

VITAL: Shaping Europe's Sustainable Future

Europe's manufacturing sector is at a turning point, facing growing environmental and resource pressures that demand urgent change. The transition from fossil-based to **biobased and recyclable materials** is no longer optional—it is a strategic necessity. The **VITAL project (Innovative Processing Technologies for Biobased Foamed Thermoplastics)** is driving this transition by developing breakthrough manufacturing solutions that make lightweight, durable, and recyclable foamed bioplastics viable for mainstream industrial use within a circular economy framework.

The VITAL Challenge

Despite progress in biobased polymers, their adoption remains limited. Take-up is best in the packaging sector, where compostable bioplastics have obvious advantages. However, their potential for durable applications has been largely overlooked. Barriers to date have included constrained raw material supplies, processing requirements that differ significantly from conventional plastics, and insufficient recycling infrastructure. Overcoming these challenges is crucial to integrate biobased plastics into durable, high-performance products.

VITAL's Breakthrough Technologies




VITAL has advanced **three complementary manufacturing technologies** that address these barriers while ensuring energy efficiency and scalability:

1. **Foam Injection Moulding of PLA**
 - Enables high-volume production of lightweight structural parts
 - Compatible with chemical and physical blowing agents
 - Intelligent control systems reduce energy use and waste
2. **Low-Energy Bead Foaming of PLA & Biobased Thermoplastic Urethane (TPU)**
 - Replaces steam with **radio-frequency heating**, slashing energy demand
 - Produces lightweight, cushioning, and impact-resistant foams
 - Scalable for automotive, packaging, and consumer goods
3. **3D Foam Printing of PLA & Biobased TPU**
 - Novel print head, capable of printing polymer foam with varying densities
 - Enables customized, complex geometries in rigid and flexible foams - unlocking design freedom with significant weight reductions
 - Uses pellets/granulates directly, eliminating the need for filaments

These innovations are supported by overarching advances in materials development (flame-retardant PLA grades), process modelling, intelligent control, and bioplastics recycling—ensuring performance, durability, and circularity.

Demonstrated Industrial Applications

To prove real-world relevance, VITAL has delivered demonstrators across sectors:

	Cruise Ship Interiors – lightweight walls, seats, and tables via large-scale 3D printing
	Fridge Parts – durable, recyclable components made at scale
	Automotive Seat Cushions – flame-retardant, soft, and long-lasting Automotive Body Panels – lightweight structures reducing vehicle mass and emissions

These case studies confirm that **biobased foamed thermoplastics meet stringent industrial requirements** while reducing carbon impact.

Impact and Market Potential

VITAL technologies (TRL 5–7) are primed for industrial uptake, with exploitation potential across:

- **Automotive** – structural and cushioning components
- **White Goods** – strong and recyclable interior parts
- **Marine & Aerospace** – customizable lightweight interiors
- **Consumer Products** – a multitude of possibilities including packaging and insulation

By reducing material mass, cutting energy use, and enabling recyclability, VITAL demonstrates that sustainability and cost-effectiveness can go hand in hand. Rising production capacity of key bio-based plastics such as PLA further amplifies the market opportunities across sectors.

Contribution to Europe’s Green Transition

VITAL directly supports the **EU Green Deal**, the **Circular Economy Action Plan**, and the **Made in Europe Partnership**. By enabling low-energy production of recyclable, biobased thermoplastic foams, the project strengthens Europe’s industrial leadership while accelerating the shift to climate-neutral manufacturing.

In Summary...

The VITAL project proves that **sustainable, high-performance materials are not only possible but ready for market integration**. Its innovations in biobased foamed thermoplastics offer a credible pathway toward circular, climate-friendly manufacturing. As industries look to the future, VITAL provides both the technologies and the vision to make Europe a leader in sustainable production.