Investment Package Manual for European Cities and Regions

VOLUME II

European investment package on circular bioeconomy for European Member States, Regions and Cities

www.hoopproject.eu

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List of Acronyms

Acronym	Description
BSF	Black Soldier Fly
CAP	Common Agricultural Policy
CAPEX	CAPital EXpenditures
CF	Cohesion Fund
CFP	Common Fisheries Policy
CIB	Circular Investors Board
DNSH	Do No Significant Harm
EAFRD	European Agricultural Fund for Rural Development
EC	European Commission
ECBF	European Circular Bioeconomy Fund
EDP	Energy Demo Projects
eeef-TA	European Energy Efficiency Fund – Technical Assistance Facility
EIAH	European Investment Advisory Hub
EIB	European Investment Bank
EMFAF	European Maritime, Fisheries and Aquaculture Fund
EOW	End-Of-Waste
EPC	Energy Performance Contracting
EPEC	European PPP Expertise Centre
EPR	Extended Producer Responsibility
ERDF	European Regional Development Fund

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Acronym	Description
ESCO	Energy Service COmpany
ESF	European Social Fund
ESG	Environmental, Social and Governance
ESIF	European Structural and Investment Fund
EU	European Union
EUCF	EUropean City Facility
GHG	GreenHouse Gas
GPP	Green Public Procurement
HE	Horizon Europe
ISO	International Standard Organisation
JASPERS	Joint Assistance to Support Projects in European RegionS
JTF	Just Transition Fund
JTM	Just Transition Mechanism
K	Potassium
LCA	Life Cycle Assessment
N	Nitrogen
NACE	*Nomenclature statistique des Activités économiques dans la Communauté européenne* - statistical classification of economic activities in the European Community
NET	Negative Emission Technology
NGO	Non-Governmental Organisation
NPV	Net Present Value
OFMSW	Organic Fraction of Municipal Solid Waste

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Acronym	Description
OP	Operational Programme
P	Phosphorous
PAYT	Pay-As-You-Throw
PDA	Project Development Assistance
PEF	Product Environmental Footprint
PPP	Public-Private Partnership
PRO	Producer Responsibility Organisation
R&D	Research & Development
RDP	Rural Development Programme
RRF	Recovery and Resilience Facility
RRP	Recovery and Resilience Plan
SDG	Sustainable Development Goals
SECAP	Sustainable Energy and Climate Action Plan
SIB	Social Impact Bond
SME	Small and Medium-sized Enterprises
TA	Technical Assistance
TEG	Technical Expert Group
TRC	Tradable Recycling Credit
TRL	Technology Readiness Level
UWWS	Urban WasteWater Sludge
VAT	Value Added Tax

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1. Executive Summary

Circular Bioeconomy needs to be deployed thanks to investments aligned with the green financing and funding to comply with requirements and goals from public policies and strategies toward a circular and carbon-neutral economy by 2050. Thanks to green finance, European cities, regions, their entrepreneurs and businesses will be able to accelerate their transition to a low-carbon, resilient and resource-efficient economy,

The Investment Package Manual was designed at first time as confidential for the HOOP project's pilot cities and regions, called Lighthouse, supporting them with knowledge and tools in their circularity journey. The HOOP project [October 2020 - September 2024] aims to unlock bio-based investments and deploy local bio economies in Europe through a systemic and cross-cutting approach. It will offer project development assistance to a group of 8 Lighthouse Cities and Regions to build the technical, economic, financial and legal expertise needed to develop concrete investments to valorise biowaste and wastewater, with the aim of obtaining safe and sustainable bio-based products.

The manual demonstrated a practical utility over time, being extensible and valuable resource for other EU Member States and their cities and regions. For this reason, the authors propose a public version that was developed to be disseminated among Cities and Regions of the HOOP Network and others across Europe and offers an overview on funding and financing schemes and opportunities at European, National and Regional levels.

The Investment Package Manual was developed on three-step approach and the public version distributed through 3 respective volumes. This Volume II guides the reader through the selection and inventory of funding and financing schemes, programmes, instruments and tools for investment projects on circular bioeconomy and bioenergy at European level.

Volume I presents the description of the EU Taxonomy concepts, methodology, objectives, technical screening criteria and DNSH ("do no significant harm") applied to economic activities linked to the circular bioeconomy technologies, processes, activities and bioproducts from biowaste and wastewater sludge feedstocks, and respective regulation package. These economic activities selected are related to the bio-based technologies and processes being invested in the HOOP project by the European Cities and Regions.

The third step (Volume III) presents a selection and inventory of funding and financing schemes, programmes, instruments and tools for investment projects on circular bioeconomy and bioenergy at National and Regional levels, under 8 European countries and regions case studies: Finland, Greece, Germany, Italy, Norway, Portugal, Spain and The Netherlands.

The Recovery and Resilience plans and Horizon Europe already included the DNSH principle from EU Taxonomy, i.e., no measure in the projects and investments should lead to significant harm to any of the 6 environmental objectives: climate change mitigation, climate change adaptation, circular economy, sustainable use and protection of water resources, pollution prevention and control, protection and restoration of biodiversity and ecosystems.

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2. Introduction

The circular economy concept is gaining attention as the consumption and use of resources increases to serve a fast-growing population with rising standards of living. Circularity refers to the circular flow and efficient use and reuse of resources, materials and products. This new economic model represents sustainable green growth, moving from a consumption and disposal-based linear model to a system that extends the life of products and materials and minimises waste. The circular model has many environmental, climate, social and economic benefits [1].

The circular economy is backed strongly by the European Commission (EC) and other European Union (EU) institutions, as well as by a growing number of cities and countries across the EU, like HOOP demonstration territories, the so-called Lighthouse Cities and Regions. It is also attracting attention from the business community and public and private investors. The circular economy goes beyond resource efficiency and recycling. It provides the framework to develop new business models aimed at increasing the value, use and lifespan of materials, products and assets and designing out waste from production and consumption [1]. Inspired by these principles, the HOOP project is ongoing, and **this manual was developed for the European Cities and Regions, in order to provide them a green investment package of knowledge and opportunities to boost urban circular bioeconomy**.

2.1. The HOOP project [2]

The HOOP project, "**H**ub of circular cities b**OO**sting **P**latform to foster investments for the valorisation of urban biowaste and wastewater", emerges to help unlock bio-based investments and deploy local bioeconomies in Europe through a systemic and cross-cutting approach. **The project offers Project Development Assistance (PDA), budgeted with EUR 5.78 million, to a group of 8 Lighthouse Cities and Regions** [2] with a variety of sizes, geographical distribution throughout Europe and different socio-economic context. In order to build the technical, economic, financial and legal expertise needed to develop concrete investments to valorise Organic Fraction of Municipal Solid Waste (OFMSW) and Urban Wastewater Sludge (UWWS), with the aim of obtaining safe and sustainable bio-based products. The urban bioeconomy concept of the HOOP project and its biowaste and wastewater cycle of material valorisation is illustrated through the **Figure 1**.

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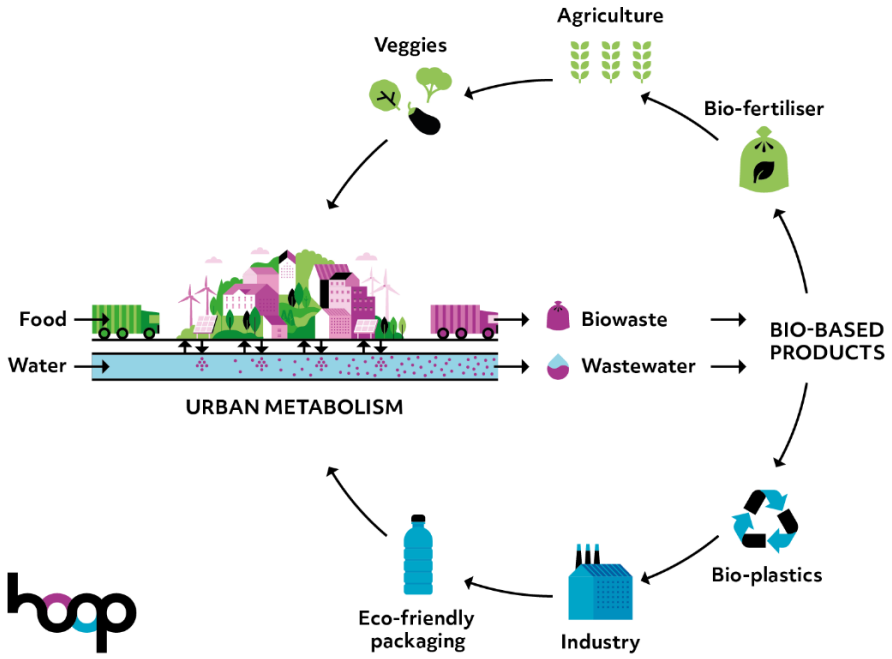

Figure 1 – Urban circular bioeconomy concept of the HOOP: biowaste and wastewater converted into innovative high-value bioproducts.

The report "State-of-the-art of technologies for the production of bioproducts from biowaste and wastewater" was presented in July 2021 and will be transformed in both a scientific review article and a series of *technology factsheets.* It provides a technical description and a multidisciplinary analysis of 17 technologies preselected by HOOP technological partners and on technology readiness levels (TRL) from 5 to 9. This document aimed to be an early tool for the identification of potential paths towards circular bioeconomy strategies for cities and regions.

Furthermore, HOOP will develop, from the bioprocesses and technologies selected by the Lighthouse Cities and Regions as BATs (best available techniques/technologies): **circular business models, technological and environmental assessments, innovative financial engineering & procurement, stakeholder engagement & mobilisation, and a replication strategy**.

The PDA will focus on a variety of projects within the cities and regions, with different investment volumes planned that are expected to be complemented by public and private investments. The HOOP project partners will create an understanding among investors on specific aspects of those processes (i.e., technical specifications, input and output materials/products, business cases, among others) as this is a prerequisite to be able to support the development of tools and the decision-making on financing solutions.

Besides Lighthouse Cities and Regions, the project impacts will be extended through the project's large **Network of Cities & Regions – a network that aims to include 100+ cities and regions to facilitate the exchange of knowledge and mutual learning** among European cities and regions that are willing to recover valuable resources from OFMSW and UWWS to make bio-based products – will ensure that the provided PDA mechanisms will reach beyond the HOOP demonstration territories and spread across all Europe. This Network

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is led by HOOP partner ACR+, acronym of “association of cities and regions for sustainable resource management”.

By joining this Network, cities and regions gain information to innovative urban bioeconomy solutions and engage in activities relevant to their context and specific interests. Participants have direct exchanges with the 8 HOOP lighthouse cities and regions, sharing experiences and expertise.

The following resources and tools will be available for the HOOP Network of Cities & Regions by September 2022:

- The Urban Circular Bioeconomy Hub;
- Circularity Label;
- Knowledge exchange activities;
- Virtual Academy.

More information about HOOP project, resources, tools and the HOOP’s Network of Cities and Regions are available on its website here [2].

2.2. The Investment Package Manual

The investment package manual was designed at first time as confidential for the HOOP’s Lighthouse Cities and Regions, supporting them with knowledge and tools in their circularity journey. This manual demonstrated a practical utility over time, being extensible and valuable resource for other EU Member States and their cities and regions. For this reason, this current public version was developed to be disseminated into the HOOP’s Network of Cities and Regions, and other interested on it. Therefore, this manual aimed at the identification of funding and financing schemes and opportunities at European, National and Regional levels, available for the European Cities and Regions. Such investment package will be considered in the financial schemes and development of business models in further advanced tasks of HOOP project.

The Investment Package Manual was delivered in the end of January 2022 as confidential (extended) version, only available for the HOOP’s Lighthouse Cities and Regions and project partners. However, the present shorter version of the Manual was designed and divided in three volumes for public dissemination and training of Cities & Regions of the HOOP Network and others across Europe.

2.3. Objectives

The manual was developed to be a thorough still easy-to-consult resource. The methodology behind its development consists of a three-step approach illustrated below in **Figure 2** and reflected in this three-volume public version of the manual. The first step (**Volume I**) is the description of the EU Taxonomy concepts, methodology, objectives, technical screening criteria and DNSH assessment applied to economic activities linked to the circular bioeconomy technologies, processes, activities and bioproducts from biowaste and

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wastewater feedstocks, and regulation package in this field. In the Volume I was also identified the economic activities and sectors related to the bio-based technologies and processes being invested in the HOOP project by the European Cities and Regions.

The second step (**Volume II**) was the selection and inventory of funding and financing schemes, programmes, instruments and tools for investment projects on circular bioeconomy and bioenergy at European level. The third step (**Volume III**) was the selection and inventory of funding and financing schemes, programmes, instruments and tools for investment projects on circular bioeconomy and bioenergy at National and Regional levels, under 8 European countries and regions case studies: Finland, Greece, Germany, Italy, Norway, Portugal, Spain and The Netherlands.

Several programmes establish both bioeconomy and bioenergy lines combined, e.g., some schemes only grant projects where circular bioeconomy activity also includes bioenergy production in order to decarbonise the organisations and economic activities. For this reason, all investment opportunities identified in this manual for the European Cities and Regions are focused on both activities.

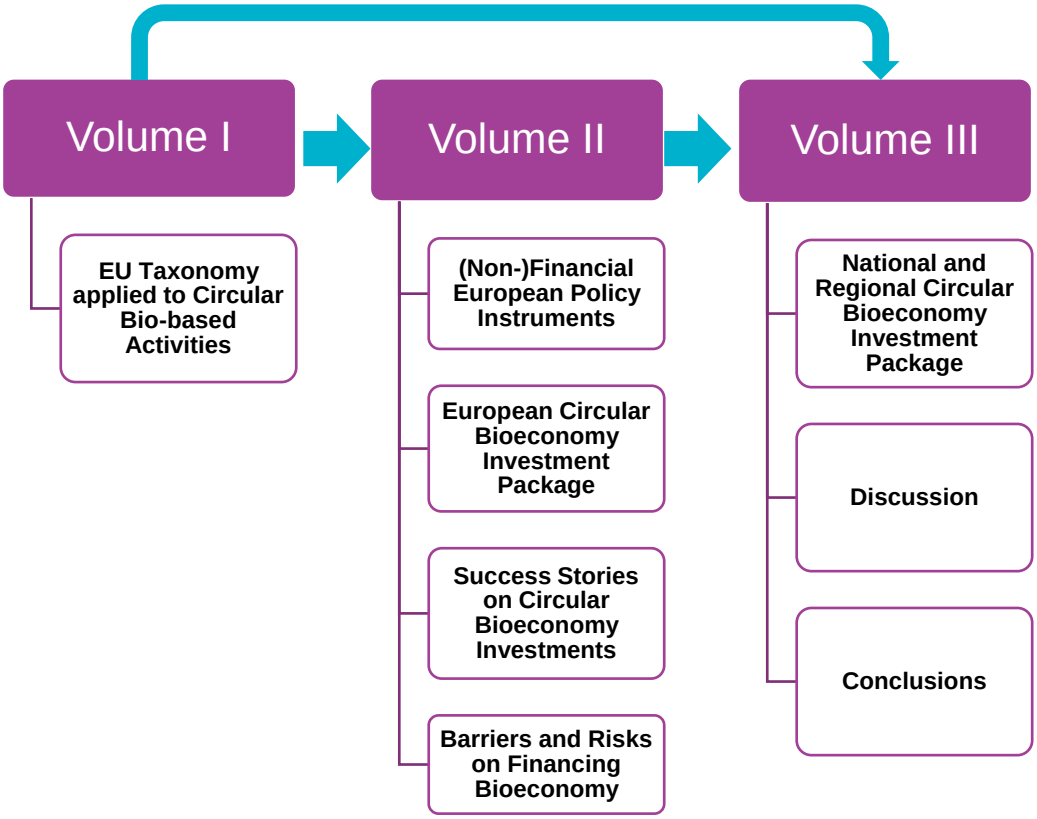

Figure 2 – Investment Package Manual's contents distributed by each Volume.

More in detail, the content of the 3 volumes constituting the public version of Investment Package Manual for the European Cities and Regions is distributed as follows:

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Volume I - EU Taxonomy applied to circular bio-based activities

- Provide a description of the concepts and methodology of the EU Taxonomy, as well as the regulation package and other issues related to its application;
- Identify the economic activities classified, namely macro-sector, NACE (statistical classification of economic activities in the European Community) levels and codes, in the EU Taxonomy linked to the circular bioeconomy technologies, processes, activities and bioproducts from biowaste and wastewater feedstocks.

Volume II - European investment package on circular bioeconomy for European Member States, Regions and Cities

- Select and characterise the financial and non-financial European policy instruments for policymakers, and European funding and financing instruments, schemes, sources, investors and tools on circular bioeconomy available for European Cities and Regions;
- Present some investment success stories on circular bioeconomy from urban biowaste and sewage sludge to inspire the European Cities and Regions.

Volume III - National and Regional investment package on circular bioeconomy for European Regions and Cities

- Identify some business models applied to circular bioeconomy projects and activities for cities and regions, as well as the circular bio-based characteristics applied to urban solid biowaste and wastewater sectors;
- Create an investment intake form on circular bioeconomy to be inserted on HOOP's website and used by the HOOP's Network of Cities & Regions in order to characterise the investment projects and provide PDA;
- Identify the national and regional funding schemes and initiatives on circular bioeconomy under 8 European countries and regions case studies;
- Provide complementary resources and tools supporting circular bioeconomy initiatives, financing services and funding available for European Cities and Regions.

