



Policy Brief

Valorisation and Use of Biological Waste and By-Products Support the European Bioeconomy

This policy brief aims at providing a concise overview of the results on valorisation, sustainability and tracking and traceability (T&T) of organic residues from four case studies assessed by the Horizon Europe project BioReCer (Biological Resources Certification Schemes). Additionally, this policy brief includes an overview of the current and future policy landscape on the utilisation of organic residues in the European bioeconomy and provides recommendations based on the results of this project. The application of adapted current certification schemes for bio-based value chains is emphasised as a potential tool.

Key Messages

01 Regulatory Framework

Support the development of harmonised regulatory frameworks that facilitate the use of biological waste.

03 Public Awareness and Education

Promote awareness and understanding of the benefits of bio-waste valorisation among stakeholders, including businesses, policymakers, and the general public.

02 Incentivise Innovation

Provide financial and policy incentives for research and innovation in bio-waste valorisation technologies, supporting start-ups and SMEs in the bioeconomy sector.

04 Monitoring and Evaluation

Establish mechanisms for monitoring the impact and efficacy of policies related to the bioeconomy, ensuring continuous improvement and alignment with sustainability goals.

Background

The European Bioeconomy emphasises the sustainable use of biological resources. With increasing awareness of climate change and environmental degradation, the transition to a bio-based economy is seen as a crucial step towards sustainability. Organic residues, including food waste, bio-waste, municipal waste and by-products as defined by the Waste Framework Directive¹ can, if managed properly, significantly contribute to the sustainability transition. However, there are challenges regarding its management. For instance, the origin of organic waste differs wildly, ranging from municipalities, industry, agriculture or forestry. In additions, they vary in nature, as organic waste can come in liquid or solid state, with more or less water content. These pose a challenge for collection and waste management.

In terms of collection, organic residues are not necessarily collected in all EU countries¹, and there are heterogenous national waste management regulations across the European Union, which hinders the development of an EU wide organic residues market. Furthermore, across the EU organic residues in are marketed and used for low value-added applications and managed with the least favourable waste management options² such as for energy generation in the form of biogas or incineration and composting for soil amendment. Nonetheless, much of it is still landfilled (23.1 % of municipal waste in the EU was landfilled in 2022³). **This leads to the loss of organic residues as valuable feedstock, although their carbon content would make them ideal for replacing fossil resources.**

In the EU, agriculture and agro-industry are significant contributors to the overall available secondary biomass, and nearly one quarter of the available industrial fisheries biomass is waste. In all preliminary studies carried out by the BioReCer consortium showed that substantial volumes of waste and by-products are generated either directly during harvesting or during post-processing (i.e., downstream). This shows that there is an untapped potential for organic residues to become a valuable resources for the European bioeconomy.

Objectives of the BioReCer Project

The project BioReCer, awarded with a Horizon Europe grant under the call HORIZON-CL6-2022-GOVERNANCE-01 aims at assessing and complementing current sustainability certification schemes for biological resources in order to enhance bio-based circular systems.

This objective will be achieved by:

- Developing a set of new sustainability criteria that aligns with the EU Taxonomy Regulation and the new Corporate Sustainability Due Diligence Directive.
- Promote the sustainability and trade of biological resources with a focus on organic residues.
- Assess four value chains with potential to provide organic residues:

Case Study 1

Industrial fish and seaweed waste for the manufacturing of fish oil, collagen and polysaccharides, and the utilisation of sewage sludge from wastewater treatment plants for the production of volatile fatty acids.

Case Study 3

Agricultural waste for the production of bio-based soil enhancers and particle boards.

Case Study 2

Organic fraction of municipal solid waste (OFMSW) and sewage sludge for the production of polyhydroxybutyrate (PHB), a bio-based and biodegradable polyester.

Case Study 4

Recovery of residues and/or by-products from the forestry industry.

The assessment of the four case studies provided a solid base from which to derive policy recommendations.

¹ Directive (EU)2018/851 of the European Parliament and Council amending Directive 2008/98/EC on waste.

