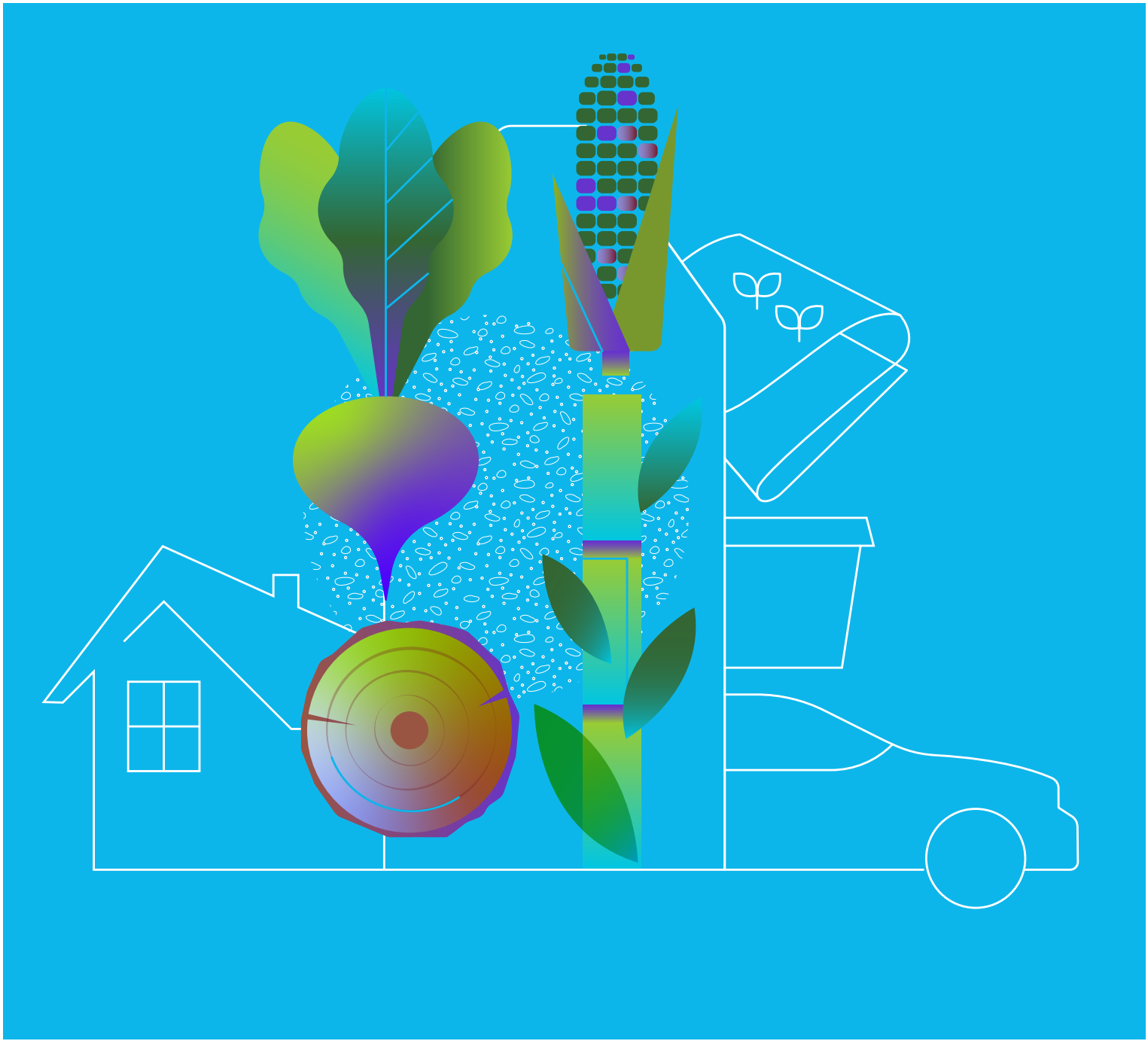
Bio-based Industries Consortium

Lead Markets for Europe's Bioeconomy

Bio-based Plastics, Polymers & Fibre-based Packaging



1. Introduction

Reducing fossil dependence in packaging, construction, mobility and agriculture

Bio-based plastics include a broad category of polymers including bio-based, biodegradable and compostable plastics.[1] Like fossil-based plastics, they can be used across several sectors and in everyday applications, ranging from consumer goods, car components, building materials and packaging. In addition, fibre-based products are one of Europe's significant market, such as construction and packaging applications. The BIC task forces identified and assessed four end-markets where substitution potential remains unrealized.