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3. European investment package on circular bioeconomy for European Member States, Regions and Cities

The circular (bio)economy also offers new growth opportunities for businesses. According to European Commission [3], circular activities "could bring net savings to businesses in the EU of up to EUR 600 billion or 8% of their annual turnover" and as such become an important enabler for green recovery, resilience and competitiveness of the economy in the long-term.

As the growing focus on projects with ESG criteria shows, investors ask businesses for appropriate disclosure of a variety of circular/sustainable impact data as part of their investment analysis and decision-making. Those requirements are usually not well aligned among financial institutes and investors, and the lack of standards for the obtaining and measurement of such impact data (e.g., GHG emissions) challenges the dialogue between technology providers and their potential investors. Therefore, closer cooperation within the financial sector is required and the adoption of frameworks, such as the ISO standards or the Circular Transition Indicators [4].

Therefore, this Volume II explores **1) EU's policy intentions and instruments, and 2) a portfolio of funding options and tools to understand how to apply**.

The circular bioeconomy offers opportunities for cities and regions, and its economic sector, to reduce their exposure to linear risks, reduce costs and exploit new market and business opportunities with new bio-based solutions, processes, technologies and products [4].

3.1. (Non-)Financial European policy instruments to boost circular bioeconomy for policymakers

Incentives are defined as any type of instrument implemented by financial or non-financial policymakers, from the Municipalities and public regional bodies, with the goal to stimulate circular bioeconomy. The incentives can be either **temporary** (when they are designed to provide a price signal to stimulate market creation or support early movers), **or permanent** (when they are integrated in laws, regulations

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and standards). **Non-financial policymakers, such as Member States, regional and municipal authorities, can introduce incentives through** [5]:

1. Financial policy instruments;
2. Non-financial policy instruments;
3. Policy incentives to boost the circular economy by regional and municipal authorities.

3.1.1. Financial policy instruments

Financial and non-financial policymakers can develop incentives through financial instruments, which also provides a possible incentives calibration approach based on market maturity and the availability and cost of finance. It reflects the different level of market barriers and market conditions. The financial policy instruments are categorised as:

1. **Prioritisation instruments (high incentives):** CAPEX grants based on NPV (Net Present Value); Interest rate/Loose Cubic Yards subsidy; Longer tenor or grace periods.
2. **Incentivising instruments (medium incentives):** No-cost partial guarantees (first loss); Low(er) intensity CAPEX grants; CAPEX grant secured against impact; Guaranteed residual value.
3. **De-risking instruments (low incentives):** Partial concessional co-financing; Concessional or waived fees; Below market-price guarantees; Deferred payment (success fee); Interest rate secured against impact.

To achieve further impact and reduce the risks of distortion, the approach proposed can be enhanced by introducing higher degree of conditionality that is proportional to the level of the incentives, through e.g., increased level of reporting, defined timeline for implementation, minimum level of organisational governance introduced, incentives linked to performance standards, etc. [5]

Typically, the **economic, environmental and social return of any incentive should exceed its cost within a reasonable timeframe**. To achieve this objective the following criteria can be considered [5]:

- Incentives should aim at achieving proven benefits in terms of circularity, i.e., be technology neutral provided that it is environmentally sustainable and flexible.
- They should be proportionate to the desired outcomes and based as far as possible on market instruments to reward optimal allocation of resources.
- They should prevent the emergence of vested interests and reduce the extent of unwanted trade-offs.
- Incentives should reflect local context and particularly, different policy/regulatory environments and levels of market maturity.
- Incentives should mitigate as much as possible free-rider effects and hence may evolve over time as cost of technologies decline and competition increases.

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In addition, incentives should be designed to maximise impacts and result, as much as possible, in multiple benefits for entire circular value chains, crowding-in private finance and promotion of transformative business models and practices, rather than focusing on small incremental improvements based on existing practices. These can also be achieved through a combination of different incentives.

3.1.2. Non-financial policy instruments

The non-financial policy instruments, that the cities can implement to boost the circular economy, are categorised in [5]:

► **Market-based instruments:** To convert environmental benefits into an economic return. Market based instruments do price externalities based on objective environmental impacts (GHG emissions/energy consumption, Natural Capital, etc.) to reward circular value chains. These instruments are categorised as:

1. **Charge systems:** effluent charges (e.g., carbon tax), deposit-refund systems, user charges, insurance premium taxes, sales taxes, administrative charges, and tax differentiation (e.g., Extended Producer Responsibility (EPR) eco-modulation, lower VAT - Value Added Tax on green/repairing products).

2. **Tradable permits:** credit programs (e.g., tradable recycling credit schemes) and cap-and-trade systems.

3. **Reducing market frictions:** market creation, liability rules, and information programmes.

4. **Government subsidy reductions**: to lift restrictions on circular products and services, and reduce/remove subsidies on mining, fossil fuels, etc.

► **Non-market-based instruments (normative and informative):** these kind of policy incentives can be:

- Ban of single-use products when a circular alternative exists;
- Promotion of social inclusion to leverage the ability of disadvantaged groups and ensure broader market participation;
- Design requirements to improve product reparability, reusability, recyclability or mandatory recycled content for specific product categories, such as packaging;
- Increase minimum legal guarantee period;
- Information to benchmark product circularity.

► **Removing normative obstacles:**

- National and regional End-of-Waste (EOW) criteria which can be mutually recognised by other Member States, to define when waste ceases to be waste and achieves product status in one Member State.
- Ease shipments of waste and secondary raw materials within the EU through harmonised rules evenly interpreted by competent waste shipment authorities across Europe.

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- Remove unnecessary technical requirements based on performance of primary materials (both public procurement and technical standards) hampering circular material flows.
- Include procurement criteria rewarding circularity to ensure that more circular products or services have equal chances in tender procedures, as the Green Public Procurement (GPP).

3.1.3. Policy incentives to boost the circular economy by regional and municipal authorities

Green Public Procurement is an important incentive to ensure that public expenditures support the objectives set by the European Green Deal and the Circular Economy Action Plan. GPP can either be **market-based (charge system)** by applying equivalence between environmental performance and price, or **non-market-based (normative)** by restricting market access to products that reach a sufficient level of environmental performance [5].

The incentives available to policymakers are typically temporary to accelerate the transition and the uptake of circular business practices [5]:

► **Incentives that stimulate value chain collaboration:**

- **Market-based:** favour support (e.g., on Research & Development - R&D) for chain integrated and sustainable projects, e.g., supporting local biodiversity.
- **Normative:** set up Green Deals and clusters at different levels.

► **Incentives that support first movers:**

- **Market-based:** financial support to R&D and existing circular activities, e.g., supporting the circular bioeconomy through return of compost from waste to agriculture with priority purchase of that produce.

► **Incentives that empower consumers to select more circular products:**

- **Normative:** stimulate the availability of reliable environmental information on products (Life Cycle Assessment - LCA, etc.) for buyers (citizens and Public Authorities), e.g., through labelling (ecolabelling, certification), lower VAT or local subsidies on circular products and information campaigns to raise public awareness about environmental and social benefits of circular products and services to empower citizens in making sustainable choices.

Another key aspect is the **review of incentives** by the local, regional and national public authorities in order to review on a regular basis and phased-out when the market operates effectively [5].

The **Table 1** provides an indicative list of policy incentives actions, and the most relevant levels of competence and recommendations respectively, that can be implemented at regional and/or municipal levels. These incentives can be implemented alone or cumulatively in order to achieve the desired objectives. This Table and its list of contents was adapted from the European report “Incentives to boost the circular economy: a guide for public authorities” [5].

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Table 1. Incentive policy actions suitable to regional and municipal authorities.

Incentive policy action	Description	Regional	Municipal
End of waste: Facilitate end-of-waste procedures and mutual recognition	Organise mutual recognition procedures with other Member States or regions. This kind of incentive is useful for specific waste flows such as wood, paper, food waste, etc. **Recommendations:** • Benchmark decisions from other competent authorities via the TRIS platform in order to use the experience for criteria development. • Clarify EOW procedures (via online description of procedures, helpdesk, training, etc.). • Help the industry understand if they are eligible for EOW. • Place past national decisions on EOW online. • Organise mutual recognition with neighbouring countries. • Introduce a procedure to recognise decisions taken by other competent authorities.	●	●
Render standards more circular	Standardisation bodies and mandates must favour the use of recycled materials, products' reparability, reusability and recyclability. They play an important role for market operators in levelling the playing field. **Recommendations:** • Develop national standards for secondary raw materials and by-products, for those that are not covered by EU standards. • Define quality standards in EOW decisions. • Lift unnecessary requirements in existing standards that may hamper the use of secondary raw materials and by-products and develop specific standards for secondary materials. • Promote the use of EU and national standards for public and private purchasing.	●	
Promote social economy in activities fostering the circular economy	Promote social economy in the collection, sorting of some specific waste streams (wood, textiles, food waste, etc.) and repair. "Refood" initiative is an example. **Recommendations:** • Introduce minimum share of waste that must be dealt by social economy in the license agreement of Producer Responsibility Organisations (PROs). • Coordinate collaboration agreements between PROs and the social economy. • Reserve part of the EPR funds to social economy.	●	●

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Favour R&D support for value chain integrated projects and investment in new circular activity	Include chain integration and circularity in criteria to access R&D financing. **Recommendations:** The EC and national bodies contribute to financing R&D. Selection and grant level depend on additional criteria: • The collaboration of actors from different stages of the value chain. • The potential contribution to the transition towards a circular economy, like new bioproducts manufactured from biowastes and wastewater sludge.	●	
Set up Green Deals and clusters at different levels	Set up Green Deals and circular clusters to implement best practices and allow fast changes with less administrative burdens that can serve as a basis for implementation a broader scale. **Recommendations:** Public Authorities can favour information exchange and improve collaboration between actors by: • Creating or supporting clusters. These clusters can perform R&D, being a knowledge centre dedicated to the specific value chain. • Setting up green deals, i.e., agreements between private and public bodies where all parties commit to act. The role of Public Authorities is a moral support, being a neutral partner that can be referred to for external communication, providing legal clarity by helping interpret legislation or, where appropriate and not lowering environmental policy ambition, less red tape.	●	
Favour environmental labelling and certification	Instrumental to empower sustainable choices by consumers. Promote relevant labels on official websites, like the European Ecolabel. **Recommendations:** • With the PEF (Product Environment Footprint) methodology, public data bases, standard modelling, default values and weighting factors, the environmental impacts can be calculated on an objective and standardised basis. This means on/off or semi-quantitative labels can be replaced by much more meaningful quantitative labels, allowing relevant comparisons between products from the same and from other product categories. • Electronic labels also allow results to be calculated specifically for each user, depending on the country, the use behaviour, and the waste management behaviour.	●	
Communication	Promote relevant circular economy communication activities (e.g., a market or seller network of bioproducts) on official websites.	●	●

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Green public procurement	GPP applies environmental/circularity criteria in the purchasing process. It is a very efficient instrument if properly applied to ensure that public expenditures support circular products and services. **Recommendations:** • Use environmental labels that include circularity criteria as a purchasing criterion: https://ec.europa.eu/environment/gpp/eu_gpp_criteria_en.htm • Require/favour the European Ecolabel. • Request an impact calculation when a PEFCR (PEF Category Rules) exists.	●	●
Landfill / incineration ban / tax	Landfill tax is efficient as it makes circular circuits more competitive, but not on its own as it will need to be combined with another incentive for full circularity. Incineration taxes are less widespread and are lower. Landfill and incineration taxes are national/regional instruments and not the competency of the EU. They are paid by waste producers, and for household waste, by local authorities. However overly burdensome financial pressure on all disposal activities can financially burden recycling activities that depend on disposal activities for the treatment of residual waste. Therefore lower (or even zero) tariff should be applied to non-recyclable residues from sorting/recycling operations to ensure that taxation applies to the untreated waste which should have been recycled.	●	
Waste producers pay the full waste management cost	The PAYT (Pay-As-You-Throw) system puts pressure on waste producers to avoid producing unsorted waste. It can be applied on containers or bags, based on volume and/or weight, possibly with some free removals in the starting phase to increase public acceptance. It is very efficient when coupled to advanced selective collection, e.g., biowaste streams. PAYT is typically applied to household and HoReCa. It is generally already applied to industrial and commercial waste. Potential improvement for non-household waste includes applying PAYT to waste generated by public services and controlling/charging access from private companies to civic amenity sites. It requests control by the Public Authorities to avoid illegal dumping.	●	●
Tradable recycling credit schemes	This TRC (Tradable Recycling Credit) mechanism pulls the demand for recycled materials and rewards in price the environmental benefits of their use which the market fails to value (e.g., wood waste). The type of actors eligible for emitting or buying credits **depends on the specific design of the policy. For instance:** • Eligible companies are those turning waste into secondary raw materials which substitute primary raw materials; • Obligated companies are manufacturers of products that contain secondary raw materials.	●	

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Subsidies	These incentives aim to stimulate private actors to change towards more circular behaviour and activities. Subsidies can turn a circular economic activity that is not economically viable into a profitable activity therefore subsidies can have significant and immediate effect, but there is also the risk of distortion of the market. There are some examples of circular economy subsidy schemes for recycling industry, composting, sludge valorisation into the soil, or local repair services. **At EU level there are large-scale subsidy schemes, being the largest and most influential ones:** • The Common Agricultural Policy. • The Cohesion Policy and its financial instruments like the European Regional Development Fund. • European R&I programmes.	●	●

The transformational potential of blended finance instruments could be further enhanced through the integration of circular (bio)economy considerations in the design of programmes linked to existing and forthcoming EU financial instruments (e.g., InvestEU). Hence, **EU financial instruments as incentives, i.e., public funding, is an opportunity to boost circular bioeconomy sector in the European cities and regions**. Circular-economy-related disclosures, in financial and non-financial reporting, should also be incentivised for local implementation [5].

3.2. Financial and funding instruments, sources and tools on circular bioeconomy

Regarding the funding and financing opportunities identified at European level for the European Cities and Regions, some considerations should be taken into account, such as:

- Several funding and financing structural schemes are not available yet, mainly because the European Commission and Member States are focused on the Recovery and Resilience Plans at the moment;
- At this moment, the EU and Member States are working on their funding programmes - the 2021-2027 period - and, for this reason, the specific lines of investment and programmes are not defined yet;
- The recent programmes and schemes listed under this subchapter are focused on innovation, renewable sources, new sustainable products, goods and services, energy efficiency, circular economy and decarbonisation of the economic activities. Therefore, this green transition will not include traditional approach in the collection and treatment of waste and wastewater activities. The new funding opportunities clearly will reward solutions with innovative approach in this sector;
- The selection of the funding and financing schemes and programmes was based on the lines of investment in circular bioeconomy and bioenergy. Several programmes establish both lines combined, e.g., some schemes only grant projects where circular economy activity also includes bioenergy production in order to decarbonise the organisations and economic activities;

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3.2.1. Digital financial information platforms

In terms of digital financial information platforms, there are two best web-based reference tools where the European cities can collect updated information about announcements of funding calls, and financial organisations/sources and instruments available to invest on circular bioeconomy projects, namely:

- **The EU Covenant of Mayors for Climate & Energy initiative**. More information can be found here [6].
- **The Circular City Funding Guide.** More information can be found here [7].

3.2.2. European Investment Bank supporting the circular transition in cities and regions

The **European Investment Bank (EIB), member of HOOP's Circular Investors Board**, provides lending on attractive terms to both public and private promoters, including for smaller and riskier circular bioeconomy projects. For cities, **EIB offers municipal framework loans**, which are multi-scheme credit lines that can finance a city's circular investment programme. **EIB also offers intermediated lending through other banks**, which can finance investments in the city itself, its utility companies and private sector municipal service providers. **EIB can also finance Urban Development Funds**, which can be purely private or blended with EU or other public funds to invest in circular city projects, including through revolving funds. For projects promoting the commercialisation of circular bioeconomy innovation, the EIB has special instruments supported by the EC [8]. See the subchapter **3.4** for specific information about the European Circular Bioeconomy Fund.

In addition to lending, **the EIB provides financial and technical advisory to cities**, in particular through the European Investment Advisory Hub, URBIS, Innovation Finance Advisory and JASPERS. These funding schemes and advisory services are described further on subchapter **3.2.4**. The **Figure 3** summarises the EIB's services and resources available for investment on circular bioeconomy projects in cities and regions.

Figure 3 – The EIB's services and resources for circular bioeconomy investment projects *[8]*.

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For more traditional and larger-scale projects, EIB offers medium and long-term direct loans with fixed or variable interest rates. **For smaller operations**, EIB offers financing indirectly through local banks and other intermediaries, particularly targeting small companies and mid-caps. More information about standard lending products can be found on the EIB's website [7].

More novel project types with medium to high levels of risk may be assisted by the European Fund for Strategic Investments, InnovFin and other special financial instruments designed to handle greater risk. **For innovative projects that are not fully financially viable, the EIB may recommend sources of grants** [1]**.**

The EIB provides loans for up to 50% of the total cost of projects in the agriculture, forestry, blue economy and solid waste management sectors and value chains. Projects must be in line with the transition to a low-carbon and climate resilient economy. Loans are awarded directly as minimum amounts of EUR 7.5 million for investment projects of minimum EUR 15 million or through intermediary banks for smaller amounts [9]. More information about this topic is available in the **Table 7**.

