

► Project *brief*

Thünen Institute of Market Analysis

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Markets for Bio-Based Materials: Recent developments and projections with BioMAT

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- We developed a new tool named **BioMAT (Bio-based Materials)** for the representation of the stylized value chains of bio-based materials in the EU and its Member States.
- The **BioMAT** database shows an increase in production of bio-based chemicals since 2010, with the respective increase in use of biomass as production input.
- In 2018 production of bio-based chemicals in the EU reached 43 million tons or 14% of the total output volume of the organic chemical industry. The main application category of bio-based chemicals is 'biofuels', followed by 'agrochemicals' and 'surfactants'. The main feedstocks in terms of volume are 'plant oils' and 'starch'.
- The **BioMAT** model provides forward-looking projections and shows further increase in production of bio-based chemicals that reaches 58 million tons by 2030.

Background and aims

The European project BioMonitor ('Monitoring the EU Bioeconomy') addresses the information gap in bioeconomy research by re-structuring its existing data and modelling framework. Significant identified gaps in data and modelling capacities are related to the markets of bio-based materials in general and bio-based chemicals in particular. Against this background, we developed a new consistent framework for the representation of the stylized value chains of bio-based materials in the EU and its Member States, with a specific focus on chemical industry, named **BioMAT (Bio-based MATerials)**. It comprises two elements: a comprehensive database (**BioMAT database**); and a multi-regional partial equilibrium model (**BioMAT model**). While the **BioMAT** database tracks historical developments (2008-2018) in the markets for bio-based chemicals and the associated demand for bio-based feedstocks, the **BioMAT** model uses this information and projects their future developments (to 2030/2050). The combination of the **BioMAT** database and the **BioMAT** model is aimed to be an appropriate tool to guide policy-making in the field of the bio-based economy, by showing prospects of the bio-based industry and its possible contribution to achieving different targets, but also revealing its limitations and the associated trade-offs.

Approach

The main source of inspiration for the development of **BioMAT** was the experience gained with the construction of the database and the subsequent modelling of the agri-food value chains in [AGMEMOD](#) (AGriculture MEmber state MODelling).

Building on the **AGMEMOD**'s concept and using its IT infrastructure, **BioMAT** operates as a module of **AGMEMOD**.

BioMAT provides a stylized representation of value chains of bio-based materials. It starts with capturing biological feedstocks in the form of raw materials and products of their first processing step used for the production of bioenergy and bio-based materials, and moves downstream the bio-based value chains through some intermediate steps to predefined product groups (or product application categories). The focus of **BioMAT** is on the chemical industry (category C20 in the NACE classification), with full coverage of all bio-based products, grouped into 16 product application categories. **BioMAT** differentiates 10 types of bio-based feedstocks; via three of them (sugar, starch, plant oils) a linkage to agricultural crop production in the EU covered by **AGMEMOD** is possible.

The core of the **BioMAT database** forms the bio-based material flow database. European official statistics on the production and trade of manufactured goods (PRODCOM, SBS, COMEXT) are used as primary sources of data. However, they provide insufficient information to generate the pursued bio-based material flow database, therefore, further information (bio-based shares, conversion rates, mapping matrixes etc.) is incorporated to generate this database. The **BioMAT** database is further enriched with economic data (market data for chemicals, biological feedstocks; macroeconomic data).

Subsequently, the final database is employed to construct the **BioMAT model** (specify equations, calibrate parameters etc.), which is used to provide projections for markets of predefined 16 product application categories and their related feedstock needs for the EU Member States and the EU27, to 2030/2050.

Results

Figure 1 shows volumes of different types of biological feedstocks (on the left side) used by the chemical industry in the EU27 in 2018 to produce bio-based chemical products, and their output volumes within different application categories (on the right side). In terms of volume, 'plant oil' (30%) and 'starch' (25%) are the main agricultural feedstocks for the production of bio-based chemicals. Regarding the bio-based production of the chemical industry, again in terms of volumes, 'biofuels' (42%) is by far the most important application category, followed by 'agrochemicals' (21%), 'surfactants' (12%) and 'cosmetics and personal care products' (6%). Other application categories have a share of only 2–3% of the total output volume.

Figure 2 shows the historical and projected developments of the total market of bio-based chemicals (C20) in the EU. The development of production, net-trade and apparent use volumes as well as the estimated bio-based share in the production volume of the total (organic) chemical industry (including biofuels) are displayed. In general, no strong dynamics could be observed in 2010–2018; production and use volumes of total bio-based chemicals increased somewhat, but the bio-based shares remained quite stable due to the overall increase in production of all chemicals.

Figure 3 shows the historical and projected developments for the use of different feedstock types for the production of bio-based chemicals (excluding biofuels).

Figure 1: Use of biological resources for production of bio-based chemicals in the EU in 2018.

