Position on future carbon raw materials

Key messages

- BASF aims to become net-zero globally by 2050 on its scope 1,2 and 3.1 emissions (2045 in Germany) and runs an ambitious carbon management program to achieve this objective. BASF also enables its customers to become climate-neutral by offering products with a low product carbon footprint (PCF).
- There is no single solution to substitute the fossil feedstock for carbon-based materials. Bio-based and recycled raw materials as well as CO_2 utilization are all required. Until enough alternatives are available, there is also a need for fossil feedstock in combination with Carbon Capture and Storage (CCS).
- An enabling political framework should acknowledge and support the variety of solutions by e. g. developing incentives for recycled and bio-based feedstocks, including a flexible mass balance chain of custody model, establishing a cascading use for bio-based feedstocks and removing hurdles for Carbon Capture and Utilization (CCU) exploitation.

About the topic

The global chemical industry uses about 700 mio t fossil-based carbon raw materials feedstock per year to produce the carbon-based materials required in all industries and value chains.[i] A gradual shift to sustainable alternatives is only possible if all technically feasible options are fully exploited to avoid the emissions that from arise the extraction of fossil raw materials and at the end of life of products[ii].

For plastic products, increasing recycling as much as possible with a complementary use of all available technologies is a priority.[ii,iii,iv] Several other (industrial) chemicals also have a potential for recycling, e. g. solvents. End products which are either consumed (e. g. food and feed) or dispersed during use (e. g. paints, adhesives, hygiene products) are typically not available for recycling. Therefore, biogenic carbon as feedstock and CCU need to be fed into the material cycle as well. All solutions have drawbacks:[ii-vi] Recycled and bio-based feedstocks are limited, while CCU requires substantial amounts of renewable energy for hydrogen, and even more energy when using atmospheric CO_2 (Direct Air Carbon Capture and Utilization, DACCU).

The necessary quantities of sustainable alternatives will only become available with time, so fossil materials in combination with CCS are required in the interim.[v,vi]

What does BASF offer?

BASF is committed to become net-zero globally by 2050 on its scope 1, 2 and 3.1 emissions.

In the past 30 years, BASF has already reduced its global CO_2 GHG emissions by almost 50 % since 1990. BASF now invests intensely into subsequent electrification measures and CCS, to further decarbonize its energy use in production. Future technologies are developed and scaled up in pilot projects, such as the electrically heated steam cracker furnaces, as well as water electrolysis and methane pyrolysis to provide hydrogen with a low CO_2 footprint.

At the same time, BASF has started the transformation of its feedstock to reduce the carbon footprint of its products.

Plastics recycling: BASF innovates to enable mechanical, chemical, and organic recycling, to make use of the most sustainable treatment for each waste stream. Examples include establishing mechanical recyclability of its plastics, e.g., (expanded) polystyrene and polyethylene/polyamide multi-layer films, cleaning solutions for recycling processes, as well as chemical recycling of tires, mixed packaging, automotive shredder light fraction, industrial scrap, and matrasses. BASF´s certified compostable bioplastics are used for e.g. organic waste collection or agricultural applications.

Bio-based raw materials: In 2023, BASF purchased around 1.0 million metric tons of bio-based raw materials based on vegetable oils, fats, grains, sugar, and wood. Applications include active ingredients for cosmetics and pharmaceuticals and plastic additives for automotive. Through our sourcing practices, we consider how renewable resources impact aspects of sustainability along the value chain. We also take into consideration recognized certification standards in our decisions, e.g. for our palm, coconut oil, or castor oil products.

Mass balance: The mass balance chain of custody concept allows BASF to communicate transparently and certified by independent third parties on sustainability benefits of alternative feedstocks (biomass, chemical recycling).

CCS: BASF is already participating in **explorative CCS projects** with industrial partners, e. g. in a cross-border CCS value chain with Air Liquide in Antwerp (co-funded by the European Union and the Flemish government), evaluation of a world-scale production plant for blue ammonia with a significantly reduced product carbon footprint, exploration of a 10 million-ton-scale CCS project in East China area with Sinopec, Shell and Baosteel and a feasibility study for construction of a hydrogen and CO_2 pipeline with Open Grid Europe, Shell and Gasunie in the Delta Rhine Corridor project .