Financing is available for small companies, large caps and special purpose vehicles under the following products until 31 December 2022 [10]:

- **InnovFin Energy demo projects (EDP):** provides loans, loan guarantees or equity-type financing typically between EUR 7.5 and 75 million to innovative demonstration projects in the fields of energy system transformation, and carbon capture utilisation and storage. **Projects contributing to the circular economy, such as circular design and production, circular use or circular value recovery can also be supported on a pilot basis under EDP** *[10]*.

- **InnovFin thematic investment platforms:** it will catalyse third-party financing for thematic areas, such as the **circular bioeconomy**. The platforms will provide access to finance via debt or equity-type products to innovative projects in specific thematic areas and will be managed by financial intermediaries and fund managers selected through open call for expression of interest *[10]*.

InnovFin Advisory also provide guidance to promoters on how to structure their R&D projects to improve their access to finance [10]. EIB also provides advisory support through the ***fi-compass* platform** (see **Table 9**).

More information can be found in the EIB Circular Economy library, namely "The 15 circular steps for cities – second edition" [8], "The EIB Circular Economy Guide" [1], the study "Access-to-finance conditions for projects supporting circular economy" [11], the report "The Joint Initiative on Circular Economy" and the brochure "Circular Economy Overview 2021", which can be downloaded on http://www.eib.org/circular-economy.

3.2.3. Funding categories and risk assessment for circular bioeconomy investment projects

To identify and successfully apply for funding by the cities and regions, it is important to know how funders assess your organisation and/or circular bioeconomy investment project. An important part of this is the risk assessment. The main funding categories and their relevance and applicability for different organisation and project types are presented under **Table 2** [7]. The funding categories are distributed in [7]:

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- **Alternative funding:** alternative forms of funding such as crowdfunding, leasing, social impact bonds, etc. The alternative funding schemes are described in **Table 8**.

- **Equity and quasi-equity:** funder invest money for a share in a project/company, earning a return from dividends or sale or share at increased value. Quasi-equity, known as venture debt, offers non-dilutive equity risk capital that is paid back based on the performance of the company. SMEs and mid-caps seeking to invest in R&D. The equity instruments are described in **Table 4** and **Table 7**.

- **Grants and subsidies:** funder give money to support a project and stimulate a certain development. Whereas subsidies are current payments aiming to influence levels of production or prices, grants are direct financial contributions for specific activities that support the policy objectives of the EU. The grant instruments are described in **Table 4** and **Table 5**.

- **Guarantees:** funder takes over (part of) the obligations if the debt cannot be repaid. Guarantees enable financial institutions to invest in businesses with a higher default risk. There are two main types of guarantees that can mitigate this higher default risk: **Collateral guarantees** provide a claim to the company's assets in case of default or bankruptcy. For start-up companies, collateral guarantees are often difficult to provide since they do not have many assets yet. Therefore, third parties can provide **loan guarantees** that assure the payment of debt service in case the company's cash flow is insufficient. The guarantee instruments are described in **Table 4** and **Table 7**.

- **Debt (loans and bonds):** funder lends money to project/organisation that is repaid in instalments with interest. Debt is usually used to finance larger investments. Issuing bonds provides a suitable alternative to attract capital when a bank loan is insufficient to fund the required amount. The debt instruments are described in **Table 4** and **Table 7**.

Table 2. Risk assessment and funding categories for several types of circular bioeconomy projects *[7]***.**

Project type	Cash-flow characteristics	Risk assessment	Funding and financial categories				
			Alternatives	Equity	Grants	Guarantees	Debt
Research & Development	Pre-revenue	Very high	●	●	●	●	
Start-up	Pre-profit	Very high		●	●	●	
Scale-up	Pre-profit to profit	High		●			●
Growth	Profit	Medium		●			●
Mature	Profit	Low					●
Advisory	N/A	N/A			●		●

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3.2.4. Funding and technical assistance guide for circular bioeconomy investment projects

The several funding opportunities and mechanisms available for circular bioeconomy investment projects, to be developed by the cities and/or regions, can be categorised, listed and described as illustrated in **Table 3**.

Table 3. Funding categories for circular bioeconomy investment projects.

Funding category	Description	Table	Funds and mechanisms
Shared management funds	Funding channelled via operational programmes in the Member States.	Table 4	**Cohesion Fund** **European Agricultural Fund for Rural Development** **European Maritime, Fisheries and Aquaculture Fund** **European Regional Development Fund** **European Social Fund+** **Just Transition Fund**
European funding programmes	Direct funding grants from the European Commission or its executive agencies for projects with specific objectives.	Table 5	**European Urban Initiative** **European City Facility** **EU Renewable Energy Financing Mechanism** **Horizon Europe** **Innovation Fund** **LIFE** **INTERREG** **URBACT**
Technical assistance and advisory support	Direct funding grants to public bodies for developing bankable projects.	Table 6	**European Energy Efficiency TA** **InvestEU Advisory Hub** **Just Transition Platform** **LIFE Technical Assistance Projects**
Financial institution instruments	Financial products such as loans, guarantees, equity and other risk-bearing mechanisms to support projects.	Table 7	**EIB Municipal Framework Loans** **InvestEU Fund** **Public Sector Loan Facility**

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Alternative financing schemes	Financial channels and instruments that have emerged outside of the traditional finance system.	Table 8	**Citizen Cooperatives** **Crowdfunding** **Energy Performance Contracting** **Green Municipal Bonds** **Revolving Loan Funds** **Lease Financing** **Social Impact Bonds**
Support services	Support Services from different digital platforms to uphold the European cities and their circular bioeconomy investment projects.	Table 9	**InvestEU Portal** **European Investment Advisory Hub** **URBIS** **Financial Instruments Advisory (fi-compass)** **Knowledge Centre for Bioeconomy** **European PPP Expertise Centre**

3.2.4.1. Shared management funds

The several shared management funds available for circular bioeconomy investment projects were listed and described in the **Table 4**. The reference of each fund category is related to the web-based platform, where is possible to get information about the specific fund at national and regional levels.

All European Structural and Investment Funds can be used in integrated packages at the local, regional or national level using territorial integrated instruments, such as Community-led Local Development and Integrated Territorial Investments.

Table 4. Shared management funds available for circular bioeconomy projects in the cities.

	Cohesion Fund (CF) [12]
Description	The CF provides support to member states with a gross national income per capita below 90% EU-27, such as **Portugal and Greece**. The Cohesion Fund supports investments in the field of environment **(water and waste management and valorisation, and bioenergy)**, trans-European networks in the area of transport infrastructure and others. In order to access the CF, applicants need to first check with the national authority in charge of managing the fund in their country.
Type of funding	Grant; Technical assistance; Financial instrument: loan, guarantee, equity.
Project size [M€]	< 1.5; 1.5-5; 5-10; 10-20; > 20

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Co-funding rate	≤ 85% of project costs; ≤ 100% for technical assistance.
Project partners/ beneficiaries	From the same country – cities; regions; countries; NGOs; companies; SMEs; educational, social and cultural organisations.
	European Agricultural Fund for Rural Development (EAFRD) [13]
Description	EAFRD is an instrument of the EU's Common Agricultural Policy (CAP) that focuses on resolving the challenges of rural areas. Rural Development Programmes (RDPs) have been conditionally extended for 2022, where many of the projects and schemes will continue to run until the end of 2025. From 2023 onwards, all new rural development actions will be incorporated into national CAP strategic plans. The RDPs until 2023 cover priorities **where are included bioenergy and bioproduct valorisation from rural biowastes and agriculture residues,** through knowledge transfer and innovation, resource-efficient and climate-resilient economy. CAP specific objectives by country. In order to get information on the open calls for project proposals, you need to contact the Ministry of Agriculture in your country.
Type of funding	Grant; Financial instrument: loan, guarantee, (quasi-) equity participation, others.
Project size [M€]	< 1.5; 1.5-5; 5-10; 10-20; > 20
Co-funding rate	Depends on the regions and the operational programme.
Project partners/ beneficiaries	From the same country – cities; regions; countries; NGOs; companies; SMEs; educational, social and cultural organisations.
	European Maritime, Fisheries and Aquaculture Fund (EMFAF) [14]
Description	The EMFAF runs from 2021 to 2027 and supports the EU common fisheries policy (CFP), the EU maritime policy and the EU agenda for international ocean governance. The EMFAF supports innovative projects that contribute to the sustainable exploitation and management of aquatic and maritime resources, **where the innovation applied to circular blue bioeconomy includes new bio-based products from food waste and wastewater valorisation**. In order to access the EMFAF applicants need to first check with the national authority in charge of managing the operational programme in their country.
Type of funding	Grant; Financial instrument: loan, guarantee, (quasi-) equity participation, others.
Project size [M€]	< 1.5; 1.5-5; 5-10; 10-20; > 20

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Co-funding rate	Depends on the regions.
Project partners/ beneficiaries	From the same country – coastal and inland communities depending on fishing.
	European Regional Development Fund (ERDF) [12, 15]
Description	The ERDF aims to strengthen economic, social and territorial cohesion in the EU by correcting imbalances between its regions. In 2021-2027, the ERDF will enable investments, **including bioenergy and bioproduct valorisation from biowastes and wastewater**, to make Europe and its regions more competitive, smarter, greener, low-carbon and resilient, through innovation and support to SME. Urban areas are directly targeted by several of the ERDF investment priorities. The action is designed to reduce economic, environmental and social problems in urban areas. In order to be financed, the project has to be in line with the Operational Programme (OP) [12] for the region/area. Applications can be done in cooperation with the local managing authority [15].
Type of funding	Grant; Financial instrument: loan, guarantee, equity.
Project size [M€]	Variable.
Co-funding rate	Depends on the regions and the operational programme.
Project partners/ beneficiaries	From the same country – cities; regions; countries; NGOs; companies; SMEs; educational, social and cultural organisations.
	European Social Fund + (ESF+) [12, 15]
Description	The ESF+, with a budget of almost EUR 99.3 billion for the period 2021-2027, will invest in reskilling and upskilling people for the transition to a green and digital Europe through the improvement of education and training systems, the upskilling of all, including the labour force, the creation of new jobs in sectors related to the environment, climate, energy, **the circular economy and the bioeconomy**. The project has to be in line with the OP [12] for the region/area. The OP is managed by the managing authorities [15]. You should consult the OP and get in touch with the respective managing authority to find out more about the OP objectives and calls for proposals.
Type of funding	Grant; Technical assistance; Financial instrument: loan, guarantee, (quasi-)equity participation, others.
Project size [M€]	Variable.

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Co-funding rate	Depends on the regions.
Project partners/ beneficiaries	No requirement for partners – cities; regions; countries; NGOs; companies; SMEs; educational, social and cultural organisations.
	Just Transition Fund (JTF) [16]
Description	The Just Transition Mechanism (JTM) is a key tool to ensure that the transition towards a climate-neutral economy happens in a fair way, supporting the most affected territories to avoid regional inequalities. It backs the activities directly linked to JTF specific objectives, **including new green jobs from circular bioeconomy**, trhgough productive investments in SME, research and innovation activities, clean energy. In order to unlock and implement JTF resources, EU member states need to prepare strategic Territorial Just Transition Plans. These plans will be annexed to the Cohesion Policy programmes entailing support for the JTF. A designated national managing authority provides information on the programme, selects projects and monitors implementation.
Type of funding	Grant; Technical assistance; Financial instrument: loans, others.
Project size [M€]	< 1.5; 1.5-5; 5-10; 10-20; > 20
Co-funding rate	Depends on the regions.
Project partners/ beneficiaries	From the same country – cities; regions; countries; companies; SMEs; educational organisations.

3.2.4.2. European funding programmes

The several European funding programmes available for circular bioeconomy investment projects were listed and described in the **Table 5**. The reference of each fund category is related to the web-based platform, where is possible to get information about the specific fund at national and regional levels.

The “Connecting Europe Facility” was excluded in the list of funding programmes, because this programme only supports the development of transport and energy infrastructures [6]. **Eureka** is another programme not included in the list of **Table 5**, given that is focused on innovation-driven entrepreneurs working together with research institutes and universities. This funding programme is divided in thematic subprogrammes like [17]:

a) **Eureka Clusters**, driven by communities of large companies, SMEs, universities, research institutes and end user to collaborate on an international and industry-driven R&D project that covers a whole value chain;

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b) **Eureka Eurostars**, driven by SMEs wishing to collaborate on R&D projects that create innovative products, processes or services for commercialisation;

c) **Eureka Globalstars**, for exploring new markets through international R&D based on calls for projects with countries outside of the network;

d) **Eureka Network projects**, applied for international R&D projects aimed to find collaboration between organisations in Eureka countries offering the freedom to design the project proposal and build the ideal consortium;

e) **Eureka InvestHorizon**, which can be possible to develop and enhance business relationships by participating in Eureka international missions and corporate activities.

In this context, **the city government can help innovation-driven companies and SMEs** by pointing them to the opportunity of the EUREKA programme and putting them in contact with universities or research institutes, in order to invest in innovative circular bioeconomy solutions from biowastes and sewage sludge. In addition, the municipality can strengthen the knowledge base on the circular bioeconomy in the city by encouraging local universities and research institutes to participate in relevant EUREKA networks [17].

Table 5. European funding programmes available for circular bioeconomy projects in the cities.

	European Urban Initiative [18]
Description	For the period of 2021-2027, the European Urban Initiative takes into consideration the current envelope of the Urban Innovative Actions. It should provide coherent support for cities that build on all thematic priorities of the Urban Agenda for the EU and **covers all urban areas**. The initiative will include three strands of which the second is based on the Urban Innovative Actions: **1. Support capacity-building:** This strand will foster a community of practice supporting urban practitioners and local stakeholders of all cities throughout Europe. **2. Support for innovative actions:** This strand will support experimentation in the area of sustainable urban development focusing on innovation in governance, strengthening the integrated and participative approaches. This is based on the current Urban Innovative Actions. Co-financing of 80% of the project's activities cost is available with a maximum of EUR 5 million per project. **3. Support for knowledge, policy development and communication:** This strand will support the deepening and evidence-based demonstration of urban facts and policies together with capitalising and disseminating results of experiences expertise "from the ground".
Type of funding	Grant.
Project size [M€]	Variable.
Co-funding rate	Depends on the call.

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Project partners/ beneficiaries	From several countries – city partners: municipalities; infra-municipal tiers; metropolitan authorities; non city partners: regional and national authorities; local agencies; universities and research centres; public bodies.
	European City Facility (EUCF) [19]
Description	The EUCF is a European initiative to support municipalities and local public entities aggregating local authorities across Europe to accelerate investments in sustainable energy and **bioenergy**. Through a EUR 60,000 grant, the EUCF finances services and activities to support the **development of investment concepts**, such as feasibility studies, market analyses, stakeholder analyses, legal, economic and financial analyses, risk analyses and further supporting tasks. The grant is not meant to directly finance investments, which might become a door-opener for many follow-up investments (such as from ELENA, PDAs to private investments). The calls are published twice a year.
Type of funding	Grant.
Project size [M€]	0.06
Co-funding rate	100%
Project partners/ beneficiaries	From the same or other country(ies) – cities, and local public entities aggregating cities located in the EU-27, in one of the EEA-EFTA States (Iceland, Liechtenstein and Norway), and in the UK.
	EU Renewable Energy Financing Mechanism [20]
Description	The mechanism will facilitate a more cost-effective roll-out of renewables across the EU, particularly in areas that have greater access to natural resources or are better suited for it in terms of geography. The mechanism will support new renewable energy projects, **including circular bioenergy projects**. The mechanism links countries that voluntarily pay into the mechanism (contributing countries) with countries that agree to have new projects built on their soil (hosting countries). However, there is no direct link or negotiation between contributing and hosting countries, as is required under other EU cooperation mechanisms. **For contributing countries, the advantages are:** • They can finance renewable energy projects elsewhere that are potentially more cost-effective than renewable energy produced on their own territory would be; • They can access renewable energy production that is absent or scarce on their own territory. **For host countries, the advantages are:** • They can receive additional local investment in renewable energy projects without burden to the national budget; • They can enjoy the benefits in terms of local employment, lower GHG emissions, improved air quality, modernisation of the energy system and reduced dependency on imports.

