



InvestCEC

Circular Economy Solution Areas For Urban/Regional Settings

CARTIF Technology Centre



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1. Executive Summary

1.1. What is this guide for?

This guide is part of the InvestCEC project, which supports the transition to the circular economy in European cities and regions and the development of a replicable model for local circular economy projects. One of the tasks of the project is the creation of tools for cities and regions to define their circular economy project needs. To enable this replication, this guide describes potential areas of circular economy solutions for urban and regional settings.

This guide has been developed to expose municipal and regional bodies to the different options available. It provides a comprehensive overview of the critical elements of the circular economy concept and its potential applications in urban and regional contexts, supporting the transition towards more sustainable and resource-efficient communities.

1.2. Who is this guide for?

The main objectives of this guide are to provide municipal and regional bodies with an overview of the different circular economy solutions available for urban and regional settings. This encourages the adoption of circular economy principles to reduce greenhouse gas emissions, ensure the efficient use of resources and help regional policy makers and stakeholders to identify optimal scenarios for the implementation of circular economy strategies, considering both environmental impacts and economic costs.

2. Introduction

2.1. What is the Circular Economy?

The circular economy is a transformative economic model that aims to maximise resource efficiency and minimise waste. This approach has important implications for urban and regional development.

The circular economy is based on several fundamental principles such as:

- ✓ *The elimination of waste and pollution: Designing systems and processes to prevent waste at its source.*
- ✓ *The maintenance of products and materials in use: Extending the lifecycle of resources through reuse, repair, recycling, and remanufacturing*
- ✓ *The regeneration of natural systems. Restoring ecosystems by adding nutrients back to the environment and using renewable resources in a sustainable way.*



Figure 1. The circular economy model¹

2.2. Why is the Circular Economy important for my region?

The circular economy is crucial in urban environments as it helps to overcome challenges such as solid waste management, which is due to population growth and overconsumption, as well as adequate wastewater treatment, which is essential to protect water resources and ensure public health.

The circular economy is positioned as a key tool to address rapid urbanisation, promoting planning models that prioritise resource efficiency, reduce waste and encourage the reuse of materials, which contributes significantly to mitigating the impacts of climate change by reducing greenhouse gas emissions through strategies such as the promotion of renewable energies. Finally, the circular economy also responds to the growing pressure to improve the quality of life in cities by offering an integrated approach that combines environmental sustainability, social equity and economic development, ensuring a more resilient and prosperous future for urban communities.

¹ European parliament research service



In resource management and waste reduction, the circular economy focuses on keeping products and materials in use for longer periods, which significantly reduces waste generation.

Circular economy practices drive innovation in various industries, the use of technologies such as artificial intelligence, 3D printing and big data analytics can help reduce waste, save money and other resources, ensure wider application of renewable energy solutions in production processes and significantly reduce environmental impact.

3. Definition of the Urban and Regional Environment

Defining the **urban and regional environment** in the circular economy involves identifying and structuring how an urban area or region can operate under the principles of the circular economy, seeking to maximise the efficient use of resources, minimise waste and create sustainable systems that benefit both the environment and society.

Also the use of different collaborative platforms in cities (e.g. sharing or renting goods and services) has shown that the adoption of circular economy practices can significantly reduce resource consumption and carbon emissions. According to a report by the Circular Economy Foundation, it is estimated that the circular economy could reduce resource consumption by 25% globally, reducing pressure on the environment and reducing the amount of waste generated. In addition, this model helps to reduce CO2 emissions, especially in areas such as goods production and waste management.²

In this urban and regional environment, analysing material flows helps to find ways to use resources more efficiently and generate less waste. This improves resource management, reduces environmental impacts, creates more economic opportunities, boosts new businesses and provides ideas for designing more sustainable cities and regions. Stakeholders to this end include governments and local and regional authorities, businesses, the private sector and environmental organisations interested in minimising environmental impacts and promoting sustainability, as well as citizens and local communities

Circularity opportunities encourage the design of reusable or recyclable products, prioritising strategic sectors such as construction and transport, and overcoming regulatory, financial and cultural barriers. These actions are essential to design more sustainable environments, reduce environmental impacts, stimulate the local economy with new business models and promoting urban resilience. Implementing them strengthens collaboration between key actors, improves the efficiency of systems and positions cities as leaders in sustainability.

² <https://www.circle-economy.com/funding>

3.1. Assessment of Material Flows, Wastewater, Waste and Identification of Circularity Opportunities

To implement circular economy solutions in urban and regional settings, it is essential to assess existing material and waste flows. This involves analysing the flow of resources through the urban system, the recovery of wastewater, building materials, consumer goods, and also examining the generation of waste, including municipal solid waste, industrial waste and e-waste.

A comprehensive assessment will help identify areas where circular economy principles can be most effectively applied. There are different guides at European level such as the EU Circular economy action plan³, the guide for the transition to the circular economy⁴, or the European circular economy platform⁵ to identify these areas. In relation to this, there are several projects e.g. the K-CCRI project ('Knowledge hub to leverage existing initiatives and projects to foster the adoption of Circular economy in Cities and Regions In Europe') which aims to consolidate the circular economy in Europe by integrating knowledge, creating educational materials and organising workshops and seminars.⁶ In addition, the Circular Invest initiative, part of the Circular Cities and Regions Initiative, supports innovative projects that promote sustainability and the circular economy.⁷

After analysing material and waste streams, municipalities and regional bodies should identify specific opportunities to implement circular economy solutions, such as extending the life cycle of products through sharing, recycling, reuse and repair, or implementing innovative waste management initiatives.

