

LIFE BIOBEST

GUIDING THE MAINSTREAMING OF BEST BIO-WASTE RECYCLING PRACTICES IN EUROPE

Summary of Guidelines

WP3: Set of guidelines

D3.1 Guideline on separate collection

D3.2 Guideline on governance & economic incentives

D3.3 Guideline on quality compost & digestate

D3.4 Factsheets on the analysis of best practices in communication & engagement from various countries



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Acronym & Term

AD.....	Anaerobic digestion
BP.....	Best practice
CR.....	European Commission Country Report(s)
D.....	Deliverable
DtD.....	Door-to-door
EC.....	European Commission
EU.....	European Union
EWR.....	Early warning report(s)
LD.....	Landfill Directive
MBT.....	Mechanical biological treatment
MS.....	Member State(s)
PAYT.....	Pay-as-you-throw
QAO.....	Quality Assurance Organization
QAS.....	Quality Assurance Scheme
WFD.....	Waste Framework Directive
WP.....	Work Package

LIFE BIOBEST Project Summary

EU obligations on the selective collection of bio-waste came into force at the end of 2023, increasing the availability of source-separated bio-waste for composting and anaerobic digestion. To ensure the development of bio-waste management best practices and the production of quality compost and digestate for soil applications, while minimizing any negative effect and closing effectively the loop, a comprehensive analysis is required regarding bio-waste management strategies, instruments and management schemes and their results given that large disparities exist among experiences in the EU.

The LIFE BIOBEST project aims to identify and validate the current Best Practices (BP) and management instruments along the bio-waste management chain (from generation to treatment) that allow the production of quality compost and digestate and establish a series of reference Key Performance Indicators (KPI), based on the analysis of existing databases and experiences. In a policy brief about barriers and through interconnected co-creation meetings with relevant expert stakeholders of the sector, solutions will be provided to overcome the identified technical, regulatory, economic and environmental barriers to widely adopt the proposed BPs.

Four guidelines and a comprehensive EU-wide guide will be created, together with two decision-support tree guides for local and regional authorities to adapt bio-waste management models to their specific context, offering feasible BP and management instruments to promote efficient collection and subsequent recycling of bio-waste into quality compost and digestate.

By means of an analysis of the input materials, treatment practices, resulting compost and digestate quality, a proposal for premium European standards for biological waste entering

composting and anaerobic digestion will be developed with the ultimate goal of promoting the certification of these materials and treatments, guaranteeing optimal management processes and a safe, beneficial return to the soil.

The outcomes of LIFE BIOBEST will promote a significant improvement of the collection and treatment systems, and consequently of the quantity and purity of the input material, reducing process rejects and favouring the conversion of bio-waste into high-quality compost and digestate.

The LIFE BIOBEST consortium is led by [Fundació ENT](#) (ENT) in partnership with [Consorzio Italiano Compostatori](#) (CIC), [ACR+](#) (Association of Cities and Regions for sustainable Resource management), [European Compost Network](#) (ECN) and [Zero Waste Europe](#) (ZWE). It is a 2.5-years LIFE Preparatory Project funded by the European Commission.

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LIFE BIOBEST Guidelines

In conjunction with the January 2024 EU separate collection mandate, the LIFE BIOBEST project investigates various facets of bio-waste management ranging from separate collection, implementation of recycling strategies, processing systems and related management options in order to create high-quality compost and digestate products.

To support upper-level authorities and decision makers in streamlining policy measures and lower-level authorities in implementing solu-

tions, LIFE BIOBEST presents four bio-waste management guidelines. Together, these guidelines offer a strategic vision and practical approaches crucial to effective bio-waste management.

The goal is to provide guidance and support for optimising implementation of the EU obligation with evidence from high performing schemes and with the definition of performance indicators. This guidance may be applied to all the involved actors in the system to maximise the potential contribution of bio-waste to circular economy and related EU targets. Whether municipalities are in the initial stages of bio-waste implementation design or an advanced state of management, these guidelines provide a point of reference for policy and decision-makers, local authorities, waste haulers, recycling entities, and technical practitioners.

