

The Circular City Centre - C3

A CATALOGUE OF CIRCULAR CITY ACTIONS AND SOLUTIONS



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Contents

①	Introduction	4
②	The circular economy and cities	5
③	The Circular City Actions Framework	6
④	Circular city actions and solutions	7
	4.1 – Built environment	9
	4.2 – Consumer goods	15
	4.3 – Food	19
	4.4 – Manufacturing	22
	4.5 – Mobility and logistics	26
	4.6 – Tourism and leisure	30
	4.7 – Waste and material management	32
	4.8 – Water and wastewater management	38
⑤	Concluding remarks	40
	References	41

1 Introduction

Cities have a critical role to play in the transition from a linear to a circular economy. They are centres of consumption and production, and they host the systems and policies that enable and govern urban life. Cities have the potential to promote and facilitate the introduction of circular practices by individuals and businesses, and they can play a key role in spreading knowledge and information about circular opportunities.

This guidance document aims to help cities identify actions and solutions that can accelerate their circular transition. The document covers eight key sectors with high circular potential. The circular approaches that can be adopted in each sector are introduced first, and this is followed by examples of potential circular actions and solutions. In addition, each section includes case studies from cities around Europe. Some of the actions and solutions span multiple sectors but have been assigned to one to avoid repetition.

The list of circular city actions and solutions presented in this guide is not intended to be exhaustive. Instead, the guide aims to highlight particularly relevant, innovative and inspiring examples and cases to illustrate how cities can accelerate their circular transition.

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More information about the C3 is available on the [C3 web page](#), which features other C3 guidance documents for download and information about the circular city and project advisory services that the C3 offers to cities.

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2 The circular economy and cities

In a circular economy, 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 reduce material consumption and generate less emissions and waste in meeting societal needs. To reap the benefits of the circular economy, the global economy must transition 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, cities are areas of innovation and hotspots of production and consumption, and they host most of the world's population and companies. Cities are also responsible for a major share of waste generation, pollution, and greenhouse gas emissions. Transforming cities' material and resource flows to become more circular will have great and positive local impact as well as global impact.

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 resource consumption and wastage. Cities are, in general, better positioned than countries to make swift decisions. Therefore, they can play an important role in establishing new circular city functions, infrastructure and services, and supporting circular business models. Cities are therefore well placed to be the catalysts, enablers and facilitators for the circular transition, as further elaborated in the C3 guide [The 15 Circular Steps for Cities](#).

Most of the impact that cities can achieve by going circular is related to resource-intensive sectors that fuel most urban activities in response to people's needs. This guide focuses on the following eight sectors:

1. Built environment
2. Consumer goods
3. Food
4. Manufacturing
5. Mobility and logistics
6. Tourism and leisure
7. Waste and material management
8. Water and wastewater management

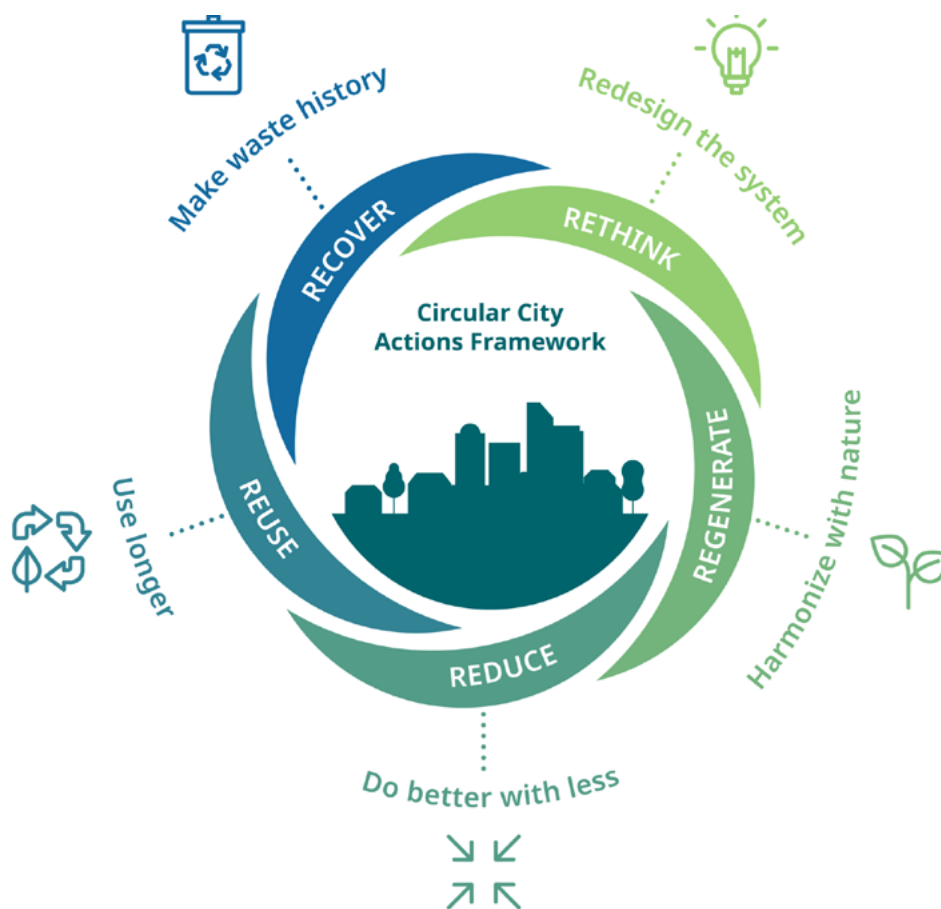
3 The Circular City Actions Framework

A circular city promotes the transition from a linear to a circular economy in an integrated way across the urban framework and city functions, and in collaboration with its people, businesses and research community. The [Circular City Actions Framework](#) (CCAF), developed by Circle Economy in collaboration with ICLEI (Local Governments for Sustainability), the Ellen MacArthur Foundation and Metabolic, helps cities take a 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 that all have city relevance.

- **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 for 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.

In this guide, this framework is used to indicate the circular strategy adopted in the presented circular actions and solutions.

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



4 Circular city actions and solutions

To inspire 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 list of circular actions and solutions that cities can consider, which are presented in more detail in this guide. Each action is classified in relation to the [CCAF](#), which is further described in this document. Page numbers include links to help readers find the different sections.

Sector	Circular actions	CCAF category	Budget	Page
Built environment	Remediation of brownfield sites for urban redevelopment/regeneration	Reduce/ Reuse	Med	9
	Make the best use of existing buildings and infrastructure	Reduce/ Reuse	Low - med	10
	Disassembly, selective deconstruction and demolition of buildings and infrastructure	Reuse	Low - med	11
	Green and circular districts based on self-sufficiency	Rethink	Low - med	12
	Circular public procurement for new buildings and infrastructure	Rethink	Med - high	13
	Procurement of products-as-a-service, circular leasing/rental models in buildings	Reduce	Low	13
Consumer goods	Public advertising to support circular behaviour	Rethink	Low	15
	Circular public procurement for goods and related services	Rethink	Low	16
	Product sharing platforms, centres (such as tools or garden machinery)	Reduce	Low	17
	Circular shops and shopping centres for repair, restoration and resale of consumer goods	Reuse	Low	17
Food	Regenerative urban and peri-urban farming	Regenerate	Low	19
	Circular public procurement of food products and services	Rethink	Low	20
	Rescue and redistribution of food surplus	Reuse	Low	21
Manufacturing	Circular innovation ecosystems and hubs	Reduce	Low - med	22
	Networking platforms/digital tools enabling circular strategies and business models	Reduce	Low	23
	Refurbishing and remanufacturing locally	Reduce	Med - high	24
	Eco-industrial/circular parks with local value loops	Reuse	Low	25

Sector	Circular actions	CCAF category	Budget	Page
Mobility and logistics	Compact city planning and development to reduce transport needs and facilitate shared solutions	Rethink	Med - high	26
	Shared or low-carbon mobility and logistics systems and platforms	Reduce	Low - high	27
	Refurbishment/technological conversion of rolling stock	Reduce	Low - med	28
	Reuse and recycling of vehicles or components	Reduce	Low - med	29
Tourism and leisure	Infrastructure and information systems to promote circular tourism	Reuse	Low	30
	Reusable products and containers	Reuse	Low	31
Waste and 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	33
	Material recovery facilities/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/chemical recovery	Recover	Med - high	36
Water and wastewater management	Grey water reuse systems	Reuse	Med	38
	Recovery of nutrients and chemicals from wastewater and sludge	Recover	Med	39

Budget: Low: < €5 million, Med: €5-20 million, High: > €20 million



4.1 Built environment

All cities contain a combination of buildings and infrastructure that provide shelter, water, energy and mobility for people. Although the urban built environment represents a relatively small fraction of land use, its impacts are far-reaching and include biodiversity loss, resource depletion, waste generation, greenhouse gas emissions and environmental pollution. This sector is highly resource intensive, and, unlike many others, the incoming material flows accumulate within the city on a large scale 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 way and 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. In addition, 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 circular built environment actions and solutions in the European Union. More guidance and examples are provided in the C3 document [A Guide for Circularity in the Urban Built Environment](#) and in the section on [built environment](#) in the Circular City Funding Guide website.

