to sell more products, items that are cheaper to produce and sell are often prioritised over higher quality items that last a long time. These patterns of unsustainable consumption lead to many consumer goods being thrown away after only a short time, while still being perfectly usable. Circular centres and shops can support the reuse of consumer goods, providing a physical location to collect and repair, repurpose and resell these goods. There are also examples of fully circular shopping malls, offering access to different types of consumer goods ranging from furniture, electronics, clothing, and more.

Local governments can support the development of circular centres by providing both financial and in-kind support, and zoning particular areas for experimentation, repair and resale. They can also play a key role in connecting existing activities throughout the city, for example using digital platforms. Furthermore, local governments can play a key role in promoting reuse and repair activities throughout the city—reducing marketing costs for the businesses themselves and raising awareness for residents. Local governments may also stimulate skills development and make training available to repair and reuse organisations.

CASE STUDY

Prague — Reuse points

Prague has developed a growing network of Reuse Points throughout the city, where circular strategies of reuse, refurbish and repair are central. In the first six months of the pilot, nearly 2,000 used items were processed: the equivalent of 14 tonnes. The reuse points have been integrated into three collection yards and upgraded to be accessible for all citizens.

[Read more online](#)

CASE STUDY

Eskilstuna — ReTuna recycle shopping centre

The world's first recycle shopping centre has been established in Eskilstuna, Sweden. Almost everything sold at ReTuna has been repaired or upcycled, and if not, it is required to be environmentally ethical. A drop-off centre is located next to the mall, so people can easily donate the things they no longer want. Before reselling, staff members repair and refurbish items—they also offer workshops to train people to reuse and repair objects.

[Read more online](#)



FOOD

Few human activities have as large a global impact on the planet as the production of food for urban citizens. It is estimated that the food system is responsible for one-third of all the GHG emissions resulting from human activity², with food products such as meat, fish and dairy generating the majority of the environmental impacts. Further to this, as much as one-third of the food that is produced globally is wasted, which represents an enormous waste of resources and injustice, as many in the world are malnourished. Food waste costs the EU around €143 billion per year and represents 15% of the food supply chain's GHG emissions. By the end of 2023, it is anticipated that the European Commission will have proposed legally binding targets for the reduction of food waste, making this a highly relevant topic for all levels of government³.

Food is deeply rooted in culture, tradition and identity, and has a profound impact on people's health and wellbeing at every stage of their lives, as well as on the local and national economies and the environment. With about 75% of Europe's population living in cities, transitioning towards more circular and sustainable approaches to food and biomass requires dedicated and coordinated efforts across the whole value chain, within and beyond cities. Circular economy principles can be applied to food production, circulating nutrients back to rural areas to improve soil quality and reduce emissions and toxins associated with fertilisers derived from fossil fuels. Additionally, once food has entered the city, a great deal can be done to minimise waste in production, transportation, storage, retail and hospitality—ensuring that optimal value is derived from food produced. While many cities may consider food to be the domain of the private sector, it is increasingly being recognised as a key focus area for government intervention in the transition toward circular cities.

The following sections present several examples of circular food and biomass actions and solutions. You can read more about [circular food and biomass](#) on the Circular City Funding Guide website.

REGENERATIVE URBAN AND PERI-URBAN FARMING

As cities expand, they often take over fertile land and push agricultural activities further and further away from urban centres, thus increasing transport distances. Additionally, 'green revolution' farming practices have increased the use of artificial fertilisers and pesticides, which negatively affect soils over time, rendering them less and less fertile. Supporting regenerative urban and peri-urban agriculture provides a number of advantages for the local economy and environment.

Regenerative farming practices adopt techniques like applying compost to support healthy soils, and improve local biodiversity through the cultivation of a more diverse selection of crops. These techniques actively improve the quality of the local environment and can range from container gardens to community initiatives and larger scale agriculture. Food can be grown in a number of under-utilised parts of the city (such as vacant land or rooftops), and encouraging citizens to use such spaces for food production can provide livelihood opportunities, build communities and regenerate un-sightly areas at relatively low cost. It will also reduce the need for long distance food transportation and related impacts on the climate, air and environment.

A local government may enable regenerative (peri-) urban agriculture by making space available in and near the city for growing food and using spatial planning to protect well-located open areas for agricultural use. Local community initiatives may be initiated through information and communication campaigns to teach citizens how and where to grow food and promote the purchasing of locally grown foods.

CASE STUDY

Rotterdam — DakAkker the rooftop farm

The City of Rotterdam supported the creation of the DakAkker, one of the largest smart rooftop farms in Europe with an area of approximately 1,000 m². The building is fitted with a smart roof that works as a sensor, predicting extreme rainfall and making extra water storage capacity available 24 hours in advance. DakAkker produces vegetables, edible flowers and fruit, and houses beehives to provide a safe space for local bees.

[Read more online](#)

CASE STUDY

Prague — Leasing land for organic food production

To support and promote sustainable agricultural practices, the City of Prague launched a pilot project that offers more than 400 hectares of its agricultural land for sustainable cultivation. Under the programme, land is available to be rented only to those who will farm with organic farming practices.

[Read more online](#)

CASE STUDY

Ghent — Creating local and regenerative food systems

Ghent en Garde, a policy launched in Ghent in Belgium, tackles different food system challenges through tailor-made responses. Demand for local food is growing rapidly thanks to the establishment of suburban farmers markets and a new logistics platform for professional buyers. The city has connected 120 stakeholders to improve access to sustainable and healthy food. Now, Ghent has become the city with the most vegetarian restaurants per inhabitant in all of Europe.

[Read more online](#)

CIRCULAR PUBLIC PROCUREMENT OF FOOD PRODUCTS AND SERVICES

Local governments can act as first movers and accelerate the transition towards a more circular food system through integrating circular criteria into public procurement for food and related services. Purchasing decisions by local governments, such as buying food or food supply services for canteens in municipal offices and schools, can have a large economic influence, and present important opportunities to create markets and demand for circular food businesses, products and services.