Bio-based plastics include a broad category of polymers including bio-based, biodegradable and compostable plastics.[2] Like fossil-based plastics, they can be used across several sectors and in everyday applications, ranging from consumer goods, car components, building materials and packaging. Today, over 99% of plastics are produced from fossil resources.

1.1 Competitiveness and innovation

Europe's competitiveness in bioplastics faces a structural challenge: competition from fossil-based plastics, whose entrenched infrastructure and lower costs make substitution slow in price-sensitive sectors. The bio-based plastic sector created opportunities for innovation and growth, offering about 57,000 jobs on a yearly basis in the decade 2014-2023, 25-30 % of which are estimated to be related to manufacturing and production of bio-based plastics.

1.2 Market data

As of 2025, bio-based plastics accounted globally for roughly 0.5 % of the total plastics production, of the 431 Mt of plastics produced annually.

Current forecasts indicate that global biobased plastics production capacity will double from 2.3 M. in 2025 to about 4.7 Mt by 2030 reflecting rising demand and emergence of ever more advanced applications and products.

The European bioplastics market is expected to expand at a compound annual growth rate (CAGR) of 18.3% from 2024 to 2030.

1.3 Sustainability

Today, over 99% of plastics are produced from fossil resources, making plastics one of the most structurally fossil-dependent material systems. As a result, the plastics value chain represents a significant source of upstream greenhouse gas emissions, largely embedded in Scope 3 emissions for downstream users. Defossilisation of material inputs therefore constitutes a key lever for reducing the climate footprint of plastic products, independently of end-of-life considerations.

Bio-based plastics contribute to this defossilisation by substituting fossil carbon with renewable carbon at the feedstock level, directly addressing Scope 3 emissions related to raw material sourcing.

From an industrial perspective, this shift is particularly relevant for brand owners and converters facing increasing disclosure and reduction requirements under EU climate and sustainability frameworks.

Importantly, sustainability performance depends not only on carbon metrics but also on sustainable biomass use.

In this respect, the cascading use principle[3] can play a central role, supporting resource efficiency and alignment with the broader bioeconomy objectives of the EU.

Bio-based products show, on average, 45% lower life-cycle greenhouse gas (GHG) emissions than fossil-based counterparts, based on a meta-analysis of 98 products across 130 studies.

Replacing fossil feedstocks generally lowers the greenhouse gas emissions over the product's whole life cycle, while for the other environmental impact categories trade-offs may also occur, especially when it comes to increased eutrophication and land/ water use.

[1, 2] Bio-based plastics are a versatile group of materials that can be classified in different manners. For further reference, JRC report on biobased plastics " JRC Publications - Bio-based plastics in a sustainable and circular bioeconomy

[3] Link to CBE JU SRIA and definition of cascading principle

2. Packaging

Replacing fossil-based packaging with renewable alternatives

Europe's packaging sector is undergoing a materials transition driven by regulatory pressure (e.g. PPWR), (corporate) sustainability commitments, and shifting consumer preferences. Within this broader market, two segments are particularly dynamic, the bio-based plastics packaging, and fibre-based packaging.

2.1 Bio-based Plastic Packaging

Introduction

The packaging sector accounts for the largest share of plastic use in Europe, making it a major climate lever if partially replaced by bio-based materials.

It is a high-volume consumer segment under strong regulatory pressure on recyclability, minimisation, and recycled content and one where bioplastic alternatives exist for almost every conventional plastic material and application, often offering equivalent or superior properties.

Packaging is the largest single application segment for bio-based plastics, dominated by food and beverage uses but extending across cosmetics, detergents, e-commerce, retail, consumer goods, and industrial and logistics packaging.

Competitiveness and innovation

Bio-based polymer technologies for packaging are broadly mature across both food contact and non-food contact applications.

For food contact packaging

For food contact applications, key resins such as PLA, PBAT, starch-based materials, and bio-based PE and PET are already produced at industrial scale. PEF, while currently produced at lower volumes, has also received food contact approval under EU food safety legislation, and deployed by major brands. So-called drop-in solutions (bio-PE and bio-PET, chemically identical to their fossil-based counterparts) require no changes to existing logistics, filling, or processing systems, significantly lowering adoption barriers and making them immediately actionable under current compliance frameworks.

A distinct innovation dimension in food contact packaging concerns certified biodegradable and compostable items deliberately designed to support bio waste collection efficiency and avoid contamination of recycling streams. This presents an opportunity for regions where bio waste collection infrastructure are established.