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Type of funding	Grant; Financial instrument with(out) blending operations.
Project size [M€]	< 1.5; 1.5-5; 5-10
Co-funding rate	Depends on the call.
Project partners/ beneficiaries	From the same country – public and private sector promoters.
	Horizon Europe (HE) [21]
Description	Horizon Europe is the EU's key funding programme for research and innovation. It tackles climate change, helps to achieve the UN's SDGs and boosts the EU's competitiveness and growth. Under Pillar II, HE is divided into 6 clusters, where **HE Cluster 6 is Food, Bioeconomy, Natural Resources, Agriculture and Environment**. This cluster 6 aims at reducing environmental degradation, halting and reversing the decline of biodiversity on land, inland waters and sea and better managing natural resources through transformative changes of the economy and society in both urban and rural areas. **Areas of intervention related to urban circular bioeconomy:** food systems; bio-based innovation systems in the EU's bioeconomy; circular systems. The calls are published yearly.
Type of funding	Grant.
Project size [M€]	< 1.5; 1.5-5; 5-10; 10-20
Co-funding rate	Innovative actions: 100% for non-profit legal entities; 70% for others Research and Innovation actions: 100% Coordination and Support actions: 100%
Project partners/ beneficiaries	From several countries (participation of at least 3 partners from 3 participating countries) – any legal entities based in the EU and other participating countries.
	Innovation Fund [22]
Description	The Innovation Fund is one of the world's largest funding programmes for the demonstration of innovative low-carbon technologies. The goal is to help businesses invest in clean energy and industry to boost economic growth, create local and future-proof jobs. **This is done through calls for large and small-scale projects focusing on, e.g., innovative low-carbon technologies and processes** in

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	energy-intensive industries, including products substituting carbon-intensive ones, carbon capture and utilisation, **innovative renewable energy generation.** Project proponents can consult the calls and apply via the EU Funding and Tenders portal [22]. The calls are published yearly.
Type of funding	Grant.
Project size [M€]	2.5 - 7.5 for small-scale projects; > 7.5 for large-scale projects
Co-funding rate	60% of additional capital and operational costs of large-scale projects. 60% of the capital costs of small-scale projects.
Project partners/ beneficiaries	From the same country – any private or public entity.
	LIFE [23]
Description	**LIFE circular economy and quality of life sub-programme** aims at facilitating the transition toward a sustainable, circular, toxic-free, energy-efficient and climate-resilient economy and at protecting, restoring and improving the quality of the environment. **There are thematic lines, where circular bioeconomy is included, namely through:** • **Recovery of resources from waste:** implementation of innovative solutions to support value-added recycled materials on separate collection and recycling of biowaste. • **Water services:** application of innovative technologies and tools for drinking water and urban wastewater treatment systems. • **Soil:** restoration, protection and improvement of soil health and prevention of soil degradation, like sustain soil fertility and soil biodiversity, restore them after pollution and enhance their capacity to improve water quality through, e.g., compost and sludge recycling. • **Chemicals:** implementation of safe- and sustainable-by-design solutions, including through the development, commercialisation, deployment and uptake of safe- and sustainable-by-design substances, material and product. The overall sustainability should be ensured by minimising the whole environmental footprint from a life cycle perspective. There are other LIFE 2021-2024 sub-programmes where the **bioenergy, bio-based processes, technologies and products applied to biowaste and sludge valorisation can be integrated under a low-carbon approach**, namely: Life Clean Energy Transition; LIFE Climate Change Mitigation and Adaptation. The calls are published yearly.
Type of funding	Grant; Technical assistance.
Project size [M€]	2-10 for circular economy projects; 0.7-2 for Environment governance actions.

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Co-funding rate	Circular economy - 60% for Standard Action Projects, Strategic Integrated Projects, and Technical Assistance.
Project partners/ beneficiaries	From the same or other country(ies) – local authorities (cities); local agencies (city's stakeholders); NGOs.
	INTERREG [24]
Description	Interreg refers to the European Territorial Cooperation under cohesion policy. In 2021-2027, Interreg will support cross-border mobility, and efforts to develop environmental protection, emergency services, skilled jobs and access to public services for the next EU Generation as well as better cooperation governance and a safer Europe. **Interreg includes the following sub-programmes:** **Interreg A** – cross border cooperation. **Interreg B** – transnational cooperation. **Interreg C** – interregional cooperation to reinforce the effectiveness of cohesion policy: Interreg Europe; URBACT; Interact; ESPON. **Interreg D** - outermost regions' cooperation. Interreg Europe 2021-2027 helps regional and local governments across Europe to develop and deliver better policy by creating an environment and opportunities for sharing good practices. The fund supports projects around the following priority axes, **which the circular bioeconomy (bioenergy and bioproducts) can be developed on any axe**: ♦ Strengthening research, technological development and innovation. ♦ Enhancing the competitiveness of SMEs. ♦ Supporting the Shift towards a low-carbon economy in all sectors. ♦ Protecting the environment and promoting resource efficiency. Through **interregional cooperation projects**, partners must identify a common interest and work together for 3-5 years in 2 phases. Initially, partners will share experience, ideas and know-how about how best to deal with the issue at hand. The project activities in this phase include exchange good practices in order to produce action plans; communication and dissemination; management and coordination. **Each partner region must:** produce an action plan; set up a stakeholder group; participate in the Interreg Europe Policy Learning Platforms. In the second phase, each partner must monitor the progress of the implementation of their action plan and report to the lead partner. **Pilot actions** may be supported during this period. Interreg Europe calls are published yearly. It is suggested to show a project with between 5 and 10 partners from a minimum of 3 countries.
Type of funding	Grant; Technical assistance; Financial instrument: loans, guarantee, equity and guarantees.
Project size [M€]	1-2 for interregional cooperation projects; 0.01-0.08 for pilot projects.

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Co-funding rate	85% for public bodies; 75% for private non-profit bodies; 50% for public and private non-profit bodies from Norway.
Project partners/ beneficiaries	From several countries – cities; regions; countries; Managing authorities/intermediate bodies on Investment for Growth and Jobs programmes or European Territorial Cooperation; Agencies, research institutes, thematic and non-profit organisations engaging with their local policymakers.
	URBACT [25]
Description	URBACT's mission is to enable cities to work together and develop integrated solutions to common urban challenges, by networking, learning from one another's experiences, drawing lessons and identifying good practices to improve urban policies. Depending on their local situation and needs, **cities may join URBACT by taking part in 3 different types of networks/calls:** • **Action Planning networks**: supporting cities in addressing a policy challenge by producing an integrated action-plan. • **Implementation networks**: supporting cities with the delivery of an existing integrated urban strategy/action-plan. • **Transfer networks**: supporting cities in adapting and re-using a good practice to enhance their urban policies. **URBACT supports city's activities by:** • **Innovative actions**: transfer mechanism for tested innovative solutions. • **Capacity Building**: through transnational URBACT networks, programmes and national level capacity-building activities, URBACT aims to increase the capacity in integrated and participatory approaches of cities, urban practitioners and local stakeholders that are part of URBACT networks. • **Knowledge, policy & communication**: URBACT will provide input to the Knowledge Sharing Platform with knowledge and methods on sustainable urban development that are gained through URBACT networks and knowledge activities. The calls have been launched annually and the **cities can develop these activities in the field of circular bioeconomy (bioenergy and bioproducts) from the recycling and valorisation of municipal biowastes and sewage sludge.**
Type of funding	Grant.
Project size [M€]	≤ 0.6
Co-funding rate	85% for partners from less developed and transition regions; 70% for partners from more developed regions; ≤ 50% for partners from Norway and Switzerland.
Project partners/ beneficiaries	From several countries – city partners: municipalities; infra-municipal tiers; metropolitan authorities; non city partners: regional and national authorities; local agencies; universities and research centres; public bodies.

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3.2.4.3. Technical assistance and advisory support

The several technical assistance and advisory support available for circular bioeconomy investment projects were listed and described in the **Table *6***. The reference of each fund category is related to the web-based platform, where is possible to get information about the specific fund at national and regional levels. The funding can be provided as direct technical support and advisory or grant.

Table 6. Technical assistance and advisory support available for circular bioeconomy projects in the cities.

	European Energy Efficiency Fund (eeef – TA) [26]
Description	eeef - TA supports projects in the sector of energy efficiency, small-scale renewable energy (**which includes bioenergy production**) and public urban transport. Projects must stimulate savings of at least 30% in terms of primary energy and CO_2e emissions. TA beneficiary is supported by way of allocating consultant services to the planned investment programmes with feasibility studies, energy audits and evaluating the economic viability of investments and legal support. **There is no deadline, the application procedure is open on a first-come-first-serve basis** and it is subject to availability of funds. The TA beneficiary will be informed by the eeef team within 20 days after submission. The winner beneficiary must complete the agreed TA work scope, including publishing a tender for the project implementation works, within a 2-year timeframe.
Type of funding	Technical assistance (TA).
Project size [M€]	> 5
Co-funding rate	Leverage factor for technical assistance: 1:20.
Project partners/ beneficiaries	From the same country – cities; regions; universities; public hospitals; other public entities.
	InvestEU Advisory Hub – JASPERS [27, 28]
Description	The InvestEU Advisory Hub is the central entry point for project promoters and intermediaries seeking advisory support and technical assistance related to centrally managed EU investment funds and Advisory initiatives under the four InvestEU policy windows, as well as under a cross-sectoral advisory component. **The InvestEU Advisory Hub offers support for** project preparation & development; capacity building to promoters, financial and other intermediaries; market development activities; communication and awareness-raising. The Advisory Hub will not just continue the existing schemes, but build on them and improve them to better meet the needs of local and regional governments and help them turn their ideas into successful projects (EIAH, JASPERS, ELENA).

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	Joint Assistance to Support Projects in European Regions (JASPERS) offers free of charge assistance for local authorities (cities and regions) and promoters from the early stages of project conception through to the final application for EU funding. The beneficiaries can be from **Portugal, Spain, Greece and Italy**. The **assistance may cover** project review and recommendations; horizontal tasks; strategic support; capacity building; implementation support; independent quality review. **JASPERS supports projects in 5 areas, including:** ♦ **Energy and solid waste (namely, building waste-to-energy facilities to recover energy from waste and reduce landfilling of waste);** ♦ **Water and wastewater.**
Type of funding	Technical assistance.
Project size [M€]	≥ 50 for environmental large projects; ≥ 75 for transport or other sectors large projects.
Co-funding rate	JASPERS assistance is free of charge for local authorities and promoters.
Project partners/ beneficiaries	From the same or other country(ies) – local, regional and national authorities; other entities with public interest.
	Just Transition Platform [29]
Description	The Just Transition Platform **shares all the relevant knowledge and information needed by authorities and beneficiaries, including funding opportunities, relevant regulatory updates or sector-specific initiatives on circular bioeconomy.** The Platform also promotes actively the exchange of best practices among stakeholders, and offers technical and advisory support to stakeholders involved in activities related to the JTM. The Platform will also provide project and expert databases to guide stakeholders and cities toward relevant knowledge, evaluations, project examples and good practices.
Type of funding	Platform of databases, regulation, funding opportunities, initiatives and expert networks for cities, regions and countries.
Project size [M€]	N/A
Co-funding rate	N/A
Project partners/ beneficiaries	N/A

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	LIFE Technical Assistance Projects [23]
Description	The Technical Assistance (TA) Projects 2021-2027 may include the following categories, **under the Environment line which integrates waste and water management, and circular bioeconomy projects**: **1. Projects for the preparation of Environment SIPs (TA-PP):** These projects are aimed at providing financial support to help applicants to prepare a Strategic Integrated Project (SIP) for national and regional waste management plans, national or regional circular economy action plans, strategies, roadmaps, and river basin management plans, for a maximum LIFE contribution of EUR 70,000 and topic budget about EUR 288,000. **2. Projects to facilitate the upscaling or replication of results (TA-R):** These projects are aimed to facilitate the upscaling or replication of results funded under the LIFE programme or, where relevant to fulfil the objectives of the LIFE programme, under other EU funds, including by preparing the access to other EU financial instruments. **3. Projects for the capacity building of Member States authorities with low effective participation (TA-CAP):** These TA projects aim at building up the capacity of member states' authorities to improve effective participation in the LIFE programme. The range of project budgets is EUR 400,000 to 425,000 for 36 months. **Eligible activities are the following:** • Implementation actions, such as training activities targeted information campaigns; • Monitoring and evaluation actions to assess the actual impact of the implementation actions; • Communication and dissemination actions; • Actions for project management and quality control.
Type of funding	Grant.
Project size [M€]	< 0.5
Co-funding rate	95% for TA-CAP; 60% for others.
Project partners/ beneficiaries	From the same country – local authorities; local agencies (city's stakeholders); NGOs.

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3.2.4.4. Financial institution instruments

The financial institution instruments available for circular bioeconomy investment projects were listed and described in the **Table 7**. The reference for each fund category is related to the web-based platform, where is possible to get information about the specific financial instrument at national and regional levels. The financial instruments can be provided for the investment projects in the form of loans, guarantees and equity.

Table 7. Financial institution instruments available for circular bioeconomy projects in the cities.

	EIB Municipal Framework Loans [9]
Description	EIB can provide **loans for urban and regional projects in the area of circular bioeconomy for waste and water sectors**, such as: **1. Investment loans for single large investment projects:** EIB lends to individual projects for which total investment cost exceeds EUR 25 million. The EIB provides loans for up to 50% of the total cost of projects in the agriculture, forestry and forest-based sector, blue economy and solid waste management sectors and value chains. Projects must be in line with the priorities of the EIB such as transition to a low-carbon and climate resilient economy. Loans are awarded directly as minimum amounts of EUR 7.5 million for investment projects of minimum EUR 15 million or through intermediary banks for smaller amounts (overview). **2. Multi-component (framework) loans:** The projects, most frequently regarding infrastructure, energy efficiency/renewables, transport and urban renovation, are re-grouped in multi annual investment programmes. Framework loans are the most flexible financial instrument for cities and regions. **Conditions**: Financing conditions depend on the investment type and the security offered by third parties (banks, other financial institutions or the parent company). **Interest rates**: Interest rates can be fixed, floating, revisable or convertible (i.e., allowing for a change of interest rate formula during the lifetime of a loan at predetermined periods). **Fees**: In certain cases, EIB may charge fees for project-appraisal, legal services, commitment, non-utilisation, etc. **Repayment**: Loan repayment is normally on a semi-annual or annual basis. Grace periods for capital repayment may be granted for a project's construction phase.
Type of funding	Loans.
Project size [M€]	≥ 25
Co-funding rate	Loans cover up to 50% of the project's total cost (on average this share is about one third).
Project partners/ beneficiaries	No requirement for partners – public and private sector promoters.

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	InvestEU Fund [30]
Description	The InvestEU Fund is a market-based and demand-driven instrument that supports the following Policy Windows **linked directly to circular (bio)economy** on **sustainable infrastructure** (financing projects in sustainable energy, waste, water, etc.) and **research, innovation and digitalisation** (financing projects in R&D, taking research results to the market, scaling up innovative companies, etc.). EIB and other InvestEU implementing partners provide direct and intermediated financing solutions for both private and public projects promoters. Financial intermediaries should also consult the offering of implementing partners active in their regions - eligible InvestEU Implementing Partners. Small mid-caps, SMEs and social or micro-enterprises should apply to their local commercial or public banks, whose financial products are covered by the EU guarantee in their country/region. The local intermediary will inform them if a particular financing programme is covered by the InvestEU Fund - access to finance.
Type of funding	Loans, guarantees and equity investments.
Project size [M€]	N/A
Co-funding rate	N/A
Project partners/ beneficiaries	No requirement for partners – Private entities (companies, SMEs, etc.); public sector entities (territorial or not); mixed entities (PPPs); NGOs.
	Public Sector Loan Facility [31]
Description	The Public Loan Facility helps to address the socio-economic challenges of the transition to climate neutrality in the most affected territories. The Facility only targets public entities, creating preferential lending conditions for projects that do not generate enough revenue to be financially viable. It is a combination of grants from the EU budget and EIB's loans. The grant support will be added to the EIB loan and reduce the financial burden for beneficiaries and increase the attractiveness of the investments. Advisory support is provided to beneficiaries through the InvestEU Advisory Hub (**Table 6**).
Type of funding	Grants; Loans.
Project size [M€]	N/A
Co-funding rate	N/A
Project partners/ beneficiaries	No requirement for partners – Public sector entities (territorial or not) and public-sector type entities.

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3.2.4.5. Alternative financing schemes

The alternative financing schemes available for circular bioeconomy investment projects were listed and described in the **Table *8***. The "on-billl-financing" (lending scheme for financing energy efficiency improvements that uses the utility bill as the repayment vehicle) and "soft loans, guarantees" (financing schemes for energy retrofitting of buildings) schemes were not included in this list, since they are out of the HOOP's scope [6].

Table 8. Alternative financing schemes available for circular bioeconomy projects in the cities.

Scheme	Description
Energy Citizen Cooperatives [32]	Energy cooperatives refer to a business model where citizens jointly own and participate in renewable/energy efficiency projects. After purchasing a cooperative share and becoming a member or co-owner of local energy project, members share in the profits and often are given the opportunity to buy the electricity at a fair price. In addition, members can be decision-makers in the cooperative on what and where the cooperative should invest and be consulted about setting the energy price. Citizen cooperatives can potentially invest in projects covering all SECAP (Sustainable Energy and Climate Action Plan) sectors, **including bioenergy projects from anaerobic digestion and/or waste-to-energy facilities**.
Crowdfunding [7, 33]	A crowdfunding platform pools resources of different actors. For small-sized initiatives, a majority up to 100% of the capital required can be crowdfunded. For larger size investments, crowdfunding may be a small part of the total capital. The **crowdfunding shows many advantages, such as: t**he city is able to reach a large group of people that can contribute to the city/project and this can create a lot of buzz and awareness around the project; if the project reaches the required amount within the set time period, this can be a strong signal for its market potential. Then, financial institutions will be more willing to invest in the initiative; it can be combined with other forms of finance. **There are different types of crowdfunding, namely:** • **Peer-to-peer lending:** it is very similar to traditional lending. The lenders expect repayment of the borrowed amount together with interest. • **Rewards-based crowdfunding:** the participating individuals expect rewards or returns for the donations or investments they make. This can be, for example, by receiving goods or services for free, at a discount, before the release date and so on. This can also be non-financial returns, for example by contributing to the realisation of social goals. • **Equity-based crowdfunding:** it is quite similar to issuing shares to investors. The funders receive an equity stake that is relative to the amount they invest in the funded company or project. **Cities, regions, countries and other kind of entities can use this platform, though its participation is dependent of national public laws and rules.** Crowdfunding can potentially finance projects in all SECAP sectors, **including circular bioeconomy projects at local, regional and national levels**. There are several crowdfunding platforms online for circular initiatives, such as Kickstarter, Indiegogo, and Gofundme. There are also platforms focused on social and environmental investments: Oneplanetcrowd, LITA.co, StartSomeGood. It is also possible to make use of the European Crowdfunding Network [33].