Remediation of brownfield sites for urban redevelopment/regeneration

In many European cities and metropolitan areas, it is common to encounter abandoned or unused areas previously used for industrial or commercial purposes. These places, known as brownfield sites, are often contaminated by hazardous waste or pollutants and typically require remediation and redevelopment efforts to make them usable and safe again. However, brownfield sites are often not considered a high-priority topic in urban agendas for several reasons. First, the remediation of contaminated brownfield sites is typically a complex and costly process, even before any redevelopment can take place. Furthermore, determining ownership and liability for brownfield sites can be challenging, especially when multiple parties have been using the site in the past. In contrast, it is often simpler and cheaper to develop on new land that has not been previously developed or built upon, so-called greenfield sites.

Despite the challenges, brownfield redevelopment is crucial in a circular urban economy because it promotes sustainable land use and resource efficiency. Such sites can also be located in central areas, which increases their value and strategic importance. Rather than leaving contaminated sites unused or developing new areas, redeveloping brownfield sites can prevent urban sprawl, preserve green spaces and contribute to biodiversity protection. Additionally, it allows for the reuse of existing infrastructure and land within developed areas, saving substantial resources by avoiding new developments elsewhere. Remediating brownfield sites can also play an important role in the city's adaptation to climate change and reducing emissions. Brownfield redevelopment often integrates blue and green infrastructure, such as wetlands and green roofs, and other nature-based solutions, which act as carbon sinks and help manage stormwater, reduce flooding and mitigate the urban heat island effect. Finally, these areas can become centres for community development, fostering job creation and offering affordable housing and cultural spaces that meet the city's specific needs.

If city governments and authorities are willing to assess and monetise the benefits of brownfield remediation accurately, they can unlock the potential of these currently vacant and underutilised spaces within densely populated urban areas. This can facilitate the implementation of new urban planning approaches and innovative strategies and promote a regenerative and circular urban built environment.

Case studies

- [Vienna – the Seestadt Aspern redevelopment plan](#)

The Seestadt Aspern is one of Europe's largest urban redevelopment projects. Its former status as an airport offered two significant advantages: a train line to Bratislava with high economic potential and ample space for the creation of an appealing, new urban centre focused on sustainability. The district was built following a small-scale block structure, the goal of which was to promote walking and cycling and maximise the use of public transport. Development plans prioritised enhanced urban services, green spaces and seamless interaction with neighbouring areas.

- [Dublin – green infrastructure network](#)

Dublin boasts a diverse green infrastructure network encompassing public parks, open spaces and privately owned green areas. Several of these public parks are located on former brownfield sites, such as reclaimed lands, quarries and landfills. Through creative repurposing, these once neglected areas now provide a positive influence on the city's environment and enhance residents' quality of life, contributing to making Dublin a more visually appealing and vibrant urban landscape.

- [Hamburg – HafenCity: A paradigm of sustainable urban regeneration and inclusive development](#)

To address the challenges posed by rapid urban growth, a shortage of affordable housing and anticipated flood risks, the city of Hamburg embarked on a transformative journey to redevelop its former port into a vibrant residential district known as HafenCity. This ambitious project marks one of the largest inner-city regeneration efforts to date, extending its downtown area by 40%. Grounded in the principles of urban regeneration, HafenCity connects economic activity, environmental improvements, and social and cultural aspects, effectively reusing existing infrastructure and land to provide more space for innovation and engagement in the community.

Make the best use of existing buildings and infrastructure

The construction of new buildings requires vast quantities of heavy materials and significant amounts of energy and water, and the demolition of old buildings generates a lot of waste. Where possible, it is preferable to renovate, refurbish or, if needed, repurpose an existing building in a circular way rather than demolishing it to build a new one. In addition, underused and vacant buildings and spaces represent an enormous untapped value, which could be used 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 workspaces, pop-up cafés, shops and similar. 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 and relevant stakeholders can identify idle or underused buildings and spaces and assess their potential in relation to the current and future requirements of their residents, for example considering the shortage of affordable housing or cultural spaces. Measures to address the underuse of buildings and spaces could include flexible zoning plans and economic disincentives for new greenfield developments in favour of refurbishing and repurposing, as well as piloting projects for repurposing or reuse of underused or vacant public buildings.

Case studies

- [Rotterdam - repurposing a 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 portion 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.

- [Barcelona – opening underused urban sites for community use](#)

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

- [London – creating a temporary work and community space](#)

During the process of redeveloping the Ebury Bridge Estate, temporarily empty buildings have been made available by Westminster City Council for use as work and community spaces. The temporary spaces include two meanwhile-use buildings (that is, short-term use of temporarily empty spaces), providing affordable workspaces and retail units with a café, a community hall and a public courtyard.

Disassembly, selective deconstruction and demolition of buildings and infrastructure

Buildings and infrastructure often include many types of components and materials that are used in ways that make disassembly and component reuse difficult. This can be solved by integrating circular concepts over the entire life cycle of buildings and infrastructure. Design for disassembly enables deconstruction instead of demolition at the end of life and recovery of high-value components, such as construction elements, doors, flooring and windows, before demolition. Likewise, selective demolition retains the structural integrity of the building and refurbishing for new uses. These circular practices not only increase the amounts of elements and material reused and the value recovered at the end of life of buildings, but are often labour intensive, creating more jobs than conventional demolition. Therefore, they can spur local innovation and industry, and contribute to preserving local character and building heritage, 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. In addition, they can undertake a cost-benefit analysis of deconstruction, building material reuse and design for disassembly in the city compared with demolition and new build. This type of analysis encourages circular approaches and helps cities set targets for construction and demolition waste minimisation, create plans for material reuse and establish 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.

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

Case studies

- [Venlo – a municipality leading the way with a circular city hall](#)

The municipality of Venlo, in the Netherlands, has commissioned and built its new city hall according to cradle-to-cradle 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 cradle-to-cradle 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.

- [Porto – Materialbase: Porto’s material bank for heritage materials](#)

To promote and safeguard components and materials that exemplify the character of Porto’s built environment, the city has established a material bank. The Materialbase collects tiles, signs and other 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.

- [Kongsvinger – the O-House made from reclaimed materials](#)

The O-House is a modular home for young people 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 aims to use demolition materials sourced from a local barn as construction material.

Green and circular districts based on self-sufficiency

Green and circular districts are innovative communities designed to foster vibrant, autonomous and eco-friendly living environments. These districts prioritise self-sufficiency, aiming to minimise waste, maximise resource efficiency and promote sustainable lifestyles. These are centralised, self-contained communities organised in a way that minimises dependency on inputs from outside the system and maximises interaction between their inhabitants. They often produce their own energy, treat their own wastewater and grow their own food, improving the security and efficiency of materials while offering residents access to local shops and sustainable products.

Local governments can incentivise the creation of circular districts through procurement, urban planning and other economic incentives. Circular districts require significant infrastructure investments. By providing financial incentives, such as tax breaks or grants, cities can help real estate development to offset the costs of incorporating sustainable features like energy-efficient buildings and renewable energy and mobility systems. Moreover, streamlining regulatory processes and offering expedited approvals for projects meeting sustainability criteria can reduce barriers and encourage developers to pursue green districts. Lastly, local governments can use circular districts as spaces for innovation through pilot projects and field research. Building more self-sufficient and circular neighbourhoods will, however, require multi-stakeholder cooperation between municipalities, land developers, construction and waste management companies and building owners.