Another opportunity is to develop recycling and reuse strategies for materials stored in existing buildings and infrastructure and to focus also on the value chains of key products such as electronics, batteries, vehicles, plastics, textiles, packaging and construction materials.⁸

³https://environment.ec.europa.eu/strategy/circular-economy-action-plan_en

⁴ https://www.eib.org/attachments/thematic/circular_economy_guide_en.pdf

⁵ <https://circulareconomy.europa.eu/platform/en>

⁶ <https://www.alda-europe.eu/k-ccri/>

⁷ <https://www.circularinvest.eu/>

⁸ Lakatos, E. S., Clinci, S. D., Koval, V., & Lakatos, G. D. (2023). CREATING LIVABLE CITIES THROUGH SUSTAINABLE BUILT ENVIRONMENTS IN THE CIRCULAR ECONOMY. *Innovative economics and management*, 10(2), 260-270.

3.2. Challenges and barriers

Municipalities and regional bodies face various challenges in adopting circular economy solutions, but these barriers can be addressed with specific strategies and clear examples:

One challenge is low public awareness due to lack of knowledge or interest in circular economy practices hinders adoption. One solution to this would be to implement comprehensive educational campaigns through social media, community events and school programmes. For example, organising hands-on workshops in schools to teach about recycling or promoting recycling competitions in neighbourhoods to motivate participation. This would lead to increased community participation in recycling programmes, increased household recycling and changes in public perception.

Another problem would be the lack of adequate facilities for recycling, waste management and reuse, where a possible solution would be to improve the infrastructure through accessible and modern recycling centres, in collaboration with public-private partnerships. This could also include establishing mobile recycling stations that visit neighbourhoods on a regular basis and promoting financial incentives for private companies to invest in advanced recycling technologies.

Negative feedback from past failures is another point to consider, where transparency in processes could be promoted by allowing citizen oversight through public audits and open reporting by publishing monthly recycling and waste management statistics online for citizens to monitor progress.

To overcome economic barriers, such as high initial investment costs, lack of financial incentives and under-investment, specific grants and credits could be created for circular economy initiatives. These initiatives could be recycling enterprises, such as, businesses engaged in collecting, processing and transforming discarded materials into new products or producing reusable goods, encouraging sustainable public sector procurement to generate demand by ensuring that materials used in municipal projects are recycled or recyclable.

Inadequate waste management and insufficient legislation are key obstacles to implementing the circular economy. To tackle illegal practices such as unauthorised dumping, monitoring mechanisms can be strengthened through advanced technology such as drones and sensors. In addition, it is essential to increase penalties for those who break the rules, which will help reduce illegal dumping and improve the proper treatment of waste. Furthermore, updating legislation to include clear targets, such as mandatory recycling quotas for businesses, together with effective enforcement mechanisms, will promote greater respect for regulations. These actions will not only reduce existing problems, but also build a more sustainable environment aligned with the principles of the circular economy.

4. Areas for Circular Economy

This chapter looks at how the circular economy transforms waste management to maximise resource recovery and minimise environmental impact, exploring key strategies such as separate collection, recycling and reuse, as well as innovations in organic waste recovery through composting and biogas, and zero waste strategies.

In addition, innovative projects are presented that exemplify how these principles are applied in sectors such as agri-food, industrial manufacturing or the design and manufacture of metal products, showing their impact on the transition towards a more sustainable and resilient economy.

Energy and the circular economy have also been taken into account with the transition to renewable energies and energy storage and smart grids with energy efficiency in urban infrastructures and self-consumption.

Another very important point is sustainable and circular mobility with the promotion of electric and sustainable transport.

Finally, in the different sections of this chapter, success stories at national (Austria) and European level have been presented.

4.1 Circular Economy in Waste Management

Adopting a circular economy approach in waste management is crucial for optimizing resources, reducing costs, and minimizing environmental impact. This approach enables the recovery of materials and energy, reducing landfill waste and greenhouse gas emissions, and generating benefits such as natural fertilizers and renewable energy. Additionally, it promotes job creation, boosts the local economy, and strengthens resilience to environmental and resource-related crises. The implementation of these strategies will position the regions as leaders in sustainability, while facilitating the achievement of global goals and attracting investments and innovative project.

When the principles of the circular economy are applied to municipal solid waste (MSW), their main objective is to maximise resource recovery and reduce environmental impacts. This approach views waste as a valuable resource rather than something to eliminate. Key strategies include separate collection systems, developing recycling infrastructure, and promoting waste reduction and reuse. Designing products for recyclability and durability will also help municipalities to achieve higher recycling rates and meet circular economy targets.

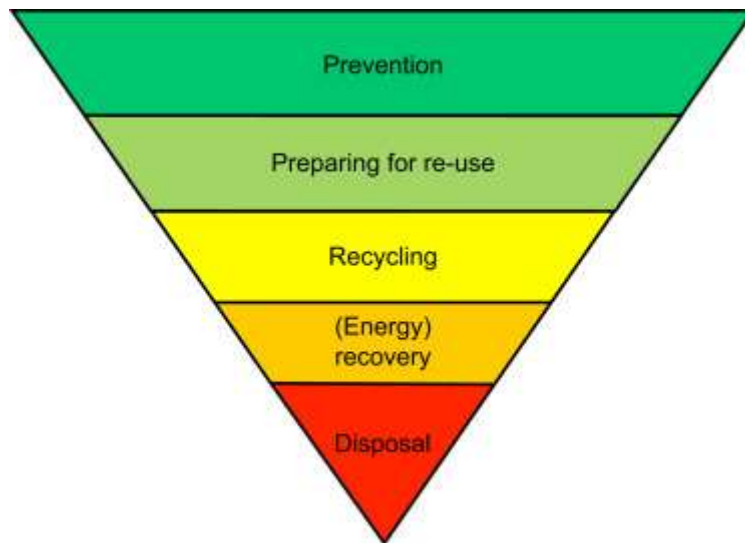


Figure 2. The waste hierarchy pyramid.⁹

Currently research projects¹⁰ are ongoing aiming at developing a Life Cycle Assessment tool for biodiversity for the construction sector. For example, the aim of the KU/DTU/Ramboell project is to provide developers a possibility to calculate a construction sites impact on biodiversity during its entire lifecycle, through developing new tools and standards – which potentially could also lead to new regulation.