Non-food contact packaging

For non-food contact applications, including personal care, cosmetics, home care, retail, and industrial and logistics packaging, the regulatory bar for material approval is lower compared to food-contact packaging, and a wider range of bio-based resins is already in commercial use.

Product examples include bottles and tubes for shampoo and body care, cosmetic jars and compacts, films and wrappers for consumer goods, and compostable mailers and loose-fill for e-commerce and logistics.

Research is increasingly focused on developing bio-based alternatives that match conventional plastics in strength, barrier properties, heat resistance, and processability, with the goal of creating materials that can truly serve as drop-in replacements across a wider range of applications.

Compostable formats are also finding application in non-sensitive goods, particularly in single-use formats where end-of-life management through industrial composting is feasible.

Market data

Packaging remains the largest market segment for bioplastics with 41.3 percent (0.95 million tonnes) of the total bioplastics production capacity in 2025, the biggest market segment within the bioplastics industry. Still, this constitutes a limited part of the global packaging demand: with plastic packaging demand set at more than 140 million tonnes, the bioplastic capacity amounts to around 0,6% of global plastic packaging demand – assuming a 100% capacity utilization (today capacity is at around 70%).

Europe is the dominant regional market, holding a 43,1 % revenue share of the global bioplastics market in 2025.

Given limited availability, bio-based plastics comes with a "green premium". According to a recent Joint Research Centre (JRC) briefing, "producing bio-plastic is generally 1.5 to 2 times more onerous than fossil fuels-based plastics".

Sustainability

EU plastic packaging waste stands at approximately 16.6 million tonnes per year, making it the single largest decarbonisation lever within the packaging sector.

The sustainability of bio-based packaging should be assessed across its full life cycle, taking into account biomass sourcing, production processes, product performance, and end-of-life management. Sustainability therefore depends not only on carbon metrics, but also on the efficient use of biomass resources and the ability of materials to integrate into circular systems. End-of-life management is also critical.

For food-contact packaging, food contamination can limit recyclability, making composting or dedicated collection streams suitable for certified biodegradable and compostable materials such as PLA and PBAT.

For non-food-contact applications, mechanical recycling is can be more efficient, as bio-PP, Bio-PET and dedicated bio based materials as PEF are compatible with current recycling and sorting streams.

2.2 Fibre-based Packaging

Introduction

Fibre-based packaging is one of Europe's most strategically significant packaging segments, combining strong domestic supply chains, high recycling rates and deep alignment with EU sustainability and circular economy objectives. Despite these strengths, significant substitution potential remains unrealised.

Fibre-based packaging spans a wide range of applications across food contact and non-food contact uses, from corrugated boxes and cardboard cartons to moulded pulp trays, barrier-coated flexible papers, and paper-based primary packaging, and in many of these formats, conventional plastics continue to dominate.

Competitiveness and innovation

The European fibre-based packaging industry benefits from a strongly integrated value chain. Around 86% of fibrous raw materials are sourced within the EU, positioning Europe as a natural base for scaling innovation in fibre-based formats.

This high level of regional sourcing supports security of supply while supporting a competitive European industry with a strong export orientation: the pulp and paper industries exports around 20% of its production and maintains a strong overall trade balance among EU manufacturing industries.

Market data

Fibre-based packaging generates €110 billion in revenue, €26 billion in added value, and supports 710,000 jobs across the European value chain. The next-generation paper-based and fibre-based packaging market in Europe generated USD 99.6 billion in 2024, expected to reach USD 122.9 billion by 2030 at a CAGR of 3.6%.

At the same time, despite this scale and the availability of proven alternatives, plastics continue to represent a major share of the market, accounting for around 40% globally and around 20% of material flows in the EU, while remaining dominant in many high-performance applications such as food contact and flexible packaging.

Food and beverage applications account for the dominant share of demand, while non-food contact segments including e-commerce, electronics, and cosmetics represent the faster-growing share, driven by plastic substitution dynamics and regulatory pressure on single-use formats.

Corrugated paper and paperboard containers

The corrugated and paperboard container are the largest European fibre-based packaging sub-segments, dominating transport, secondary, and e-commerce packaging..

The EU market was valued at USD 44.2 billion in 2024, projected to reach USD 56.8 billion by 2035, with the e-commerce sub-segment growing at a CAGR of 10.9%. With an 89% recovery rate, it offers an immediate and scalable alternative to plastic secondary packaging.