This work is crucial to promote the collection of large quantities of high-quality bio-waste in order to produce quality outputs such as compost and digestate for safe use on soil and biogas. Given the diversity of local contexts, these guidelines provide a comprehensive outlook on bio-waste management as well as existing Best Practices from a number of EU countries where management instruments are successfully applied.

The four LIFE BIOBEST guidelines are:

- **D3.1 Guideline on separate collection** provides an overview of the different bio-waste separate collection schemes and assesses the pros/cons. This guideline includes a set of Best Practices that focus on collection from households and other producers in various contexts.
- **D3.2 Guideline on governance and economic incentives** discusses the governance tools and economic instruments needed to improve management schemes. The guideline presents these instruments alongside examples of their application and includes an analysis of the economic viability of Best Practices in bio-waste management from separate collection to treatment.

- **D3.3 Guideline on quality compost and digestate** breaks down the treatment technologies and resources that support the production of compost and digestate. The guideline provides insights about the processing options, analysis of product characteristics, quality assurance systems as well as related EU legislation and the ECN quality assurance scheme.
- **D3.4 Factsheets on the analysis of best practices in communication and engagement from various countries** delves into the topic of public communication and education. Public participation and awareness are key complementary issues to management schemes. This guideline includes an analysis of experiences from frontrunners and gives insight about impacts of communication activities.

The backbone of these guidelines is the empirical knowledge of the LIFE BIOBEST consortium and the successful experiences and instruments provided in each document. Taken individually or as one, these guidelines contain information key for institutions and stakeholders in the bio-waste value chain.

This summary document aggregates the main conclusions and lessons learned from each guideline for expedited readability. Separate collection of bio-waste is of utmost importance for achieving environmental sustainability and economic efficiency of the waste management system, as well as for promoting circular economy principles. Moreover, since December 2023, the diversion of bio-waste is obligatory across all EU countries according to the Waste Framework Directive (WFD) and is pivotal to reach high recycling targets of MSW. Implementing effective bio-waste management systems requires a combination of infrastructure development, education and supportive policies.

For more information, please refer to full LIFE BIOBEST guidelines available on the [LIFE BIOBEST project website](#).

Conclusions from D3.1 Guideline on separate collection

The D3.1 Guideline on separate collection aims to summarise the key aspects that have to be considered when implementing a separate collection scheme for bio-waste and, in particular, for kitchen waste. The aim of the guideline is to address local authorities at the municipal or district level and provide the basic technical information about how to establish a separate collection scheme for bio-waste.

The guideline includes a focus on necessary tools for households (and other producers) such as bins and containers, collection frequencies for bio-waste (and other related municipal solid waste streams) and on the quality of kitchen waste collected, so that decision makers and local authorities will take a leap towards the implementation of the WFD mandates. The guideline also includes a short section on home composting, a technique where households handle their domestic bio-waste in a private space.

A set of diverse Best Practice (BP) cases identified in the framework of LIFE BIOBEST project and included in Annex 1: Best Practice cases on bio-waste collection of the guideline details the aspects of collection, treatment and recycled products, illustrate the models implemented in specific areas and local contexts.

There are a number of elements that can be highlighted from the best practice cases investi-

gated and the suggestions included in the guideline. Bio-waste is a mixture of variable amounts of kitchen and garden waste, whose quantities depend on how the scheme is set-up and what types of biodegradable waste is requested to be sorted, according to the instructions delivered by local authorities and the collection services to waste producers.

Commercial activities generating bio-waste such as hotels, restaurants, cafeterias and others can be included into the public or municipal scheme for separate collection; this depends sharply on the boundaries of the public MSW service defined by national legislation or local regulation. The guideline primarily focuses on collection from residential users and only secondarily on non-residential collection.

There are additional types of bio-waste producers that may (or may not) be served by local or municipal waste services, such as marketplaces or companies being responsible for the maintenance of public green areas or spaces. This depends on the local legislation or how collection services are set-up locally. These types of producers are not addressed in the guideline.