Similar type of projects are expected in the near future to provide more tools to support circular economy.

Success cases in waste management

The Vienna waste management system

Vienna has a wide range of waste prevention measures in place, exceeding the EU target of a 60% recycling rate by 2030. By 2050, 100% of Vienna's non-avoidable waste will be recycled. Vienna's waste management system will reach net zero by 2040. On the other hand, food waste will be reduced by 50% by 2030 and reduced to a permanent minimum by 2050. Vienna has topped the list of the world's most liveable cities by magazines such as The Economist, taking into account the categories of urban planning, cleanliness, recycling and organic waste management.¹¹

⁹ <https://www.sciencedirect.com/science/article/pii/B9780128206850000193>

¹⁰ E.g. LifeCycleAssessment Ph.D study partnering :Copenhagen University, Denmark's Technical University & Ramboell

¹¹ <https://vienna.impacthub.net/about-waste-management-and-waste-incineration-in-vienna>



Figure 3. Overview of Vienna, the world's most liveable city according to *The Economist*¹²

Waste Incineration Plants

Vienna operates state-of-the-art waste incineration plants, such as the [Spittelau](#) plant, which not only efficiently manage waste but also generate electricity and district heating. Approximately 50% of the energy produced annually at these facilities comes from biogenic or renewable sources.¹³

Both the electricity and the heat produced are considered renewable because they are derived from the continuous stream of municipal waste, which is a constantly replenished resource. The waste-to-energy process at Spittelau not only produces usable energy but also reduces the volume of waste that would otherwise end up in landfills, making it an efficient and environmentally friendly solution for both waste management and energy production

¹² <https://unsplash.com/es/fotos/fotografia-aerea-de-edificios-de-la-ciudad-5SjAaqqCCmY>

¹³ <https://positionen.wienenergie.at/en/projects/spittelau-waste-incineration-plant>



Figure 4. Incineration plant of Spittelau¹⁴

Industrial Symbiosis: Styrian Eco- World Recycling Cluster

The Austrian state of Styria has established the **ECO WORLD STYRIA** cluster, a network connecting over 180 companies and research institutions. This initiative facilitates the exchange of waste materials and byproducts between industries, promoting innovation in recycling technologies. As a result, the cluster has achieved notable reductions in waste and resource consumption while creating new business opportunities within the circular economy.¹⁵

Amsterdam: Waste Management

Amsterdam has implemented advanced waste sorting and recycling systems especially for automated sorting technologies, which has significantly reduced landfill and increased material recovery rates. For example, in source separation, residents separate waste into categories (organic, plastics, paper, etc.), which facilitates recycling and recovery of valuable materials. Automated sorting technologies are used to improve recycling efficiency and reduce contamination.

¹⁴ <https://positionen.wienenergie.at/en/projects/spittelau-waste-incineration-plant/>

¹⁵ <https://cordis.europa.eu/article/id/36612-europes-green-tech-valley>

The city also promotes the reuse of resources, transforming waste into new products and reducing waste sent to landfill. To facilitate efficient collection and minimise visible litter in the city, underground waste containers are used. In many neighbourhoods, the city uses curbside bins that feed underground containers. Residents can deposit their sorted rubbish and recyclables in these containers at their convenience. Some of these bins are equipped with RFID readers, which allow access via free RFID cards issued to residents. This system prevents access by vermin and reduces the need for kerbside collection.¹⁶

Amsterdam: Energy and Resource Efficiency through Waste Conversion

Amsterdam uses waste-to-energy plants and district heating systems to use waste as an energy resource. The main plant, AEB Amsterdam, incinerates municipal solid waste to generate heat and electricity through cogeneration. The heat is distributed through the Warmtebedrijf district heating network, providing thermal energy to thousands of buildings in the city. This system is a key part of Amsterdam's circular economy strategy, which also recycles by-products such as incineration ash for other industrial uses.¹⁷

Utilization of Organic Waste: Composting and Biogas

Organic waste recovery is essential for implementing the circular economy in waste management, using composting and anaerobic digestion. Composting decomposes organic matter to create soil amendments, while anaerobic digestion produces biogas and digestate, used as renewable energy and fertilizer. Its benefits include reducing landfill waste, generating renewable energy, producing valuable soil amendments, and lowering greenhouse gas emissions. For example, by 2030, biogas production in densely populated areas could reach nearly 9 million m³/year, generating 17 GWh of renewable energy annually.¹⁸

By engaging with the farming communities, municipal/regional bodies can explore different options available, and identify potential barriers for better utilization of organic waste. Mandates can also be given to local or regional public utilities to actively involve farming communities in the implementation of solution, including solutions which to become economically feasible need a wider catchment area than a local community.

¹⁶ <https://www.core77.com/posts/102208/Amsterdams-Smart-System-of-Underground-Garbage-Bins>

¹⁷ <https://www.aeb-amsterdam.nl>

¹⁸ Rolewicz-Kalińska, A., Lelicińska-Serafin, K., & Manczarski, P. (2020). The circular economy and organic fraction of municipal solid waste recycling strategies. *Energies*, 13(17), 4366.

