



# MASS BALANCE VERSUS SEGREGATED BIOECONOMY: THE INEVITABLE COHABITATION?

## A world still predominantly fueled by oil

The world today remains overwhelmingly dependent on fossil resources, particularly oil. These resources are not only limited but increasingly subject to geopolitical tensions, making their availability volatile and their cost unpredictable, something that the current war in the Middle East very well demonstrates. Beyond these challenges, the climate impact of fossil-based materials renders continued use unsustainable.

This dependence also carries major economic and strategic implications, especially for countries that do not produce oil, raising issues of resource sovereignty. While most fossil resources are consumed for energy, a significant share is dedicated to the chemical industry, where nearly 90% of materials are derived from fossil carbon.

Despite efforts **to develop alternatives and optimistic prospective studies from experts<sup>1</sup>, the chemical industry still struggles to replace these resources in everyday** products and materials. Currently, the share of biobased materials in chemistry remains limited.

### Biobased product

*A biobased product is a product - material, intermediate, semi-finished or finished product - that is entirely or partially derived from biomass (cereals, oils, woods, algae, etc.) It is characterized by its biobased carbon content (in Europe according to EN 16640 - expressed in dry matter as the ratio of biobased fractions (C, H, O and N) to total product mass).*

**Unlike Mass Balance products, these are derived from segregated production process.**



# A promising future for Bioeconomy

**The transition to biobased products is a key lever for strengthening sovereignty and reducing dependence on fossil resources**, especially for regions lacking local fossil reserves. Today, **bioeconomy is rapidly emerging as a cornerstone of economic resilience**, industrial competitiveness, and long-term sustainability.

According to ADEME<sup>2</sup>, “the mobilization of biomass for energy and materials could double by 2050, provided that agricultural and forestry practices, as well as allocation between uses, evolve.” This highlights both the potential and the need **to accelerate the responsible and efficient use of renewable resources**.

Beyond environmental benefits, the development of bioeconomy has a strong strategic dimension: it strengthens resource independence, contributes to carbon sequestration, and drives local economic development by creating value within territories.

## Mass Balance

Applied to bioeconomy, the mass balance approach provides a set of rules for allocating biobased raw materials to different end products. This method, based on the principle of conservation of mass, ensures the appropriate allocation of biobased content to end products via verifiable accounting. The mass balance method is a practical solution to meet customer expectations for the gradual substitution of fossil materials in supply chains. Finished products obtained in this way are not biobased!

For more information :  
[Choosing a sensible path to sustainability - AFYREN](#)

## Accelerating the transition to Biobased products

**While promising, a full transition to 100% biobased solutions will take time and must overcome several structural challenges:**

### Initial investments capitalization:

Biobased feedstocks and processes often struggle to compete with fossil feedstocks, which benefit from decades of optimization, economies of scale, and established infrastructure. In contrast, emerging biobased technologies typically require higher upfront investment (CAPEX), resulting in higher unit costs.

### Technology & Innovation Gaps:

New biobased production technologies are often at low technology-readiness levels, requiring further research, scale-up, and demonstration to reach commercial maturity. Sustainable biomass is a finite resource and can compete with other sectors (energy, food, materials). Strategic allocation and prioritization will be critical as demand continues to grow.

### Policy trends and Regulatory Constraints:

In many regions, regulatory frameworks and incentive systems still lag behind. This can slow down investment and delay the large-scale deployment of biobased alternatives.

# Mass Balance : A bridge for renewable feedstocks, not the final destination

Mass-balanced products are to the chemical industry what hybrid vehicles are to the automotive sector: **a transitional solution, imperfect, yet helpful, on the path toward scalable long-term alternatives** such as fully electric mobility and segregated biobased products.

They offer clear advantages: enabling the partial integration of renewable or recycled feedstocks, reducing carbon footprints compared to fossil-based equivalents. As drop-in solutions, **they can directly substitute conventional products without requiring reformulation**, facilitating rapid adoption. Produced using existing infrastructure, **they also remain relatively cost-competitive, supporting quick adoption**. But globally, they are not a long-term solution.

In this sense, mass balance helps bridge the gap between today's fossil-based system and a future driven by renewable carbon. Allowing biobased and recycled inputs to be integrated into current production systems, it supports early market deployment and demand growth without waiting for fully segregated value chains to scale.

**However, this model has also several disadvantages and it is not a substitute for dedicated biobased supply chains.** Its complexity can raise concerns around transparency and sustainability claims, making robust standards and certification essential. Recent publication of chain of custody standards (ISO22095-2 and ISO22095-3) should provide some clarification.

