

Mass Balance Approach

Driving Circularity in Chemical Production



The European Union is taking decisive steps towards a sustainable future, and the European Green Deal provides an action plan to boost the efficient use of resources by moving to a **carbon-neutral circular economy**.

As a global chemical company deeply rooted in the European economy, BASF strives to support these goals by investing in a **broad range of solutions to turn this ambition into reality**.

We are committed to:



Replacing fossil
raw materials



Driving circularity by using
250,000 metric tons of
recycled and waste-based raw
materials annually as of 2025.



Doubling our sales
generated with circular
economy solutions to
€17 billion by 2030.

A low-carbon, circular economy requires a shift to non-fossil raw materials based on biomass or waste. The mass balance approach is a means to achieve this transition in a fast, economic, scalable and socially accepted manner for a large number of products.

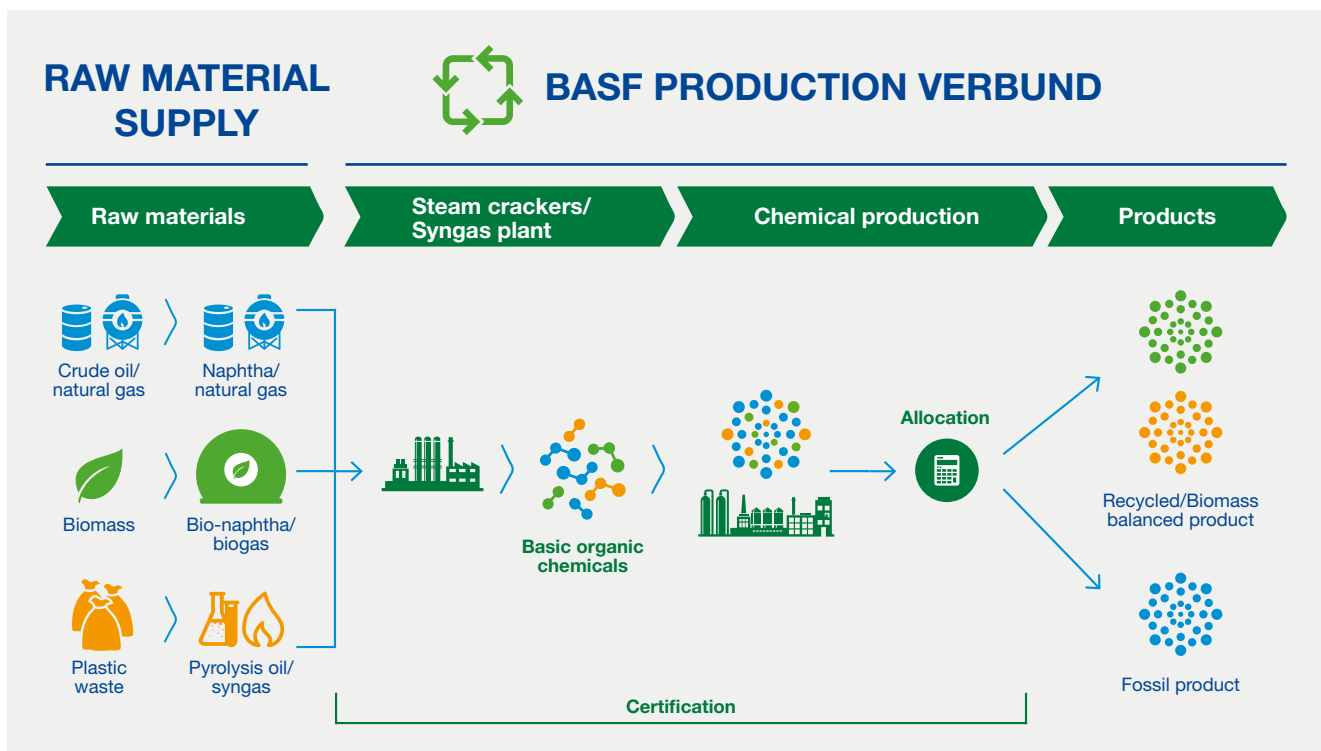


What is the Mass Balance Approach?