Public procurement criteria could, for example, prioritise regionally and organically produced foods, discourage the use of packaging and reduce food waste generation. Low carbon and plant-based menus could also be prioritised to reduce demand for emission-intensive meat and dairy products. Used strategically, public procurement can drive innovation in the sector to meet these circular and ecological demands, for example with new circular cultivation techniques and technologies, improved storage to minimise spoilage and wastage, and low-impact food and packaging solutions.

CASE STUDY

Paris — Procurement of seasonal & local food to boost local economy and reduce environmental impact

Under the Sustainable Food Plan, the City of Paris has been implementing a policy for developing sustainable food in its municipal catering services since 2009, and is one of the pioneering cities in this field. 'Sustainable' food is defined as organic, local and seasonal produce or food that is certified under a relevant sustainable food label (such as Label Rouge). The Plan covers all 1,200 of Paris's municipal restaurants, including schools, retirement homes and staff restaurants, which collectively serve 30 million meals a year.

[Read more online](#)

CASE STUDY

Turku — Embracing circular food procurement

Turku, in Finland, is using circular procurement to decrease food service GHG emissions. The city's strategic procurement department set targets for food waste reduction and percentage of vegetarian meals served. The department also uses an emission monitoring tool to track emissions connected to its food service contracts.

[Read more online](#)

RESCUE AND REDISTRIBUTION OF FOOD SURPLUS

Wastage of edible food is a major problem, not only in terms of the need to provide safe disposal solutions, but also due to the energy and resources consumed and emissions generated during its production, storage, processing and transportation. In many cases, surplus food from restaurants, canteens, food services, manufacturing and retail operations is perfectly edible when it is discarded, but the way in which it is disposed of can significantly reduce its value.

Platforms (both on and offline) can help to collect and redistribute food surplus coming from households, retail, restaurants, canteens, food services and manufacturing. In addition to improving social and environmental credentials, such platforms could yield financial benefits for businesses, and cost savings for those that buy or take up the food surplus. Unused food can, in some instances, also be redirected to social enterprises, such as soup kitchens or food banks that support residents in need.

Local governments can play an important connecting role between sources of surplus to non-profit organisations. If the food is no longer edible, it can be supplied to businesses that extract value from it in the form of animal feed, chemicals or soil conditioners. Awareness raising, exchange platforms, logistics and dedicated space in the city for storage and redistribution can support these activities.

CASE STUDY

Milan — Food redistribution through neighbourhood hubs

As part of the City's innovative food policy, Milan has established neighbourhood food hubs with the aim of halving the city's food waste by 2030. These hubs collect and redistribute the surplus food from across the city including shops and canteens. The food is supplied to local organisations and charities that feed residents in need.

[Read more online](#)

CASE STUDY

Bergamo — Social food pantry

The Italian city of Bergamo is a supporter of La Dispensa Sociale (Social Food Pantry), a circular economy project that recovers food discarded by large retailers, vegetable markets and agri-food companies. Surplus food, products close to expiry date, imperfect vegetables, fruits or other foods that are no longer marketable (because of packaging defects, for example) are recovered and redistributed to organisations and institutions that take care of vulnerable people.

[Read more online](#)

CASE STUDY

Frome — Communal fridge to reduce food waste

The British town of Frome has created a huge communal fridge in a converted public toilet building, inspired by the Spanish 'Solidarity Fridge' initiative. Anyone is free to donate or take food, and thousands of items have been redistributed since the project began in June 2016. Businesses are encouraged to get involved as food from certified kitchens can be stored in the fridge with no health and safety concerns—but households can also contribute, subject to a few restrictions.

[Read more online](#)



MANUFACTURING

The manufacturing sector includes a wide variety of activities and production processes that transform materials into goods and products. In Europe, the manufacturing sector is one of the oldest and most prominent economic sectors, employing over 29.9 million people in 2018⁴. Of all societal and sustainability challenges that will influence enterprises and their international value chains, it is expected that environmental issues will be the most important driver for change⁵.

Industrial manufacturing activities put a lot of pressure on the environment in the form of air and water emissions, waste generation and resource consumption. Despite fewer pollutants being released by the European industry over the last decade, the impacts and costs of pollution from industry remain high. In fact, industrial manufacturing is still one of the main contributors to air pollution in Europe⁶. Industrial manufacturing is also sensitive to linear risks related to, for example, resource depletion, global supply chain disturbances and protectionism.

In a circular economy, manufacturing is focused on closing product and material cycles, as well as optimising products to last for as long as possible. A circular manufacturing industry is an essential part of achieving a more circular and resilient economy. According to the Ellen MacArthur Foundation, the European manufacturing industry has the potential to save up to €550 billion⁷ a year on raw materials if it fully adopts circular manufacturing practices. This is equivalent to a 10 to 15% reduction in material consumption⁸. Cities can enable circularity in their manufacturing sector by, for instance, raising awareness of circular business models amongst local companies, providing spaces for sustainable manufacturing businesses to share resources and connecting them via digital platforms.

The following sections present examples of circular manufacturing actions and solutions. You can read more about [circular manufacturing](#) on the Circular City Funding Guide website.

CIRCULAR INNOVATION ECOSYSTEMS AND HUBS

The past few decades have seen an increased quantity of fast-moving consumer goods that are designed to be cheap to buy and easily disposable. There is, nevertheless, an opportunity for cities to support innovation and encourage the development of new circular products and business models (such as products-as-a-service).

Local and sustainable producer ecosystems are networks of local entrepreneurs and initiatives that innovate sustainable products and services. These ecosystems could be established in physical locations, such as a makerspace, and can support the innovation of ideas and products that use locally sustainable and abundant materials (such as renewable or residual materials).

Local governments can support the creation of local and sustainable producer ecosystems by providing rent-free access to the facilities and locations for entrepreneurs and initiatives that are developing circular economy innovations. Local governments can also engage in dialogue with participants of local spaces to understand and overcome the barriers towards a local circular economy and could even connect initiatives with residual material streams.