To maximise sustainability, it is necessary to prioritise the renovation of existing districts or the remediation of brownfield sites before considering using greenfield land for development of new circular districts.

Case studies

- [Espoo – the Kera district](#)

The city of Espoo in Finland is transforming a previously industrial area known as the Kera district into a mixed-use circular neighbourhood designed to accommodate 14 000 residents. Centrally situated around the existing train station, the city aims to make Kera an international example of the circular economy. Emphasising encounters and experimentation, Kera will blend old and new by repurposing existing buildings for temporary use during construction. Moreover, all construction will be bio-based or fully recyclable, favouring carbon-neutral solutions and integrating emission-free energy solutions. The whole area will also be designed to promote walking and cycling, while the urban landscape will include green courtyards and public art. Construction began in 2023. Kera will also serve as a thriving centre for services and workplaces, including Nokia's campus and headquarters, leveraging its strategic location near railway connections and major urban centres.

- [Zaantad – circular area development in the Achtersluispolder](#)

The Achtersluispolder business district in Zaanstad, the Netherlands – currently an industrial business park – is undergoing redevelopment into a mixed-use neighbourhood to address housing affordability and sustainability challenges. With a goal of constructing 8 000 homes and creating 3 000 jobs, the project aims to revitalise the area while meeting housing demand in the metropolitan region of Amsterdam. The district will prioritise self-sufficiency and sustainability, featuring renewable energy sources and zero-waste practices. Emphasising green spaces, the neighbourhood design promotes physical activity, social cohesion and biodiversity. The community-oriented approach also fosters strong social networks and supports grassroots initiatives.

- [Colombes, Paris and London – a bottom-up approach to circular districts](#)

The R-Urban initiative represents a grassroots approach to building circular districts, focusing on co-producing a commons-based resilience strategy from the bottom up. By emphasising local production and consumption through sustainable practices, R-Urban aims to create closed ecological cycles and alternative models of living between urban and rural areas. The initiative provides tools and resources to help people create a network of resident-run facilities known as civic hubs. This bottom-up strategy encourages collaboration among diverse stakeholders, including public, civic and private players, at various levels, such as economy, housing, urban agriculture and culture. The initiative currently oversees pilot projects in cities like Colombes, France. These projects include [AgroCité](#) for urban agriculture, [RecyLab](#) for recycling and green building, and [ECoHab](#) for cooperative and ecological housing. Similarly, in London, the WOW unit encourages collective production using local materials and expertise.

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 for the built environment, as cities manage a sizeable 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, while minimising and, ideally, avoiding greenhouse gas emissions across the entire life cycle of procured construction materials and activities.

Local governments have several levers at their disposal, for example investing in renovation and maintenance work; retrofitting and repurposing (if necessary) existing building stock to avoid new construction; and 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. In addition, the uptake of “green contracts” agreements that require the contractor to develop and carry out 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 studies

- [Amersfoort – circular public procurement for construction](#)

The municipality of Amersfoort, in the Netherlands, is participating in the Dutch government’s Circular Procurement Green Deal, which 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.

- [Copenhagen – source separation and recycling requirements for construction](#)

The city of Copenhagen has published the 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 uncontaminated construction rock material must be crushed and reused on site, unless an exception is granted by the Municipal Environmental Protection Department.

Procurement of products-as-a-service, circular leasing/rental models in buildings

In the circular economy, product-as-a-service models are used to retain the value of products by offering them as services (such as via renting, subscriptions, etc.) instead of selling as many units as possible. For instance, in the built environment sector, heating and ventilation systems and elevators can be leased, with external parties responsible for installation, maintenance and replacement. Another example of products-as-a-service in the built environment is lighting-as-a-service. Instead of purchasing lighting fixtures, businesses or municipalities can lease lighting solutions from providers. These providers are responsible for the installation, maintenance and upgrading of the lighting systems, ensuring optimal performance and energy efficiency over time. This model not only reduces the upfront costs for the user but also ensures that lighting infrastructure remains up-to-date with the latest technology, leading to energy savings and reduced environmental impact. As such, product-as-a-service business models incentivise suppliers to provide higher-quality products designed for a longer life and reduce waste while balancing costs and benefits among stakeholders.

City governments play a crucial role in incentivising the adoption of product-as-a-service models in the built environment sector. By providing financial incentives such as tax breaks or subsidies and streamlining regulatory processes, governments can encourage businesses to embrace these innovative models and overcome upfront costs. Additionally, they can lead by example by integrating products-as-a-service into their own procurement processes for public infrastructure projects. Lastly, city governments can take advantage of their network and resources to establish industry partnerships and showcase the application of these impactful circular business models.

Case studies

- [Belgium – lighting-as-a-service promoting circularity in the retail sector](#)

Signify employs an innovative business model that offers lighting-as-a-service, enabling retailers in Belgium and the Netherlands to procure light instead of lighting equipment. Lighting-as-a-service ensures access to advanced lighting systems and services, delivering high-quality illumination, substantial energy savings, and operational efficiency. Embracing a circular lighting approach, the company designs equipment specifically for reuse and recycling, thereby reducing negative environmental impacts. Signify works with installers that handle installations and maintenance services.

- [Netherlands – facades-as-a-service pilot project](#)

In this pilot project, three facade builders – Alkondor Hengelo, Blitta and De Groot & Visser – have partnered to build and offer facades-as-a-service. This joint venture of facade builders organised as a facades-as-a-service company retains ownership, while the facades are offered as a service to customers, namely home owners. This innovative business model can potentially increase circular incentives while removing the responsibility of maintaining the facade from house and building owners.

- [Bremen, Germany – battery-as-a-service](#)

At the Beck & Co brewery in Bremen, Germany, EDF Renewables has introduced a practical solution to manage energy challenges: battery-as-a-service. As part of AB InBev, the brewery faces high energy demands, particularly during heat and cooling processes. EDF's battery-as-a-service solution strategically places battery storage systems onsite to store excess energy during off-peak times. When energy demand spikes, the batteries seamlessly kick in to provide additional power, reducing reliance on the grid and lowering electricity costs. This approach not only ensures a stable energy supply but also minimises the impact of high electricity prices during peak hours. The battery-as-a-service model allows Beck & Co. to benefit from advanced energy management without the burden of upfront investment or maintenance.



4.2 Consumer goods

Consumer goods refer to products that people 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 a reduction in the 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 consumption, 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 of goods (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 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 and more. Many cities generate revenue from selling advertising space in well-used public places such as bus stops, trains and town squares. For many cities, this 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 people's 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 the concepts of sufficiency and sustainable consumption and circular economy initiatives within the city, such as "libraries of things," second-hand stores, repair cafés 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 to the community for street art, notice boards or greening.

Case studies

- [Somerset – ban of adverts for high-carbon products](#)

North Somerset Council, in the United Kingdom, 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.

- [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.

Circular public procurement for goods and related services

Cities and local governments can engage in circular procurement for most of the consumable products used in public establishments and institutions. This includes purchasing second-hand furniture, refurbished IT equipment and other similar products. Municipalities can also shift from procuring physical products based on ownership models to procuring the use or functionality of specific items through product-as-a-service contracts. For example, leasing or pay-per-use schemes can be adopted for the use and maintenance of public vehicle fleets. Lastly, local governments may also consider introducing requirements to prioritise the use of secondary and renewable (bio-based) materials in procurement contracts. This approach encourages circular business models, extends product and material lifespans, reduces operational costs and ultimately prevents waste generation.¹

Case studies

- [Catalonia Region – improving the air quality through clean vehicle procurement](#)

The Catalan government has adopted a multi-dimensional approach to encouraging the circular procurement of vehicles. This approach includes the provision of a Green Vehicle Procurement Guide and the development of specific agreements to facilitate the use of low-emission vehicles in local government entities and to promote sustainable mobility. These measures also help to align policies across government levels and send clear signals to the market regarding the need to deliver more sustainable options.

- [Danish municipalities – circular procurement of office furniture](#)

In 2012, Denmark's central procurement agency (SKI) launched a four-year programme for sustainable office furniture across 60 municipalities. They set technical standards based on the Nordic Swan eco-label, emphasising environmentally friendly manufacturing processes and materials. Requirements included using safe chemicals, ensuring materials could be separated and recycled, and sourcing wood from legal and sustainable sources. Through this framework, municipalities saved up to 26% compared to market prices and expanded the market for sustainable furniture.