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Energy Performance Contracting (EPC) [34]	Under an EPC arrangement, an external organisation (Energy Service Company - ESCO) implements a project to deliver energy efficiency, or a renewable energy project (**including bioenergy production**), and uses the stream of income from the cost savings or the renewable energy produced to repay the costs of the project (including the costs of the investment). The approach is based on the transfer of technical risks from the client to the ESCO based on performance guarantees given by the ESCO. The EPC ESCO remuneration is based on demonstrated performance, as the level of energy savings or energy service.
Green Municipal Bonds [35]	Bond is a debt investment in which an investor loans money to an entity, which borrows the funds for a defined period of time at a variable or fixed interest rate. Bonds are issued by companies, municipalities and states to raise money and finance their projects, **including in the field of circular bioeconomy at waste and water sectors**. Green bonds are all those instruments which are used exclusively to fund qualifying green investments. They can be made attractive via tax-exemptions.
Revolving Loan Funds [7]	A revolving loan fund is addressed to multiple sustainable energy projects, **which include bioenergy production from waste and water sectors**. Revolving funds can provide loans for projects that do not have access to other types of loans from financial institutions, or can provide loans at a below-market rate of interest (soft loans).
Lease Financing [7]	**In general, there are two types of commercial leasing:** With a **financial lease**, the lessee becomes the legal owner of an asset after the contract period, whereas with operational lease, the assets will be returned to the lessor. **Operational product lease**, also referred to as Product-as-a-Service, can be considered a new business model that supports circular economy. Product leasing is a service compensation model in which the customer pays for the utilisation of the product over an agreed period. In this period, the customer will not own the product. Instead, the manufacturer holds the ownership of the product and is responsible for its delivery, maintenance, and take-back. This also extends the product's life and reduces resource use. After the return of a product, it can be refurbished or remanufactured, after which it can be offered under a new life lease.
Social Impact Bonds (SIB) [7]	A SIB enables private investments in **projects that contribute to tackling societal challenges**. The return or repayment of the investment is contingent upon the achievement of the social outcomes of the project, which means that the private investors bear the financial risks of the project. SIBs are issued by public sector entities or governmental authorities. On a project level, the public organisation works in close collaboration with the implementing entities (social enterprises), investors, and sometimes with intermediaries. SIBs aim to create long-term results with sustainable impact. SIBs provide **opportunities for city governments to raise funds to invest in innovative circular city initiatives** without financial risk. SIBs pay out only when the project is completed, and only if it has reached its goals. In other words, social impact bonds allow city governments to achieve a social goal while remaining budget-neutral. The SIB-contract is generally less strict than a regular bond contract. If the implementation is not going as planned, adjustments can be made along the way. ABN AMRO and SITRA are examples of financial organisations that offer support to set up SIBs and they also invest in SIBs themselves.

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3.2.4.6. Support services

The European cities and their circular bioeconomy investment projects may have support by "Support Services" from different digital platforms, where they are listed and described in the **Table 9**.

Table 9. Support services available for circular bioeconomy projects in the cities.

Support Service	Description
InvestEU Portal [36]	The InvestEU Portal allows project promoters to reach investors worldwide. Adding projects to the portal is free of charge. The **sectors covered are:** Knowledge and digital economy; **Energy Union, including bioenergy;** Transport; Social infrastructure and other; **Resources and environment, where biowastes and sewage sludge are included;** Financing for SMEs and mid-caps.
European Investment Advisory Hub (EIAH) [37]	The EIAH aims to strengthen support for project development and preparation by assisting Member States and other promoters to identify investment needs and to prioritise, prepare and structure projects in the EU. Services available via the EIAH include project development support throughout all stages of the project cycle (from pre-feasibility to financing), as well as upstream or policy advice on market studies, sector strategies, and project screening. Capacity building services are also provided by this assistance scheme. **The projects can include circular bioeconomy activities.** Financial advice is also provided to boost companies' ability to access adequate sources of financing. More horizontal assistance can be obtained via methodological guidance and trainings on investment projects (e.g., tendering process, cost benefit analysis, etc.), access to finance and use of EU funds.
URBIS [38]	URBIS is a dedicated urban investment advisory platform within the EIAH, providing advisory support to urban authorities to facilitate, accelerate and unlock **urban investment projects, programmes and platforms, including in the circular bioeconomy field**. The activities supported are related to awareness raising of existing instruments, programmes, services; tailor-made technical and financial advice to cities; exploring innovative financing approaches for city investments. **Some eligibility criteria are addressed to:** advice should be given on smart, green and socially inclusive investments as addressed in the EU Urban Agenda; the support should be for or on behalf of urban authorities (may involve either public or private entities); advice will be given for integrated urban investment programmes, with typically 3-5 years horizon. Investment programmes given support should have an overall indicative investment target of at least EUR 20 million. The advice may also be given to stand-alone projects of significant size, typically over EUR 20 million. Urban authorities wishing to access the service should first submit a request form.
Financial Instruments Advisory (fi-compass) [39]	fi-compass is a platform for advisory services on financial instruments under the European Structural and Investment funds (ESIF) and microfinance under the Programme for Employment and Social Innovation. fi-compass is designed to provide practical know-how and learning tools on financial instruments, promoting access to **finance and investment in agriculture and bioeconomy**. To support managing authorities in their programming exercise in the post-2020 period, *fi-compass* recently published a study on financial needs in the agriculture and agri-food sectors in 24 EU Member States.

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Knowledge Centre for Bioeconomy [40]	The Knowledge Centre for Bioeconomy is an EC initiative on better knowledge management for policymaking on the bioeconomy, which **provides important information related to circular bioeconomy** events, publications, policies at European, regional and local levels, projects, stakeholders, case studies, etc. This platform has a bioeconomy country dashboard, where is possible to identify policies and other initiatives dedicated to the circular bioeconomy for each Member State.
European PPP Expertise Centre (EPEC) [41]	The European PPP Expertise Centre supports the public sector across Europe in delivering better public-private partnerships (PPPs). **EPEC covers the following activities, including related to circular bioeconomy actions:** • Sharing good practice (address practical issues in implementing PPPs, share PPP market intelligence and develop PPP guidance and tools); • Assisting policy development (PPP legal and regulatory frameworks, PPP institutional arrangements and processes for preparing, approving and managing PPPs); • Supporting PPP project preparation (high-level strategic advice, early-stage involvement and support tailored to individual projects).

3.3. The Recovery and Resilience scheme

The Recovery and Resilience Facility (RRF) is the key instrument at the heart of EU Next Generation to help the EU emerge stronger and more resilient from the COVID-19 pandemic crisis. Small cities and tourist cities, especially, have been subject to significant economic consequences. RRFs incentivises the adoption of clean technologies and renewables, renovating buildings to increase their energy efficiency, etc. [42]. For this reason, **circular bioeconomy processes and technologies is being financed through Recovery and Resilience grants and loans in order to decarbonise the European cities and economies.**

The TEG summarised the **5 high-level principles for sustainable recovery and resilience, which can be applied to circular (bio)economy funding and projects** [43]**:**

1. Stimulating the creation of green jobs and boosting circular economy and low carbon technologies and activities.

2. Encouraging investments on social, economic and ecosystem resilience.

3. Ensure that recovery investments, economic activities, grants and spending at least DNSH, according to the EU Taxonomy.

4. Apply all measures to both private and public sectors.

5. Collaborate internationally to better serve resilience, with mutual supports agreements at regional level.

Below it has picked out a couple of the **most important of such funds that could help to build circular bioeconomic resilience in regions and cities** [42].

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The Recovery and Resilience Facility (RRF)

The RRF is a temporary recovery instrument, realising EUR 723.8 billion in loans (EUR 385.8 billion) and grants (EUR 338 billion) [42]. The package of reforms and public investment projects should be implemented by 2026. The Plans should effectively address challenges identified in the European Semester, particularly the country-specific recommendations. The Facility is structured around 6 pillars: green transition; digital transformation; economic cohesion, productivity and competitiveness; social and territorial cohesion; health, economic, social and institutional resilience; policies for the next generation. The National RRPs are available to consult on the website of the Facility [42].

Just Transition Mechanism (JTM)

The JTM provides targeted support to help mobilise at least EUR 150 billion over the period 2021-2027 in the most affected regions, to alleviate the socio-economic impact of the climate-neutral transition, through 3 pillars: 1) a new Just Transition Fund of EUR 40 billion; 2) InvestEU Just Transition scheme mobilising EUR 30 billion; 3) EIB public sector loan facility of EUR 10 billion [29].

3.4. The European Circular Bioeconomy Fund for private sector

In order to understand better the European Circular Bioeconomy Fund (ECBF), the contents in this subchapter were organised in the form of FAQ, based on the information available on the website of the fund [44]. **The investment projects on valorisation of municipal biowaste and wastewater sludge into bio-based products and bioenergy production are eligible for financial support from the ECBF, helping companies and SMEs, and bio-based industries, that operate in the cities and regions.**

1 What is the scope of ECBF?

ECBF is the first venture fund exclusively focused on the circular bioeconomy in Europe. The ECBF invests in and partners with ambitious and visionary European entrepreneurs to accelerate circular and bio-based industries in Europe.

2 Which kinds of financial instruments are provided by the ECBF?

The ECBF provides equity, quasi-equity, and debt funding.

3 What are the beneficiaries of the fund?

SMEs, midcaps, large caps, and special purpose vehicles/entities.

4 What is the ECBF's objective?

ECBF funds bioeconomy projects and companies in the demonstration and commercial development phases, filling the late-stage funding gap to bring products to the markets.

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5 What is the ECBF's budget?

The ECBF aims to raise EUR 250 million to provide access to finance to innovative circular bioeconomy companies and projects of various sizes.

6 What is the ECBF's sectors of investment?

The ECBF focuses on 6 sectors of the circular bioeconomy:

- Blue economy & Fishery.
- Agro, Farming and Forestry.
- Basic Materials & Chemicals.
- Packaging.
- Nutrition.
- Home & Personal Care.

Hence, the investment projects on valorisation of biowaste (food, garden and park, post-consumer wood) and sewage sludge into new innovative bioproducts and bioenergy (biogas, biofuels, etc.) may be developed under those 6 sectors.

The target industries subsectors included in the circular bioeconomy are:

- Circular business models (re-use, recycling, waste stream utilisation);
- Biorefineries and conversion technologies;
- Biomass production: increased output and reduced footprint;
- Bio-based materials: construction, polymers, fibres, composites.

7 What is the ECBF's geographical investment target?

The ECBF's geographical investment focus are the 27 Member States of the EU, as well as countries that are associated with the EU Horizon.

8 What are the technology readiness levels required for the investment projects?

Investments are focused on projects with TRL of 6 to 9 and some first significant commercial traction.

9 What is the investment size for the projects?

The investment size ranges from EUR 2.5 - 10 million.

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10 Do projects have to comply with any criterion?

All projects have to commit to ESG criteria, which is a condition for an investment. Contributions to CO_2 reduction, biodiversity, circularity, mitigation toxic substances are highly valued.

11 What role can cities play in the ECBF?

Projects that implement and demonstrate technologies for the valorisation of biowaste could be eligible for financial support from the ECBF. Such projects often require collaboration between different private and public organisations in which city authorities can play an important facilitating role.

3.5. Mobilising blended investment and finance for circular clean and bioeconomy projects

Mobilising clean and circular investments will depend on obtaining finance from both local and international sources, and also from blended (private-public) financing. International capital providers may find it easiest to invest in large, bankable assets, but action is also needed to better connect financial markets with projects for end-use decarbonisation and to build capacity for local currency fundraising. While clean energy and circular transitions rely on much higher levels of both equity and debt, capital structures are likely to hinge on the mobilisation of more debt, including through expanded use of project finance and third-party arrangements, and it is used to finance over half of all investment by 2030 [45].

While many actions are needed to mobilise the necessary capital for clean and circular transitions, **2 cross-cutting themes in particular need urgent consideration by public and private decision makers** [45]:

► **Redoubling international support:**

An international catalyst is needed to boost clean and circular investment. Mobilising additional private capital on the back of these commitments will rely in particular on the enhanced **deployment of blended finance to catalyse clean and circular bioeconomy project developments**. This will need to include the packaging of a range of instruments and approaches ranging from guarantees to concessional loans to first-loss equity. Such packages are critical to improve the risk profiles of some market-ready investments and to support development of small-scale projects that lack a track record with banks. It will also be important to deploy risk capital in sectors at early stages of readiness to support, for example, industrial decarbonisation, which currently accounts for a small share of DFIs climate finance commitments, and to help in cases where risks are hard to mitigate, such as energy access projects for vulnerable communities and cities or in remote areas [45].

► **Mobilising wider pools of private capital:**

The results highlight challenges for ESG regulation and sustainable finance taxonomies, as well as for companies in their corporate planning and decision making. The key challenge is how to ensure that adequate financial channels remain open to support these “contingent” and “transition” investments without this becoming a loophole for investments that are not aligned with the Paris Agreement, or that allow for greenwashing [45].

One of the most important ways for companies to send appropriate signals about investment in circular and clean projects is by setting credible (science-based) targets that include measures to reduce emissions, and to

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complement this by improving the quality and quantity of metrics, governance and key performance indicators that allow the financial community to assess their progress towards these targets. A number of companies and public authorities around the world have set ambitious targets, but their potential impact remains uneven [45].

It is necessary to develop better and more consistent reporting and assessment standards and improved ways to translate climate performance data into investment. **These recommendations are applicable for private sector, but also for public sector including municipalities, regional bodies and national agencies** [45].

3.6. Application procedure for European funding programmes

The guide presented in this subchapter helps the municipalities and other kind of organisations to make a good practice in terms of application procedure for European funding programmes, based on the European online manual for funding tenders' opportunities [46].

1st Identify a relevant funding programme.

In order to receive funding for a project, first identify a relevant funding programme. Also, select a call for proposals that best fits the description of the project. Then, carefully follow the specific application guidelines. In subchapter **3.2.4** is possible to identify a relevant funding programme and respective call in its web-based reference or here in the European online manual for funding tenders' opportunities [46] and in the European website about regional and urban programmes [12].

Since each funding programme prioritises a different EU objective, checking the priority of each funding programme is vitally important. Each programme has a different way of managing the project and they finance different types of actions.

Hence, the project will only be accepted for funding if the priorities match those of the funding programmes objectives. It is therefore important to clearly outline the projects objectives and joint activities needed at a European level.

Since the project will likely need a source of co-financing, check for internal resources. Be prepared for the time and hard work that goes into writing a project proposal. So, making sure there are enough staff resources at hand is critical.

Finally, keep up to date with information regarding the chosen funding programme. For example, subscribe to the newsletters, or study the work programmes which can be found on the respective websites.

2nd Choose amongst the call for proposals.

It is important to study all relevant documents such as the call for proposals, the Programme guide, the Applicants guide and the application form. Summarising the most important information will help to understand more about the specific calls.

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The most important elements to consider in a call for proposals are the objectives, eligible actions, eligibility criteria (e.g., eligible countries, min and max budget, eligible expenditure, eligible activities), co-financing rules, administrative requirements, application form needed, selection process and evaluation methodology, and the deadline for submission. Choose here the current open calls in the European online manual for funding tenders' opportunities [46].

3rd Developing a project.

Construct a summary of the project idea and write a preliminary 2-3 pages about the objectives, target group, milestones/main deliverables, and the ideal project partnership (e.g., types of organisations). To develop a good project, make sure to detail the situation that the project wishes to improve thanks to the EU funding. This is important for the funding programmes to know so that they can evaluate project impacts. The sequence of actions during the project should be logical and linked to the project description. The expected results and quantitative estimates of impacts should also be clearly defined. Finally, make it clear which actions the project should fund. For more information on how to develop a project, see the INTERREG Europe guide here [24].

4th Identifying partners.

The active participation of the main key stakeholders affected by the problem addressed is key to ensuring a successful project partnership, as well as a series of experts to help solve the problem throughout the project.

To identify this partnership, think about who is affected by the problem; who will use the solutions/tools developed in the project and how they can be involved; and who can help with solving the addressed problem. See here to identify potential project partners through the European online manual for funding tenders' opportunities [46].

5th Communication, dissemination and exploitation.

Communication, dissemination and exploitation are crucial horizontal activities which must be taken up in EU-funded projects. These activities not only inform about the project and promote its results, but they also ensure that other entities can make concrete use of those projects results and learn from success and/or mistakes.

The EU funding programme will better consider projects that contain good strategies to share and invite other entities to exploit results. This is seen as a key added value in a project proposal. See here for more guidelines on dissemination and exploitation activities in European online manual for funding tenders' opportunities [46].

6th Combining EU funds.

Regarding EU funding programmes which focus on achieving similar objectives, it is possible to combine them which can help to boost project results. For example, synergies can be exploited between H2020 or the new Horizon Europe and LIFE actions. These programmes develop synergies with other programmes too. For example, **in the promotion of bioenergy production from biowaste and sewage sludge as an alternative fuel**. See here [47] for more details on synergies between funds through the guidance "Enabling synergies between European Structural and Investment Funds, Horizon 2020 and other research, innovation and competitiveness-related Union programmes".