Folding cartons and food contact paperboard, including greaseproof papers

Folding cartons and food contact paperboard, including greaseproof papers are used as primary packaging for dry food, ready meals, consumer goods, and foodservice, with the central innovation frontier being the replacement of fossil polymer coatings with bio-based alternatives.

Cartonboard accounts for 45.1% of the European paperboard market in 2024, with liquid cartons growing at the fastest CAGR of 5.31% to 2030.

Moulded fibre plates, trays and bowls

Disposable tableware and protective trays for foodservice, electronics, and cosmetics at full commercial maturity. The European moulded pulp market was valued at USD 1.28 billion in 2024, projected to grow at a CAGR of 8.1% through 2030.

Greaseproof papers

Food contact material for wrapping, baking, and food preparation, toward bio-based alternatives such as plant waxes and PLA coatings at TRL 7–8. The Nova Institute estimates that 100,000 tonnes of additional recyclable paper packaging could be unlocked by compostable bio-based barriers, avoiding 60,000 tonnes of multi-layer plastic annually.

Paper cups, bowls, bags and food containers

The paper cups, bowls, bags and food segment has grown to fill the gaps generated by the phasing out of fossil plastic formats across HoReCa, catering, and retail. The EU meal delivery market — a key demand driver — is projected to exceed USD 60 billion by 2029.

Sustainability

EU paper and board recycling rates are the highest globally, with an 89% corrugated recovery rate and a sector target of 90% by 2030. The climate case for substitution is compelling: in 2021, the use of approximately 20 million tonnes of paper and board in the EU is estimated to have substituted around 10 million tonnes of plastic, delivering an estimated emissions reduction of approximately 80 million tonnes of CO_2eq. The emissions differential between materials is striking — cartonboard generates around 420 kg CO_2eq per tonne compared with roughly 6,000 kg CO_2eq per tonne for rigid plastic — and significant further gains remain available as fibre-based formats continue to displace plastics across applications where they do not yet dominate.

A saving of -106Mt CO2eq by 2050 is estimated in the EU by switching from fossil plastic packaging to fibre-based packaging.

When also biodegradable and compostable according to international standards they contribute in supporting biowaste collection (avoiding its contamination with non-compostable items) and they do not release persistent microplastics.

3. Agriculture & Horticulture

Supporting sustainable and resource-efficient farming

Bio-based plastics are increasingly used in agriculture and horticulture to reduce dependence on fossil-based materials and improve sustainability. Applications include mulch films, plant pots, seedling trays, clips, twines, greenhouse clips, irrigation components, controlled-release fertilizer coatings.

Many of these materials are based on starch, polylactic acid (PLA), polyhydroxyalkanoates (PHA), lignin, cellulose, polybutylene adipate terephthalate (PBAT) or bio-based polyethylene (bio-PE).

These products are already used in Europe (e.g., organic farming) and can be ploughed in after use to decompose. They eliminate retrieval, reducing labour and cost for farmers, and prevent permanent plastic pollution.

3.1 Bio-based, certified soil biodegradable mulch films

Bio-based, certified soil biodegradable mulch films are one of the fastest-growing applications of bioplastics in European agriculture and horticulture. These films are used to cover soil around crops to suppress weeds, retain moisture, improve soil temperature, and increase crop yields. Unlike conventional polyethylene mulch films, many modern bio-based mulch films are designed to biodegrade in soil after use, reducing plastic waste and microplastic accumulation. Such materials, where compliant with the test methods defined in EU legislation, have been recognized as fertilizers within the Fertilizing Products Regulation[4], which also defined biodegradability criteria for coating agent and water retention polymers.[5]

4 Commission delegated regulation (EU) 2024/2787

5 Commission delegated regulation (EU) 2024/2770

In Focus: Biodegradable mulch

In Europe, more than 270,000 ha is under biodegradable mulch (2023), representing 8% of bioplastic capacity for agriculture. This represents around 83,000 tonnes per year of agricultural plastic use, making them the second-largest agricultural film application.

More than 720,000 tonnes of agricultural plastics are used annually in Europe, while only about 24% is recycled. This recycling challenge has accelerated interest in certified soil-biodegradable mulch films based on materials such as starch blends, PLA, PHA, PBAT, and PBS.

