Market Creation is Key to the Success of the Bioeconomy

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Following the updated Bioeconomy Strategy from end of last year, Europe has taken active steps to create a supportive system for industrial scaling of the bioeconomy. A critical component of this effort is establishing viable markets for bio-based products, particularly as long as direct competition with established fossil-based alternatives remains highly challenging. This article provides on the effectiveness of quotas, or content-targets, to facilitate systemic build-up of the bioeconomy.

The agricultural land used for bioeconomy in Germany is estimated at 2.27 million hectares (ha) in 2025. This is slightly below the previous year's level (down two per cent). A slight downward trend is also evident when looking at the decade as a whole. (FNR 2026)

Accounting for just under 14 per cent of agricultural land, renewable raw materials represent a significant source of income for farms in Germany. They produce raw materials for bioenergy and biofuels and for industrial use. At the same time, they generate considerable quantities of protein-rich by-products for animal feed. (FNR 2026)

The graphic below, based on the FNR data, shows the development of the total area of agricultural land being utilised for energy (for heat, electricity and biofuels) and industrial crops (mainly for the chemicals and materials industry) in Germany from 1994 to 2025.

While the development of cultivated area for energy crops shows a strong increase in the two decades between 1998-2018 before entering a stagnation level, the use of agricultural biomass for chemicals and materials is significantly lower today than in the peak year of 1999. Between 1999 and 2025, there were only some fluctuations, partly due to time-limited funding programmes, e.g. for insulation materials – despite several attempts to foster the use of biomass in chemicals and materials within the frame of bioeconomy strategies and initiatives. Germany was among the first countries worldwide to adopt a national bioeconomy strategy. It launched its "National Research Strategy BioEconomy 2030" in 2010, followed by a dedicated Bioeconomy Policy Strategy in 2013 and an integrated National Bioeconomy Strategy in 2020. However, the impact on cultivation areas was negligible; cultivation levels were never higher than in 1999.

What is the reason for the very different developments, that energy crops increased fivefold between 1994 and 2025, while industrial crops remained at the same level as in 1994?

The key driver appears to be market demand creation via quotas. The EU introduced its first union-wide biofuel quota in the form of Directive 2003/30/EC. This directive set an indicative target of 2% biofuels in transport fuels by 2005, rising to 5.75% by the end of 2010. This resulted in a surge of investment in first-generation biodiesel and bioethanol plants during the early to mid-2000s, with the majority of EU biofuel production capacity being established during that decade. Subsequently, the 2009 Renewable Energy Directive (RED I, 2009/28/EC) tightened this target, setting a binding goal of 10% renewable energy in transport by 2020.

From the outset, the quotas were politically controversial and faced criticism from many stakeholders – and strong support from the agricultural sector such as farmer associations. The policy faced opposition from both incumbent fossil fuel interests, represented by e.g. OPEC, and environmental NGOs such as e.g. Greenpeace, highlighting the breadth of the controversy. As with any major industrial transition, concerns were raised regarding costs, competitiveness and implementation. Nevertheless, policymakers deliberately introduced the quotas as a market-based mechanism to create investment certainty and accelerate the transition. Despite the debate, the framework succeeded in triggering substantial investments and market development (OPEC 2008, Greenpeace 2008). Importantly, the difficulties during early biofuels uptake, like the debate on food vs fuels or land-use change concerns, generated valuable lessons and led to governance and certification systems. These are meanwhile well established and also frequently applied in chemicals and plastics.

Between 50 and 100 bioethanol plants and between 50 and 100 biodiesel plants were built in the European Union. The cumulative investment in EU first-generation biodiesel and bioethanol infrastructure is estimated to be between 6.5 and 10 billion euros. (Transport & Environment 2017)

The Commission’s impact assessment for RED II estimated that around €900 million per year of investment in advanced bio-refineries would be required from 2021 to 2030 to meet the advanced renewable fuels targets (Annex IX feedstocks). (European Commission 2016)

The EU Sustainable Transport Investment Plan (STIP) estimates that meeting the ReFuelEU Aviation and FuelEU Maritime fuel targets will require around €100 billion of investment in sustainable alternative fuels (SAFs and maritime e-fuels) by 2035. (Transport 2025)