CASE STUDY

Prato — A circular textiles district

Recognising its well-established textiles industry, the city of Prato saw the industry as a strong starting point to develop a new circular economy strategy. By aligning the city's strategy to existing production processes and expertise, the city was able to make the local textile industry enthusiastic about the topic. In its current circular programme, a coordinating body brings together various stakeholders that are active in the district to support innovation and development of the local circular economy.

[Read more online](#)

CASE STUDY

Valladolid — Circular business support

The City of Valladolid launched a subsidy programme for circular projects to support the development of local circular initiatives to create employment and economic prosperity. Initiatives are scored for their expected impact on Valladolid's local economy. Valladolid wants to go beyond just financial support, towards creating a circular community. To achieve this, the municipality regularly invites all beneficiaries of the call to meet, pitch their projects, and share problems they encounter.

[Read more online](#)

ECO-INDUSTRIAL/CIRCULAR PARKS WITH LOCAL VALUE LOOPS

Manufacturing can be one of the main industrial activities in urban areas. This kind of activity often concentrates in defined industrial zones in the outskirts of urban areas. An eco-industrial park is a physical location where different businesses are co-located and collaborate on environmental and resource issues. They promote resource efficiency and circular economy practices such as industrial symbiosis, where energy, water, waste and other by-products from one company are redirected to another to be used as useful resources by another company. This not only reduces resource use, but also gives businesses a competitive advantage and helps to bridge the gap between industries and cities, significantly contributing to the sustainable development of urban areas.

Local governments can develop standardised approaches for the implementation of eco-industrial parks. They can redirect businesses to eco-industrial parks by providing financial incentives or via zoning and spatial planning. Positive impacts can be maximised when cities prioritise the conversion and redevelopment of brownfield areas for eco-industrial parks instead of finding new spaces for these businesses to operate in.

CASE STUDY

Frankfurt — Supporting the sustainability transition of an industrial park

The Frankfurt city council decided in March 2012 to modernise the industrial parks of North Fechenheim and Seckbach. The city measures range from improving the energy and resource efficiency of infrastructure, to vacancy management and a shared daycare centre. Companies in the area receive advice on funding opportunities and certification procedures, opportunities to network and use synergies economically, such as holistically connecting water, waste and material flows across different industries.

[Read more online](#)

CASE STUDY

Kalundborg — Supporting and promoting industrial symbiosis

Kalundborg is home to the world's first industrial symbiosis park, embracing circular principles to production. Since 1972, companies and industries in Kalundborg exchange their residual materials, water and energy to be used as input to other processes. Kalundborg symbiosis is a world leading example of the potential of industrial symbiosis and is a partnership between nine public and private companies in the area.

[Read more online](#)



MOBILITY & LOGISTICS

As cities have grown in size and traded increasingly further afield, mobility has become an essential part of the urban economy. Infrastructure for public and private mobility occupies vast areas of prime urban land, and the relative priority given to different modes of mobility can have significant positive or negative repercussions for citizens, the economy and the environment. In the last century, the rise of private vehicle use in cities has resulted in high levels of pollution, GHG emissions, heat-island effects, noise pollution and injuries and deaths. High levels of traffic congestion make cities less liveable, leading to lost productivity, wasted time and higher emissions than necessary.

As the planet becomes increasingly urbanised, there is a need for greener mobility that moves more people and goods whilst occupying less space, demanding fewer resources and resulting in less emissions. Circular economy principles provide inspiration on how to diversify modes of transport with the objective of reducing virgin material needs for infrastructure, vehicles and fuel, minimising waste and pollution, and maximising efficiency in use of transport and utility for citizens. Fortunately, many old European cities and towns were designed before private cars, and are therefore well structured to allow a return to non-motorised mobility options.

The following sections present a number of examples of circular actions and solutions for mobility and logistics. You can read more about [circular mobility systems](#) on the Circular City Funding Guide website.

COMPACT CITY PLANNING AND DEVELOPMENT TO REDUCE TRANSPORT NEEDS AND FACILITATE SHARED SOLUTIONS

The mobility choices and behaviours of residents and businesses can vary greatly depending on the structure and design of the city. A sprawling city covering large areas with wide highways and no bike lanes discourages cycling and increases dependence on private vehicles, which contribute significantly to resource demand and GHG emissions. Meanwhile, a more compact city with mixed use developments, accessible public transport and extensive and appealing pedestrian and cycle networks enables and encourages walking, cycling and other non-motorised, low-carbon forms of mobility. Combined with urban planning that incentivises higher densities along major public transport routes, transit-oriented development can help to slow the outward expansion of cities into the surrounding countryside.

Compact city planning can help local communities build and create more efficient, safe and viable cities. This concept includes ideas such as the 15-minute city or 'complete neighbourhoods', whereby all of the basic needs and services of a resident can be accessed within 15 minutes by walking, cycling or public transport. This concept has also attracted attention as a way to reduce inequality by ensuring that all neighbourhoods have access to affordable mobility options.

Local governments can support the development of compact and low-carbon cities by integrating such concepts into the city's urban plans, and ensuring that all residents are easily able to conduct their day-to-day lives using non-motorised or public transport. Cities can also ensure that necessary and facilitating infrastructure is provided, such as cycle lanes, pedestrianised areas and public transport options, to enable the shift away from dependency on personal vehicles.

CASE STUDY

Paris — The 15-minute City

The City of Paris has championed the idea of a 15-minute city within its urban design; whereby everything that residents need can be reached within 15 minutes, either on foot, by bike or public transport. The city is developing new cycle ways, community facilities and social housing, homes and workplaces, as well as planting new trees. As workplaces, stores, and homes are brought into closer proximity, street space previously dedicated to cars is freed up, eliminating pollution and making way for daily activities of residents and nurture welcoming, safe streets and squares.

[Read more online](#)

CASE STUDY

Barcelona — Car-free 'superblocks'

'Superblocks' are 400 x 400 metre units, i.e. bigger than a normal block yet smaller than a whole neighbourhood. Through this urban design concept, Barcelona aims to recover space for the community, improve biodiversity, move towards sustainable mobility and encourage social cohesion. Making it faster to travel within a city, as well as encouraging people to travel by foot, bike and public transport, is an important step towards a more circular city through reduced material requirements and fossil fuel consumption.