3.2 Compostable plant clips

Compostable plant clips are mainly used for tomatoes, cucumbers, peppers, berries, and ornamental crops in greenhouse and vertical farming systems. The global market for compostable and biodegradable plant clips is still relatively small compared with the overall agricultural plastics market, but it is expanding rapidly due to increasing greenhouse horticulture, sustainability targets, and regulations on plastic waste. Recent market studies estimate that the broader global plant support clip market is valued at approximately USD 250–500 million in 2024–2025, with biodegradable and compostable clips representing one of the fastest-growing segments. Expected annual growth rates for biodegradable clips are around 8–10% through 2030–2033. Europe is one of the leading regions for compostable plant clips because of its advanced greenhouse horticulture sector and strong environmental legislation. Countries such as Netherlands, France, Germany, Italy, and Spain are major adopters.

The European market is estimated to account for roughly 25–35% of global demand for compostable horticultural clips and accessories.

3.3 Compostable agricultural twines

Compostable agricultural twines are increasingly used in greenhouse horticulture, vineyards, orchards, hop cultivation, and open-field agriculture as sustainable alternatives to conventional polypropylene (PP) twines.

These materials are designed to provide sufficient mechanical strength during the crop cycle while biodegrading or composting after use, reducing agricultural plastic waste and microplastic pollution.

Modern biodegradable horticultural twines are engineered to withstand humid greenhouse conditions and high crop loads.

Competitiveness and innovation

Innovation is focused on improving durability, soil biodegradation, and cost competitiveness.

Companies are developing advanced PLA/PHA blends, starch composites, and cellulose-based materials with improved UV resistance and mechanical performance for demanding agricultural conditions. There is also increasing interest in recyclable bio-based plastics and precision agriculture materials compatible with circular economy systems.

Market data

Agricultural bioplastics represent 8-9% of global bioplastic capacity (2022-27). The global market for bio-based and biodegradable plastics in agriculture is growing rapidly. Agricultural mulch films alone represented a global market of more than €1.5 billion in 2024, with Europe accounting for around 25–30% of demand due to strong environmental regulations and restrictions on conventional plastic residues in soil. Biodegradable mulch films are among the fastest-growing segments, with annual growth rates estimated at 12–15%.

Europe is a leading region, particularly in countries such as Italy, France, and Germany, where policies encourage biodegradable agricultural materials.

In Focus: Biodegradable agricultural twine

The global biodegradable agricultural twine material market size reached USD 712 million in 2024, propelled by increasing adoption of sustainable farming practices and stringent environmental regulations. The market is forecasted to grow at a robust CAGR of 8.4% during the period 2025 to 2033, reaching a projected value of USD 1.42 billion by 2033.

Europe is currently the leading regional market, accounting for more than one-third of global revenue in biodegradable agricultural twines. Countries such as Netherlands, Spain, Italy, France, and Germany are major users because of intensive tomato, cucumber, pepper, and berry greenhouse production.

3.4 Biodegradable plant guard market

The global biodegradable plant guard market size reached USD 1.17 billion in 2024, driven by increasing environmental awareness and regulatory support for sustainable agricultural practices.

The market is expected to grow at a robust CAGR of 9.6% during the forecast period, with the market size anticipated to reach USD 2.72 billion by 2033.

Sustainability

Environmental benefits include reduced fossil resource use, lower greenhouse gas emissions, and decreased plastic accumulation in agricultural soils. Conventional agricultural plastics can leave persistent microplastic residues after use, while certified biodegradable mulch films can degrade in industrial composting or, in some cases, directly in soil under controlled conditions.

Lifecycle assessments show that bio-based agricultural plastics can reduce lifecycle greenhouse gas emissions by approximately 20–50% compared with conventional polyethylene products, depending on feedstock and end-of-life treatment.

The EU has introduced the EN 17033 standard for biodegradable mulch films, defining strict requirements for biodegradation, ecotoxicity, and soil safety. Since November 2024, certified soil-biodegradable mulch films can also obtain CE marking under the EU Fertilising Products Regulation (FPR), supporting wider adoption across the European Economic Area.

Properly used biodegradable mulches degrade in approx. 2 years with no toxic residue, cutting plastic contamination and avoiding CO_2 emissions from virgin fossil-based plastic production. Plus, these films can improve soil structure (leaving organic matter) and preclude on-site burning of plastic waste (a banned yet occasional practice). The climate balance is positive especially if the film is bio-based (e.g., PLA from starch, releasing biogenic CO_2). Since they are inherently biodegradable, they do not release persistent microplastics in soil.

4. Compostable Packaging & Disposable Plastics

Supporting circular solutions for organic waste management

Biobased compostable bags and disposable products, certified according to international standards, are gaining increasing importance in the transition toward a more sustainable and circular economy.