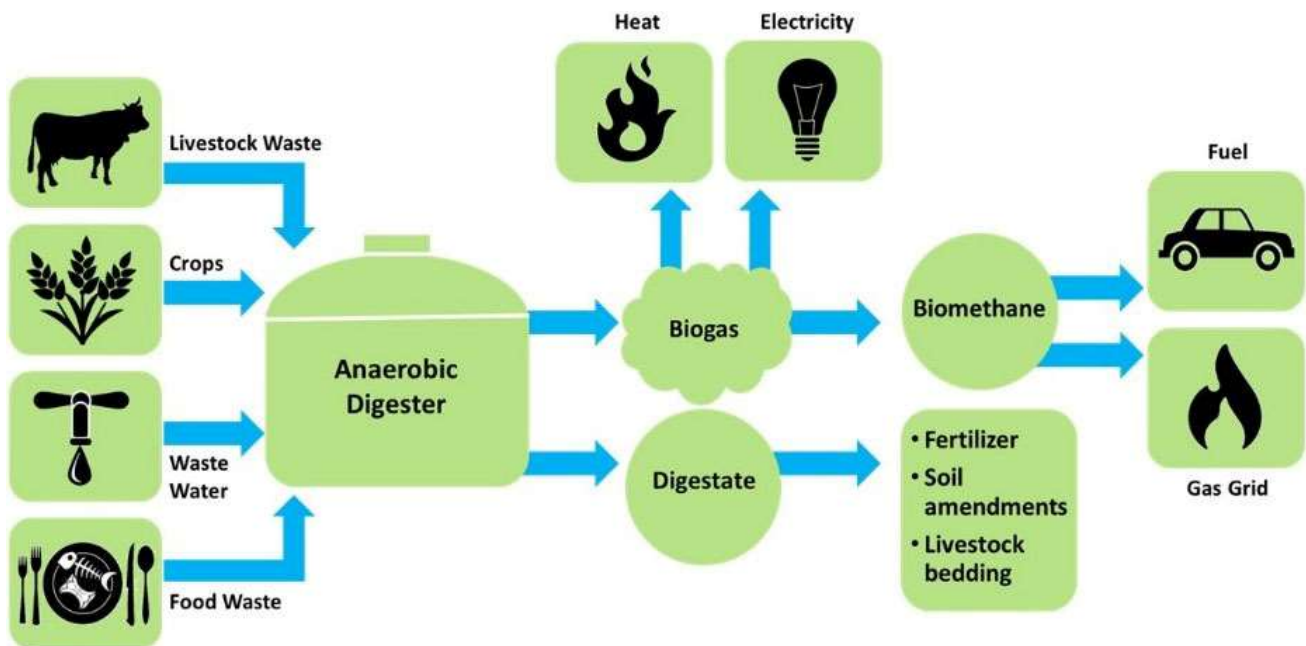


Figure 5. Anaerobic digestion process¹⁹

Zero Waste Strategies

Zero waste strategies are vital to address environmental challenges, focusing on reducing, reusing, recycling, composting, refusing and rethinking consumption. Reduction involves conscious purchasing and choosing packaging-free options, while reuse encourages the repair and creative reuse of items. Recycling helps to manage unavoidable waste, and refusing single-use products reduces waste generation. Finally, rethinking consumption habits, priorities and daily practices from a more sustainable perspective will encourage greener choices and participation in collaborative economies, helping to move towards a better understood sustainable circular economy.

¹⁹ <https://www.eesi.org/papers/view/fact-sheet-biogasconverting-waste-to-energy>

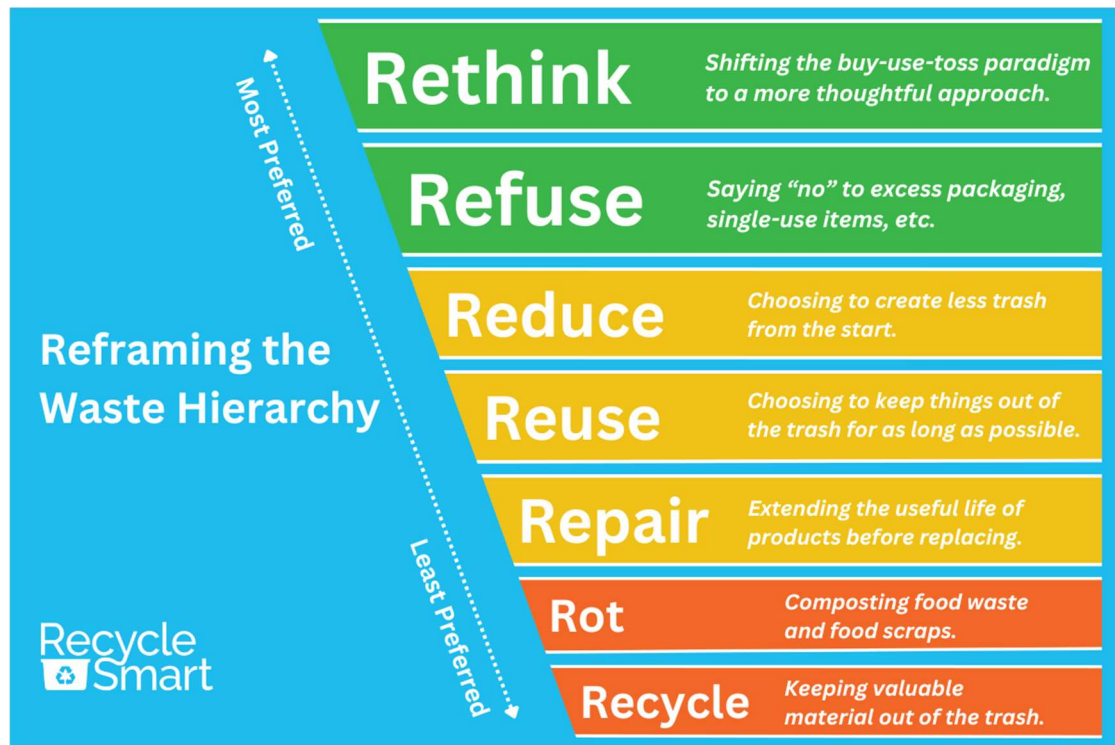


Figure 6. Reframing the waste hierarchy²⁰

Below are some examples of funded projects focused on zero waste strategies in various fields such as the challenge of reducing and preventing food waste and losses in the agri-food chain, the design of low waste food value chains, the design and manufacture of zero-defect metal products or advanced solutions to achieve zero defective materials in manufacturing processes.