Key elements regarding kitchen waste collection

- Kitchen waste is a critical waste to sort at home and on the premises of commercial activities due to its high moisture and the tendency to degrade fast, especially if it contains meat or cooked residues. Hence, almost all success schemes make use of a set of tools to ease households in sorting their kitchen waste at home. These tools start from (vented) kitchen caddies including biodegradable and compostable paper or plastic liners.
- Kitchen waste collection at households and commercial activities works better where door-to-door schemes are in place, allowing the design of the service according to the production and the needs of single (or groups of) waste producers. In addition, door-to-door schemes allow to check the

quality of the waste sorted at single households or buildings. Hence, compared to bring-schemes these approaches increase the amount collected and reduce the physical contaminants.

- Frequencies of separate collection play an important role when aiming to engage the participation of households and large, commercial producers. In this context, kitchen waste should be always collected more frequently than residual waste.
- Type and size of the bins for kitchen waste collection influence the possibility to allow garden waste to be delivered together with kitchen waste. Kitchen waste -only schemes are characterised by the production of smaller volumes per person compared to schemes collecting both garden waste and kitchen waste. The availability of large volume bins bear the risk to collect also non-recyclable or bulky MSW.

Key elements regarding commingled versus separate kitchen waste and garden waste collection

- Bio-waste represents a commingled collection of both kitchen waste and garden waste generated in private gardens and/or vegetable gardens.
- Commingled collection is logistically simpler to perform compared to single-stream schemes. However, the joint delivery of both, garden waste and kitchen waste, at the same recycling plant and therefore with the same fees, may impact negatively the costs for recycling, considering that the cost for treating kitchen waste is generally higher than the one for garden waste.
- Separate collection of kitchen waste and garden waste as individual streams allows a better planning of both collection services, adapting the latter to the seasonal arisings and limiting unrequired bin volume that could be filled with contaminants other-

wise. It also allows local authorities to collect kitchen waste more frequently.

Key elements regarding garden waste collection

- Garden waste is collected less frequently than kitchen waste, reflecting the different characteristics of the two streams and the seasonality of garden waste compared to the generation of kitchen waste; supervised collection centres or door-to-door schemes perform better in preventing contamination during separate collection.
- Low-frequency collection schemes for garden waste also stimulate the participation of households in home composting initiatives, thus preventing large amounts of bio-waste to be managed by public services.

Key elements identified in best practices

- The best practice cases attached to the guideline clearly show how kitchen waste collection has been established by local authorities, by considering a broad picture of integrated MSW management approaches. Thus, in most cases it includes a significant reduction in collection frequency for and amount of residual waste, following the reduction of the amounts of putrescible waste that is sorted with a dedicate collection scheme.
- The cases investigated also prove that intensive sorting scheme for kitchen waste can be successfully applied in a wide range of houses, ranging from detached, to semi-urban and to metropolitan areas. In addition, the role and contribution of home composting is detailed in a number of rural, low-density areas.
- The examples investigated cover also most climatic conditions that can be found in EU countries, ranging from West to East and from South to North.

Conclusions from D3.2 Guideline on governance & economic instruments

Waste management is a complex problem characterised by multi-layered interdependencies, compound social dynamics and webs of stakeholders (Lenkiewicz, 2024). The interconnected institutional and regulatory frameworks work to promote or hinder the use of certain measures, thereby streamlining strategies towards common targets. Frameworks must establish transversal and enforceable regulations and include standards for bio-waste collection, processing, and the use of outputs. In this process, economic instruments and incentives are crucial.

D3.2 Guideline on governance and economic incentives provides a descriptive survey of the governmental elements and economic instruments that can be leveraged to improve bio-waste management schemes. This includes discussions of the organizational and structural elements of governing bodies as well as economic instruments that may be applied along the bio-waste value chain steps to prevent, collect, valorise and dispose of waste. The final sections of the guideline include description of the costs and the Key Performance Indicators (KPIs) identified by LIFE BIOBEST consortium.