[Read more online](#)

SHARED OR LOW-CARBON MOBILITY AND LOGISTIC SYSTEMS AND PLATFORMS

A combination of shared mobility options (such as public transport, bike and car sharing) and low-carbon mobility systems (such as walking and cycling) can significantly reduce the energy demand and associated emissions of moving people and goods in cities. If implemented effectively, these solutions can reduce the overall demand for vehicles by alleviating the need for personal car ownership, and consequently also reducing the extraction of virgin materials required for the production and fuelling of private vehicles. Shared and low-carbon passenger mobility systems can take a number of different forms, from the provision of trains, trams or buses powered by renewable energy, to lift sharing services and rental cars, scooters and bicycles. Similarly, shifting freight from road to rail and powering freight vehicles with low-carbon fuels (LCF) such as biodiesel, bioethanol, green hydrogen and renewable compressed natural gas (R-CNG) can help to decarbonise freight transport.

Local governments can stimulate the use of low-carbon energy throughout the urban mobility system by transitioning their fleet towards electric vehicles or low-carbon fuels. They can also improve the availability and accessibility of electric charging infrastructure for private electric vehicles. Moreover, cities can play a role in the connection and integration of different forms of shared mobility (such as bike sharing, public transport, and car sharing) through a city-wide or national online platform. To discourage private car use, parking bays can be replaced with pocket parks, parking costs can be increased (in certain parts of the city) and cycling lanes can be expanded. Sustainable Urban Logistics Plans (SULP) can be adopted to reduce emissions from freight transport. Introduction of car free zones or congestion charges are other ways to encourage the shift to shared transport solutions.

CASE STUDY

London — Creating a low carbon, high tech transport network

To help create a low carbon, high tech transport network in London, the Mayor's Biodiesel Programme is working with the fuel industry and local authorities to inspire a biodiesel industry revolution in London. The aim is to produce biodiesel made from used cooking oil, fats and grease within the city, as a substitute for fossil fuels. Growing London's biodiesel industry to fuel buses and municipal fleets can deliver green jobs, provide a local renewable fuel supply and reduce carbon dioxide.

[Read more online](#)

CASE STUDY

Kalundborg — Whim Mobility-as-a-Service app

Helsinki is the first MaaS (Mobility-as-a-Service) developer city in the world, launching Whim as a multimodal journey planning app. With three types of services, Whim offers a free option for journey planning, providing access to public transport, local shared bikes and taxis, whereas Whim Unlimited offers access to all transport types. The Whim app is currently available in Helsinki and Turku (Finland), Antwerpen (Belgium), Vienna (Austria) and West Midlands (UK), multiple cities in Switzerland, and Greater Tokyo (Japan).

[Read more online](#)

REUSE AND RECYCLING OF VEHICLE COMPONENTS

The most common and visible problems associated with vehicle use and transportation in cities are road accidents, air pollution, or traffic congestion. However, vehicles also present a problem at the end of their useful lives. Even if fossil fuel vehicles are phased out, the shift to electric vehicles in the short term could lead to more internal combustion engine vehicles being scrapped, and to mountains of battery waste in the longer term.

High-value reuse and recycling of vehicles and their components is key to a sustainable future of mobility. For instance, vehicles can be 'retrofitted' to run off batteries, remanufactured, or dismantled to allow the reuse of parts and recycling of materials. When batteries cannot be reused to power a passenger car any longer, they can be reused for less demanding tasks, such as storage of electricity from wind turbines and solar farms. When reuse is not an option, advanced recycling technologies can extract valuable raw materials, such as lithium and cobalt, before batteries are disposed of. This would not only reduce the burden on incinerators and landfills, but could provide a new, local and more circular source of critical materials for the automotive industry.

Although only few initiatives exist at the municipal level to support high-value reuse and recycling of vehicle components, many initiatives are being supported at national level and businesses are taking the lead in implementing pilot projects across Europe⁹. In the future, local governments could support the recycling of materials by implementing environmental standards for pollution reduction, dismantling, crushing and shredding of vehicles, as well as financial incentives (such as tax rebates and subsidies.) for remanufacturing of cars and part recovery. Alternatively, cities could ban the landfilling of scrap metals and batteries without any previous treatment. Collaboration and engagement with local businesses can help local governments to accelerate research and disseminate knowledge about circular economy approaches to end-of-life vehicle management.

CASE STUDY

Salzgitter — Battery recycling pilot plant

Volkswagen Group Components has opened the group's first plant for recycling electric car batteries in Salzgitter, Germany, and pilot operation has started in the Lower Saxony city. Until now, used batteries have mostly been incinerated. Volkswagen Group Components uses for the first time a mechanical process to drain and dismantle the batteries in their components so that they can be recovered here and returned to the production cycle.

[Read more online](#)

CASE STUDY

Amsterdam — Reuse car batteries for electricity storage

The Johan Crujff ArenA sports venue in Amsterdam has developed a renewable energy storage system that utilises second-life electric vehicle batteries. Formed as part of a collaboration with businesses and partners, the innovative system enables electric vehicles to be used for a greater extent of their functional lives and provides a sustainable solution to energy storage.

[Read more online](#)



TOURISM & LEISURE

Citizens often spend a share of available earnings on tourism and leisure activities to help them unwind¹⁰. As Europe is one of the world's top travel destinations, it is not surprising that the tourism sector is its third largest economic sector, generating approximately 10% of the EU's GDP¹¹. While tourism and leisure provide many benefits for the economy, these activities can have significant negative impacts at the local and environmental level.