²⁰ <https://recyclesmartma.org/2023/09/reframing-the-waste-hierarchy/#:~:text=Clue%3A%20This%20phrase%20is%20an,we%20talk%20about%20waste%20reduction>



FOODRUS Project (https://www.foodrus.eu/)	This project addresses the challenge of reducing and preventing food waste and losses in the agri-food chain. It aims to develop innovative solutions to minimise waste along the food supply chain, from production to consumption
LOWINFOOD Project (https://lowinfood.eu/)	LOWINFOOD focuses on designing low-waste food value chains by demonstrating innovative solutions to reduce food loss and waste. The project works on practical approaches to minimise waste at various stages of food production and distribution.
Project ENGINE (https://theengineproject.eu/)	Develops a system for the design and manufacture of zero-defect metal products, aiming to reduce waste, cut costs and reduce emissions in manufacturing.
OPENZDM Project (https://www.openzdm.eu/)	Creates an open platform with advanced ICT solutions to achieve zero defective materials in manufacturing processes.

Success cases in Zero Waste strategies

Paris:Urban agriculture

Paris has adopted circular economy principles through various initiatives that promote sustainability and resource efficiency.

The city has encouraged the creation of rooftop gardens and urban farming projects to reduce food transportation distances and enhance local production. A notable example is [Nature Urbaine](#), the world's largest rooftop urban farm, located at the Paris Expo Porte de Versailles. This 14,000-square-meter facility produces one ton of fresh food daily, including a variety of fruits and vegetables grown using hydroponic and aeroponic techniques.



Figure 7. Image of Nature Urbaine²¹

²¹ <https://emag.archiexpo.com/2024-objectives-for-europes-largest-rooftop-urban-farm-nature-urbaine/>

Paris: Repair and Reuse

Paris has established a network of second-hand shops to encourage product longevity and reduce waste. For instance, [Les Établis](#) combines a café with a repair service run by skilled artisans, giving Parisians the opportunity to extend the life of damaged items. Additionally, the city hosts numerous flea markets and vintage shops that promote the purchase of second-hand goods, contributing to reduced consumption and waste generation.

4.2 Energy and Circular Economy Transition to Renewable Energies

Key aspects for the transition to renewable energy in urban and regional areas include the implementation of public policies, resource and waste management, and the development of sustainable infrastructure such as solar, wind, hydro and geothermal systems. Local and regional authorities should implement economic incentives such as subsidies, tax exemptions and affordable financing programmes for renewable energy projects. In addition, it is crucial to prioritise investment in research and development to improve technological efficiency, reduce production costs and promote innovative solutions such as advanced energy storage and smart grids. This must be accompanied by efforts to integrate these technologies into existing urban infrastructures, through the modernisation of electricity grids and the installation of distributed generation systems in buildings and public spaces.



Figure 8. City of Kalundborg

A remarkable “circular economy” cases is the Kalundborg Symbiosis²² (Denmark), which is a partnership between sixteen public and private companies in the small Danish city of Kalundborg.

²² <https://www.symbiosis.dk/>



Figure 9. Partners in Kalundborg Symbiosis

Together, since 1972, they have developed the world's first industrial symbiosis with a circular approach to production. The main principle is that a waste stream in one company becomes a resource in another, benefiting both the environment and the economy. In a local partnership, they have been able to share and reuse resources, saving money and minimizing waste. The Kalundborg symbiosis has also created growth in the local community and supports the green transition. Kalundborg Symbiosis include major international companies, which under “normal” conditions would not foster close cooperation – but by “combining” their interest and “waste” they all are facing individual positive business cases from the cooperation. In Kalundborg Symbiosis, the city's largest industrial companies collaborate across sectors and share their surpluses of energy, water, and materials with each other, so that one company's surplus product can provide value to another. Public and private companies are physically connected to each other in the Symbiosis and together create profits - both the kind measured on the bottom line, but also what comes from better utilization of resources.