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3.7. HOOP's Circular Investors Board

With the aim to provide a framework to exchange on lessons learned and best practices in the financial sector, **HOOP established a Circular Investors Board (CIB) consisting of a selection of leading sustainable finance investors and financiers**. Under the guidance of the HOOP project partners RdA Climate Solutions, Bax & Company and CETENMA, those investors will act mainly as advisors to the project yet may also, after the completion of the project, invest in sub-projects developed during or triggered by HOOP. The virtual CIB meetings have been chaired by Jorge Rodrigues de Almeida (RdA Climate Solutions).

Hence, the CIB connects investors and financiers who recognise the benefit of best practices, standardised evaluation frameworks, and decision-making tools and have an interest in bankable investment projects in the circular (bio)economy.

The CIB composition is detailed and updated on website of HOOP [2], which consists of around 20 investors, from business angels to larger financing institutions, with a background in sustainable finance and investment. **The mandate of the CIB is aligned with the HOOP project duration until the 30th of September 2024. The Board cannot be considered a legal structure.**

3.8. Success stories on circular bioeconomy investments

In this subchapter is listed some **inspiring stories resulted from the success on the use of funding and financial instruments and sources applied for circular bioeconomy projects**, **in urban biowaste and sewage sludge valorisation into innovative bio-based products**. These case studies are listed and summarised in the following **Table 10**, and described in detail in Annex **5** for each case study.

Table 10. Success stories on circular bioeconomy from the valorisation of biowaste and sewage sludge into new bioproducts and bioenergy.

	Nasekomo	PeelPioneers	TrÆls	PYREG	Berliner Pflanze
Waste feedstock	Biowaste (food waste) Biomass by-products from agroindustry and agriculture activities	Citrus peel waste from beverage and food industries, and from Biowaste (HoReCa, supermarkets)	Post-consumer wood waste from cities (biowaste), companies, civil construction, etc. Wood by-products from processing and manufacturing	Biowaste (food, green, wood) Sewage sludge Organic agricultural waste Organic industrial waste Mixed waste (rubber, plastics)	Sewage sludge

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Bioprocess conversion / technology	Black Soldier Fly larvae	Biorefinery	Sustainable hand manufacturing	Pyrolysis (carbonisation)	
Bioproducts	Insect protein Bio-oil Soil fertiliser	Bio-oils (fragrances) Dietary fibres D-Limonene solvent Pulp food	New wood furniture with innovative design and utility Wood in/outdoor environments Art & decor products	Biochar Renewable heat	Long-term mineral NP fertiliser
Target markets	Aquaculture Animal feed Agriculture	Cosmetics and body care products Perfumes Cleaning products Food industry Animal feed	Companies Stores (clothing, etc.) Events (festivals, congresses, fairs, etc.) Hotels, restauration Public places (gardens, playgrounds, etc.) Art e décor Civil construction	Agriculture Forestry Animal industry Cement industry and civil construction	Agriculture Horticulture
Maturity level	Company	Start-up growing to company	SME (growing)	SME (growing)	Company
Country	Bulgaria	The Netherlands	Denmark	Germany	Germany
References	[48, 49]	[50, 51, 52]	[53, 54]	[55]	[56, 57]

3.9. Barriers and risks on financing circular bioeconomy

Multiple barriers addressed to market failures, public and private financing, have not developed as quickly as expected the circular bioeconomy, as explained in the **Table 11**, which also illustrates the correlation between different categories of incentives/instruments and specific market barriers/risks [5].

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Table 11. Main barriers/risks addressed to boost and financing circular bioeconomy for each category of incentive.

Category	Barriers/risks
Economic / Financial	• Level playing field. • Resource price distortion (e.g., cost of secondary materials vs primary materials). • Limited access to capital. • Transaction costs/project granularity and fragmentation. • High initial costs. • Affordability constraints. • Financing risks. • Market and demand risks.
Technological	• Lack of product longevity in business models. • Early-mover externalities due to low diffusion of technologies and underdeveloped supply chain and distribution networks. • Lock-in effects (due to dominant, fully depreciated linear technologies/products). • Innovation externalities (i.e., innovation policies and R&D investments don't factor 'linear' spill overs). • Risk perceptions associated with new technologies. • Availability risks (more fragmented supply chains compared to linear business models). • Projects heterogeneity (circular economy requires a novel business taxonomy).
Policy / Regulatory	• Lack of integration of the costs of externalities. • Environmental externalities not priced in 'tragedy of the commons'. • Fiscal distortions. • Lack of or inadequate regulatory frameworks. • Lack of or inadequate implementation or enforcement of policies. • Permitting and tendering risks (circular models tend to have longer implementation time). • Volatile policy and regulatory context.

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Information and awareness	• Lack of financial knowledge about the circular economy. • Hidden costs of linear practices. • Difficulty in appraising the quality of the investments. • Imperfect information/lack of awareness. • Lack of performance data and tools • LCA analysis not available.
Capacity	• Insufficient value chain collaboration. • Lack of relevant skills/ experience (especially in SMEs). • Limited understanding of co-benefits (e.g., improved business resilience). • Lack of common metrics and targets. • Circular benefits not shared.
Organisational / Institutional	• Insufficient action by first movers. • Organisational set-up: lack of internal decision-making processes, accountability, etc. • Perceived low return of circular economy investments. • Weak corporate governance standards. • Lack of long-term vision. • Linear risks not factored in business decisions.
Behavioural / Cultural	• Insufficient market participation by consumers. • Split incentives (principal-agent problem). • Entrenched cultural norms/social barriers. • Behavioural inertia (e.g., when environmental benefits of circular models are not clear). • Irreversibility and the option to wait.

Focus on environmental awareness and behavioural change in the cities is a key factor to support ambitious circular (bio)economy policy. The 2020 Circular Economy Action Plan recognises this aspect and is committed to promote, under the ESF, that investment in education and training systems, lifelong learning, and social innovation. CF will also help funding circular economy awareness raising, cooperation and capacity building [5].

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3.10. Circular Bioeconomy resources and tools

There are some additional non-financial resources and tools, listed in **Table 12**, that may be useful for the cities and regions to implement circular bioeconomy initiatives and projects from the valorisation of urban biowastes and sewage sludge.

Table 12. Complementary resources and tools supporting circular bioeconomy initiatives in cities and regions.

	Category	Ref.
Circular City Centre (C3)	Digital platform	[58]
Circle City Scan Tool	Digital tool	[59]
Circular City Re.Solution	Digital platform	[60]
European Bioeconomy Network (EuBioNet)	Digital platform	[61]
Circular Cities Declaration	Political declaration	[62]
CityLoops	Horizon 2020 project	[63]
Circular Economy Guidebook for Cities	Guidebook	[64]
Accelerating the transition towards Circular Cities	Brochure	[65]
Cities and Circular Economy for Food	Report	[66]
City Analysis Guide – City Benefits Tool	Excel file tool	[67]
Circular economy for food: city government self-assessment	Online self-assessment survey	[68]
A guide to circular cities	Guidebook	[69]
Circular cities. Cities of tomorrow	Position paper	[70]
Circular Cities Solution Booklet	Booklet	[71]
Climate-neutral & Smart City Guidance Package	Guidance package	[72]
100 Climate-Neutral and Smart Cities by 2030 – Info Kit for Cities	Info Kit	[73]
Circular Bioeconomy: the business opportunity contributing to a sustainable world	Report	[74]

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Top emerging bio-based products, their properties and industrial applications	Brochure	[75]
Future transitions for the bioeconomy towards sustainable development and a climate-neutral economy	Report	[76]
Categorisation system for the circular economy	Report	[77]
Pathways to a circular economy in cities and regions	Policy brief	[78]
EU policy on biowaste management: a review	Report	[79]
The circular economy as a de-risking strategy and driver of superior risk-adjusted returns	White paper	[80]

The HOOP project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N°101000836

4. References

[1] European Investment Bank, “The EIB Circular Economy Guide: supporting the circular transition,” Luxembourg, 2020.

[2] HOOP, “HOOP project - Hub of circular cities bOOsting Platform to foster investments for the valorisation of urban biowaste and wastewater,” 2021. [Online]. Available: https://hoopproject.eu. [Accessed 16 12 2021].

[3] European Commission, “Action Plan: Financing Sustainable Growth,” *Communication from the Commission to the European Parliament, the European Council, the Council, the European Central Bank, the European Economic and Social Committee and the Committee of the Regions,* 8 3 2018.

[4] Ellen MacArthur Foundation, “Towards the circular economy - Economic and business rationale for an accelerated transition,” 2013.

[5] European Commission, “Incentives to boost the Circular Economy: a guide for public authorities,” Publications Office of the European Union, Brussels, 2021.

[6] EU Covenant of Mayors for Climate & Energy, “The EU Covenant of Mayors for Climate & Energy,” 2021. [Online]. Available: https://www.eumayors.eu/. [Accessed 20 12 2021].

[7] European Investment Bank, “The Circular City Funding Guide,” 2021. [Online]. Available: https://www.circularcityfundingguide.eu. [Accessed 15 12 2021].

[8] European Investment Bank, “The 15 circular steps for cities – Second edition,” European Investment Bank, Luxembourg, 2021.

[9] European Investment Bank, “Loans, guarantees, equity investments and advisory services,” 2021. [Online]. Available: https://www.eib.org/en/products/index.htm.

[10] European Investment Bank, “InnovFin - EU Finance for Innovators,” 2021. [Online]. Available: https://www.eib.org/en/products/mandates-partnerships/innovfin/index.htm.

[11] European Investment Bank, “Study on Access-to-finance conditions for investments in bio-based industries and the blue economy,” European Investment Bank, Luxembourg, 2017.

[12] European Commission, “EU Regional and Urban Development Programmes,” 2021. [Online]. Available: https://ec.europa.eu/regional_policy/en/atlas/programmes/.

[13] European Commission, “Rural Development Programmes,” 2021. [Online]. Available: https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/rural-development/country_en.

The HOOP project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N°101000836

[14] European Commission, “European Climate, Infrastructure and Environment Executive Agency,” 2021. [Online]. Available: https://cinea.ec.europa.eu/european-maritime-fisheries-and-aquaculture-fund_en.

[15] European Commission, “Managing authorities,” 2021. [Online]. Available: https://ec.europa.eu/regional_policy/en/atlas/managing-authorities/.

[16] European Commission, “Just Transition Funding sources,” [Online]. Available: https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/finance-and-green-deal/just-transition-mechanism/just-transition-funding-sources_en.

[17] EUREKA, “EUREKA,” 2021. [Online]. Available: https://www.eurekanetwork.org/.

[18] European Commission, “European Urban Initiative,” 2021. [Online]. Available: https://futurium.ec.europa.eu/en.

[19] European City Facility, “European City Facility (EUCF),” 2021. [Online]. Available: https://www.eucityfacility.eu/home.html.

[20] European Commission, “EU renewable energy financing mechanism,” 2021. [Online]. Available: https://ec.europa.eu/energy/topics/renewable-energy/eu-renewable-energy-financing-mechanism_en#closer-cooperation-on-renewable-projects.

[21] European Commission, “Horizon Europe Cluster 6: Food, Bioeconomy, Natural Resources, Agriculture and Environment,” 2021. [Online]. Available: https://ec.europa.eu/info/research-and-innovation/funding/funding-opportunities/funding-programmes-and-open-calls/horizon-europe/cluster-6-food-bioeconomy-natural-resources-agriculture-and-environment_en.

[22] European Commission, “Innovation Fund,” 2021. [Online]. Available: https://ec.europa.eu/clima/eu-action/funding-climate-action/innovation-fund_en#tab-0-0.

[23] European Commission, “LIFE Programme,” 2021. [Online]. Available: https://cinea.ec.europa.eu/life_en.

[24] European Union, “Interreg Europe,” 2021. [Online]. Available: https://www.interregeurope.eu/.

[25] European Union, “URBACT,” 2021. [Online]. Available: https://urbact.eu.

[26] European Energy Efficiency Fund, “European Energy Efficiency Fund - Technical Assistance (eeef-TA),” 2021. [Online]. Available: https://www.eeef.lu/eeef-ta-facility.html.

[27] European Union, “InvestEU Advisory Hub,” 2021. [Online]. Available: https://europa.eu/investeu/investeu-advisory-hub_en.

[28] European Investment Bank, “Joint Assistance to Support Projects in European Regions (JASPERS),” 2021. [Online]. Available: https://jaspers.eib.org/.

[29] European Commission, “Just Transition Platform,” 2021. [Online]. Available: https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/finance-and-green-deal/just-transition-mechanism/just-transition-platform_en.

[30] European Union, “InvestEU Fund,” 2021. [Online]. Available: https://europa.eu/investeu/investeu-fund_en.

The HOOP project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N°101000836

[31] European Commission, “CINEA: Calls for proposals,” 2021. [Online]. Available: https://cinea.ec.europa.eu/calls-proposals_en.

[32] European federation of citizen energy cooperatives, “European federation of citizen energy cooperatives,” 2021. [Online]. Available: https://www.rescoop.eu/.

[33] European Crowdfunding Network, “Eurocrowd,” 2021. [Online]. Available: https://eurocrowd.org/.

[34] European Union, “Practices and opportunities for Energy Performance Contracting in the public sector in EU Member States,” Publications Office of the European Union, Luxembourg, 2017.

[35] Climate Bonds Initiative, “Climate Bonds Initiative,” 2021. [Online]. Available: https://www.climatebonds.net/.

[36] European Commission, “InvestEU Portal - the EU matchmaking portal,” 2021. [Online]. Available: https://ec.europa.eu/investeuportal/desktop/en/index.html.

[37] European Investment Bank, “European Investment Advisory Hub,” 2021. [Online]. Available: https://eiah.eib.org/index.

[38] European Investment Advisory Hub, “URBIS,” 2021. [Online]. Available: https://eiah.eib.org/about/initiative-urbis.htm.

[39] European Investment Bank, “fi-compass,” 2014. [Online]. Available: https://www.fi-compass.eu/.

[40] European Commission, “Knowledge Centre for Bioeconomy,” 2021. [Online]. Available: https://knowledge4policy.ec.europa.eu/bioeconomy_en.

[41] European Investment Bank, “European PPP Expertise Centre,” 2021. [Online]. Available: https://www.eib.org/epec/.

[42] European Commission, “Recovery and Resilience Facility,” 2021. [Online]. Available: https://ec.europa.eu/info/business-economy-euro/recovery-coronavirus/recovery-and-resilience-facility_en.

[43] EU Technical Expert Group on Sustainable Finance (TEG), “5 high-level principles for Recovery & Resilience,” European Union, 2020.

[44] European Circular Bioeconomy Fund, “European Circular Bioeconomy Fund,” 2021. [Online]. Available: https://www.ecbf.vc/.

[45] International Energy Agency, “World Energy Outlook 2021,” 2021. [Online]. Available: https://www.iea.org/reports/world-energy-outlook-2021.

[46] European Commission, “Online Manual for funding tenders opportunities,” 2022. [Online]. Available: https://webgate.ec.europa.eu/funding-tenders-opportunities/display/OM/Online+Manual.

[47] European Commission, “Enabling synergies between European Structural and Investment Funds, Horizon 2020 and other research, innovation and competitiveness-related Union programmes,” 2014.

The HOOP project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N°101000836

[48] fi-compass, “Nasekomo: sustainable food from insects,” October 2021. [Online]. Available: https://fi-compass.eu/f/fi-compass-news-autumn-2021/nasekomo-bulgaria-the-next-big-thing-in-the-food-industry/?utm_source=sendinblue&utm_campaign=fi-compass%20Newsletter%20Autumn%202021&utm_medium=email.

[49] Nasekomo, “Nasekomo,” 2021. [Online]. Available: https://nasekomo.life/.

[50] Live Circular Canvas, “Live Circular Canvas: PeelPioneers,” 2020. [Online]. Available: https://livecircularcanvas.eu/en/circular-practices/131/peelpioneers.

[51] PeelPioneers, “PeelPioneers,” 2021. [Online]. Available: https://peelpioneers.nl/.

[52] Innovation Origins, “PeelPioneers open Europe’s largest peel-processing factory in Den Bosch, the Netherlands,” 2 October 2020.

[53] Live Circular Canvas, “TrÆls,” 2020. [Online]. Available: https://livecircularcanvas.eu/en/circular-practices/6.

[54] TrÆls, “TrÆls,” 2018. [Online]. Available: https://traels.nu/.

[55] PYREG, “PYREG - net zero technology,” 2021. [Online]. Available: https://pyreg.com/.

[56] Berliner Wasserbetriebe, “Berliner Pflanze,” 2021. [Online]. Available: https://www.bwb.de/de/berliner-pflanze.php.

[57] European Investment Bank, “BERLIN ABWASSER UND UMWELT II,” 2018. [Online]. Available: https://www.eib.org/en/projects/pipelines/all/20170298.

[58] European Investment Bank, “Circular City Centre (C3),” 2022. [Online]. Available: https://eiah.eib.org/about/circular-city-centre.htm.

[59] Circle Economy, “Circle City Scan Tool,” 2021. [Online]. Available: https://www.circle-economy.com/digital/circle-city-scan-tool.

[60] European Cooperation in Science & Technology, “Circular City Re.Solution,” 2021. [Online]. Available: https://circular-city.eu/.