Globally, tourism generates about 5% of emissions, and this is expected to double in the next 25 years. Transport contributes to around 75% of these emissions (predominantly from air travel), and accommodation around 20% (for lighting, heating, cooling, maintenance and more). Many tourism and leisure activities require significant amounts of water (such as swimming pools, spas and golf courses) and tourists are estimated to consume three times more water per day than locals¹². Tourism and leisure activities also generate a lot of waste, including many single-use 'disposable' items like coffee cups, water bottles, straws and shopping bags. Lastly, the rapid seasonal fluctuations in the number of inhabitants in a city strains waste management and sewage systems, which can negatively impact local communities.

Shifting to more sustainable transport and infrastructure systems will reduce related emissions and environmental impacts, and there is significant overlap between the types of interventions required to ensure more circular tourism and leisure activities and other economic sectors. Additional areas of focus could include interventions to reduce food and packaging waste, and to save energy and water (especially in water scarce areas). As visitors may not be aware of local circular options, it is important to educate and encourage them to make use of them to support a city's efforts to be more circular.

The following sections present several examples of circular actions and solutions within the tourism and leisure sectors. You can read more about what [circularity means for the tourism industry](#) on the Circular City Funding Guide website.

SOCIALLY RESPONSIBLE SHARING PLATFORMS

The success of the circular economy greatly depends on the engagement of people, on behavioural change and on changing underlying social norms. Behaviour across the journey of purchase, use and disposal needs to shift to more circular practices that avoid waste at its source and extend the useful life of the products bought.

The sharing economy is an integral part of the way people consume goods and services in a circular economy. It means that consumers choose not to own a product, but instead share it with other users, for example, by renting or leasing. When doing so, products are used more and for longer, less resources are consumed and less waste is generated.

Local governments can play a crucial role in shaping behavioural changes in this direction. A circular/sharing economy can be made a core element of circular economy strategies and influence business programs, waste management plans and quality of life programs. Additionally, cities can ensure that sharing rather than owning is easier and more convenient for consumers. This can take the form of mapping reuse hubs and repair cafes across the city, or the integration of various sharing platforms via a common city-wide platform or card to ease its use. Collaboration with the businesses and the general public is crucial to ensure that this new way of doing business and of consuming goods and services can be scaled up across sectors and throughout the whole city.

CASE STUDY

Gothenburg — Smart Map for sustainable initiatives

The Smart Map in Gothenburg wants to make it easier for people to live more sustainably by encouraging community, new meetings and access over ownership. To do so, the digital map shows initiatives and networks to find bike kitchens, swap groups, clothing swap days, free shops and digital platforms, among other things. What is shown on the map is decided by criteria that have been agreed between local civic associations and the City.. The map has now expanded to other cities in Sweden, such as Umea, Malmö and Stockholm.

[Read more online](#)

CASE STUDY

Amsterdam — A project for a sharing city

The project Amsterdam Sharing City was launched to take advantage of the benefits that sharing offers in the areas of sustainability, social cohesion and economy. The project was initiated in response to several observations, such as a willingness to share in the city of Amsterdam and an established digital infrastructure. With the City of Amsterdam on board, Amsterdam Sharing City was launched in February 2015. There have been several sharing economy projects launched including: Sandd (provides logistics to sharing economy startups) and Peerby Go (a pilot with renting from neighbours instead of purchasing new).

[Read more online](#)

REUSABLE PRODUCTS AND CONTAINERS

Single-use packaging is very common in food services and retail, and its expanded use in recent years has led to multiple health, sanitation and environmental problems—polluting public spaces, waterways and surrounding ecosystems. However, this is a relatively new phenomenon, and there is a lot that can be done to shift away from non-biodegradable materials and encourage a return to reusable containers. Reusable containers can be used, washed and reused multiple times to reduce waste generation.

Commonly, the implementation of reusable food and drinks containers relies on a strong collaboration with businesses to adopt and facilitate such schemes. Yet, local governments can play an important role in promoting and supporting these behaviours through, for example, raising awareness of alternatives and promoting participating businesses. Experimental zones can also be used to test and encourage the use of reusable containers. Local governments can, in partnership with regional and national governments, regulate the use of certain single-use materials and packaging in the city.

However, caution is warranted: with their often higher per-unit impact when compared with single-use alternatives, implementing reusable container schemes must be balanced with behaviour change away from a throw-away mindset to ensure that these containers are used multiple times, otherwise the expected environmental impact may not be realised.

CASE STUDY

Paris — Zero plastic waste water movement

The zero plastic waste water movement promotes the change of habits, to reduce the amount of single-use plastics for water. A key dimension of the programme is to promote the consumption of tap water with refillable bottles across the city, in Paris' fountains, restaurants and at home. The movement has partnered with festivals and events across the city to further promote no-plastic water.

[Read more online](#)

CASE STUDY

Luxembourg — Reusable food and drink containers

To promote the use of alternatives to single-use plastic packaging, Luxembourg supported the launch of two initiatives: the EcoBox scheme in 2018 and Cup2Go in 2022. The Cup2Go initiative allows customers to use reusable drink containers in participating restaurants across the city to receive reward tokens. In the EcoBox scheme, damaged containers are collected by the manufacturer for recycling into new products. There are approximately 25,000 EcoBoxes in use across more than 100 participating restaurants, while Cup2Go can be found in over 50 establishments

[Read more online](#)

CASE STUDY

Bonn — Encouraging adoption of reusable beverage containers

The German City of Bonn directly supports take-back systems for containers for direct reuse, for instance, reusable cups. Through this initiative, the city helps citizens and businesses to understand the benefits that can be derived from reusing items, such as cups and other food containers, by raising awareness, sharing knowledge, and showing where and how items can be used and returned in Bonn.

[Read more online](#)



WASTE & MATERIAL MANAGEMENT

Reconsidering and transforming waste into a resource is a core element of the circular economy. In contrast to the 'take-make-waste' linear model, a circular economy is regenerative by design and aims to gradually decouple growth from the consumption of finite resources. In a fully circular economy, waste is either fully designed out, or at least minimised to the extent possible so that resources are kept in use in closed loops, ensuring that unavoidable waste or residues are recycled or recovered. However, the linear 'take-make-waste' economy still prevails to a large extent. Every year in the European Union, approximately 500 kg of municipal waste is generated per person, which amounts to about 225 million tonnes of municipal waste annually¹³. Moreover, less than half of the municipal waste generated in the EU is recycled and only 12% of the input materials to EU industry are secondary raw materials¹⁴. This indicates strong potential for circular strategies to further reduce and recycle waste, thereby conserving resources and minimising the negative impact of waste on the environment.