Finally, mass balance value chains are fully integrated in global fossil production chains and can thus be exposed to global geopolitical pressure and instability.

**Mass balanced products should act as a transitional ally and not a competitor to biobased solutions.** Their role is to accelerate progress, not divert attention from the ultimate objective: the development of a fully biobased, low-carbon, and circular chemical industry.

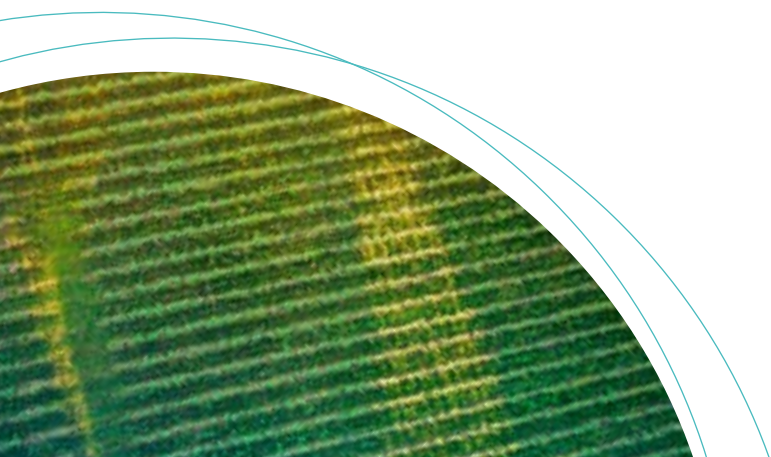


	Mass balance	Segregated biobased
Advantages	<ul style="list-style-type: none"> <li>• Relatively price-competitive</li> <li>• Relatively easy to scale</li> <li>• Limited CAPEX required</li> <li>• Usually low carbon footprint</li> <li>• A step towards 100% bio-based</li> </ul>	<ul style="list-style-type: none"> <li>• Simple concept: biogenic carbon inside</li> <li>• Full traceability</li> <li>• Secured supply chains</li> <li>• No dependence on fossil resources</li> <li>• Usually low carbon footprint</li> </ul>
Limitations	<ul style="list-style-type: none"> <li>• Dependent on fossil chemical production structure</li> <li>• Complex concept (difficult marketing)</li> <li>• Only allocated renewable content</li> </ul>	<ul style="list-style-type: none"> <li>• Relatively hard to scale</li> <li>• Brand new technologies that need optimization</li> <li>• Policy and regulation delay</li> </ul>

## With bio-based products, you know what you're buying!

Across industries, from food and fashion to aviation and packaging, mass balance supply chains have proven to be **a powerful enabler of scale, allowing companies to integrate sustainable** inputs into complex global supply chains and accelerate the transition without waiting for fully segregated systems.

This allocation approach is already integrated into our daily lives: green electricity in "100% green electricity" contracts, the electrons generated by wind turbines or solar panels do not physically reach our homes, instead, they are fed back into the broader power grid. The energy supplier commits to feeding a volume of renewable electricity into the grid equivalent to your consumption. This principle is also used in fair-trade chocolate and coffee supply chains; the finished products do not necessarily contain the fair-trade raw materials from the certified producer. In the chemical industry, one of the most visible applications for end users is the chemical recycling of plastics. For example, claims and labels on plastic bottles often indicate that they are made partly, or even entirely, from recycled material. In many cases, these claims rely on a mass balance approach, where recycled inputs are accounted for a system level rather than physically traced in each individual product.



# AFYREN – the way to mass balance and fully biobased

While mass balance is a rational pathway to progressively integrate renewable feedstocks, AFYREN goes one step further. Rather than relying on partial integration in a global system, AFYREN's ingredients are 100% biobased, offering full traceability and eliminating the ambiguity often associated with allocation methods. **AFYREN's solutions can also integrate into mass balance systems as raw materials**, supporting companies at different stages of their transition.

But for those aiming to move beyond gradual change, it demonstrates that fully biobased, circular alternatives are not only possible, they are already a **reality**.

Read more about our technology ([AFYNERIE® : Fermentation technology that valorizes biomass.](#)) and our product portfolio [Biobased short and medium chain fatty acids - Our products.](#)

<sup>1</sup>Experts : [Study Confirms Biomass Can Meet 20% of Carbon Demand in Chemicals Sector by 2050 without compromisi...Carbon for chemicals: How can biomass contribute to the defossilisation of the chemicals sector? Bio-based-and-Biodegradable-Materials-Regulatory-Science-Network\\_Discovery-Phase\\_Report-v2.pdf](#)

<sup>2</sup>ADEME : [ADEME Library – Biomass: A Strategic Challenge of the Ecological Transition](#)