- [Netherlands – circular procurement of textiles](#)

In 2017, the Dutch Ministry of Defence aimed to procure towels and overalls with a sustainability focus. They specified that the goods must include at least 10% recycled post-consumer textile fibres, but they surpassed expectations by achieving over 30% or even 50% recycled content, earning recognition and awards as a result. The ministry procured a total of 100 000 towels and 10 000 washcloths with 36% recycled content, as well as 53 000 overalls boasting 14% recycled content. These contracts resulted in substantial savings, including 15 252 kg of cotton, 68 880 kg of CO₂ emissions, 23 520 MJ of energy, and over 233 million litres of water.

- [Madrid and Milan – low embodied carbon materials for new climate-proof cities](#)

Madrid and Milan are joining forces with a cross-disciplinary group of partners to accelerate efforts to lower embodied carbon in two large urban regeneration projects: Nuevo Norte (Madrid) and L'Innesto (Milan). The initiative will work to procure carbon-neutral construction materials while integrating aesthetics, regulatory innovation, financial incentives and new technological solutions. This systemic approach will highlight best practices and inspire further positive climate action in European cities.

Product sharing platforms, centres (such as tools or garden machinery)

The success of the circular economy greatly depends on the engagement of people, behavioural change and changing underlying social norms. Behaviour throughout the buy-use-dispose process needs to shift to more circular practices that avoid waste generation and extend the useful life of products.

The sharing economy is an integral part of the way people consume goods and services in a circular economy. Under this model, consumers choose not to own a product, but instead share it with other users, for example via renting or leasing. This enables products to be used more and for longer periods, consuming fewer resources and generating less waste.

Local governments can play a crucial role in shaping this kind of behavioural change, with circular or sharing economy principles enshrined as a core element of circular economy strategies and reflected in business and quality-of-life programmes. Cities can also ensure that sharing rather than owning is easier and more convenient for consumers, for example by mapping the locations of reuse hubs and repair cafés in the city, or by combining different sharing platforms into a common city-wide platform or card. Cooperation with businesses and the public is key to ensuring that this new way of providing and using goods and services can be scaled up across sectors and throughout the city.

Case studies

- [Gothenburg – Smart Map for sustainable initiatives](#)

The Smart Map in Gothenburg aims to make it easier for people to live more sustainably by encouraging access and use over ownership. To do so, a digital map shows initiatives and networks such as bike sharing, swap groups, clothing swap days and digital platforms. What is included on the map is decided by criteria that have been agreed between local associations and the city. The map has now expanded to other cities in Sweden, such as Umeå, Malmö and Stockholm.

- [Amsterdam – a project for a sharing city](#)

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

Circular shops and shopping centres 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 centres, offering access to different types of consumer goods, including furniture, electronics and clothing.

Local governments can support the development of circular centres by providing 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 studies

- [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 residents.

- [Eskilstuna – ReTuna recycle shopping centre](#)

The world's first recycling shopping centre was established in Eskilstuna, in Sweden. Almost everything sold at ReTuna has been repaired or upcycled, and, if not, is required to be environmentally ethical. A drop-off centre is located next to the shopping centre and 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.



4.3 Food

Few human activities have as large a global impact on the planet as the production of food for urban residents. It is estimated that the food system is responsible for one-third of all the greenhouse gas emissions resulting from human activity,² with food products such as meat, fish and dairy generating the majority of the environmental impacts. Furthermore, 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 European Union around €143 billion per year and represents 15% of the food supply chain's greenhouse gas emissions. In response to this, in 2023, the European Commission proposed legally binding targets for the reduction of food waste, making this a highly relevant topic for all levels of government.³

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 recovery and recycling 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. In addition, once food has entered the city, a great deal can be done to minimise waste in production, transport, 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 towards circular cities.

The following sections present 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. In addition, "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 such as applying compost to support healthy soils and improving 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 underused parts of the city, such as vacant land or flat roofs. Encouraging people to use such spaces for food production can provide livelihood opportunities, build communities and regenerate unsightly areas at relatively low cost. It will also reduce the need for long-distance food transport 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 composting and growing food or using spatial planning to protect well-located open areas for agricultural use. Local community initiatives may be started through information and communication campaigns to teach residents how and where to compost, grow food and promote the purchasing of locally grown foods.

Case studies

- [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 by those who will farm it with only organic farming practices.

- [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. Through this, Ghent has become the city with the most vegetarian restaurants per inhabitant in all of Europe.

- [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.

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 impact, 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 studies

- [Paris – procurement of seasonal and 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' municipal restaurants, including schools, retirement homes and staff restaurants, which collectively serve 30 million meals a year.

- [Turku – embracing circular food procurement](#)

Turku, in Finland, is using circular procurement to decrease food service greenhouse gas 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.

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 because of the energy and resources consumed and emissions generated during its production, storage, processing and transport. 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 (online 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 also, in some instances, 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 and 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 studies

- [Milan – food redistribution through neighbourhood hubs](#)

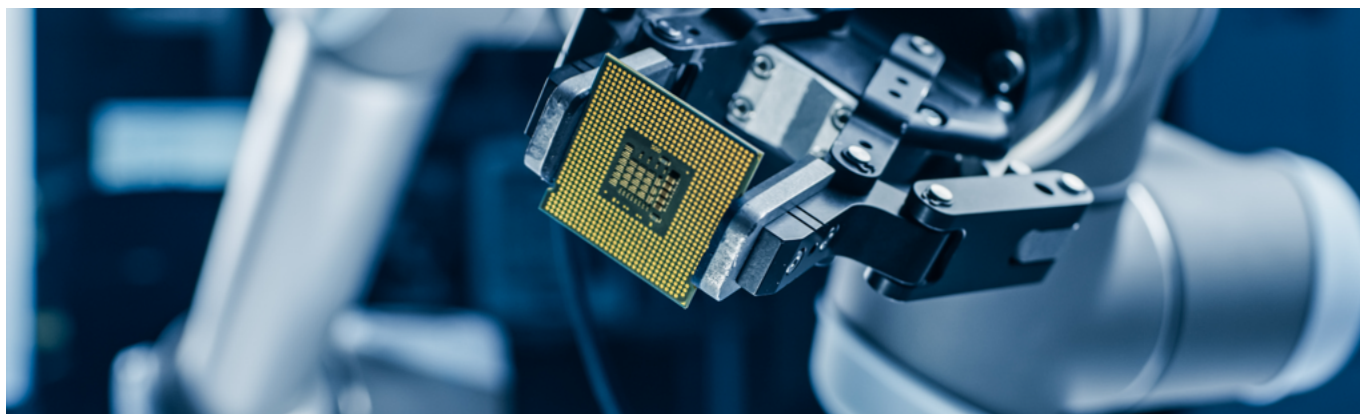
As part of the city's innovative food policy, Milan has established neighbourhood food hubs with the aim of halving the city's food waste by 2030. These hubs collect and redistribute the surplus food from across the city, including from shops and canteens. The food is supplied to local organisations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

- [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 agrifood companies. Surplus food, products close to expiry date and imperfect vegetables, fruits or other foods that are no longer marketable, for example because of packaging defects, are recovered and redistributed to organisations and institutions that support vulnerable groups of people.

- [Frome – communal fridge to reduce food waste](#)

The UK 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, and households can also contribute, subject to a few restrictions.



4.4 Manufacturing

The manufacturing sector includes a wide variety of activities and production processes that transform materials into goods and products. In the European Union, the manufacturing sector is one of the oldest and most prominent economic sectors, employing over 32.2 million people in 2023.⁴ Of all societal and sustainability challenges that influence enterprises and their international value chains, it is thought that environmental issues are the most important driver for change.⁵

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 Europe.⁶ 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 billion a year on raw materials if it fully adopts circular manufacturing practices. This is equivalent to a 10-15% reduction in material consumption.⁷ Cities can enable circularity in their manufacturing sector by, for instance, raising awareness of circular business models among 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 disposed of. 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 or subsidised access to the facilities and locations for entrepreneurs and initiatives that are developing circular economy innovations. Local governments can also engage in dialogue with those participating in local spaces to understand and overcome the barriers to a local circular economy and could even connect initiatives with residual material streams.