Mass balance is a chain-of-custody approach to account for materials entering and leaving a system. In the chemical industry, renewable or recycled feedstock is mixed in a continuously operating production process and allocated to the end products after chemical transformations have taken place.

There are several approaches to mass balance, BASF uses a site-based balance approach depending on the available feedstock. In either case, a connection between the recycled feedstock and the end product exists. Only raw materials used as feedstock, not for energy production, are considered for mass balance.

How Does the Mass Balance Approach Work in Chemical Production?



Why the Mass Balance Approach?



Faster transition to a carbon-neutral circular economy



More affordable green products



Transparency for sustainable purchasing decisions



Flexible scale-up with identical product quality



An established and successful method

A Commonly Used Approach

Similar systems are already used in many sectors



Renewable Electricity

When buying renewable electricity from a grid with mixed power generation, consumers help to increase the share of renewable electricity but cannot be certain that the electricity they use in their homes has come directly from renewable sources. However, the power company may only sell as much “green” power as it can generate in a renewable way.



Sustainable Wood and Paper

Several established programmes, such as FSC and PEFC in the timber and paper sector, use a mass balance approach to label products of mixed origin. With paper derived from mixed materials, it is impossible to determine what percentages of recycled or sustainably sourced materials have been used in a single sheet of paper.

Why the Mass Balance Approach is the Right Tool for the Chemical Industry

The chemical industry transforms a limited number of raw materials into tens of thousands of different products. Production occurs in large plants that involve many intermediary steps. For example, the integrated BASF site in Ludwigshafen has about 200 production plants and covers an area roughly three times the size of New York’s Central Park. Integrated production puts circular economy principles into action. By-products from one plant are used in others. Waste is reduced, excess heat or steam is recovered and used, and transport emissions are avoided.

Recyclates and renewable-based feedstock can be co-fed and are transformed into molecules that are identical to those produced from traditional feedstock. Since both feedstock streams are used in the same production plants, which are usually operated around the clock, it is not possible to track each feedstock molecule through to the end product. If the industry were to segregate chemicals produced from recyclates and renewable-based feedstock and fossil sources, new plants would need to be built, which is neither economic nor environmentally beneficial.

BASF site in Ludwigshafen



Advantages of the Mass Balance Approach



Faster transition to a carbon-neutral circular economy

The mass balance approach encourages use of sustainable raw materials based on biomass or waste in the highly efficient plants and infrastructure that already exist in the chemical industry. Environmentally and financially wasteful investments in new plants are not necessary. The shift to alternative feedstocks reduces both consumption of fossil resources and greenhouse gas emissions.



More affordable green products

By avoiding the need to invest in dedicated new facilities and allowing efficient production in existing plants, use of the mass balance approach can reduce the cost of sustainable products throughout the value chain. This means that greener products become more affordable to a wider group of consumers.



Flexible scale-up with identical product quality

Use of the mass balance approach allows the amounts of alternative raw material to be flexibly adjusted. Production can thus grow hand in hand with increasing consumer demand while keeping the product quality identical.



Transparency for sustainable purchasing decisions

Under the mass balance approach, the use of raw materials based on biomass or waste is subject to third-party certification. This supports informed consumer purchasing decisions by allowing end products to be labeled transparently.



An established and successful method

The mass balance approach is an established chain-of-custody model and is already successfully used for electricity, biofuels and a range of other products. In the chemical industry, the mass balance approach can be used to support the substitution of fossil raw materials with biomass or waste-based alternatives.

The Future

The European chemical industry aims to speed up the substitution of fossil feedstock by more sustainable alternatives such as sustainably sourced biomass or recycled feedstock derived from plastic waste. Ultimately, this transformation is driven by the purchasing decisions of consumers.

Mass balance enables substitution of feedstock and provides the necessary transparency about the value of circular feedstocks. Through appropriate product labeling, consumers can be supported in their decision to actively choose more sustainable solutions.



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