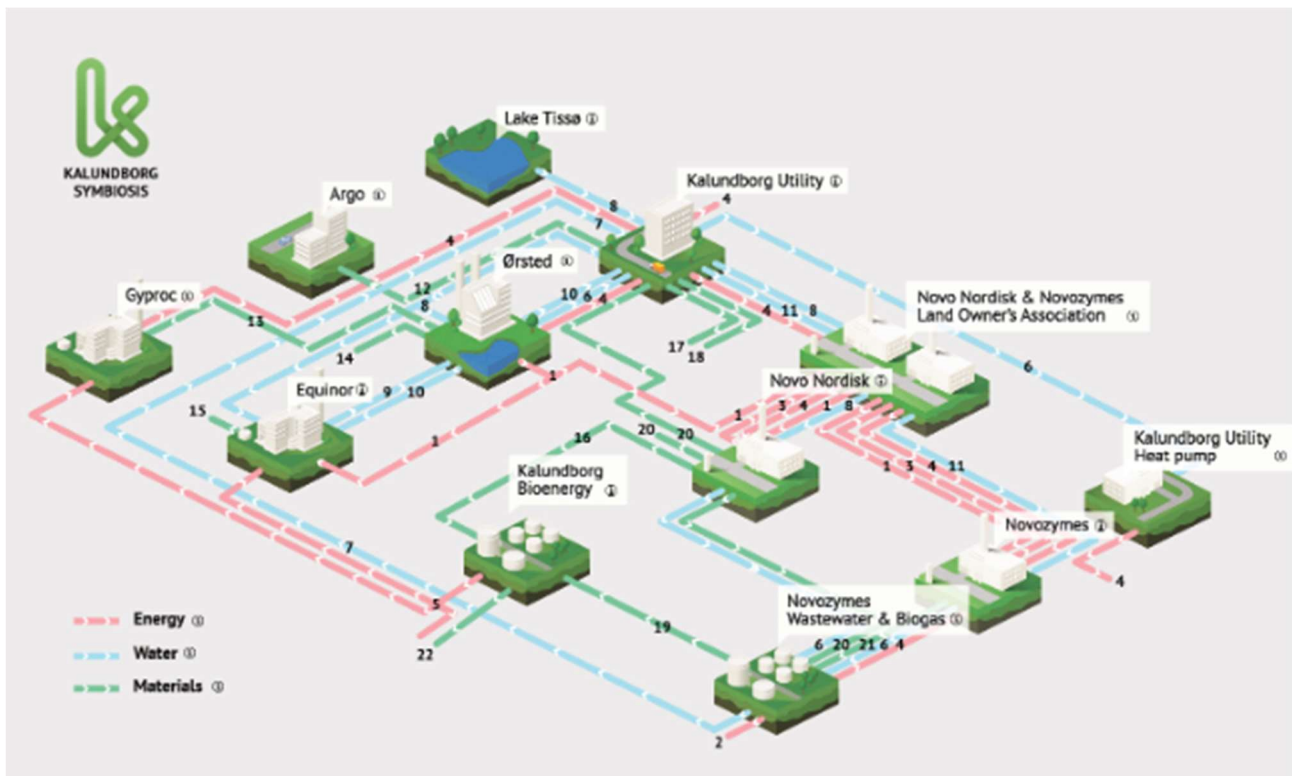


Figure 10 The Kalundborg Symbiosis network of reuse/exchange of energy, water and waste

Production companies globally can learn a great deal from the circular model created in this small corner of Denmark, and today Kalundborg Symbiosis is known throughout the world and helps to market Denmark as a green pioneer country. In addition, Kalundborg Symbiosis, as a local partnership with a focus on efficient resource utilization, can contribute to achieving the Danish government's ambitious reduction target of 70% less CO₂ emissions by 2030.

Storage and Smart Energy Networks

Smart energy grids and storage are important for efficient energy management in circular economies. Using IoT, AI and data analytics, these systems improve energy distribution and consumption, support decentralised energy systems for resilience and balance supply and demand with advanced storage technologies. Local authorities should work with private or semi-public energy companies and energy marketers to improve grid infrastructure for smart technology integration, promote smart metering, energy management systems, and collaborate with technology companies to develop innovative storage solutions. A case like Kalundborg Symbioses would not have materialized without close cooperation between the local public Kalundborg Utility and the involved private companies



Energy Efficiency in Urban Infrastructures

Improving urban energy efficiency is vital for sustainable development, involving green infrastructure, smart city projects, and the use of green building materials and technologies. Urban energy efficiency improvements in private buildings can be achieved through a combination of strategies, policies, technologies and community participation including building retrofitting (thermal insulation, energy efficient windows and HVAC systems).

Integration of renewable energies such as solar panels, energy storage and efficient appliances, implementation of automation technologies to monitor and control energy consumption in real time and IoT sensors. All of this could be achieved through grants and tax breaks, green loans providing low-interest loans for energy efficiency improvements and energy performance contracts allowing homeowners to finance improvements through future energy savings.



Figure 11. Zurich: Example of a Smart City ²³

²³ <https://govinsider.asia/intl-en/article/how-ar-and-ai-are-making-zurich-a-smarter-and-safer-city-david-weber-zurich>

Distributed Energy and Self-Consumption

Distributed energy systems and self-consumption models improve energy resilience and sustainability by promoting renewable self-consumption and addressing financial barriers, such as reducing their energy costs by generating and using their own energy, decreasing their dependence on external suppliers and fluctuating tariffs, and promoting sustainability and energy resilience.

These systems would include technologies such as solar photovoltaic panels, small wind turbines, cogeneration systems and batteries. Ownership could range from residential users reducing grid dependency to companies investing in systems such as CHP plants, utilities improving grid resilience, or private investors installing and operating these systems to sell electricity. Operation could be carried out directly by individual owners or by third parties under leasing systems or power purchase agreements (PPAs), where specialised companies operate the systems and users consume the power generated.

Local policies to support distributed energy generation and collaboration with local companies in community energy projects could create incentives for self-consumption. Examples of local policies would be, for example, direct subsidies for the installation of solar panels to reduce initial investment costs. Tax reductions for those who integrate distributed generation systems in their homes or businesses, fair energy tariffs that allow users to offset their energy consumption with excess energy generated, fair payment for surplus energy sent to the grid, education and awareness programmes, and simplification of procedures.

By focusing on these areas, municipalities can implement circular economy solutions in the energy sector in cooperation with grid operators and electricity and district heating companies. Much can also be achieved through planning measures, if the national legal framework assigns this competence to the regional/local level by promoting sustainability and resilience in urban and regional settings.