Case studies

- [Rotterdam – BlueCity Lab](#)

The BlueCity Lab is a workspace where startups, students, designers and private companies can innovate and experiment pioneering and bio-based solutions that contribute to the transition to the circular economy. The BlueCity Lab consists of four main spaces: the Fabrication Lab (a workshop for circular prototypes), the Biochemistry Lab (designed to experiment with light bio-chemical processes), the Fungi Lab (intended for growing fungal cultures) and the Microbiology Lab (used for growing bacterial cultures). Overall, the workspace helps users explore and grow their ideas until reaching a prototype that is ready to be scaled up.

- [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 create enthusiasm about the topic within the local textile industry. 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.

- [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 move beyond just providing financial support towards creating a circular community. To achieve this, the municipality regularly invites all beneficiaries of the programme to meet, pitch their projects and share problems they encounter.

Networking platforms/digital tools enabling circular strategies and business models

There is an urgent need for the manufacturing sector to become more circular. Networking platforms and digital tools are key to driving innovation, sharing knowledge and addressing inefficiencies. These tools inspire collective action and facilitate the exchange of best practices among businesses, academia, non-governmental organisations and individuals. Digital marketplaces for circular products, for example, can unlock new opportunities by connecting buyers, renters and sellers of recycled materials. Additionally, digitalisation is expected to enable tracking material flows throughout product lifecycles, thus generating valuable insights regarding resource use and waste generation across value chains. The data can then help identify opportunities for optimisation, resource efficiency (for example, through asset sharing among industrial manufacturing companies) and waste reduction.

It is essential for local authorities to promote and support the development of such solutions. For example, they can take advantage of their extensive networks of local stakeholders and small and medium-sized enterprises (SMEs) to encourage them to adopt these tools. This, in turn, helps foster cooperation while raising awareness, showcasing best practices and providing the technical training needed so that all interested stakeholders can contribute and benefit from these platforms. Local governments can also work on establishing access to digital infrastructure for all individuals and companies, use economic instruments like grants to support their utilisation and legal instruments like certificates and standards to validate circular manufacturing products and practices.

Case studies

- [Rotterdam – platform for additive manufacturing](#)

The Port of Rotterdam, in collaboration with Innovation Quarter and RDM Makerspace, launched RAMLAB, a company providing on-demand manufacturing-as-a-service offerings for certified and tailor-made secondary (recycled) metal parts to other manufacturing companies. It also offers access to shared workshop facilities and supports businesses in material certification processes. RAMLAB notably helps to extend ship lifespans by facilitating repair services for a wide range of ship components.

- [United Kingdom – Manufacture 2030 empowering manufacturers and suppliers to adopt sustainable practices](#)

The Manufacture 2030 platform is the continuation of the 2Degrees project, the goal of which was to make sustainable business happen at scale. Manufacture 2030 software-as-a-service was launched to bring major corporations and their supply chain partners together to turn bold carbon commitments into reality and create a more sustainable future by 2030. Drawing from the learnings of the 2Degrees project, major milestones have already been reached, including securing certification, receiving recognition at important events like the World Economic Forum, and increasing impact through partnerships.

- [Paris – rental and resale software-as-a-service](#)

Lizee is a software company providing a data-driven renting or reselling management system that handles the rental, transportation, refurbishing or reselling of products for which retailers want to offer circular options to their customers. The platform also embraces flexibility as a built-in feature, with the system allowing companies to choose the circular business model that best suits their products (for example, subscription, one-off or on-demand rental) and their targeted customer group.

Refurbishing and remanufacturing locally

The globalised consumer goods markets have enabled manufacturing and retail companies to reach every corner of the world. However, this expansion has come at significant ecological and social costs, especially in producing countries. Moreover, the hyper-globalisation of value chains makes it challenging to reuse, repair or refurbish products at their end-of-life. Often, products are sold far from where they were produced, lack access to materials, facilities, technology or know-how for repair, and may not have even been designed to be repaired. Circular economy principles therefore advocate for localised production and consumption systems to mitigate transport-related impacts and facilitate maintenance and repair. Establishing local remanufacturing, refurbishing and repair facilities can foster sustainability and self-sufficiency, reducing risks associated with resource scarcity, and creating new economic opportunities. A local remanufacturing sector can address local needs and disparities while preserving community identity and culture.

Establishing local repair and remanufacturing systems can be a challenge, as it means breaking away from the linear global supply chain model and convincing manufacturers to decentralise production. Cost competitiveness is also a concern, requiring early mobilisation of economic and regulatory instruments. While these measures primarily fall under national and supra-national governance, local authorities must provide means and incentives at the city level. They can enact land use zoning measures to support circular activities and invest in raising awareness and building capacity to shift consumer attitudes towards this transition.

Case studies

- [Munich – Halle 2](#)

Halle 2 is Munich's flagship reuse hub and an important element in the city's circular economy strategy. By selling goods that are collected across the city's 12 recycling centres and then repaired, Halle 2 extends the lifespan of useful everyday items that would otherwise have become waste. Statistics show that around 1 000 tonnes of items are reused or repaired at Halle 2 each year.

- [London – Reclaim to Wear](#)

The Reclaim to Wear brand was first introduced by the From Somewhere fashion label, which is a pioneer in ecological fashion and one of the first to work with fashion houses to upcycle the production of cuts to original creations. Following a similar approach, Reclaim to Wear works closely with academia, retailers and consumers to tackle the problem of textile waste. The brand is gradually forming more partnerships with other companies and aiming to process larger amounts of fabric.

- [Graz – local repair network](#)

The city of Graz in Austria has been working on establishing a repair culture. To achieve that goal, the city has taken two steps involving different stakeholders, specifically individuals and companies. The first step was the introduction of a public funding scheme to incentivise repair by individuals by raising awareness and trying to achieve a positive attitude based on good repair experiences. The second step was the establishment of a repair network to strengthen the supply side and the number of companies associated with repair, aiming to establish a critical mass of repair service suppliers. Other expected outcomes for Graz include waste reduction, community building, skill development and cost reduction, as well as a contribution to a healthier urban environment.

- [Netherlands – the circular kitchen](#)

The Technical University of Delft, Chalmers University of Technology (Gothenburg), AMS Institute for Advanced Metropolitan Solutions (Amsterdam) and industry partners are currently developing a modular kitchen. This kitchen consists of a docking station and modules that can be demounted based on their function and expected lifespan to achieve optimal material value retention while enabling easy assembly and disassembly. Modularity allows for easy personalisation and flexibility, while modules are taken back for repair, refurbishment and remanufacturing and are prepared for a new lifecycle. The take-back system is based on a buyback agreement, with the supplier remaining the kitchen owner.

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 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 studies

- [Frankfurt – supporting the sustainability transition of an industrial park](#)

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.

- [Kalundborg – establishing long-term best practices through industrial symbiosis](#)

Kalundborg is home to the world's first industrial symbiosis park, embracing the use of circular principles in production. Since 1972, companies and industries in Kalundborg have shared their residual materials, water and energy for use as inputs 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.

- [Birmingham – supporting and promoting industrial symbiosis](#)

Since 2002, Birmingham City Council has had a strong history of supporting and promoting industrial symbiosis. Concrete industrial symbiosis initiatives include the creation of the Tyseley Environmental Enterprise Zone and the Big City Plan, which integrates industrial symbiosis in city planning. This approach has demonstrated substantial contributions to multiple objectives of the city, for example by reducing carbon dioxide (CO₂) emissions by over 1.8 million tonnes of CO₂ in the Tyseley Environmental Enterprise Zone, creating more than 3 000 jobs, and supporting local innovation through the engagement with local universities and Birmingham's small and medium-sized enterprises.



4.5 Mobility and 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 people, the economy and the environment. In the last century, the rise of private vehicle use in cities has resulted in high levels of pollution, greenhouse gas 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, while 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 the efficient use of transport and utility for people. 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 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 greenhouse gas 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 of reducing 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 studies

- [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 or 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, shops and homes are brought into closer proximity, street space previously dedicated to cars is freed up, eliminating pollution, making way for residents' daily activities and nurturing welcoming and safe streets and squares.

- [Barcelona – car-free “superblocks”](#)

“Superblocks” are 400 × 400 metre units, and therefore are 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.