Good governance is the lynchpin of effective environmental policy and implementation. The extension, efficacy, longevity and scalability of technical instruments and economic incentives for bio-waste management rely on governance

and decision-making to set objectives and direct capital, human resources, infrastructure, communication, and technical know-how.

Economic instruments can be effective policy tools in the prevention, minimisation and sound management of bio-waste. Furthermore, economic instruments can be useful in encouraging the behavioural changes necessary to achieve waste policy objectives (OECD, 2019). In some cases, these instruments are a decisive tool to mobilise authorities and producers to improve bio-waste management.

Given the complexity of governance, instruments and local contexts, there is no one-size-fits-all solution. Instead, institutions and public entities must evaluate the options – such as those provided in the document – and select tools that best fit their circumstance. Throughout the guideline, case examples demonstrate how the instruments are applied in specific locations.

Key elements regarding governance

- Incorporate strategic waste management plans on the national, regional, and municipal level to reinforce and streamline the regulatory framework, adding key specificities unique to the respective jurisdiction.
- Solvent financial capacity supported by grants, subsidies, and loans to encourage investment in bio-waste management and innovation in the field.
- Governments must be capable of specifying the criteria with follow-up mechanisms and establishing the destinations of EU funds in terms of management model and the development of waste infrastructure that supports improving bio-waste prevention and recycling performance.
- Adequate bio-waste treatment infrastructure and investments are key. Planned or existing treatment infrastructure capacity must match the planned volumes of bio-waste generation and target collected amounts, favouring the proximity principle.



- Ensure the provision of all necessary processes by clearly defining roles, responsibilities and quantity/quality objectives in waste related private-public partnerships and public tendering.
- Utilise public participation and participatory decision-making in policy design and implementation. Public confidence and acceptability depend on public perceptions about the effectiveness of the policy, its distributional effects, and its local appropriateness.
- Deploy well-designed campaigns with sufficient resources for the implementation of bio-waste collection and continuous user communication and monitoring services. Provide materials for separation at the source.
- Implement training and empowerment actions for politicians, technicians, agricultural producers and other key stakeholders to improve skillset for bio-waste management systems.
- Data management systems on the local, regional, national and EU level must be connected and are essential for monitoring implementation results (including service coverage, quality/quantity and objective achievements), composition of the residual fraction, infrastructural capacity and results of disposal taxes.
- User participation, incident monitoring and related indicators are necessary for local authorities to evaluate and improve collection and enforcement.
- Control the quality at the service delivery point and implement periodic bio-waste characterisations upon entrance to bio-waste facilities to minimise impurities at the source.

Key elements regarding economic instruments

- Promote disposal taxes on incinerators and landfills and re-evaluate the effectiveness of current ones, increasing or modulating taxes to rebalance the economic viability of bio-waste management.
- Complement disposal taxes with tax refund or premium system that return the tax revenue to the local entities according to the quantity and quality of the bio-waste collected and treated.
- Include measures or economic instruments in respective sectorial laws to enhance the marketability of biogas/biomethane and compost/digestate. Promote the final uses and the supply chain of these outputs.
- Include in national/regional waste laws the obligation for local authorities to apply waste charges that cover the total cost of waste management services.
- Promote and implement PAYT or variable charges schemes based on participation in the separate collection services and number of set-outs for residual waste. This type of charges can be included in waste laws as a compulsory measure to extend their implementation. Data recording and management should guarantee the integrity and quality of the information and the compliance with personal data protection legislation. The array of examples included in the report provide various possible approaches that may fit various contexts and may include a certain varying degree of complexity, efficacy and simplification.
- Promote the application of variable gate fees based on the quality of the input bio-waste in biological treatment facilities. Complement these fees with the establishment of impurities limits to accept the collected flows.