² As according to waste hierarchy present in 1

³ <https://www.statista.com/statistics/1480844/european-union-municipal-waste-landfill-share/>

Gaps in EU Policy

The European Union, while committed to a circular economy and sustainable resource management, faces several policy gaps that act as a barrier to fully exploit organic residue valorisation. A cohesive, overarching policy framework targeting organic residues valorisation is currently absent and is scattered across multiple policies. Furthermore, current economic incentives, such as subsidies and tax breaks, often favour traditional waste management practices (landfill and incineration for the production of energy) over innovative valorisation technologies, even when this is against the waste hierarchy provided in the Waste Framework Directive that prioritises reutilisation and recovery above disposal.⁴

Additionally, data on the generation, composition, and potential valorisation pathways of various organic residues is lacking and this hinders informed decision-making and policy development⁵. Insufficient knowledge sharing and collaboration among stakeholders, including policymakers, industry, and academia, can slow down the development and adoption of innovative solutions.

From the consumer perspective, there is a negative perception of products derived from organic residues which can be addressed by creating consumer awareness about organic waste nature and environmental and economic benefits². Effective communication strategies are needed to educate the public about the value of organic residue valorisation and the benefits of using bio-based products.

Addressing these gaps is crucial to create a more enabling environment for the sustainable valorisation of organic residues. By fostering a cohesive policy framework, providing adequate economic incentives, streamlining regulations, enhancing data availability, and improving public perception, the EU can significantly contribute to a circular economy and a more resilient bioeconomy.

Research Findings

Volume, Management and Collection of Organic Residues in the EU

In the EU, agriculture and agro-industry are significant contributors to the overall available secondary biomass⁶, and nearly one quarter of the available industrial fisheries biomass is waste. In all four case studies, **substantial volumes of waste and by-products are generated** either directly during harvesting or downstream, e.g. during food processing or in the context of pulp and paper production.

Biological waste and by-products are mainly treated via disposal, landfill, composting, anaerobic digestion, incineration or for energy generation. For example, in the case of forestry by-products, the material flow analysis carried out in BioReCer showed that only 50% is recycled as material for the traditional wood industry (panel production and pulp and paper industry), while ca. 33% of agricultural residues are used as animal feed. The management of sewage sludge is not well defined and the destination of ~17% is unknown or not specified.

The assessment of the case studies makes clear that **in the EU substantial volumes of organic residues are not collected and thus not accessible for the bio-based industry**: In agriculture, approximately 78% of the totally generated quantity of residues generated during harvesting (straw, stems and stalks) is not collected. This is because they are often left in the field for soil amendment purposes. Also, only 32% of the potentially generated organic fraction of municipal waste is separately collected and managed sustainably in the EU.

Valorisation and Applications

The integration of residual biomass flows into higher-value applications is relatively low for all organic residues. According to the material flow analysis in BioReCer, only a very small percentage of organic residues are valorised and proceed to the bio-based industry (e.g. forestry: 3%, OFMSW: 2%, sewage sludge: 0.3%). The bio-based industry based on agricultural by-products is still relatively small compared to the biological processing of primary agricultural products. This is because of constraints that hinder valorisation, namely:

- Spatial distribution of waste generation that makes logistics management difficult and costly.
- Seasonality in residue production, which does not guarantee a sustained influx of raw materials.
- Insufficient quantities of organic waste available for use and difficulties in their storage.
- Data limitations: For examples, in the case of fisheries, there is no data on available organic waste. **Thus, substantial volumes of valuable material are lost for the bio-based industry** that could be easily transformed into proteins, lipids, collagen and fat-soluble vitamins.

The current applications of organic residues for bio-based products are agrochemicals including organic fertilisers, bioplastics, bio-composites, cosmeceuticals and surfactants. **However, there are many prospects of development of the circular bio-based industry, as many technologies are under development, already available or even on the way to commercialisation.**

⁴ Directive (EU)2018/851 of the European Parliament and Council amending Directive 2008/98/EC on waste.

⁵ BioReCer (2024). D4.1 Report on the whole development of the BRSP

⁶ i.e. biomass that does not originate from food crops or wood

Initial Policy Recommendations

Based on the findings of the consortium members and the discussion with stakeholders, the BioReCer consortium is able to provide initial policy recommendation that aim at fostering the utilization of organic residues. The following recommendations could provide a starting point for a discussion that may lead to a more conducive environment for the development of an organic residues industry that contributed to the fulfilment of the Europea Green Deal objectives:

- 01** | Clearly define organic residues and the corresponding sustainability ambitions for bio-based materials and products and clearly define potential entry points of organic residues in the processing value chains. These ambitions should include not only environmental aspects, but also social and economic aspects.
- 02** | Foster the use of organic residues for bio-based products in the EU, especially in the cases in which organic residues cannot be reduced or avoided and legitimate the uses with safety standards whenever necessary.
- 03** | Clearly set quantitative sustainability targets and strategies for the utilisation of organic residues. The current legislative framework only recognises the added environmental benefits if organic residues are utilised for energy production, this should also be the case for bio-based products whose bio-based share is fulfilled with treated organic residues.
Regarding this point, we also suggest to:
- 04** | Clarify, where possible, future bio-based requirements of products and which of these requirements can be fulfilled by organic residues. An ideal consideration would be to incorporate a mandatory quota of bio-based content in products and materials and a sub-quota that can only be fulfilled by organic residues. This way a demand market is created from which financial incentives can be channelled.
- 05** | Adapted certification schemes should be recognised as the central solution to avoid greenwashing and consumer deception, and to guarantee corporate due diligence: Concise certification will ensure T&T of biological feedstock and that global value chains are just and sustainable. Furthermore, certification of organic feedstock and bio-based products will ensure that green claims are based on generally recognised scientific evidence and relevant international standards (see proposal of the Green Claims Directive). It will then be easier for consumers to distinguish between sustainable and non-sustainable products.
- 06** | Implementation of mass balance and free attribution (MBFA) in EU policy to facilitate the transformation of the EU economy to a circular bioeconomy: The term “mass balance” describes bio-based products for which biomass is used as a feedstock but where this sustainable feedstock is mixed with conventional material (e.g. if the biological feedstock is not available in sufficient amounts). “Free attribution” means that the share of fossil feedstock does not necessarily be specified as a percentage in certain selected end products. Thus, the MBFA approach enables the substitution of large quantities of fossil resources with biomass, while at the same time facilitating the gradual transition to a circular bioeconomy as according to the EU bioeconomy strategy⁷. Both, mass balance and the free attribution are based on solid and established certifications. Therefore, MBFA should be applied by the EU as an approach to defossilise the industry, i.e. to stepwise abstain from fossil resources and increase the share of renewable feedstock in products and materials.

⁷ https://research-and-innovation.ec.europa.eu/research-area/environment/bioeconomy/bioeconomy-strategy_en

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Concise consumer information and awareness activities on bio-based products should be promoted: Utilising organic residues for bio-based products represents a paradigm shift where waste is treated as a resource, aligning with EU directives and sustainability goals. However, consumer apprehension persists due to misconceptions and lack of trust. To address this, it is imperative to implement targeted consumer awareness and education campaigns. These initiatives should emphasise the value proposition of bio-based products, highlighting their environmental benefits, reduced carbon footprint, and contribution to circular economy principles. Moreover, clear communication on certification schemes and sustainability credentials will help consumers make informed choices. Such efforts are essential to dispel greenwashing and ensure consumer confidence in bio-based products. By empowering consumers with accurate information, we can foster a market environment conducive to the sustainable uptake of bio-based products and drive the transition towards a circular bioeconomy.

Conclusions and Next Steps

The valorisation of organic residues holds significant potential to advance the European bioeconomy, reduce dependency on fossil resources, and contribute to achieving EU sustainability goals. However, current policy gaps, such as fragmented regulations, insufficient data, and inadequate incentives, hinder the full exploitation of this potential. The BioReCer project highlights the need for cohesive policy frameworks, enhanced certification schemes, and targeted consumer education to drive the transition towards a circular bioeconomy.

Key next steps include setting clear sustainability targets, fostering innovation in bio-waste valorisation technologies, and integrating mass balance and free attribution approaches into EU policies. By aligning efforts across stakeholders — policymakers, industry, academia, and the public — the EU can unlock the untapped value of organic residues, ensuring a just and sustainable bio-based future.

Annex – Relevant Definitions from the Waste Framework Directive⁸

“Municipal waste” means mixed waste and separately collected waste from households, including [...] bio-waste, wood, [...], (and) collected waste from other sources, where such waste is similar in nature and composition to waste from households.

“Bio-waste” means biodegradable garden and park waste, food and kitchen waste from households, offices, restaurants, wholesale, canteens, caterer and retail premises and comparable waste from food processing plants.

“Food waste” means all “‘food’ (or ‘foodstuff’) means any substance or product, whether processed, partially processed or unprocessed, intended to be, or reasonably expected to be ingested by humans”⁹ that has become waste.

⁸ Directive (EU)2018/851 of the European Parliament and Council amending Directive 2008/98/EC on waste.

⁹ Regulation (EC)178/2002 of the European Parliament and the Council on food law and food safety.