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 around 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 bikes. Similarly, shifting freight from road to rail and powering freight vehicles with low-carbon fuels such as biodiesel, bioethanol, green hydrogen and renewable compressed natural gas 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 can be adopted to reduce emissions from freight transport. Car-free zones or introducing congestion charges are other ways to encourage the shift to shared transport solutions.

Case studies

- [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 CO₂ emissions.

- [Helsinki – Whim mobility-as-a-service app](#)

Helsinki is the first 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, as well as Whim Unlimited, which offers access to all transport types. The Whim app is currently available in Helsinki and Turku (Finland), Antwerp (Belgium), Vienna (Austria), the West Midlands (United Kingdom), multiple cities in Switzerland and Greater Tokyo (Japan).

Refurbishment/technological conversion of rolling stock

Applying circular principles to trains, trams or other rolling stock can tackle several critical challenges within the mobility sector, such as system inefficiencies, high carbon and material footprints and waste generation, while providing better safety for passengers. Refurbishing existing rolling stock should be prioritised where the units have not yet reached the end of their life. This involves upgrading interiors and implementing retrofits that extend the vehicles' lifespan and improve safety and/or passenger experience. Another option is the modernisation of rolling stock, such as using advanced technologies to prolong operational efficiency. This could include driver assistance systems helping to optimise acceleration/deceleration, or the integration of new, low-carbon technologies. As the cascade progresses, however, the oldest assets that require more frequent and costly maintenance should eventually be removed from service and replaced by newer, more efficient models. Replaced assets should then be disassembled and their components reused or recycled to the extent possible, contributing to resource conservation and waste reduction.

However, implementing refurbishment and modernisation processes for rolling stock also poses challenges, including technical complexities, higher initial investment costs and the need for coordination among many stakeholders. The presence of unique features within the fleet can limit the feasibility of upgrading and replacing components, while the limited investment timelines often seen in public service contracts may not be long enough to accommodate repayments for upgrades. Local governments can support these processes and advance circularity by investing in pilot projects that showcase their applicability and positive results, and they can offer financial incentives for manufacturers and transportation companies to encourage the adoption of circular approaches. Local authorities can also advocate for reforming the national and regional regulatory frameworks to remove barriers and integrate sustainability criteria into public procurement, for example, in collaboration with public transport companies. Lastly, they can offer manufacturers incentives in tenders that include sustainability or circular requirements.

Case studies

- [Ankara – second-hand diesel public buses converted into electric vehicles](#)

Ankara Metropolitan Municipality has partnered with its subsidiary company BELKA A.Ş. to transform old diesel buses (from 2005) that have reached the end of their economic life into electric-powered buses. The goal of the project is to accelerate the process of transitioning to a more carbon- and environmentally friendly vehicle solution for public transportation that extends the life of buses in a circular manner. The project has converted 22 buses so far.

- [Paris – fleet life extension](#)

Alstom was selected to renovate up to 41 MI84 four-car trains in service on the Line B of the Paris RER network. The refurbishment included an increase in seating capacity from 216 to 312 seats per car and internal changes like new floors, grab bars, LED lighting and CCTV camera installation. Air-conditioning was also added, the electronic equipment was replaced, and a new external livery was applied. The goal was to increase the overall life and reduce the upgrade cost of the fleet while focusing on improving the passenger experience and increasing the value of the trains.

- [Deutsche Bahn – Austria's second-hand trains to serve Germany's intercity fleet](#)

Deutsche Bahn faced technical challenges with new trains, prompting a shift towards sustainable solutions. Capitalising on Austria's offer of used trains, Deutsche Bahn initiated a refurbishment programme. These upgraded trains, now equipped with modern amenities, efficiently met rising passenger demands. This move not only tackled immediate issues, but was also aligned with the operator's sustainability goals as it extended the lifespan of existing assets. While the cost remains undisclosed, the refurbishment exemplifies circular economy principles in mobility.

- [Munich – Mireo: A train that intelligently combines it all](#)

Siemens' regional train, Mireo, stands as a prime example of cutting-edge rolling stock, embodying key principles of energy efficiency, recyclability, flexibility and profitability. It is engineered for superior energy efficiency compared to other trains with a similar capacity, resulting in reduced greenhouse gas emissions. Its design incorporates lighter materials, optimised aerodynamics and innovative features such as the driver advisory system, all contributing to enhanced performance, cost savings and environmental sustainability. With a recycling rate exceeding 95% and a focus on preventive service and smart maintenance, Mireo also ensures a prolonged lifespan of the asset and operational reliability. The train was successfully piloted in the outskirts of Munich and could expand its application to the rest of Bavaria and Europe.

Reuse and recycling of vehicle components

The most common and visible problems associated with vehicle use and transport in cities are road accidents, air pollution and 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 could lead to more internal combustion engine vehicles being scrapped in the short term and to accumulation of battery waste in the longer term.

High-value reuse and recycling of vehicles and their components is key to a sustainable future for mobility. For instance, vehicles can be “retrofitted” to be powered by electric engines and batteries, or they can be 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 a few initiatives exist at the municipal level to support high-value reuse and recycling of vehicle components, many initiatives are being supported at the national level and businesses are taking the lead in implementing pilot projects across Europe (for example, [new battery recycling initiatives](#)). In the future, local governments could support the recycling of materials by implementing environmental standards for pollution reduction and the 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 studies

- [Salzgitter – battery recycling pilot plant](#)

Volkswagen Group Components has opened the group’s first plant for recycling electric car batteries in Salzgitter, in Germany, and a pilot operation has started in the Lower Saxony city. Until now, used batteries have mostly been incinerated. Volkswagen Group Components is using, 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.

- [Amsterdam – reusing car batteries for electricity storage](#)

The Johan Cruijff Arena sports venue in Amsterdam has developed a renewable energy storage system that uses 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.

- [Netherlands circular – investigating the potential for high-value reuse in a circular economy](#)

The Dutch Ministry of Infrastructure and Environment and the RACE (Realising the Acceleration towards a Circular Economy) programme consortium have prepared tools, guidelines and frameworks to educate municipalities, businesses and consumers about high-value reuse and recycling of products. The initiative identified knowledge, technology, market, legal and culture barriers and developed a Product Reuse Framework to identify opportunities for high-value reuse. VEGE, a Dutch engine manufacturer located in Spijkensisse, in the Netherlands, showcases how this can be done for cars and vehicle components, by purchasing defective engines from used vehicles and remanufacturing them into as good-as-new engines, while also producing a wide variety of remanufactured vehicle components as spare parts.



4.6 Tourism and leisure

People often spend a share of available earnings on tourism and leisure activities to help them unwind.⁷ 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 European Union's gross domestic product.⁸ While tourism and leisure provide many benefits for the economy, these activities can have a significant negative impact locally and on the wider environment.

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 contributes to around 20% (from 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 locals.⁸ Tourism and leisure activities also generate a lot of waste, including many single-use "disposable" items such as 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 impact, 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 inform and encourage them to make use of them to support a city's efforts to be more circular.

The following sections present 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.

Infrastructure and information systems to promote circular tourism

Local governments can play a crucial role in promoting circular tourism through infrastructure changes and information and awareness campaigns.

To encourage residents and travellers to adopt circular practices and minimise waste, local governments can install infrastructure such as public drinking fountains, which motivate people to reuse water bottles, thereby reducing plastic waste. Furthermore, incentives such as free transport can encourage sustainable behaviour. Cities can also build a green and sustainable identity that cultivates sustainable and circular behaviour among residents and that attracts tourists. Public art and installations can raise awareness and encourage circular or sustainable approaches while supporting arts and culture, reinforcing the sustainable identity of the city.

Case studies

- [Paris – zero plastic wastewater movement](#)

The zero plastic wastewater movement promotes behavioural change 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".

- [Las Palmas de Gran Canaria – incentivising public transport](#)

Las Palmas, the capital of Gran Canaria, established Bus Rapid Transit as the backbone of its strategy to attract more residents and tourists to public transport. The city also introduced new one- and three-day unlimited travel cards for tourists through cooperation with the local hotels, and expanded its bike-sharing programme.