Cities can play a key role in enabling more circular material and waste management by leveraging technology, processes and citizen participation. This includes expanded and improved separate collection of recyclable materials and bio-waste, and advanced sorting of recyclable materials using digital technologies and artificial intelligence to increase both quality and quantity of materials recovered for recycling. To incentivise citizen participation in separate collection systems, cities can implement pay as you throw (PAYT) systems, whereby those who produce less waste and dispose of it in separate collection containers pay lower fees for waste collection. Cities can further involve citizens to facilitate the transition to a circular economy through awareness raising campaigns that encourage them to reduce the amount of waste they generate.

The following sections present a number of examples of circular actions and solutions for more circular waste and material management. You can read more about what the circular economy can mean for the [waste management and material recycling](#) in cities on the Circular City Funding Guide website.

EXPANDED/IMPROVED SEPARATE COLLECTION OF RECYCLABLE MATERIALS

When recyclable materials are mixed with wet organic waste (e.g. food waste), they become difficult to separate, which limits the potential to recover materials of any value. Source separation increases the potential to separate clean material streams that can easily be recycled and ensures that downstream recyclers receive cleaner feedstock, thus reducing the loss of value in contaminated materials. Source separation systems can take a variety of forms, such as providing individual households with colour-coded bins or bags for collection of paper, glass and other materials. Collection can also take the form of a distributed network of communal collection points throughout a city for residents to drop off specific types of recyclable materials.

Local governments can support source separation by developing and providing the necessary infrastructure in convenient locations throughout the city or engaging in public-private partnerships to provide source separation systems. Information campaigns can help to inform residents on which types of consumer goods can be recovered, and the most effective means of disposal. PAYT user charge systems can provide citizens with direct economic incentives to separate their waste at lower cost rather than disposing of mixed waste.

CASE STUDY

Ljubljana — Frontrunner in waste separation and collection system

Ljubljana in Slovenia has developed an effective source sorting and separate collection for municipal waste. Since its implementation, the city has reduced landfilling by 59% and waste generation by 15%, with a recycling rate now 20 percentage points above the EU average, making the city a frontrunner in circular waste management.

[Read more online](#)

CASE STUDY

Barcelona — Green Points for source collection and separation

The city of Barcelona has established Green Point areas where individuals and businesses operating in the commercial and services sectors can dispose of waste that cannot be disposed of in street containers. A Green Point allows the collection of a wide variety of consumer goods, ranging from large appliances to old furniture or clothes. Larger containers are often situated on the outskirts of the city, while smaller ones are available within the urban area.

[Read more online](#)

EXPANDED/IMPROVED SEPARATE COLLECTION OF BIO-WASTE

The circular potential of food and other organic waste is dependent on the quality and contamination rate of the stream that is collected. Food and organic waste decay rapidly and it is difficult to separate such waste after collection. Mixing food and other biodegradable waste with other waste types severely limits opportunities for value capture, so it is important that they are collected separately.

Due to their strong influence over and involvement in the planning and operation of local waste management systems, local governments have a key role to play in ensuring the provision of separate organic waste collection systems throughout the city. This will also be mandatory in the EU as of 1 January 2024. Collections systems can be adapted to suit the specific characteristics of particular neighbourhoods and areas of a city. For example, areas with detached homes have more space for dedicated organic waste bins, or even home composting. For multi-dwelling apartment buildings on the other hand, communal containers may be more appropriate. Communication campaigns can help to raise awareness and encourage the participation of residents in separating their organic wastes responsibly.

CASE STUDY

Bergamo — Collection of old sports equipment to be transformed into playground floors

In the Italian city of Bergamo, a collaborative project –together with the organisation Ecosport– collects old sports equipment –from shoes, tennis balls to bike inner – across a dozen collection points across the city. Once collected, these old sports equipment are delivered to a recycling plant that transforms them into padded floors for children's playgrounds, an initiative called il giardino di Betty (Betty's garden).

[Read more online](#)

CASE STUDY

Porto — Expanding and enhancing bio-waste collection system

Porto in Portugal has set up over 500 proximity bins (complemented by a Smart Collection System tool that allows every container to be identified and located) in highly populated areas. The project offers access control with an electronic identification card, alongside the distribution of over 60,000 7 litre containers in the housing areas. It covers approximately 60% of the city's population and enables the collection of nearly 7,000 tonnes a year of organic waste.

[Read more online](#)

CASE STUDY

Milan — Door to door food waste collection system

The City of Milan has implemented an effective organic waste collection system and information campaign that was first introduced in 2012. The door-to-door system collects bio-waste twice a week. For apartments, small kitchen bins designed to minimise odours are used. With the help of this system, food waste recycling has increased from 34.5% in 2011 to 48.3% in 2014.

[Read more online](#)

MATERIAL RECOVERY FACILITIES (MRF) / SORTING FACILITIES FOR SEPARATELY COLLECTED RECYCLABLE MATERIALS

Once recyclables have been collected, municipalities or private sector actors can play a key role in sorting and separating them further in Material Recovery Facilities (MRFs). These are installations that receive, separate and prepare recyclable materials for recycling. They use machines to sort materials such as plastics, metals and paper, using advanced separation technology including optical sorting and robotics. MRFs also include equipment to prepare recyclables for easier transport, e.g. through baling.

CASE STUDY

Eskilstuna — Optical sorting of recyclable materials

Eskilstuna has implemented an advanced optical sorting technology to support the recovery of recycled materials. In a facility owned by ESEM (Eskilstuna Strängnäs Energi och Miljö AB), seven fractions of residual materials are separated, including textiles, plastics and paper through an optical sorting mechanism that sort residual materials that are collected in different colour bags. The facility's capacity operates at 18,000 tonnes each year and is connected to several local municipalities.