[61] European Bioeconomy Network, “The European Bioeconomy Network (EuBioNet) platform,” 2021. [Online]. Available: https://eubionet.eu/.

[62] Circular Cities Declaration, “Circular Cities Declaration,” 2020. [Online]. Available: https://circularcitiesdeclaration.eu/.

[63] CityLoops, “CityLoops,” 2020. [Online]. Available: https://cityloops.eu/.

[64] Centre for Sustainable Consumption and Production (CSCP), “Circular Economy Guidebook for Cities,” Wuppertal, 2018.

[65] Circular Cities and Holland Circular Hotspot, “Accelerating the transition towards Ciruclar Cities,” Hoofddorp, 2019.

The HOOP project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement N°101000836

[66] Ellen MacArthour Foundation, “Cities and circular economy for food,” 2019.

[67] Ellen Macarthur Foundation, “Cities and circular economy for food publications,” 2019. [Online]. Available: https://ellenmacarthurfoundation.org/cities-and-circular-economy-for-food.

[68] Ellen Macarthur Foundation, “Circular economy for food: city government self-assessment,” 2019.

[69] United 4 Smart Sustainable Cities, “A guide to circular cities,” Geneva, 2020.

[70] Enel, “Circular cities. Cities of tomorrow. 3rd edition,” 2020.

[71] Smart Cities Marketplace, “Circular Cities Solution Booklet,” Smart Cities Marketplace, Brussels, 2021.

[72] Smart Cities Marketplace, “Climate-neutral & Smart City Guidance Package,” Brussels, 2020.

[73] European Commission, “100 Climate-Neutral and Smart Cities by 2030 – Info Kit for Cities,” Brussels, 2021.

[74] World Business Council for Sustainable Development, “Circular Bioeconomy: the business opportunity contributing to a sustainable world,” Geneva, 2020.

[75] Ecologic Institute , “Top emerging bio-based products, their properties and industrial applications,” Ecologic Institute, Berlin, 2018.

[76] U. Fritsche, G. Brunori, D. Chiaramonti, C. Galanakis and S. Hellweg, “Future transitions for the Bioeconomy towards Sustainable Development and a Climate-Neutral Economy - Knowledge Synthesis FInal Report,” Publications Office of the European Union, Luxembourg, 2020.

[77] P. Hirsch and C. Schempp, “Categorisation System for the Circular Economy: a sector-agnostic approach for activities contributing,” Brussels, 2020.

[78] M. Bačová and e. al., “Pathways to a circular economy in cities and regions – a policy brief addressed to policy makers from European cities and regions,” Lille, 2016.

[79] EUBIA, “EU Policy on biowaste management: a review,” VALUEWASTE, 2019.

[80] Bocconi University, Ellen MacArthur Foundation, Intesa Sanpaolo, “The circular economy as a de-risking strategy and driver of superior risk-adjusted returns,” 2021.

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5. Annex: Success stories on circular bioeconomy investments

Nasekomo: sustainable food production from insects

The Nasekomo is at the forefront of European insect-based sustainable food production. **It rears Black Soldier Fly (BSF) larvae to produce insect protein, oil and fertiliser for the animal feed and agriculture industries**. Nasekomo feed their insects using ingredients such as spent grains from breweries, as well as by-products from cereal and beetroot processing [49, 48]. The **Figure 4** summarises the key highlights for this success story on circular bioeconomy.

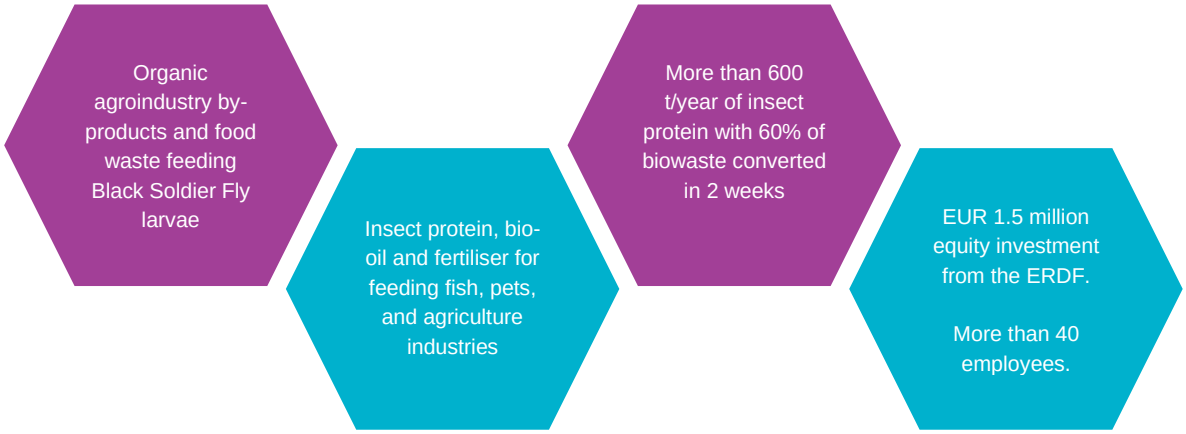

Figure 4 – Key highlights for Nasekomo's case study.

Nasekomo **drives circular bioeconomy with a zero-waste production by transforming organic agroindustry by-products into animal proteins through BSF insect farming**. The frass produced by the insect is an organic low-carbon-footprint fertiliser. Furthermore, it also prevents the impoverishment of soil by re-injecting in the ground various micro-elements taken for the local agricultural coproduction [49].

BSF insects reproduce fast and are very efficient in gaining body mass, thus minimising protein production costs. Specifically, an adult female of our insect of choice, the BSF can lay up to 1000 eggs. During its lifecycle, the fly feeds only in its larval form, which means that the adult flies are not potential carriers of diseases and do not require particular care**. In less than 2 weeks, insects can convert 60% of organic waste into proteins,**

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lipids and other useful substances in a local loop. The BSF larvae reach maturity in 12 days during which time they increase their weight 9000 times [49].

Figure 5 – Nasekomo's bioproducts: food for pets (A), food for fish (B) and organic fertiliser (C) *[49]***.**

Nasekomo **lowers the carbon footprint of the feed industry**, building their factories next or in close proximity to agro-industrial sources of feed for BSF larvae in order to eliminate the need for long-distance transportation. The frass is a fertiliser (**Figure 5 - C**) which unlike chemical fertilisers is produced without additional use of energy, and is reused locally with limited transportation. **This organic fertiliser replaces traditional chemical ones**, which are made from fossil fuels, being a perfect choice for soil nutrition and remediation. Rich in organic matter, essential minerals (with N, P, and K levels at 5%, 3% and 2% respectively), and chitin, this organic fertiliser contributes to healthy crops and strengthens the natural defences of plants [49].

Moreover, the Nasekomo's bio-based products **improve animal health** (**Figure 5 - A and B**), according to studies that demonstrate that insect fat fraction has anti-bacterial and anti-fungal activities that improve animal digestive track health, and chitin component is also an immunity enhancer. This biotechnology industry preserves the biodiversity and keeps the value chain plastic free. By using insect meal, instead of fish meal, the oceans' biodiversity and ecosystemns could be preserved [49].

"Nasekomo is among 5 insect producers in Europe…
…to secure needed permits for sale of insect protein."

Supported by a EUR 1.5 million equity investment from the ERDF, through the Fund Manager of Financial Instruments in Bulgaria, the successful biotechnology company will soon open an industrial demonstrator with a capacity of 600 t/year. With strong demand for its products based on insect protein meal, the company is already planning a further fundraising round to allow it to scale up [48].

In 2020, Morningside Hill Capital and NewVison3 took part in an investment round of EUR 1.8 million along with other investors. The two funds became equity investors for a total amount of EUR 1.5 million (EUR 1 million for MorningSide Hill and EUR 0.5 million for NewVision3) and attracted an additional EUR 0.3 million from the rest of the co-investors. This had allowed to invest in R&D, and the industrialisation of the production [48].

Despite the company was founded only 4 years ago, it employs 42 employees and remain the sole company involved in the insect industry in the Southeast Europe region, where there is a significant potential in terms of feedstock and clients such as the aquaculture industry [48].

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PeelPioneers: turning chemicals from citrus peels into cosmetics and cleaning products

Each year in the Netherlands, around 250 million kg of **citrus peel are left over from this production process (and more will be if we include HoReCa, supermarkets and domestic activities that produces urban biowaste)**, where most of it is orange peel. PeelPioneers' technology offers a circular bioeconomy solution for these activities, which means that none of the orange remains unused, offering a local alternative to many products [50].

PeelPioneers was founded as a start-up in 2017 with the idea of processing citrus peels and turning them into secondary raw biomaterials. Since then, the company has grown to become a scale-up business, being the first company in the world that **processes the components of citrus peel waste into valuable new raw biomaterials, such as essential oils (fragrance), chemicals (pectin, cellulose and flavonoids) and sustainable animal feed, thereby providing a 100% circular solution for the flow of citrus peels that remain after making fresh juice** [50, 51]. These resources are sold as commodities or used in products that can go back to the peel suppliers, therefore making their business model circular [51]. The **Figure 6** summarises the key highlights for this success story on circular bioeconomy.

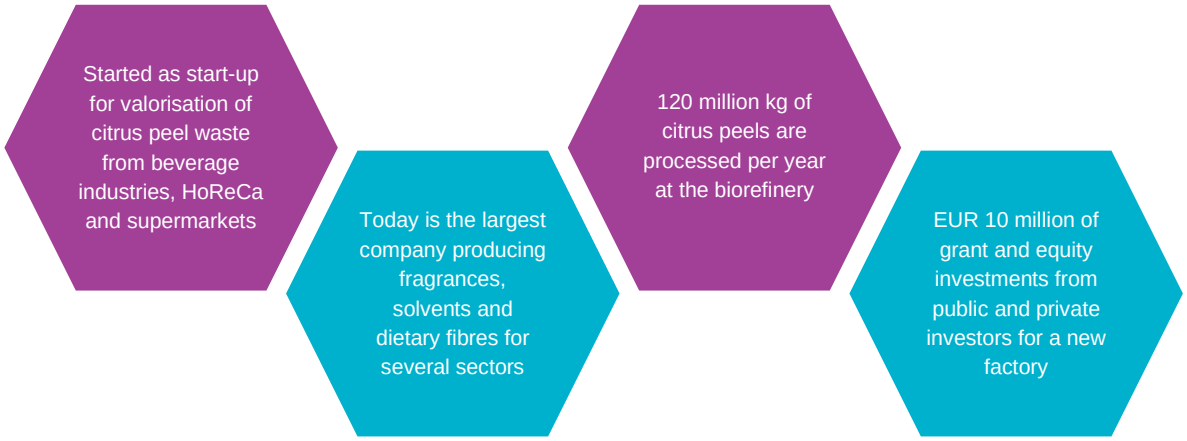

Figure 6 – Key highlights for PeelPioneers's case study.

The company opened the world's first orange peel factory in 2018, where more than 10 million kg of citrus peels are processed per year. PeelPioneers is growing very fast and is the market leader in the Netherlands. Within 5 years, the company will grow to become the processor of citrus peels in Europe [51].

The scale up PeelPioneers is opening a new and Europe's largest peel processing factory in Den Bosch (Netherlands) in 2021. This new plant triples the **company's processing capacity to 120,000 thousand kg of peels per day**. **The new production facility will be realised due to a EUR 10 million investment of a consortium**, consisting of Rabobank, the Netherlands Ministry of Economic Affairs (top sector energy grant), National Green Fund, Brabant Development Fund BOM, European Circular Bioeconomy Fund, and initial investor DOEN Participaties [52].

"first company in the world that…
… processes the components of citrus peel waste into valuable new raw biomaterials."

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PeelPioneers is **based on a biorefinery approach** that turns citrus peel waste into valuable bioproducts: dietary fibres, antioxidants, orangeade and orange oils (**Figure 7**) [50, 51]. PeelPioneers' bioprocess **extracts raw materials from citrus peel waste in 2 phases** [50]:

1. Essential oils: essential oils are extracted from the citrus peel waste, which can be used as a natural fragrance and flavouring in foods, for instance, in soft drinks and products from the pastry industry. The oil can also be used in cleaning products and cosmetics.

2. Citrus pulp: the pulp that PeelPioneers produces goes to livestock farms, where it is used as supplementary nutrition for livestock.

Figure 7 – PeelPioneers's bioproducts: bio-oil (A), D-Limonene solvent (B) and dietary fibres (C) *[51]***.**

The **bioproducts (Figure 7) commercialised from the bioconversion of citrus peel biowaste are** [51]:

- **Cold pressed oil** is pressed directly from the orange peel and purified, with minimal further processing (**Figure 7 - A**).
- **Five-Fold oil** is a highly concentrated orange aroma that can be used in foodstuffs and possibly drugstore products such as soap, cosmetics and perfume.
- **D-Limonene** is a strong degreasing agent and a natural solvent (**Figure 7 - B**), which is ultimately used to make cleaning products.
- **Functional Fibre** is a dietary fibre that fulfils technical functions in food, such as binding agent, thickener, emulsifier, adhesive. It is a white to light cream-colored powder with virtually no orange odour or taste. This makes it very widely applicable, from liquid products such as drinks and sauces to meat substitutes and bakery products.
- **Original Fibre** is a dietary fibre that contains orange flavour, aroma and colour (**Figure 7 - C**). Particularly used in bakery products, where an orange flavour and golden yellow colour have added value.
- **Animal feed:** After the oil has been pressed from the peels, they are used for the animal feed industry.

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TrÆls: turning post-consumer wood waste into innovative furniture and in/outdoor environments

TrÆls is a small company with 8 employees, which was established in 2016. It is a company that builds furniture or physical environments out of recycled wood materials for sale and rent [53].

"do not want to follow demands…
… but want to "design" the customer's needs and a new market based on sustainable and circular principles."

Examples of their furniture products are urban furniture, stalls, art & decor work, markets, plant boxes/vases, benches, tables, chairs and other specially designed products. **They use residual, urban biowaste and by-products materials, primarily made from wood, which they process and reuse into new products and new outdoor** (**Figure 9)** **and indoor** (**Figure 10**) **environments with innovative design and utility**, like in hotels, public places, gardens and parks, art e décor, stores (e.g. clothing), restaurants and cafes, playgrounds, buildings, construction, events (festivals, congresses, etc.), etc. **Therefore, they increase the life of the materials and create an opportunity for a "sharing culture" as they not only sell, but also rent the recycled wood products and environments** [53, 54]. The **Figure 8** summarises the key highlights for this success story on circular bioeconomy.

Figure 8 – Key highlights for TrÆls's case study.

TrÆls takes inspiration from UN's 17 Sustainable Development Goals, with a special focus on sustainable development, social responsibility and circular economy. **They also engage in networks, projects and events to promote a better learning and understanding of sustainability and circular bioeconomy**. The specific challenge that TrÆls addresses is to reduce waste and irresponsible consumption and prevent trees cutting for production. Anders Jensen, **the owner of TrÆls, is also founder and serial entrepreneur behind the companies Brainwash, Håndslag and AKJ, as well as the recycling system ReDo and one of the main partners in the Compas Commercial Building, Hedensted** [53, 54].

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Figure 9 – TrÆls's outdoor urban furniture in the city of Kolding (Denmark) *[54]***.**

Therefore, **TrÆls's business model is based on sustainability and circularity, being that the company has complied with the circular ReSOLVE principles** [53]:

- **Sharing:** rents out the products and physical environments.
- **Optimise:** uses residual, waste and surplus materials, such as disposable pallets, demolition materials, by-products and much more post-consumer wood waste from urban biowaste and other economic activities.
- **Loop:** treats and reuses post-consumer wood waste for new products and physical environments with innovative design and utility.
- **Regenerate:** use reusable materials and they prevent unnecessary harvest of trees.

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Figure 10 – TrÆls's indoor art & décor in the "Ecolarium" science centre in the city of Vejle (Denmark) *[54]***.**

TrÆls aims to "use yesterday's waste to create a modern, technological design". Hence, TrÆls designs special made furniture to their customers, but they do not try to develop products based on the customer's needs. **They do not want to follow demands, instead they want to "design" the customer's needs and a new market** based on sustainable and circular principles. For this reason, they engage in a lot of projects and activities to promote environmental awareness on this thematic [53, 54].

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PYREG: worldwide market leader in biochar and heat production from biowaste and sewage sludge

PYREG is a German manufacturer of carbonisation technologies (**Figure 12**) for upcycling organic waste into valuable CO_2-sequestering biochar and regenerative heat. **PYREG-Biochar** is a patented pyrolysis technology **being Negative Emission Technology (NET)**. **PYREG systems "closes the loop" and removes carbon from the atmosphere** [55]. The **Figure 11** summarises the key highlights for this success story on circular bioeconomy.