- [Druskininkai – making tourism an enabler for green regeneration](#)

Druskininkai, in Lithuania, is an example of how natural resources can be the crucial element for urban regeneration focused on making the city a sustainable tourism destination. The city managed to drive its ecological transition from an ageing resort town to becoming an important spa and ski destination in Europe through preserving its heritage of sources of local water, rich in minerals and famous for its healing effects.

Reusable products and containers

Single-use packaging is very common in the tourism and hospitality sector, for example through accommodation, food services and retail. Its expanded use in recent years has led to multiple health, sanitation and environmental problems, such as polluting public spaces, waterways, seas and surrounding ecosystems. In the tourism industry there is therefore a growing recognition of the need to shift away from single-use, non-biodegradable materials and encourage a return to reusable containers that can be used, washed and reused multiple times to reduce material consumption and waste generation.

The implementation of reusable food and drinks containers often relies on a strong collaboration with businesses to adopt and facilitate such schemes. Local governments can promote and support such schemes through, for example, raising awareness of alternatives and promoting participation among local businesses. Experimental zones can also be used to test and encourage the use of reusable containers. In partnership with regional and national governments, local governments can regulate the use of certain single-use products and packaging in tourism establishments.

However, caution is warranted. With their often higher per-unit environmental impact in production when compared with single-use alternatives, implementing reusable container schemes must be balanced with behavioural 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 studies

- [Luxembourg – reusable food and drink containers](#)

To promote the use of alternatives to single-use plastic packaging, Luxembourg has supported the launch of two initiatives. The [EcoBox](#) scheme, established in 2018, offers reusable food containers in two sizes under a deposit-refund system, and as a complement also reusable cutlery. 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. In addition, in 2022, the [Cup2Go](#) system for drinks was established. It allows customers to use reusable drink containers in participating restaurants across the city and in return receive reward tokens. The Cup2Go system is available in over 50 establishments in Luxembourg.

- [Balearic Islands – Circular Tourism Law](#)

In 2022, the Balearic Islands in Spain adopted the first law for circular tourism as a response to the need for more circular and sustainable standards and requirements in the region's most important sector. The law introduces key targets to be achieved by tourism establishments on the reuse of paper and plastic containers, among others, in combination with broader waste reduction and recycling targets.

- [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 people and businesses to understand the benefits that can be derived from reusing items, such as cups and food containers, by raising awareness, sharing knowledge, and showing where and how items can be used and returned in Bonn.



4.7 Waste and material management

In contrast to the “take-make-waste” linear model, a circular economy is regenerative by design and aims to gradually reduce the consumption of finite resources. In a fully circular economy, waste is either fully designed out or at least minimised to the greatest 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. 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 annually.¹⁰ Moreover, less than half of the municipal waste generated in the European Union is recycled and only 12% of the input materials to EU industry are secondary raw materials.¹¹ 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 people’s 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 the quality and quantity of materials recovered for recycling. To incentivise people’s participation in separate collection systems, cities can implement pay-as-you-throw 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 people 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 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 [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, for example 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, plastics, 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. Pay-as-you-throw user charge systems can provide people with direct economic incentives to separate their waste at lower cost rather than disposing of mixed waste.

Case studies

- [Ljubljana – frontrunner in waste separation and collection system](#)

Ljubljana, in Slovenia, has developed effective source sorting of 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.

- [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.

- [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 Esosport, collects old sports equipment, for example shoes, tennis balls and bike inner tubes, at a dozen collection points across the city. Once collected, these old sports items 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).

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, and so it is important that they are collected separately.

Owing 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 has been mandatory in the European Union as of 1 January 2024. Collections systems can be adapted to suit the characteristics of specific neighbourhoods and areas of a city. For example, areas with detached homes have more space for dedicated organic waste bins, or even home composting; however, for multidwelling apartment buildings, 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 studies

- [Porto – expanding and enhancing bio-waste collection system](#)

Porto, in Portugal, has set up over 500 proximity bins in highly populated areas, complemented by a Smart Collection System tool that allows every container to be identified. The project offers access control with an electronic identification card, alongside the distribution of over 60 000 7-litre containers in 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.

- [Milan – door-to-door food waste collection system](#)

Introduced in 2012, the city of Milan has implemented an effective organic waste collection system and information campaign. The door-to-door system collects bio-waste twice a week. For apartments, small kitchen bins designed to minimise odour are used. With the help of this system, food waste recycling increased from 34.5% in 2011 to 62.6% in 2019.

Civic amenity/recycling centres

Recycling centres play a pivotal role in fostering the circular economy, as they contribute to more efficient waste management practices and divert different kinds of materials away from landfills. By recovering valuable materials and reintroducing them into the economy, the centres contribute to closing material loops, reducing the demand for virgin materials and facilitating the transition to a more resource-efficient and resilient economy. Many recycling centres also offer places where items for reuse can be left, thus promoting life extension. Since such centres also accept other material streams that should not be disposed of with other waste (such as hazardous and medical waste, construction and demolition waste and garden waste from households), they are an important complement to other waste collection services. Furthermore, these centres support job creation and re-skilling opportunities in the recycling industry and stimulate innovation and competition in waste management technologies.

Local governments play a crucial role in supporting the creation and operation of recycling centres. First, financial instruments, such as grants or subsidies, can support the establishment and expansion of recycling centres and help offset the initial capital investments while incentivising private stakeholders to invest in such infrastructure. Second, cities can provide the space for these civic amenities and centres, combining them with education programmes for the community. Cooperation between local authorities and community organisations, businesses and waste management companies is key to establishing such centres.

Case studies

- [Reggio Emilia – Remida: The creative recycling centre](#)

Remida is a cultural project that focuses on sustainability, creativity and research on waste materials. The core idea of the project is that imperfect and seemingly useless things can offer an educational resource and have cultural value, meaning they should not be regarded as waste. Remida collects materials that would otherwise become waste and redistributes them, conducts research for innovative material uses and offers training programmes for students, companies and individuals involving increasing sustainability. Remida's materials come from about 200 companies that deliver residues and by-products, defective products, products that were not sold, etc. destined for disposal, which the centre recovers or offers for recovery. The centre is visited by more than 3 000 people every year, including teachers, artists, students, administrators and interested individuals from all over the world. It also organises events.

- [Sofia – Ecopak Bulgaria: The first interactive educational recycling centre for packaging waste](#)

This recycling centre specialises in sorting paper, plastic and aluminium packaging waste. Right next to this latest state-of-the-art sorting facility there is an educational centre, raising awareness on how to recycle the various packaging materials. Ecopak offers a tour where visitors can walk above all sorting lines and observe them through a transparent floor. The processes of handling and recycling waste, turning it into new products or into art are presented to visitors with motivational information on the benefits of recycling.

- [Halmstad – Stena Nordic Recycling Center](#)

The Stena Nordic Recycling Center employs cutting-edge technology to safely and efficiently recycle complex old products on an industrial scale, aiming to produce high-quality recycled materials that can replace virgin ones and fulfil the growing demand for circular solutions. With a high recycling rate, the facility extracts valuable materials like stainless steel and gold and supplies them back into the industry, saving 870 000 tonnes of CO₂ emissions annually. Working with companies and stakeholders, the centre explores the potential of recycling their waste for mutual benefit. Additionally, the Stena Recycling Lab, situated within the centre, fosters innovation, tests new technologies and designs scalable processes for implementation in other recycling plants.

Material recovery facilities/sorting facilities for separately collected recyclable materials

Once recyclables have been collected, municipalities or private sector organisations can play a key role in sorting and separating them further in material recovery facilities. 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. Material recovery facilities also include equipment to prepare recyclables for easier transport, for example through baling.

Case studies

- [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 different fractions are separated, including textiles, plastics and paper, through an optical sorting system that sorts the different materials that are collected in different colour bags. The facility's capacity is 18 000 tonnes per year and it serves several local municipalities.

- [Malmö – advanced sorting of textile waste](#)

Textile waste generated within Malmö and its surroundings is being automatically sorted in a facility that uses optical sensors to separate textile waste for fibre-to-fibre recycling. Funded by Vinnova, the Swedish government's research and development agency, and led by the IVL Swedish Environmental Research Institute, the facility is part of the SIPTex (Swedish Innovation Platform for Textile Sorting) project. The sorting plant is capable of sorting up to 24 000 tonnes of textiles per year and has operated in South 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.