4.1 Introduction

By reducing dependence on fossil-based plastics and supporting organic waste collection and recovery, these materials can contribute to lower environmental impacts and improved waste management systems.

Such products also allow to facilitate recycling of multi-material packaging.
PPWR (Art.9) mandates compostability for specific applications such as fruit stickers, permeable tea, coffee or other beverage bags, and allows member states to include additional mandatory compostable packaging (non-permeable tea, coffee or other beverage system, lightweight and very lightweight plastic bags, packaging that are banned form Annex V).

Important materials used in compostable bags and disposable plastics include PLA (polylactic acid), PBAT, PHA, starch blends, and other bio-based polymers.

4.2 Competitiveness & innovation

Compostable bags based on starch/PLA/PBAT blends are already widely deployed in several EU countries. Recent innovations focus on improving the performance, durability, and compostability of products made from materials such as PLA, PHA, starch blends, cellulose, seaweed, and mycelium-based polymers. New high-barrier compostable films are now able to protect food against oxygen and moisture, allowing compostable packaging to expand into applications such as snack foods, ready meals, and takeaway packaging.

Another important innovation is the development of home-compostable bags and disposables, which can degrade under lower-temperature composting conditions without requiring industrial composting facilities.

Emerging technologies also include compostable coffee pod components, edible coatings, mono-material bio-based packaging, and reusable-compostable hybrid systems, which are expected to further expand the global market for compostable disposables in the coming years.

4.3 Market data

Compostable biobased compostable bags and disposables are increasingly recognized as an important solution for reducing the environmental impact of single-use plastic products.

Their use is growing rapidly in applications such as food packaging, organic waste collection bags, catering items, and agricultural products. The global compostable packaging and disposables market was valued at approximately USD 80–85 billion in 2024–2025 and is expected to grow at annual rates of around 7–8% over the next decade.

Europe is one of the leading markets, representing approximately 40% of global demand due to strong EU legislation such as the --Use Plastics Directive and Circular Economy Action Plan.

Major applications include compostable food packaging, bags, cutlery, cups, trays, and catering products made from materials such as PLA, starch blends, cellulose, and PHA.[6]

The global market for biobased compostable bags specifically has grown rapidly in recent years, driven by increasing environmental awareness, restrictions on single-use plastics, and stronger sustainability policies. Market studies estimate that the global compostable bags market was valued at $1.2 billion in 2024 and is projected to reach $3.5 billion by 2033, growing at a CAGR of 12.5% during the forecast period 2025-2033. Europe is currently one of the leading regions in the market.

4.4 Sustainability

Biobased compostable bags and disposables can significantly reduce the environmental impact of conventional single-use plastics when used in appropriate applications.

Studies show that biobased plastics can reduce greenhouse gas emissions by approximately 25–75% compared to fossil-based plastics, depending on the raw material and production process, and bio-based compostables have a 45% lower GHG lifecycle.

In Europe, more than 60 million tonnes of food waste are generated annually, and compostable bags can help increase separate organic waste collection rates by improving consumer participation and reducing contamination. Such bags can be thrown out with kitchen scraps, boosting capture rates by up to 30% according to waste operators. The use of such products can help to avoid the accumulation of microplastics in compost and soil.

Certified compostable products compliant with EN 13432 are designed to biodegrade by at least 90% within 6 months under industrial composting conditions, and it remains important to take into account sustainable agricultural practices.

Currently, Europe operates more than 3,500 industrial composting and anaerobic digestion facilities, supporting the growing use of compostable materials in organic waste management systems. Biodegradable and compostable products do not release persistent microplastics, therefore contribute to avoiding the accumulation of non-biodegradable materials in the environment.

6 However, the SUPD excludes biopolymers for such applications, including PHA, since they are considered "not natural" and only obtained through human intervention. PHAs are naturally produced by microbes, but do require production with human intervention in an industrial setting.

In this case, EU legislation like SUPD should focus on the environmental and sustainability merits of the materials given the concerned applications, not on distinctions on where the material is produced.

5. Automotive
Reducing vehicle emissions through bio-based materials

5.1 Introduction

The automotive industry is rapidly adopting innovative bio-based plastics to reduce vehicle weight, lower carbon emissions, and improve sustainability. Major car manufacturers such as BMW, Toyota, Ford, and Mercedes-Benz increasingly use renewable materials derived from plants, agricultural waste, or recycled biomass in interior and exterior vehicle components. Examples include bio-based polyamides, polylactic acid (PLA), natural fibre composites, bio-polyurethane foams, and lignin-based materials. These plastics are applied in dashboards, door panels, seat cushions, trims, and under-the-hood parts.