[Read more online](#)

CASE STUDY

Malmö — Advanced sorting of textile waste

Textile waste generated within Malmö and its surroundings is being automatically sorted using optical sensors that separate textile waste and send it to fibre-to-fibre recycling. Funded by Vinnova, the Swedish government's research and development agency, and led by IVL, the Swedish institute for environmental research, the facility is part of the SIPTex project (Swedish Innovation Platform for Textile Sorting). The sorting plant is capable of sorting up to 24,000 tonnes of textiles per year and has operated in Southern Sweden since 2021. It is the world's first fully automated sorting facility that allows the processing of large amounts of textile waste with high precision, functioning as the link between textile collection and high-quality textile recycling.

[Read more online](#)

CONSTRUCTION AND DEMOLITION WASTE REUSE AND RECYCLING

Currently, most Construction and Demolition (C&D) waste is mixed and used for backfilling or sent to landfill. Some of it is incinerated or downcycled into products of much lower value. This has become a pressing issue in many urban areas due to the sheer volume of C&D waste, which often is the biggest proportion of the waste stream. Improving separation of different materials at demolition sites and establishing or improving facilities for reuse and recovery of C&D waste allows for value to be retained within the local economy, reducing the burden of urban C&D waste management and helping cities achieve a more resource-efficient urbanisation. By recovering building components from buildings that are to be demolished, fewer new components need to be produced, and fewer raw materials need to be extracted. This reduces environmental impacts and emissions at each step of the value chain, from extraction to transportation and manufacturing.

Cities can influence the type of waste management infrastructures developed within the city's borders, as well as how different facilities throughout the city connect to one another. They can invest and support in developing infrastructure, both physical and digital, that can facilitate the closing of material and energy loops throughout the urban built environment. This can take the form of C&D recycling facilities, facilities for reconditioning of deconstructed building elements, and material and component marketplaces to collect and recover disassembled pre-used building components and material.

CASE STUDY

Oslo — A database for demolition projects

The city of Oslo, Norway, maintains a database of demolition projects to serve as 'material banks' for construction projects in the city. When buildings owned by the city are demolished, social enterprises are given the chance to reclaim materials.

[Read more online](#)

CASE STUDY

Amsterdam — Creating a geological map of urban mining

The PUMA project by AMS research institute and multiple Dutch universities has researched the urban mining potential of Amsterdam. The research focused on the prevalence of three metals (copper, iron and aluminium) in Amsterdam, tracing them on a geological map to show the potential for urban mining in the city. This allowed for wider, more targeted and effective implementation of urban mining across the city.

[Read more online](#)

CASE STUDY

Mikkeli — Circular demolition of public buildings

The municipality of Mikkeli in Finland is using circular material management methods to carry out circular demolition of healthcare facilities. Two sites have been scanned so far. Following a selective demolition procedure, salvaged materials were incorporated into a digital databank and a construction materials marketplace. The use of the marketplaces is being promoted to both private and public actors who are interested in obtaining secondary construction materials.

[Read more online](#)

COMPOSTING AND ANAEROBIC DIGESTION OF BIO-WASTE

While it is important to rescue edible food surplus for its highest use as nutrition, food and other organic waste deemed unsuitable for human or animal consumption can release vast amounts of GHGs into the atmosphere during their decomposition, if incorrectly managed. There are a variety of techniques and technologies to manage organic waste streams. Both mechanical and organic processes can transform them into valuable materials and compounds which can be used as inputs for agriculture, landscaping, pharmaceuticals or other applications. Some of these approaches are low tech and relatively affordable, such as composting to rapidly transform organic wastes into soil conditioner. Others, like anaerobic digestion, require more advanced facilities to effectively minimise the GHG impacts of the waste, but at the same time can also provide a local source of clean energy for generating electricity, producing biogas for the grid or fuelling vehicles.

Local governments are in a strong position to ensure that approaches that derive value from food and organic waste are prioritised over processes that render them worthless, such as landfilling. While local governments can initiate such projects as part of their waste management operations in the city, the formation of public-civic partnerships can be an effective means of implementing such solutions.

CASE STUDY

Prague — Converting food waste into biogas and fertiliser

Prague became the first Czech city to implement household food waste collection. The collected food waste is converted into biogas in a large anaerobic digestion plant that produce bio-CNG used to power waste management trucks. Excess energy is pumped back into the grid and digestate produced in the process is transformed into soil conditioner for local agricultural projects.

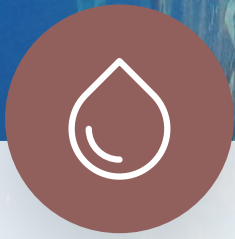
[Read more online](#)

CASE STUDY

Porto — Community composting

To promote the utilisation of organic waste within the circular economy, a community composting initiative was set up through a collaboration between Porto's waste management body, LIPOR, and a municipal company Porto Ambiente. The initiative directly involved local residents in the process of collection and composting of organic waste at specific sites around the city. The compost can be used by those taking part in the project. Support and monitoring is provided by the Master of Composting who has been a key ingredient to the success of the initiative.

[Read more online](#)



WATER & WASTEWATER MANAGEMENT

Piped water is one of the most essential services that city authorities provide, and sanitation services like wastewater collection and treatment are crucial to preserving the quality of water courses and preventing disease in densely populated urban areas. Cities must supply large amounts of fresh water to meet citizens' needs for safe drinking water and adequate sanitation, but also to fuel industries and commercial activities. The production of safe potable water requires significant energy and resources, and it is often used for all purposes from drinking to cleaning and irrigation. In many parts of the world, water is a scarce resource that needs to be managed with care. It is estimated that global demand for freshwater will exceed viable resources by 40% by 2030 if we continue consuming as we do today¹⁵.