Construction and demolition waste reuse and recycling

Currently, most construction and demolition 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 large volume of construction and demolition waste, which often is the biggest share of the waste stream. Improving separation of different materials at demolition sites and establishing or improving facilities for reuse and recovery of construction and demolition waste allows value to be retained within the local economy, reducing the burden of urban construction and demolition 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 the environmental impact and emissions at each step of the value chain, from extraction to transport and manufacturing.

Cities can influence the type of waste management infrastructure developed within the city's borders, as well as how different facilities throughout the city connect to one another. They can invest in and support the development of physical and digital infrastructure that can facilitate the closing of material and energy loops throughout the urban built environment. This can take the form of construction and demolition 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 studies

- [Oslo – a database for demolition projects](#)

The city of Oslo, in 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.

- [Amsterdam – creating a map of materials for urban mining](#)

The Prospecting the Urban Mines of Amsterdam (PUMA) project by the Amsterdam Institute for Advanced Metropolitan Solutions 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), tracing them on a 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.

- [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 private and public organisations who are interested in getting secondary construction materials.

- [Leuven – a material bank for individuals and professionals](#)

Materialenbank Leuven is an initiative of Atelier Circuler, a non-profit organisation providing an exchange and retail platform for recovered building materials. The materials are primarily sourced from donations by private individuals, but also from the local waste management company EcoWerf. Partnerships exist with the city council, KU Leuven and UZ Leuven for managing material flows. Individuals and professional are welcome to buy materials from the material bank, and Atelier Circuler also facilitates workshops focused on the design and execution of various woodwork and metalwork for indoor and outdoor applications.

Composting and anaerobic digestion of bio-waste

While it is important to rescue edible food surplus for nutrition, food and other organic waste deemed unsuitable for human or animal consumption can release vast amounts of greenhouse gases into the atmosphere during their decomposition, if incorrectly managed. There are a variety of techniques and technologies to manage organic waste streams. Mechanical and organic processes can transform them into valuable materials and compounds that 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, such as anaerobic digestion, require more advanced facilities to effectively minimise the greenhouse gas emissions from the waste, but can at the same time 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 start such projects as part of their waste management operations in a city, the formation of public-civic partnerships can be an effective means of implementing such solutions.

Case studies

- [Prague – converting food waste into biogas and fertiliser](#)

Prague was the first Czech city to implement household food waste collection. The collected food waste is converted into biogas in a large anaerobic digestion plant, which produces bio-compressed natural gas used to power waste management trucks. Excess gas is fed into the grid and digestate produced in the process is transformed into soil conditioner for local agricultural use.

- [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 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 key to the success of the initiative.

Urban biorefineries for food/feed/chemical recovery

There is plenty of biomass available in current urban systems that remains largely underutilised. Large quantities can be collected from the by-products of food manufacturing processes and the organic municipal waste stream. Biorefineries can make use of such biomass streams as well as by-products from agricultural activities that would otherwise become waste, turning them into high-value products like animal feed, chemicals or other materials. Biorefineries can also generate new sources of income for farmers and increase regional self-sufficiency through the promotion of local production of animal feed. These facilities can thus offer a strategic advantage to cities and regions through sustainable economic development and waste minimisation.

For these processes to be sustainable, however, a number of conditions must be met. Biological resources should be extracted and managed sustainably and not exceed ecosystems' regenerative capacities. Biomass feedstocks for the bio-based economy should not compete with land for food, and bio-based products should be designed for circularity so that residues can be returned to soils and enable nutrient cycling. Additionally, using these technologies should go hand in hand with phasing out fossil fuel consumption and other decarbonisation efforts. These conditions constitute the factors where local governments can actively ensure that biorefinery processes benefit all stakeholders and the environment.

Case studies

- [Straubing region – Renewable Raw Materials cluster](#)

The Straubing Renewable Raw Materials cluster was initiated as part of a Bavarian focus and regional priority on life sciences and has a top-down structure. The cluster focuses on the entire biomass value chain for both material and energy use, and all public stakeholders in Straubing are working to promote the use of renewable raw materials. The cluster is closely tied to a technology park under development aiming to create a cluster of companies working in the green chemistry, bioenergy, biotech and biorefinery industries.

- [Ireland – small-scale farmer-led green biorefineries](#)

The Biorefinery Glas project includes setting up small-scale mobile biorefineries on multiple farms in the Cork region of Ireland. Through bio-refining, grass is fractionated into a variety of new products. The aim of the project is to improve the sustainability, value and resource efficiency of Ireland's livestock sector. Another goal is to validate a viable diversification opportunity for farmers in the circular bioeconomy by demonstrating an innovative business model. The project targets a 40% increase in usable protein per hectare, a 25% reduction in nitrogen emissions in cattle excrement and additional emissions savings through the displacement of soybean feed imports with a grass-based monogastric feed.

- [Stockholm – the world's first large-scale biochar urban carbon sink](#)

The Swedish capital of Stockholm has built a pyrolysis plant to produce biochar and renewable energy from its green urban waste. The Stockholm Biochar Project turns the city's park and garden waste into renewable energy and biochar, which sequesters carbon by converting it into a stable soil-like element that can stay in the ground for a very long time. Biochar serves as a substitute for other materials such as peat, clay and sand, and it is used by the city in public plant beds and by residents in private gardens. This pioneering project achieved environmental, social and economic benefits for the city without increasing land use. Specifically, 6 500 metric tonnes of organic waste can be turned into a resource every year, 100 000 residents could use biochar in their gardens, and the pressure of dealing with the disposal of park and garden waste was alleviated for Stockholm.

- [Groningen – Chemport Europe](#)

Chemport Europe is an industrial cluster fostering industrial symbiosis activities and an integrated approach to bio-refining, green chemistry and green energy. The cluster allows companies, governments and knowledge organisations to work together under a shared ambition to change the nature of chemistry and advance bioeconomy. For instance, Chemport encourages industrial symbiosis by utilising the by-products of one facility as the input for another process, thus closing material loops. Some utility networks, such as steam pipelines, are shared by different stakeholders, and proximity plays an important role in the way industrial processes are realised as well as the optimisation of value chains.



4.8 Water and 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 freshwater to meet people's 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 today.¹²

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, greywater and partially treated wastewater. By aiming to use 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, while 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

Water used 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 the 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 greywater reuse system is compulsory, unless it is considered 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 for building local market demand.

Case studies

- [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 of Lisbon decided to reuse water to reduce costs and the pressure on local water sources. This initiative is part of the city's integration of the circular economy into its sustainability strategy.

- [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 washbasins, rainwater from roofs and groundwater from the chalk aquifer to supply around 500 m³ 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, catering for over 6 million visitors in the year 2000, and can now meet 55% of the building's water demand by reclaimed water.

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 studies

- [Billund – recovering wastewater for energy, clean water and nutrients](#)

Billund BioRefinery is a resource recovery plant in the Danish municipality of Billund that uses urban wastewater, 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.

- [Vaasa – creating circular loops through biogas buses](#)

In 2014, the city of Vaasa, in Finland, committed to procure a fleet of 12 buses that could run fully on biogas recovered from organic waste and wastewater 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: one for the service provider and one for the biogas vehicles, including their maintenance. Expected savings for the biogas buses amounted to 1 000 tonnes of CO₂ per year.

5 Concluding remarks

Reading and talking about the circular economy or testing it on a pilot scale is easier than taking real circular action at scale. A first important step in progressing in the circular transition is to identify where there is potential for circular change. This guide therefore presents a wide range of circular actions and solutions across eight different sectors and thematic areas with high circular potential, and all are relevant in a city context. The case studies, which demonstrate how such actions and solutions are implemented in different cities in Europe, can inspire cities to explore the potential for replication.

The list of circular city actions and solutions is not exhaustive, but highlights particularly relevant, innovative and inspiring examples and cases to inspire cities to start or accelerate their circular transition.

While the guide provides a lot of different examples, cities may find it difficult to translate some of the actions to their city context. There may also be questions and challenges involved in scoping or preparing actions and projects, and in accessing finance for them.

To help cities advance in their circular transition, the C3 offers Circular City Advisory programmes that can help cities prepare a circular strategy or develop a pipeline of circular projects. The C3 also offers Circular Project Advisory services to help cities advance their circular projects towards a stage where they can access financing and start implementation. More information about these programmes, which are free of charge for cities, can be found on the [C3 web page](#).

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