Natural fibre composites and bioplastics are also increasingly used in electric vehicles to lower lifecycle carbon footprints. Also, the global market for bio-based rubber is growing rapidly, driven by sustainability targets in the automotive, footwear, industrial, and consumer goods sectors. Bio-based rubber includes natural rubber and bio-derived synthetic elastomers produced from renewable feedstocks such as plant oils, sugar-based monomers, guayule, and dandelion latex. The largest application is the automotive industry, especially tires, seals and gaskets, hoses, vibration damping components.

5.2 Competitiveness & innovation

Natural fibre reinforced composites based on flax, hemp, kenaf, or wood fibres are particularly attractive because they combine low weight with good mechanical performance.

Lightweight biobased materials can help reduce vehicle weight by 10–30%, contributing to lower fuel consumption and reduced greenhouse gas emissions during vehicle use.

Electric vehicle manufacturers are especially interested because lightweight materials increase battery efficiency and driving range. BMW uses kenaf and recycled natural fibers in interior panels, while Toyota developed bio-PET and PLA-based materials for seat fabrics and trims.

Another emerging innovation is lignin-based plastics derived from wood-processing residues. Lignin can partially replace fossil-based carbon fibres and engineering plastics in structural automotive applications.

Researchers are also developing bio-based polyamides from castor oil for high-temperature under-the-hood components because they combine durability with lower greenhouse gas emissions.

5.3 Market data

The global market for biobased plastics in the automotive industry is growing steadily as vehicle manufacturers increase their focus on sustainability, lightweight materials, and carbon footprint reduction.

The global automotive bioplastics market was estimated at approximately USD 0.9–1.0 billion in 2025 and is expected to exceed USD 2.4 billion by 2035, with annual growth rates above 10%. Major growth drivers include the rapid expansion of electric vehicles, stricter emission regulations, and increasing use of renewable and recyclable materials in vehicle interiors and components. Recent market studies estimate the global bio-based rubber market at USD 3–4.5 billion in 2024, expected to reach USD 7–9 billion by 2033. Forecast growth rates are between 7% and 10% CAGR over the next decade.

Europe accounts for about one quarter of the global market, supported by strong environmental regulations, circular economy policies, and growing use of renewable materials in the automotive industry.

5.4 Sustainability

Up to 48% of consumers willing to buy a sustainable vehicle are willing to pay up to 10% more for it, while 15% would push their budget up to 50% higher. Eco-friendly interiors—such as recycled plastics, plant-based leather alternatives, and natural fibre composites—are becoming crucial brand differentiators for automakers.

Bio-based automotive plastics can reduce lifecycle greenhouse gas emissions by 20–70% depending on the material and feedstock source.

Examples: Toyota and KIA use bio-based plastics in interior components to reduce vehicle lifecycle emissions, and Ford Motor Company has used biocomposites reinforced with natural fibres such as hemp and wheat straw.

Many bioplastics and natural-fibre composites are lightweight materials. Replacing metal or heavier petroleum plastics can reduce vehicle weight, which improves fuel efficiency in conventional cars, driving range in electric vehicles, overall energy efficiency. A weight reduction of 10% in a vehicle can improve fuel efficiency by roughly 5–7%.

Bio-based rubber can reduce lifecycle greenhouse gas (GHG) emissions by around 20–50% compared with fossil-based synthetic rubber, depending on feedstock and production method.

6. Construction
Bio-based materials for a lower-carbon built environment

Bio-based plastics and polymers are increasingly applied in the construction sector as sustainable alternatives to conventional fossil-based materials. Main applications include thermal and acoustic insulation foams, pipes and tubing, window and door profiles, flooring systems, wall panels, roofing membranes, coatings, adhesives, and sealants.

6.1 Introduction

Natural fibre-reinforced biocomposites made with hemp, flax, jute, or wood fibres are also used in lightweight structural elements and interior components. In addition, fibre-based products are also used in construction. All these materials help reduce the environmental footprint of buildings by lowering fossil resource consumption and embodied carbon emissions while supporting circular construction and green building standards.

The market for bio-based construction polymers is growing rapidly due to stricter climate regulations, green building certifications, demand for lower-carbon materials, and circular economy policies in Europe.

Examples are bio-PE for pipes, membranes, and profiles; PLA for panels, flooring, and interiors; PHA for coatings and composites; bio-PU for insulation foams, cellulose composites from wood pulp for boards and insulation; natural fibre composites for structural panels.