Success cases in Waste Management and Energy

Copenhagen: Waste Management and District Heating

Copenhagen and the Greater Copenhagen Region (Region Hovedstaden) has implemented a highly efficient waste management system. Copenhagen and the Greater Copenhagen Region (Region Hovedstaden) has a selective collection system that facilitates the separation of different types of waste at the source. Citizens have access to specific containers for general waste, paper, plastics, organic waste, metals, and glass. This approach promotes recycling and reduces the amount of waste sent for [incineration or landfill](#).



Figure 12. Amager Bakke, Co-generation plant with roof top recreational areas

The city of Copenhagen has developed an extensive district heating system that covers approximately 98% of Copenhagen's buildings. This system is powered by diverse sources, including biomass cogeneration plants and waste-to-energy facilities.

A notable example is Amager Bakke, a waste-to-energy plant that not only effectively manages waste but also generates electricity and heating for the city.²⁴

4.3. Sustainable and Circular Mobility

This section will list a range of actions and solutions that combine European Commission (EC) support with innovative and sustainable strategies to address the challenges of mobility, transport, urban development and resource management. Through approaches such as shared and circular mobility, promotion of electric transport, sustainable infrastructure and circular economy in vehicles, construction and water management, a transition to a more efficient, green and resilient model is proposed. The following sections present a number of initiatives that demonstrate the potential of these strategies to create sustainable cities and a cleaner future.

²⁴ <https://www.c40.org/case-studies/cities100-copenhagen-carbon-neutral-district-heating/>

Shared and Circular Mobility

Shared and circular mobility focuses on maximising the use of vehicles and reducing the number of private vehicles on the roads. This includes systems that allow users to rent vehicles for short periods. Public bicycle networks available for shared use, car sharing platforms: applications that connect drivers with passengers sharing similar routes. These systems promote more efficient use of resources and reduce carbon emissions associated with individual transport.

The benefits of shared mobility have several aspects such as exploiting synergies, increasing relevance, improving the quality of life and making the general public see its positive aspects. On the other hand, these benefits contribute to meeting existing legal obligations, making better sustainable plans, making more efficient use of limited resources and moving towards a new mobility culture.



Figure 13 Benefits of the Sustainable Urban Mobility



Success cases in Sustainable and Circular Mobility

Sharing Economy: Carsharing in Graz

The city of Graz has implemented the ‘tim’ initiative (täglich. Intelligent.mobil)²⁵ an integrated mobility service that combines electric and conventional car sharing vehicles with public transport, accessible via a single mobility card. This system has generated significant benefits with reduced private car ownership: Each ‘tim’ car sharing vehicle replaces approximately 19 private cars, reducing parking demand by about 7.8 kilometres of parking space. Moreover, the service has more than 5,100 registered users and more than 30,000 annual bookings, indicating strong community adoption. By encouraging shared mobility and integrating electric vehicles, it contributes to reducing emissions, supporting Graz's environmental goals. Integrating car sharing with public transport offers a flexible alternative to private car ownership, improving urban mobility and resource efficiency.



Figure 14. Tim initiative

²⁵ <https://www.tim-oesterreich.at/graz/>

Amsterdam: Sharing Economy

Amsterdam has promoted several platforms to facilitate the exchange and sharing of goods and services, thus supporting a circular economy model that reduces overall consumption. The main platforms include:

Peerby: A platform that allows users to share or rent objects for occasional use (tools, equipment, etc.), encouraging shared access rather than ownership. This helps reduce new product purchases and resource consumption.²⁶

Swapfiets: Bicycle rental service, where users can rent a bicycle and exchange it if it becomes damaged or worn out, avoiding the constant purchase of new bicycles.²⁷

ReShare: Network of second-hand stores to buy and donate products, contributing to the reuse and reduction of waste.²⁸

The city's "Sharing Economy Action Plan" focuses on supporting pilot projects, leading by example, expanding the sharing economy to all residents, developing appropriate regulations, and positioning Amsterdam as a sharing city.²⁹

Sustainable Transportation: Copenhagen

Copenhagen and the Greater Copenhagen Region (Region Hovedstaden) has invested significantly in cycling infrastructure, achieving a rate where 45% of commutes to work or school are made by bike. The city boasts over 350 km of cycling routes and has introduced several "bicycle superhighways" connecting the city center with outlying areas. Additionally, the public transport system has incorporated electric buses and an efficient metro network, reducing emissions and promoting sustainable mobility³⁰

Promotion of Electric Transport

The shift to electric vehicles is vital for reducing transport emissions, supported by strategies like extensive charging networks, tax incentives, and low emission zones, all fostering sustainable, circular mobility.

Sustainable Transport Infrastructures

Green mobility requires sustainable infrastructure such as safe cycle lanes, permeable pavements to reduce runoff, and smart lighting systems that adapt to traffic and light levels.

²⁶ <https://www.peerby.com/en-nl>

²⁷ <https://swapfiets.nl/en-NL/amsterdam>

²⁸ <https://cosh.eco/es/tiendas/amsterdam/reshare-store-amsterdam>

²⁹ <https://circulareconomy.europa.eu/platform/en/strategies/amsterdam-shaping-sharing-economy-works-everyone>

³⁰ <https://www.c40.org/es/case-studies/c40-good-practice-guides-copenhagen-city-of-cyclists/>



Circular Management of End-of-Life Vehicles

Circular vehicle management maximizes material recovery through efficient dismantling, battery recycling, and remanufacturing, supporting the automotive industry's circular economy goals.

Efficient Public Transport Systems

Sustainable urban development depends on efficient public transport with integrated planning, optimized routes, and smart monitoring, reducing emissions and promoting health. Tailored governance is essential for success.