CCU: BASF is working on **innovative technologies** to use and recycle CO_2. For more than 50 years, BASF is working in the field of industrial gas treatment. The gas treatment portfolio under the OASE® brand also comprises technologies and amine-based solvents for carbon capture or gas fermentation using various compositions of CO and CO_2 in combination with H_2 to produce chemicals. BASF is already using **CO_2 as a raw material**. Given current availabilities of hydrogen and renewable electricity, this is at present limited to specific reactions and processes, e. g. urea and carbonates. Finally, BASF has developed dedicated CCU catalytic systems for conversion of CO_2 to synthetic methane and methanol, using CO_2-free hydrogen. Both technologies are mature and available on the commercial scale. BASF is exploring, in a variety of research projects, alternative pathways to the existing value chains, e.g., Flue2Chem.

Our position

The best fossil carbon exploitation is the one that doesn´t take place: Reducing demand for carbon feedstocks by reconsidering consumption patterns, making more with less, establishing re-use systems and developing circular business models is a priority.

At the same time, sustainable alternative sources of carbon need to be systematically exploited to meet the demand of society for products.

BASF advocates on the following points to unlock the potential of alternative raw materials:

1. **Fully accept and encourage chemical recycling** where mechanical processes are either not technically feasible or economically viable:
   - Set **recycling rates** which utilize the potential of all forms of recycling. If competition between mechanical, chemical and organic recycling is a concern, split targets could be set up for specific applications, e. g. packaging.
   - Consider chemical recycling combined with a flexible mass balance chain of custody model for **recycled content targets via attribution** ("attributed recycled content").
2. **Implement a "cascading use" of biomass and increase availability of sustainably sourced biomass.** Non-food & feed biomass should be primarily used in applications where direct electrification is not an option. Hence, biomass as a carbon source for production of materials should be preferred and incentivized over use as fuel whenever electrification of transport is possible.. Mandated fuel quota should be curtailed for road transport.
3. **Exploit CCU and acknowledge its role in keeping carbon in the ground irrespective of a product´s lifetime**. The prerequisites for CCU at scale are large quantities of renewable energies and hydrogen at competitive cost which are needed in any case for the energy transformation. In the political framework CCU should be supported by **exempting the saved CO_2 emissions from ETS** cost which is not yet the case.
4. **Fully accept a flexible mass balance chain of custody model for alternative feedstocks**: Mass balance attributed recycled, biobased or CO_2 content should be incentivized to the same extent as segregated alternative feedstock content and accepted for reduced product footprint calculations. Such acceptance is required to create the necessary pull by customers. A flexible mass balance approach reduces the cost of the raw material transformation because already existing assets can be utilized.
5. **Develop a CCS infrastructure**: Until enough alternative raw materials are available, fossil materials **in combination with an equivalent capacity for CCS is needed**. Established CCS infrastructure also has the potential to sequester biogenic or atmospheric CO_2 and contribute to negative emissions which are needed to reach Net Zero.
6. **Synchronize the conversion of existing infrastructure**, e. g. natural gas to hydrogen and/or CO_2 pipelines, **with the raw material change of the industry**, to continuously fulfill the need for hydrogen as well as carbon input via methane.

[i] Levi, P.G; Cullen, J.M. *Environ. Sci. Technol.* **2018**, *52*, 1725.
[ii] Vidal et al., Nature **2024**, *626*, 45 - 57
[iii] Bachmann, Bardow et al, Nature Sustainability **2023**, *6*, 599-610
[iv] Stegmann et al, Nature **2022**, *612*, 272–276
[v] SystemIQ **2022**, Plant Positive Chemicals
[vi] Mazzotti et al., Industrial & Engineering Chemical Research **2020**, *59* (15), 7033–7045