

The German Chemical Industry – Competitiveness and Bioeconomy

Preliminary Remarks

The chemical industry is traditionally a key part of the German economy. The sector is characterized by a highly concentrated structure. The chemical industry's main customers include the automotive industry and the machine-building sector, which in themselves are central to the German economy. The chemical corporations active in Germany, as well as a number of highly specialized medium-sized companies, compete globally. German chemical companies generate nearly 60% of their revenue abroad. Together with the USA, Japan and China, Germany is one of the largest players in the global market. Although many raw materials and preliminary products are imported, Germany has been a net exporter for many years. The reason for its success is its efficient and almost optimally configured composite structure at its base in Germany. The key raw materials for the chemical industry are petroleum products (naphtha) and natural gas. Nowadays, renewable raw materials such as fats, starches, cellulose and sugar are already being successfully used in biobased and thermochemical processes, if they offer competitive advantages in terms of sustainability, profitability or technology.

Challenges for the Bioeconomy

- **Establishing new processes:** Under the existing market and framework conditions, established fossil-based production usually offers cost advantages and better margins compared to new, still to be established, biobased production. There is therefore no financial incentive to invest in the development of more environmentally friendly, biobased products and processes.
- **Converting the existing infrastructure:** Germany boasts a mature and beneficial infrastructure for the petroleum-based chemical sector, manifesting itself in the form of crackers, pipelines and integrated and specialized production facilities. These facilities and the exploitation of material flows have been optimized over the course of decades. In most cases the infrastructure was written off several years ago and is therefore highly profitable; the process chains are well established. A transition to biobased production would involve considerable investment in new infrastructure and production facilities. Such investment, however, would not increase profits in the short term and is therefore not popular with the financial market.
- **Economies of scale:** In the basic chemicals sector, profit is primarily determined by economies of scale. For many chemicals there is only one "world scale" production plant. To bring corresponding biotech processes to such scales of production would require special knowhow, which is currently in limited supply.
- **Biotechnical challenges:** Special knowledge in the optimization of production organisms, fermentation and regeneration processes, as well as applications engineering, is required to develop biotech processes. Development times are usually long and the associated costs and expenditure high.
- **Lack of supply chains:** So far, farmers and agricultural businesses do not see themselves as feedstock or upstream suppliers for the chemical industry. There are no starting points for building up value chains and alliances that also include small and medium-sized companies. In particular, there are problems due to the heterogeneity of biomass, which is produced locally, mainly by small agricultural units and ideally consists of agricultural residues (cascaded use). Some of the coordination aspects relating to supply chain links and the suitable processing of this biomass for the chemical industry are still not resolved.
- **Lack of financing options:** The lack of available venture capital, which is in part due to the lack of depreciation allowances for R&D investment in Germany, has had a negative impact on the innovative strength of German SMEs. Because of their limited capital assets, they are particularly dependent upon investors. In contrast to the pharmaceutical sector, the market for acquisitions of small and medium-sized businesses is underdeveloped in the chemical sector. However, the possibility of making high profits from selling off companies is a key incentive for venture capitalists.
- **Prices and demand:** Driven by sustainability considerations, an increasing segment of consumers is interested in biobased and biotechnologically produced products. However, the willingness to pay premium prices for biobased chemical products is limited. Besides, the biobased content or production process is difficult to communicate to the consumer. In this respect, the first consumer goods companies have launched marketing activities in the bioeconomy with the aim of differentiating and better communicating the benefits of biobased products..



The chemical industry is a central innovator. However Bioeconomy is not perceived as a key area.

Conclusion

The chemical sector is dominated by a few large companies. These companies do not yet perceive the bioeconomy as a key area for innovation and growth. However, certain elements of the sustainability debate can be considered as part of a bioeconomy strategy. The size of the companies, healthy demand, almost ideal process conditions and vertical integration rather encourage incremental improvements in existing products and processes based on fossil resources. At the present time, however, it is difficult to imagine the chemical industry comprehensively transforming into a „biobased economy“ in the sense of it turning away from petrochemicals. Due to the favourable trend in natural gas (and in future also crude oil), a renaissance in the use of fossil feedstock seems more likely in the midterm than a comprehensive transition to renewable raw materials. The systematic transition to a biobased economy is more difficult than generally assumed, precisely because of the economic strengths and excellent structure of the German chemical sector. It is therefore expected that biological processes will only be used by large companies where biobased products are more economical to produce, if they have no chemical equivalents or if they are clearly distinguished by improved properties in the marketplace. This applies to both fermented complex molecules such as amino acids and vitamins, and to the supplementation of individual synthesis steps by biocatalysis, where, for instance, special selectivities are required. Particularly the many small and medium-sized chemical companies in Germany that develop and manufacture user or consumer-oriented products are already making increasing use of biobased processes. Intensification is clearly discernible in this sector.

Observations regarding German Policy

The question is: how can the German chemical industry make greater use of the bioeconomy to remain competitive in the future and to produce more sustainably? The potential of the bioeconomy lies not merely in the substitution of raw materials but rather in the development and marketing of new biobased and bioinspired products with enhanced properties. The industry's future competitiveness crucially depends upon exploiting this innovative potential. The traditional instruments of public R&D funding as a basis for these innovations must be further developed or supplemented. The structure of funding programs should increasingly be aimed at involving medium-sized companies and investors. In many cases such measures go beyond the remit of individual ministries. We therefore need to look more closely at how to incentivize bold and unconventional business decisions and to encourage the mobilization of investment capital. It is important to involve society in the debate about the future viability of the country and its economic basis at an early stage. This also requires more widespread information and publicity about the social benefits of biobased products and methods and "nudging" incentives for consumers. In order to promote a "market pull" effect, consumers should be enabled to assess the benefits of biobased products, e.g., based on understandable information and verified sustainability measures.

About BÖRMEMOS

BÖRMEMOS summarize the Council's appraisal of key aspects of the bioeconomy in a condensed form. They do not claim to provide a comprehensive study of these facts. Rather, they present a focused and generally comprehensible view of each area and its relationship to the bioeconomy. They have their theoretical basis in extensive background papers that are also published on the Council's home page. BÖRMEMOS are assessed together with BÖR background papers (peer review). While this process is taking place, they are identified as preliminary and the authors are named. This memo on the chemical industry was provisionally published on 4th June 2014 and finally approved by the Council at the 10th meeting on 14th November 2014,