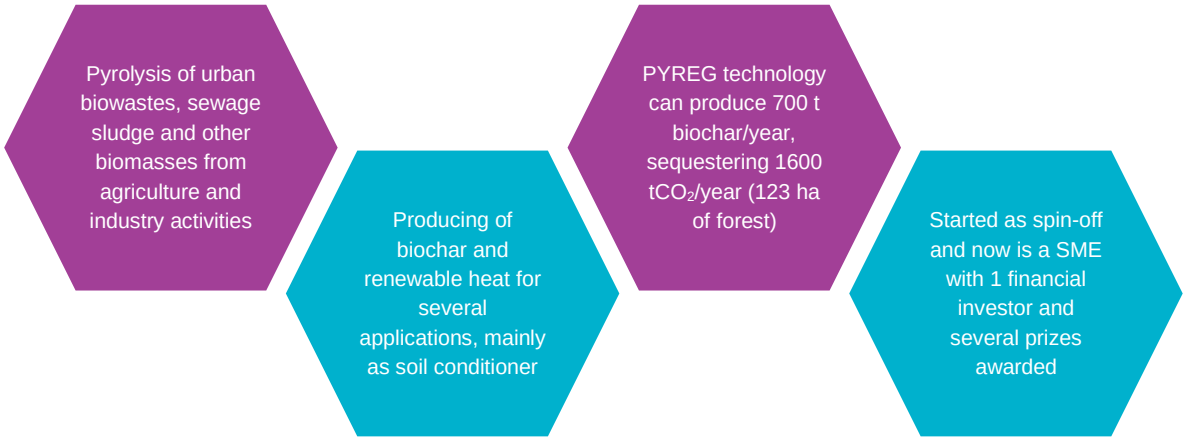

Figure 11 – Key highlights for PYREG's case study.

PYREG was founded in 2009 as a spin-off of TH Bingen, University of Applied Sciences. Since that, it has keeping research collaboration with several universities, what make it a pioneer in the industry sector with continuous innovations and further developments. **The Venture Capital-Backed is the unique financial private investor** [55].

"PYREG is worldwide market leader…
…in biochar and renewable heat production from biowaste and sludge."

PYREG have been designing and manufacturing certified high quality carbonisation plants (**Figure 12**) for more than 10 years. Moreover, its technology meets the highest environmental standards, being a global market leader in the field of phosphorus recycling from sewage sludge and the production of high-quality biochar. PYREG's plants are certified by the industry EBC-standard, designed to ensure harmonised and verifiable standards for climate-protective biochar production [55].

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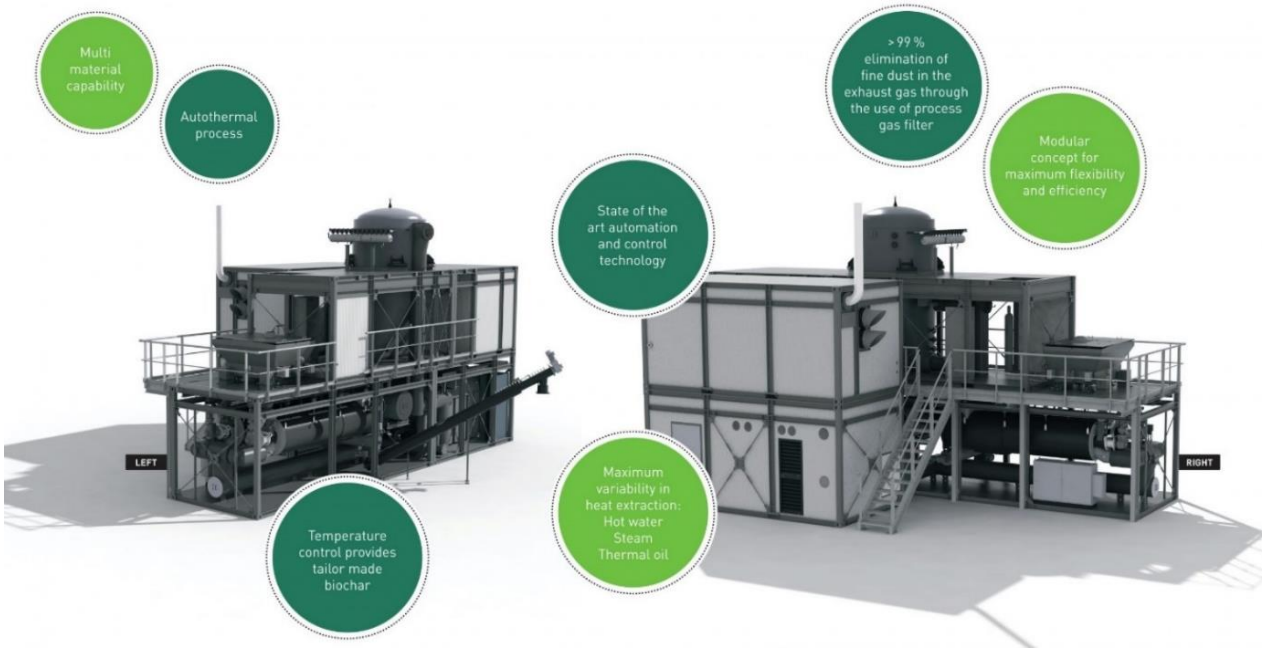

Figure 12 – PYREG's technology and process *[55]***.**

PYREG technology, with its modularly manufactured plants, helps to close the loop in the carbon cycle and reduce the carbon footprint by converting the biowaste and sludge into valuable bioproducts – biochar and renewable heat [55].

PYREG's technology is fed by organic wastes from the following streams [55]:

- **Biowaste:** post-consumer wood waste, garden and park waste, wood chips, fruit shells and food waste.
- **Mixed waste:** rubber, plastics, packaging and composite.
- **Sewage sludge from wastewater treatment plants**.
- **Agricultural waste**: sludge, fermentation residues, slurry and manure.
- **Industrial waste:** industrial sludges, by-products waste and other organic wastes.

The PYREG system can supply up to 210 households with renewable heat. At the same time, it can be used to obtain valuable products like biochar, bio-oil or activated biochar. These **bioproducts can be produced by an upcycling process based on eco-friendly carbonisation, established from a business model assured by "closing the loop" and circular bioeconomy.** Through the process of pyrolysis, the organic waste is not incinerated, but thermally degassed at low temperature (up to 750 °C) and low stoichiometric oxygen till sanitise completely the biochar. Hence, biochar plays an important role on the soil carbon sequestration [55]. The **Figure 13** illustrates the PYREG's circular bioeconomy model from biowaste and sludge into biochar and renewable heat by pyrolysis.

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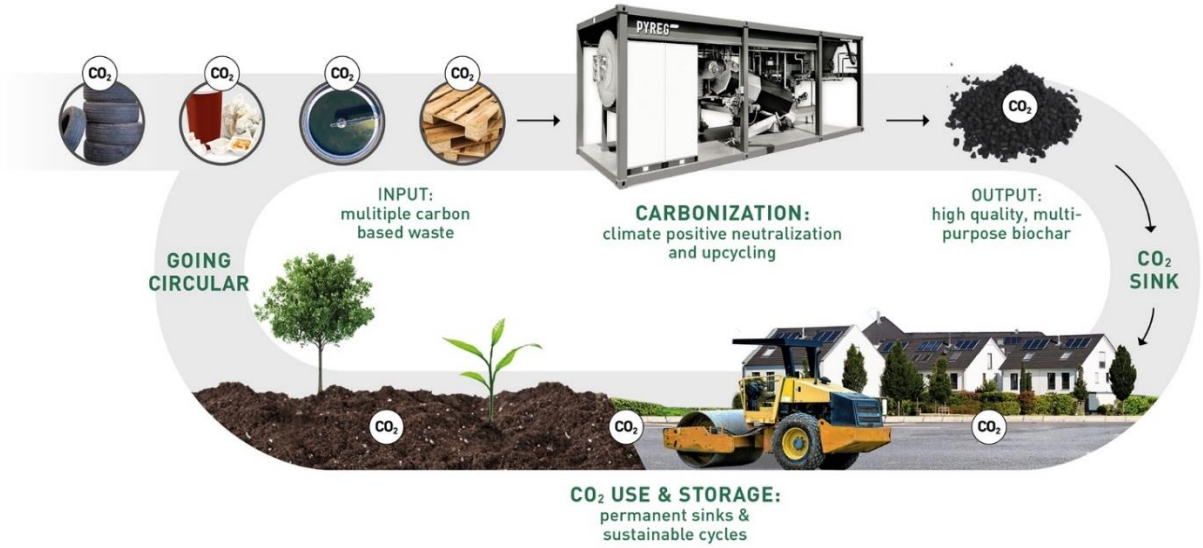

Figure 13 – PYREG's circular bioeconomy model *[55]***.**

The PYREG's process and technology involve the following key advantages [55]:

- **CO_2-Sink Certificates: 1,600 tCO_2/year emissions avoided, approx. EUR 168,000 saved**

During the pyrolysis process, most of the carbon is sequestered in the bioproduct biochar, thereby inhibiting the release of CO_2 into the atmosphere. This sequestered CO_2 amount can be certified and used either to achieve sustainable corporate goals or to trade them on the open market.

- **Upcycling the organic waste to biochar: 700 t/year biochar = €560,000**

The carbonisation process allows a final waste weight reduction up to 90% (for a conversion rate of 20 to 30% in waste weight on dry basis), which reduces the waste materials, their transportation and disposal costs. Using the PYREG Standard System PX 1500, an average output of 700 tons of biochar can be produced every year. Incorporated into the soil as a soil improver, this can sequester as much **CO_2 per year as 128 000 trees.**

- **CO_2 storage: 1,600 tCO_2/year sequestered = 123 ha forest**

During yhe PYREG process (NET), the carbon contained in the wastes binds it stably in the biochar and thus sequestrate it from the atmosphere. When this biochar is permanently incorporated into soil, building materials, asphalt, etc., the storage of CO_2 is successful at long-term.

- **Renewable heat: from biomass pyrolysis - 700 KW_{th} ≈ 5.25 GWh_{th}/year = 210 households; from sludge pyrolysis - 750 KW_{th} ≈ 5.6 GWh_{th}/year;**

Under the carbonisation, the energy from the waste is sufficient for the thermal treatment. It is even possible to benefit from the excess heat produced, which an amount of 150 up to 750 kW_{th} may be used for drying the humid biomass or sludge, for heating or power generation. Therefore, up to 5.6 GWh_{th} of heat produced per year can be used as hot water, steam or thermal oil.

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- **High quality end-bioproduct - biochar as fertiliser: nutrient content up to 905 g/kg with a specific surface area up to 300 m^2/g; biochar stores water, nutrients and soil microorganisms**

Biochar acts like a sponge, retaining water and nutrients in the soil, with a water retaining capacity up to 5 times its own weight. It is highly porous, which permits to realise slowly the nutrients for the plants when is disposed in the soil. Furthermore, biochar also allows to settle the soil microorganisms in its pores. These qualities, dependent of waste proprieties and pyrolysis operating conditions. Depending on the processing stage and input waste characteristics, biochar can be used in a wide range of applications, as showed in **Figure 14** [55]:

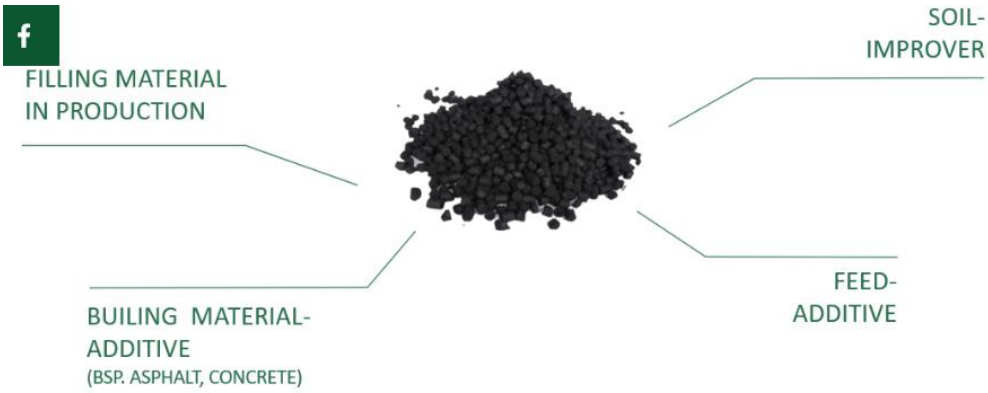

Figure 14 – Areas of application of the biochar *[55]***.**

- **Biochar as a feed additive:** biochar is used in silage, as animal feed, in litter for manure treatment or as a compost additive. Biochar also improves animal health, reduces unpleasant odours, optimises the quality of fertiliser and reduces losses of nutrients that are harmful to the climate and environment.

- **Biochar as a soil conditioner/amendment:** biochar is as an intact humus layer that stores nutrients and water as well as large amounts of CO_2. With a high surface area and porosity, biochar can absorb up to 5 times its own weight in water and the nutrients contained on it. Biochar is not a fertiliser if used alone, it needs to be activated through enriching with nutrients and soil microorganisms, for example during composting processes. This “green carbon” remains stable during decomposition and does not rot. For this reason, farmers can improve the quality of soil with biochar, saving money for fertilisers and obtain additional credits from emission certificates. Thus, biochar substitutes fossil fuels and improves the carbon footprint.

- **Biochar as a filling additive and building material:** low-quality biochar can be used as filling material in cement production or as a building material additive in asphalt or concrete. It also has numerous positive effects when used in industrial processes.

Recently, **PYREG was nominated as forward-looking innovation and scalable solution in the 14th German Sustainability Award in the Transformation Field “Climate**”. This top national award recognises companies that have their business model sustainable [55].

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Berliner Pflanze: a long-term mineral NP fertiliser from sewage sludge

Berliner Wasserbetriebe, a company focuses on sewage and surface water treatments for domestic, commercial, and industrial uses in Germany, has developed a patented solution for **recovering phosphorus from wastewater sludge** [56].

Figure 15 – Berliner Pflanze's long-term mineral NP fertiliser *[56]***.**

Berliner Pflanze (**Figure 15**) is a magnesium ammonium phosphate, **a high-quality mineral slow-release fertiliser that received the GreenTec Award in 2015**. **The granulate has been approved according to the EU fertiliser regulation since 2008.** The N-P fertiliser contains important minerals and trace nutrients and is free from harmful substances, being used in horticulture and agriculture. Moreover, the fertiliser is very readily available to plants and is crystalline, odourless and sanitised [56]. The **Figure 16** summarises the key highlights for this success story on circular bioeconomy.

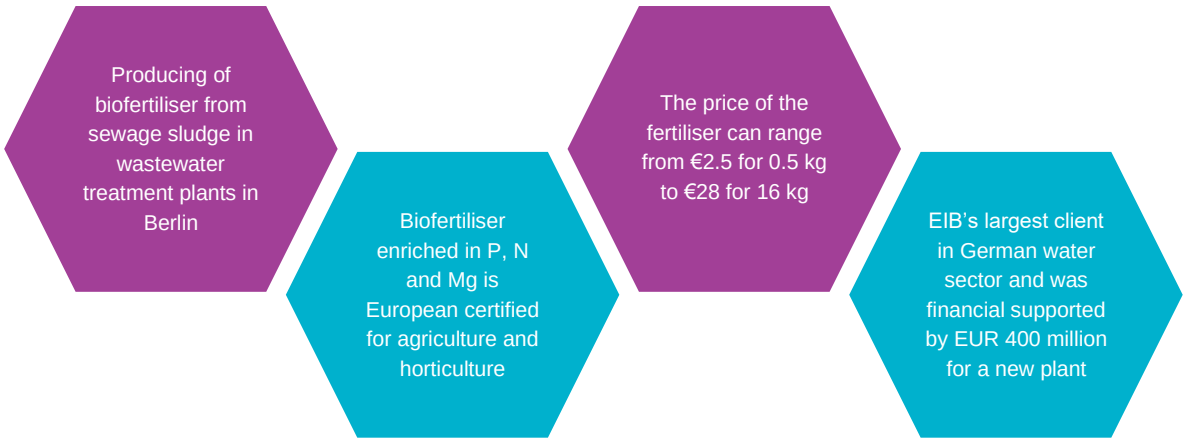

Figure 16 – Key highlights for Berliner Pflanze's case study.

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- **Nutrition composition and chemical-physical proprieties of the Berliner Pflanze:** 12% MgO + 5% N + 23% P_2O_5 + 10% other minerals as B, Ca and trace nutrients. The fertiliser is composed by 20% of organic matter, 20% of moisture content and 10% of carbonates *[56]*.

- **Application of the Berliner Pflanze in the soil:** the fertiliser must not be sprinkled on the soil surface but applied into the soil. Berliner Pflanze is slowly dissolved in water and creates the best effect near to the plant roots. The nutrients from the crystals are gradually released to the plants, thus there is no risk of plant burning. Depending on the soil and culture requirements, approx. 60 to 70 g/m^2 for the agriculture soil or 10 to 15 g for a plant vase of 1 meter of length (twice a year) *[56]*.

- **Berliner Pflanze's prices:** 0.5 kg at a price of €2.50; 2 kg at a price of €4; 5 kg at a price of €10; 16 kg at a price of €28 *[56]*.

Berliner Wasserbetriebe is the EIB's largest client in the German water sector, which receives EUR 400 million from EIB finance in 2018 for EUR 800 million of total costs. Compliance with the EU Water Framework Directive (2000/60/EC), Drinking Water Directive (98/83/EC), the Urban Wastewater Directive (91/271/EEC) and EU and national environmental legislation will be verified during appraisal [57].

"Berliner Wasserbetriebe developed the NP fertiliser from sewage sludge since 2008…
… and is the EIB's largest client in the German water sector."

In terms of procurement, the EIB will require the promoter to ensure that contracts for the implementation of the project will be tendered in accordance with the relevant EU procurement legislation, 2014/25/EU, where applicable, as well as Directive 92/13/EEC, as and where required [57].

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