- Align instruments related to energy and emissions (such as emissions trading permits, cap-and-trade models, and energy production taxes) with bio-waste management objectives. The inclusion of lower hierarchy options like municipal waste incineration installations in the EU ETS would contribute to the circular economy by encouraging upper hierarchy options.
- Subsidies are key instruments to facilitate the introduction or improvement of bio-waste collection systems and treatment facilities. For a more efficient and well targeted subsidies, it is key to establish the specifications and destinations of the funds in terms of management model, eligible materials and accompanying activities. One of the main criteria should be the project's capacity to increase quality and quantity bio-waste recycling. The EU provides a varied set of possible funding mechanisms, framed by the EU Taxonomy, that may fit different projects and necessities, and which exclude funds to landfilling and incineration, thereby directing all funds to activities on separation, composting, recycling and reuse.
- Optimised collection models and the continuous monitoring and improvement of the service will result in a more advantageous economic balance and savings. Shared and consociated bio-waste collection services or treatment facilities under economic scale efficiency models is a key instrument especially addressed to smaller local entities.

Conclusions from D3.3 Guideline on quality compost & digestate

The treatment of separately collected bio-waste is a crucial step towards a closed loop of organic resources. Depending on the technology applied, its products bear many benefits. Biogas can be a crucial component in the transition to a fully renewable energy mix and has special benefits in terms of storage capacity. Compost and digestate can both act as fertiliser, while especially compost has beneficial properties for soil improvement and soil health.

D3.3 Guideline on quality compost and digestate includes a technical part as well as a regulatory part. The technical part focusses on the material recycling of bio-waste, aiming at supporting the set-up of processes for the production of high-quality compost and digestate. Therefore, the guidance starts with the presentation of process options including a qualitative comparison of anaerobic digestion, composting and an integrated system combining both. Furthermore, it introduces crucial equipment for processing as well as pre- and post-treatment steps aiming at the refining of the final product.

Furthermore, it gives an overview of crucial quality characteristics from countries and regions with a long history of a quality assurance scheme present, finalised by the presentation of two best practice cases showing the broad range of process complexity.

The guideline introduces the crucial steps of a quality assurance scheme and its benefits towards the production of high-quality compost and digestate. Current EU framework is highlighted including minimum requirements of compost and digestate quality for different application purposes. Finally, the ECN quality assurance scheme (ECN-QAS) is introduced followed by the introduction of national QAS in conformity with the ECN-QAS.

The emphasis of the report is placed on the production of compost and digestate from separately collected municipal bio-waste, prioritising products for soil application, thus excluding biogas. Anaerobic digestion will be considered as the process that allows the production of digestate and an intermediate step towards compost production.

Key elements discussed in the guideline

- Options for process technologies suited for the production of high-quality compost and digestate, including factsheets on pre- and post-treatment technologies,
 - Expectations for product characteristics and qualities,
 - Best practice cases for bio-waste treatment including key performance indicators,
 - A detailed definition of quality assurance schemes,
 - Introduction to existing quality assurance schemes and quality standard parameters for high-quality compost and digestate products, national ones and the one developed by the ECN (ECN-QAS) and
 - Final considerations for product application.
- ### Key elements regarding the promotion of high-quality compost and digestate
- High-quality feedstock material eases the production of high-quality products.
 - Pre- and post-treatment is important for improving the quality of and refining the final product.
 - Know benefits of anaerobic digestion and composting as well as their combination. Be aware of local circumstances and technical potentials for treatment in order to select a preferred treatment pathway as well as the required capacity. Consider the principle of proximity when planning the location of the treatment plant.
 - Best practice cases showcase that with different types of technology, similar products can be obtained. However, advanced processes can deal with lower quality of input material.
 - Get acquainted with EU legislation and the ECN-QAS if national legislation is inappropriately developed.
 - Requirement to implement a national body that develops or adapts standards as well as a QAS for high-quality compost and digestate.
 - Countries with a fully developed quality standard and QAS also produce the highest quality of compost.
 - Know about the different market sectors that may require different specifications for compost and digestate.
 - Be aware of the fertiliser market and the marketing potentials with composts and digestate from different feedstock materials and with different product qualities that may be suitable for different end uses. The continuous production of high-quality compost and digestate will increase the acceptance

of the customers and create a higher value on the market as compared to non-quality assured products.

