# Bioplastics in the Green Chemistry Transition

*State of play, bottlenecks and perspectives to 2035*

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ieri, oggi e domani

Con il patrocinio
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*Vent’anni fa, il 21 marzo 2006, un piccolo gruppo di esperti e ricercatori, insieme a Legambiente, costituiva l’associazione Chimica Verde Bionet, con l’obiettivo di promuovere e sviluppare, secondo criteri ecologici, la ricerca e l’applicazione industriale e commerciale di materie prime di origine vegetale. Era all’epoca un’assoluta novità nel panorama italiano. Per celebrare il 20° anniversario, l’associazione organizza questo evento speciale, interamente dedicato alla storia e alle prospettive della chimica verde in Italia e nel mondo.*

Draft slide deck based on the sector sheet and the conference programme

# Italian bioplastics sector: strong growth, then a sharp pause

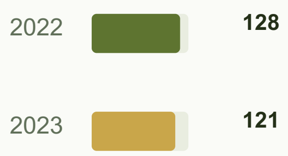
### Four points for the current picture

• Europe resumed growth after the 2020 slowdown, but much of the new global capacity is shifting to Asia.
• Italy built one of Europe's strongest value chains for compostable products and remains a reference case for green chemistry.
• In 2022, Italian production reached about 128 kt of compostable manufactured goods with turnover of €1.17 bn.
• In 2023, volumes stayed almost flat at about 121 kt, while turnover fell to €0.83 bn because of weak market conditions, low-cost imports and policy uncertainty.

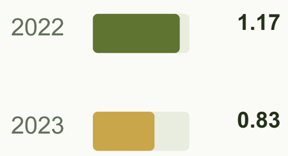
## Italy: 2022 vs 2023

*Output remained broadly stable; value contracted sharply.*

**Output**
*thousand tonnes*




**Turnover**
*EUR bn*




**Important nuance**

The 2023 setback is not only cyclical: the SUP directive also created a non-negligible shock for Italy's compostables-focused value chain.

**2022 production**
**~128 kt**

**2023 turnover**
**€0.83 bn**

# Innovation pipeline: from feedstocks to designed end-of-life

*The frontier is no longer only “bio-based”: it is about combining performance, controlled biodegradation and recoverability.*

### 1. Feedstocks

• Plant-based inputs remain important.
• Residues and waste streams are gaining relevance.
• $CO_2$-linked biomass routes are entering R&D.

### 2. Biotech routes

• PLA from waste via fermentation.
• PHA from microalgae with $CO_2$ fixation.
• More efficient bio-processing pathways.

### 3. Material targets

• PHA moving toward industrial scale.
• PEF poised to enter bottle and rigid-pack uses.
• Next-generation PLA with better heat resistance.

### 4. Circularity

• Controlled degradation in defined conditions.
• Dedicated mechanical or chemical recovery routes.
• Compatibility with real end-of-life systems.

**Key design question** How can we make materials that stay stable in use, but become recoverable — by composting or recycling — when the product actually reaches its intended end-of-life?

# Applications are expanding beyond packaging

*Packaging still represents about half of today's market, but the next growth wave is moving into technical and regulated uses.*

### Packaging

Largest outlet today: carrier bags, organic-waste bags, food-service items and food packs.

### Agriculture

Biodegradable mulch films, plant clips, pots and controlled-release supports.

### Automotive

Bio-based polyamides and natural-fibre composites for non-structural interior parts.

### Textiles

PLA fibres and compostable non-wovens with lower microplastic impact when properly handled.

### Medical

Resorbable devices, tissue scaffolds and early compostable pharmaceutical packaging.

**From short-life uses to durable technical applications: different end-of-life logics will coexist.**

# Four structural bottlenecks still limit scale-up

*The sector needs technology, markets, rules and infrastructure to move forward together — not one by one.*

### Market

- Costs remain higher than for conventional plastics.
- Asian producers are adding price pressure.

### Technology

- Heat and mechanical resistance can still be limiting.
- Compostability and recyclability rarely coincide.

## Scale-up gap

*No single bottleneck can be solved in isolation.*

### Policy

- SUP created uncertainty by hitting compostables too broadly.
- Implementation has been uneven across countries.

### End-of-life

- Standards such as EN 13432 help, but they are not enough.
- Without collection and composting capacity, benefits are lost.

# Why regulation is decisive: from SUP to PPWR

*For a sector that is highly specialized in compostable applications, policy design is not background noise — it shapes the market itself.*

## SUP

• Since 2021, broad bans on several single-use items also affected compostable products.
• The result was a significant shock for Italy's specialized compostables chain.
• The main effect: uncertainty before the market reached maturity.

**Policy window** →

## PPWR

• The new framework keeps mandatory compostability only for selected uses.
• But it also leaves room for Member States to promote or require compostables where the environmental benefit is clear.
• This opens a policy window for targeted national measures.

**Stable, coherent implementation is the condition for a credible domestic market.**

# 2024–2035 outlook: growth will continue, leadership will change

*The likely future is not a single global race, but a differentiated market in which Asia and Europe will compete on different strengths.*

| 2024 | 2030 | 2035 |
|---|---|---|
| Scale-up choices policy + investment | Global capacity could triple | Broader use in automotive, textiles, medical |

**Technology vector**

PHA is expected to expand strongly with new industrial plants, while PEF and better-performing PLA will widen the portfolio of biobased options. Dedicated recycling routes will also become more important.

## Probable competitive map

- Asia is likely to dominate high-volume, lower-value segments thanks to lower energy costs and strong scale-up policies.
- Europe can retain an advantage in advanced materials, regulated applications and solutions designed for specific end-of-life systems.
- Italy can build on compostables know-how and the integration with organic-waste collection.

**But this specialization is not automatic: it needs stable rules and industrialization of innovation developed in Europe.**

# Take-home messages

**Bioplastics are moving from a niche alternative to a strategic platform for selected applications in the bioeconomy.**

The next step is not simply “more bioplastic”. It is smarter material design, better infrastructure and rules that recognize where compostable solutions create real environmental value.

01 Bioplastics are no longer only a packaging story.

02 Performance and end-of-life design must evolve together.

03 Europe and Italy can remain leaders only in selected high-value segments.

04 **Regulation, infrastructure and industrial scale-up must move in parallel.**

*Thank you*