Wastewater typically contains useful nutrients and substances that can be recovered and used as a source of local renewable energy in a circular city. It is important to recognise that there are different grades of water that can be used for different purposes, such as rainwater, grey water and partially treated wastewater. By aiming to utilise these grades of water at their highest value instead of using potable water for all needs, cities can reduce demand for potable water and lighten the burden on waste production, storm water and wastewater infrastructure whilst closing water loops. Circular water systems also exploit synergies between activities, for instance, by providing safe non-potable water and nutrient rich soil conditioners for agriculture, or by extracting fat or methane from wastewater flows to generate electricity or fuel vehicles.

The following sections present a few examples of circular actions and solutions for a more circular management of water and wastewater flows. You can read more about [circular water and wastewater management](#) systems on the Circular City Funding Guide website.

GREYWATER REUSE SYSTEMS

The water consumed by households must be of a sufficiently good quality to safely drink, bathe and clean with. However, the quality of water required for each of these needs differs significantly. For example, potable or drinking water must be of a higher quality than the water used to flush a toilet or irrigate a garden. It is possible to significantly reduce our overall water consumption by using and reusing non-potable water sources for lower quality purposes. For example, greywater reuse systems can be applied at household level to collect water from showers and baths, filter and treat it, and then recirculate it to flush toilets or irrigate gardens. Alternatively, a sports centre can collect greywater from showers and hand basins and process it to be used to irrigate an adjacent sports field or community garden.

Cities can encourage the uptake of greywater reuse systems through awareness campaigns, regulations and financial incentives. Awareness campaigns can show the potential environmental benefits and utility cost savings of installing such systems. Regulations can take the form of building codes and requirements in which the installation of a grey water reuse system is compulsory, unless practically infeasible. Financial incentives usually take the form of rebates for installing such systems. Municipal governments can also lead by example and procure such greywater reuse systems in municipal or city-run buildings, such as municipal offices or schools. This can not only improve the water-efficiency of such buildings, but can also showcase the benefits of these systems to build local market demand.

CASE STUDY

Lisbon — Advancing economic growth by reusing water

After identifying high costs related to water use for public purposes (such as watering green spaces, washing streets), the city decided to reuse water, therefore reducing both costs and the pressure on local water sources at the same time. This initiative is part of the city's integration of the circular economy into its sustainability strategy.

[Read more online](#)

CASE STUDY

London — Reusing water in large public spaces

The Millennium Dome in London, the eighth largest building in the world by usable volume, has been reusing the greywater from hand wash-basins, rainwater from roofs, and groundwater from the chalk aquifer to supply around 500m³ of water per day to flush all the toilets and urinals on the site. It is one of the largest in-building recycling schemes in Europe. It catered for over 6 million visitors in the year 2000 and can now meet 55% of the building's water demand by reclaimed water.

[Read more online](#)

RECOVERY OF NUTRIENTS AND CHEMICALS FROM WASTEWATER AND SLUDGE

Much of the wastewater generated by homes, industries, and businesses must be treated before it is released back into the environment. This is because it contains nutrients and other substances that can be harmful to the environment and human health, as well as to aquatic fauna and flora. These nutrients can cause oxygen depletion in water bodies, beach closures and contamination of drinking water. However, if the nutrients are recovered, they can often be put to beneficial use.

For instance, biorefineries use wastewater as a source of raw materials, generating products of value from waste nutrients and simultaneously producing clean water for reuse or discharge. Nutrients such as nitrogen and phosphorus can be converted into environmentally friendly fertilisers, and used for ecological restoration and agricultural purposes. Biosolids from wastewater can be used as fuel for heating, replacing fossil fuels and reducing the amount of biosolids sent to landfill.

Local governments have an important role to play in providing pipes, water management and treatment infrastructure to ensure that water is safely handled. They can also play a role in monitoring privately run facilities to ensure compliance with environmental performance standards. Finally, cities can connect stakeholders to match supply and demand for non-potable water, energy and nutrients recovered from wastewater.

CASE STUDY

Billund — Recovering wastewater to energy, clean water, and nutrients

Billund BioRefinery is a resource recovery plant in the Danish municipality that uses urban wastewater and source separated organic household wastes along with organic industrial wastes to produce energy. Instead of using oil to generate electricity and heat, the anaerobic digestion system produces energy, clean water, and nutrient-rich natural fertiliser, effectively cleaning all the influent waste streams. While producing more energy, the nutrient recovery in the plant helps improve phosphorus security of the local farmers.

[Read more online](#)

CASE STUDY

Vaasa — Creating circular loops through biogas buses

In 2014, the City of Vaasa (in Finland) committed to procure a fleet of 12 buses, which could run fully on biogas recovered from organic waste and waste-water sludge at local treatment plants. Contract performance clauses, which specified a rebate for the supplier if annual consumption was more efficient than estimates, or a refund if less, were also included to incentivise lasting and reliable performance. The city organised two separate tender competitions 1) for the service provider and 2) for the biogas vehicles, including their maintenance. Expected savings for the biogas buses amounted to 1,000 tonnes of CO₂ per year.

[Read more online](#)



CONCLUSION

This guide shows the diversity of circular actions and solutions available to cities wishing to take a more circular route to development, across a range of sectors and thematic areas. The case studies demonstrate how such actions and solutions are implemented in different cities in Europe.

The guide is intended to help city stakeholders assess the circular potential in their own cities, identify impactful opportunities and inspire circular action and change.

THE CIRCULAR CITY CENTRE (C3)

The European Investment Bank (EIB) supports EU cities in their circular economy transition through [The Circular City Centre \(C3\)](#). The C3 is a competence and resource centre that aims to address many of the linear problems cities struggle with today, and make cities more regenerative, resilient, clean, liveable and attractive to both citizens and companies. It has been established with the support of the European Commission through the European Investment Advisory Hub.

As part of C3, EIB is also offering a Circular City Advisory programme, a short and focused one-on-one support to cities in their transition towards a circular economy. This programme offers guidance in preparing circular strategies, identifying and screening circular projects, as well as assessing and improving circular project quality and soundness with a view to improve access to finance. The programme is available free of charge to interested cities.

More information about the C3 can be found here: [The Circular City Centre \(eib.org\)](#)
The C3 team can be reached at C3@eib.org

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