Figure 15 Example of a sustainable and efficient transport system³¹

³¹ <https://unsplash.com/es/fotos/estacion-de-carga-electrica-de-alto-voltaje-para-la-carga-de-autobuses-electricos-en-la-ultima-parada-de-la-ruta-urbana-autobus-en-la-ultima-parada-con-la-puerta-abierta-tP3aKJD5fUo>

4.4. Circular Construction and Urban Development

Circular construction refers to an approach to building that emphasises sustainability, efficiency and waste reduction through the principles of the circular economy. This method involves designing structures and systems that allow for the reuse, recycling and regeneration of materials throughout their life cycle. Key aspects of circular construction include material efficiency, waste minimisation and Sustainable Materials. While challenges remain, such as the need for expertise and supportive policies, future efforts should focus on improving materials recovery and integrating circular practices into urban planning.

Success cases in Circular Construction and Urban Development

Amsterdam: Construction Sector

Amsterdam has positioned itself as a leader in Europe in implementing circular economy initiatives, developing comprehensive strategies in various key sectors:

The city has adopted circular building principles, promoting the use of recycled materials and designing buildings to facilitate disassembly and reuse of components. The "[Amsterdam Circular Strategy 2020-2025](#)" sets clear goals to reduce the use raw materials by 50% by 2030 and achieve a fully circular economy by 2050.

³²

Circular Water Management in Urban Areas

Circular water management in cities aims to address water scarcity and pollution through closed-loop systems focused on conservation, reuse, stormwater management, and wastewater recovery. Strategies like smart metering, green infrastructure, and advanced recycling enhance water security and reduce pollution and might be considered as circular solutions facilitating water management, though challenges like high costs and regulations remain.

These high costs can be reduced by implementing decentralised water treatment systems where smaller, more localised facilities can reduce costs, and by incentivising water reuse and, as mentioned above, the use of green infrastructure.

Regulations could be simplified and harmonised and public-private partnerships could be promoted by sharing the associated costs and risks.

By combining these approaches, cities can work to remove high costs and regulatory barriers to circular water management, leading to more sustainable and efficient urban water systems.

³² <https://knowledge-hub.circle-economy.com/article/7580?n=Amsterdam-Circular-Strategy-2020-2025>



4.5 Innovation in Circular Consumption and Production

Circular Production Models in Local Industries and Collaborative Economy and Shared Consumption

Circular production models in local industries focus on minimising waste and maximising resource efficiency by designing products and processes to reuse, recycle or repurpose materials. These models aim to create closed-loop systems in which resources are kept in use for as long as possible, extracting maximum value before being recovered and regenerated at the end of their useful life.

The collaborative economy is bringing economic growth to cities. This new economic model has developed rapidly in a variety of sectors, transforming urban environments and creating new economic realities.³³³⁴ For example, platforms such as Airbnb and Uber have created flexible jobs, boosting tourism and local commerce by providing solutions to urban challenges such as mobility and housing. The introduction and expansion of Airbnb in cities around the world brings great benefits as well as potential costs such as the impact on the housing and rental market. The proliferation of short-term rentals through platforms such as Airbnb has reduced the availability of housing for long-term rentals, contributing to price increases and affecting housing affordability in several cities. In addition, some cities have implemented regulations to mitigate these effects and protect access to affordable housing for local residents³⁵. The ‘Airbnb effect’ bears a striking similarity to gentrification, as it gradually increases the value of an area to the detriment of local residents, many of whom are displaced due to financial constraints. In this respect, local governments (such as mayors, councillors and other municipal and administrative authorities) responsible for administering and managing urban areas, and in charge of designing and implementing balanced public policies and regulations, should promote sustainability, ensuring social inclusion and collaborating with these platforms to address local challenges.

³³ <https://blog.iese.edu/cities-challenges-and-management/2017/03/15/how-the-collaborative-economy-is-changing-cities/>

³⁴ <https://www.weforum.org/stories/2014/11/four-ways-cities-can-embrace-sharing-economy/>

³⁵ <https://www.forbes.com/sites/garybarker/2020/02/21/the-airbnb-effect-on-housing-and-rent/>

5. Governance and Public Policies for Circular Economy

Governance and public policies play a crucial role in the transition to a circular economy in urban and regional settings. Within the InvestCEC project a deliverable called D.3.3. Mid term Policy recommendations brief has been developed providing valuable information on existing initiatives and frameworks, as well as on current barriers to circular investments in cities and regions.

The European Union has established a solid framework to promote the circular economy through various policy initiatives. The Circular Economy Action Plan, adopted in March 2020, is the main guidance document that aims to make sustainable products the norm in the EU, empower consumers and public purchasers, reduce waste, focus on high impact sectors, lead global efforts towards the circular economy by providing a solid basis for cities and regions to develop their own circular economy strategies.

The deliverable also identifies four main categories of barriers to the implementation of the circular economy in cities and regions:

- ✓ *Technological barriers. Lack of efficient technologies for resource recovery, recycling and remanufacturing.*
- ✓ *Institutional and regulatory barriers. Fragmented regulatory environments and lack of infrastructure.*
- ✓ *Social and cultural barriers. Conservative business culture and low consumer awareness.*
- ✓ *Market barriers. Market distortions and lack of financing for circular investments.*

To address these barriers, solutions in urban and regional settings could include:

- *Technological innovation, encouraging research and development of circular technologies adapted to local needs.*
- *Regulatory harmonization, implementing consistent policies that support circular practices at local and regional levels.*
- *Education and awareness-raising by developing programs to raise awareness of the circular economy among citizens and businesses.*
- *Financial incentives by creating specific financial instruments to support circular economy projects in cities and regions.*



Some of the concrete policy initiatives implemented listed below have had an impact, such as the development of circular economy strategies adapted to the local context, the implementation of circular public procurement systems, the promotion of collaboration between different actors (businesses, citizens, academia) and the creation of circular innovation centres to support entrepreneurs and SMEs, as well as the setting of objectives and targets for circular economy projects.