- In contrast to mineral fertilisers, digestate and especially compost have positive long-term properties on soil health and stability in addition to the fertilising properties. These benefits shall be communicated to promote the use of high-quality compost and digestate to farmers and other end users in order to increase their acceptance.

Conclusions from D3.4 Factsheets on communication & engagement best practices

Drawing from interviews and data analyses across various local, regional, and national contexts, D3.4 Factsheets on communication and engagement best practices aims to present some of the best communication and engagement practices found in Europe that contribute to enhancing the quality (reducing the percentage of impurities) and quantity (increasing the percentage of the population participating) of bio-waste.

Comprising a series of ten factsheets, each drawn from various examples across the EU, this collection provides detailed case studies of successful communication and engagement strategies that cities and regions have introduced during the implementation of bio-waste separate collection.

By synthesising a wealth of successful practices from diverse contexts, the guideline seeks to equip policymakers and waste management authorities with adaptable tools to effectively promote bio-waste separate collection among citizens and businesses and enhance their participation.

While promoting environmentally sustainable behaviours like bio-waste sorting can pose challenges, particularly in urban settings, insights from behavioural economics can, and should,

be effectively applied to the design of the collection schemes.

The primary objective of the factsheets is to highlight the significance of behavioural factors in enhancing engagement in effective bio-waste management models.

Adhering to key elements regarding communications during both the design and implementation phases is essential to ensure the success of such interventions. Although each of the ten specific cases presents unique characteristics valuable lessons and general recommendations can be drawn for the design and implementation of a successful communication and engagement strategy, transferable to any particular context.

Key elements of communication and engagement with insights from behavioural science

- The EAST framework suggests that “people are more likely to adopt behavior changes that are ‘Easy, Attractive, Social, and Timely’”, emphasizing the role of habitual or fast thinking in decision-making. When applied to bio-waste management, this insight highlights the importance of convenience and user-friendliness in sorting schemes.
- Well-designed communication and engagement efforts must be paired with a convenient collection system to effectively increase citizen participation. The “hardware” elements (such as scheme design and ease of use) and the “software” components (like communication and education) are complementary.
- Providing collection tools, such as compostable bags and kitchen caddies, is a key factor in the success of bio-waste collection programs, frequently identified by citizens as essential to encourage participation.
- Losses and disadvantages have greater impact on individual preferences than gains and advantages. Variable charging

schemes such as Pay-As-You-Throw (PAYT) can therefore leverage this cognitive bias to encourage desired behaviours. Such tools perform better when associated together with incentives and rewards to motivate participation and compliance with waste management regulations (ex: rebates for households practicing home composting or reductions in fees for households generating less waste via PAYT systems).

- Many important lessons can be drawn from behavioural science studies to improve the persuasiveness of the communication tools designed to influence positively user’s behaviours. For example, the notion that individuals often prefer avoiding losses over receiving equivalent gains, or that visualising one’s behaviour for others to see nudges people into actions that are deemed the social norm.
- In this respect, it is essential that local authorities, before designing a potential campaign, investigate the factors that may influence citizens’ understanding of and participation in bio-waste sorting, in order to better understand the barriers to and motivations behind greater engagement.
- The success of a communication intervention greatly relies on its adaptability, versatility and inclusivity. Such strategies must consider the diversity of a community, whether language, age or other key factors to reach all population segments. The language used must be kept simple. It is important to always communicate from a user perspective.
- Engage citizens through pre-consultations, ongoing in-person meetings, and online surveys plays a vital role in this process. These strategies not only facilitate the gathering of valuable feedback but also create a sense of ownership among community members, encouraging them to contribute to the dialogue.
- One-time communications (e.g. a campaign) must be always combined with regular or continuous interventions (e.g. bin

inspection by an eco-patrol) to maintain system performance over time, focus and engagement from the community after the initial implementation.

- Begin with pilot projects in smaller areas of the municipality to test the communications method and new system, before gradually scaling up across the rest of the city.
- Maintain close collaboration with waste companies before and throughout, ranging from conducting inspections on sorted materials to data collection.

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