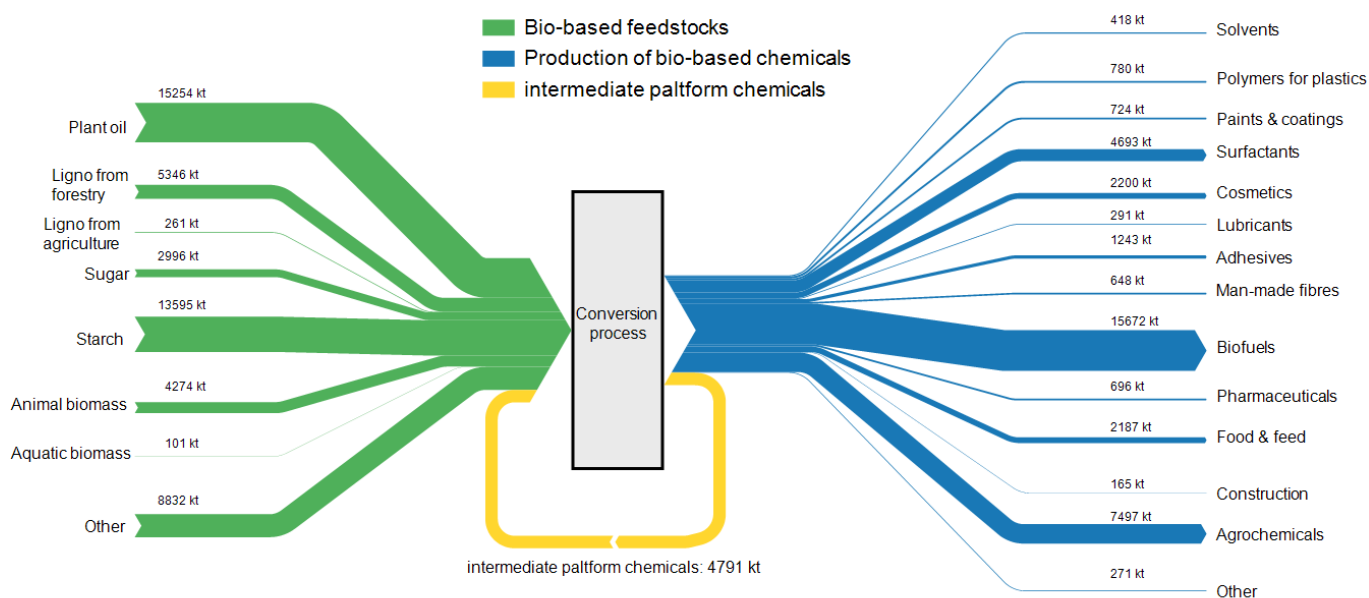


Figure 2: Development of the market of bio-based chemicals in the EU.

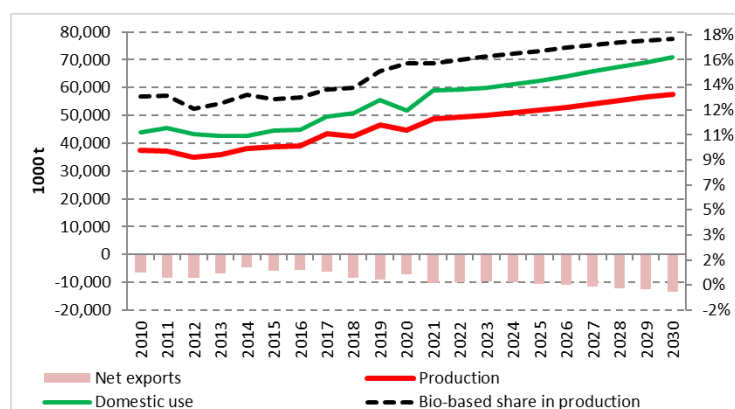
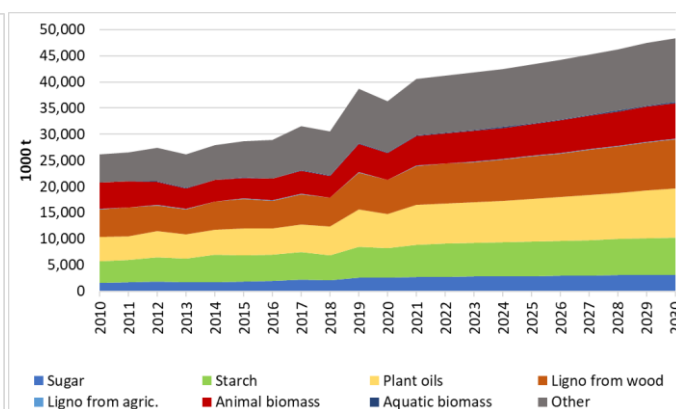


Figure 3: Development of use of different feedstocks by chemical industry (excl. biofuels) in the EU.



Further Information

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Project logo



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Publications

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Leeuwen M van, Gonzalez-Martinez AR, Sturm V (2022) Developing BioMAT: A new conceptual framework to model the market of bio-based materials in the EU. Stud Agric Econ 124(2):82-87, DOI:10.7896/j.2289.

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