6.2 Competitiveness & innovation

Current innovation focuses on recyclable and reusable bio-based composites, mycelium and algae-based construction materials, bio-based high-performance foams, nanocomposite bioplastics with enhanced thermal and electrical properties, 3D-printable biopolymers for architecture.

6.3 Market data

Globally, the bio-based construction polymer market was valued at approximately USD 12.8–15.5 billion in 2024–2025 and is projected to reach between USD 21 billion and USD 61.6 billion by 2032–2035, depending on the market scope and methodology used. Reported annual growth rates range from 6% to nearly 15%, reflecting strong expansion in sustainable construction materials.

Europe is one of the leading regions for bioplastics and bio-based polymers due to strict environmental legislation, circular economy strategies, and strong adoption of green building standards such as LEED and BREEAM.

In Focus: Bio-based polyurethane (PU) foams

Current innovation focuses on fully bio-based polyols, recyclable PU systems, non-toxic flame retardants, PU foams from agricultural residues and lignin, hybrid natural fiber–PU composites, low-emission spray foam technologies.

Bio-based polyurethane (PU) foams are increasingly used in the construction industry as sustainable alternatives to conventional petroleum-based polyurethane insulation materials. Bio-based PU foams are widely applied in thermal insulation for walls, roofs, and floors; spray foam insulation; insulation panels, sealants and gap fillers, lightweight structural components; etc.

They are especially important in energy-efficient and low-carbon buildings because polyurethane foams have very low thermal conductivity, helping reduce heating and cooling demand. the global PU foam market exceeded USD 50 billion in 2024, with bio-based PU still representing a smaller but rapidly growing segment.

Europe is one of the leading regions for bio-based PU adoption because of stricter energy performance regulations for buildings and growth in nearly zero-energy buildings (NZEB).

Globally, the bio-based construction polymer market was valued at approximately USD 12.8–15.5 billion in 2024–2025 and is projected to reach between USD 21 billion and USD 61.6 billion by 2032–2035, depending on the market scope and methodology used.

6.4 Sustainability

Bio-based plastics and polymers are becoming strategically important for the European construction sector because buildings and construction are among the largest sources of emissions, energy use, and waste in Europe.

Buildings account for approximately 40% of the EU's energy consumption and 36–40% of CO_2 emissions related to energy use. In addition, the construction sector generates more than 35% of all EU waste, while construction materials and renovation activities contribute an estimated 5–12% of total national greenhouse gas emissions.

The importance of sustainable materials is increasing because Europe is currently not on track to meet its climate-neutral building targets. The European Buildings Climate Tracker shows that the EU building sector remains more than 40% behind the required decarbonisation pathway for 2030 and 2050 goals.

Studies indicate that partially bio-based polyurethane foams can reduce lifecycle CO_2 emissions by approximately 20–40% compared with conventional PU foams. In addition, improved building insulation can significantly reduce operational energy use as buildings in Europe account for around 40% of total energy consumption and 36% of energy-related CO_2 emissions.

In the construction sector, pipes and drainage systems often remain in service for more than 50 years, meaning that lower-carbon materials can significantly reduce the embodied carbon footprint of buildings and infrastructure over long periods.

In addition, lightweight plastic pipe systems reduce transportation energy and installation impacts compared with heavier traditional materials such as concrete or metal.

In Focus: Bio-based pipes and conduits

Bio-based pipes and conduits are increasingly used in sustainable construction and infrastructure because they reduce dependence on fossil-based plastics and lower the carbon footprint of buildings. These products are applied in water supply systems, drainage, cable protection, and electrical conduits. They offer durability and technical performance comparable to conventional plastic pipes.

The overall global plastic pipe market exceeds USD 100 billion annually, while the European plastic pipe market alone was valued at approximately USD 14–15 billion in 2024 and is projected to grow to more than USD 23 billion by 2033, with annual growth rates around 5–6%.

Although bio-based pipes currently represent only a small share of the total pipe market, growth is accelerating as governments and construction companies increasingly prioritize renewable, recyclable, and low-carbon materials in infrastructure development.

Annex – References

The complete list of references is available in the separate publication Annex – References.

Bio-based Industries Consortium

Bio-based Industries Consortium (BIC)

Square de Meeûs 38/40, 4th floor
Brussels 1000, Belgium

info@biconsortium.eu

www.biconsortium.eu

#BetterwithBiobased