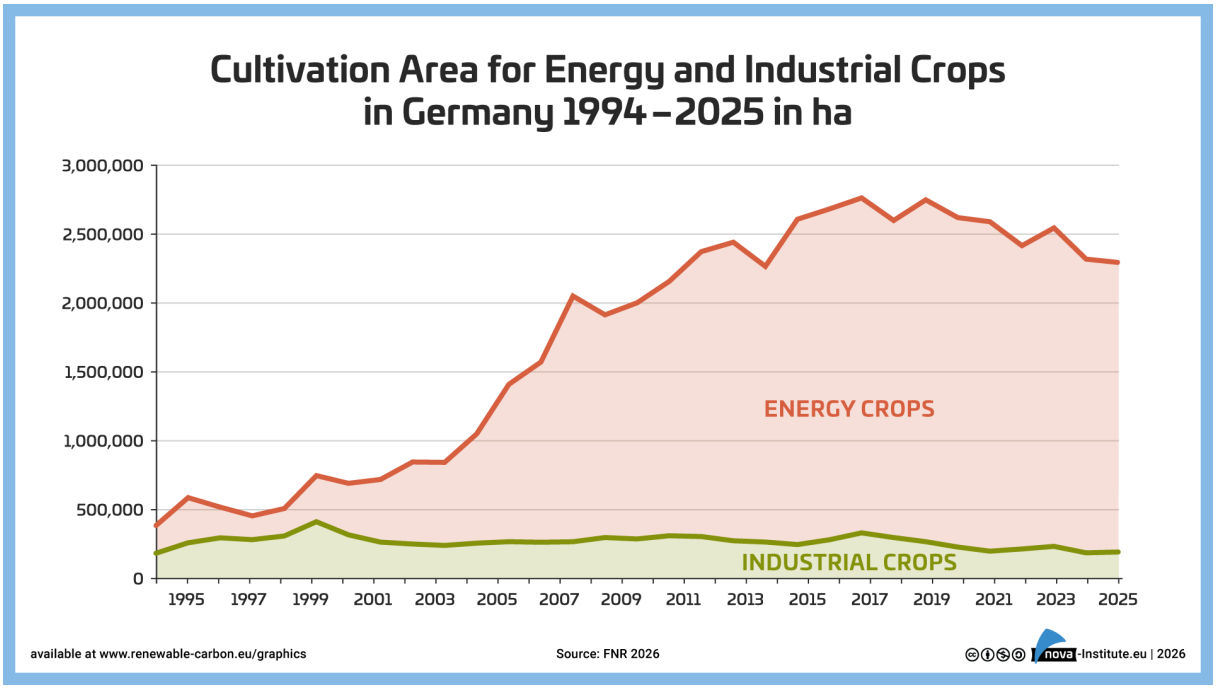
These impressive investment figures demonstrate the significant impact of fuel quotas. The graphic only covers Germany, but in other countries, such as France, the growth of biofuels was even greater. However, no comparable statistics on the cultivation areas of energy and industrial crops are available for Europe or its member states.

Unlike the biofuels sector, no quotas have been introduced for industrial crops used in chemicals and materials in Europe. Consequently, no comparable demand-side market mechanism has emerged, and market uptake has remained modest. While research, innovation and strategic frameworks have advanced considerably, experience indicates that dedicated demand-side measures may be required to accelerate market development. Product quotas are one potential option among several policy instruments, but likely a very effective one.

The impact could be similar to biofuels quota, as explored by the following projection: „[...] A 5% bio-based (including bio-attributed) polymer quota would generate €5.3 billion in investment, similar to

the level of investment in first-generation biofuels. A subsequent 30% bio-based (including bio-attributed) polymer quota would generate €32 billion, similar to the level of investment in sustainable aviation fuels (SAF) in the next decades." (Carus 2026)

Against this background, the ongoing discussion in Brussels on introducing a bio-based content target for plastics in packaging under the PPWR (DG ENV) is particularly noteworthy. If adopted, it would represent the first demand-side measure of its kind for bio-based plastics in Europe and could provide an important signal for market development. By creating predictable demand, such a measure could encourage e.g. packaging companies and other value-chain players to identify and adopt suitable bio-based solutions, thereby supporting investment, production scale-up and innovation across the value chain. Similar demand-side instruments may also be considered for additional sectors in the context of the forthcoming Biotech Act II.



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