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Integrated toolbox for cross-sectoral assessments: On the sustainability of the production and recycling of bio-based versus fossil-based polymers.

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In this project two in-house models, the Model of the World (MotW) and the Modular Applied GeNeral Equilibrium Tool (MAGNET) are being used to assess the transition of polymers towards a bio-based economy and sustainable development. By exploring and developing linkages between the two models and by comparing the model's inputs and outputs a more general feedback can be provided.

The MotW pursues to support the decision making towards a sustainable and climate neutral world through the assessment of global cross-sectoral actions that aim for the reduction of Green House Gases (GHG) emissions. The model consists of a database and a solver. In the database processes as well as demands and restrictions of some of the most important products and commodities (fossil -based and bio-based raw materials) are stored. The solver uses linear programming to find an optimum solution based on demands, restrictions and cost minimization. The first scenario of the MotW assumes all polymers come from fossil feedstocks; this is followed by a sequence of future scenarios with different GHG targets. The model is free to chose different processes (including biopolymers) to fulfil the target while minimizing the cost.

MAGNET is a recursive dynamic, multi-regional, multi-commodity model, covering the entire global economy. The model is used to analyse policy scenarios on agricultural economics, bioeconomy, food security, and international trade. MAGNET describes production, use and international trade flows of goods and services. The database distinguishes 140 countries. The MAGNET model was extended to include three main biobased sectors (including bioplastics) and a waste module was implemented which also includes plastic recycling. Additionally, to the baseline scenario. New scenarios, where bio-polymers are increased to 15% and 50% of the worldwide demand for polymers are evaluated.

The models have been updated to run a baseline scenario for the year 2015. The model's results are compared to provide feedback on the potential drawbacks and benefits of switching polymer production from different fossil -based to bio-based raw materials.

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