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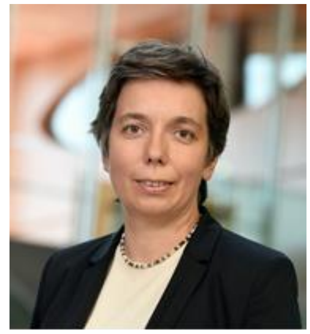

Opportunities and limits of a bio-economy as an integral part of the Circular Economy – or how to get plastics circular?

Plastics are part of a global fossil-based industrial production network. They offer great benefits daily consumer goods as well as for low carbon technologies such as light-weighting for automotive technologies, and high-performance insulation materials for buildings. However, handling them in a sustainable manner becomes a global challenge due to rapidly increasing consumptions rates and unintended ubiquitous dissipation in the environment, both associated with significant environmental impacts.

The production and use of plastics increased globally from 2 Mt in 1950 to 381 Mt in 2015 (GEYER et al. 2017). In 2017, more than 99 % of plastics were produced using intermediate products derived from crude oil (see IfBB 2018, p. 42; PlasticsEurope 2018b, p. 18). This resulted in Europe 4 to 6 % of the crude oil used was consumed to manufacture plastics (PlasticsEurope 2018a, p. 8). More than 99 % of plastic waste is classified as recovered according to the definition of the Waste Framework Directive, more than half of it by energetic recovery. In 2017, mechanical recycling accounted for 46.2 % of the total amount of plastic in Germany.

Despite of existing legislation and technologies, present data on plastics flows show a significant circularity gap. Barriers rapid transition towards circular plastics economy are existing waste management structures as well as, both, product-use and material-inherent properties. To develop future-prove solutions several boundary condition have to be taken into consideration. Future greenhouse gas neutrality and associated decarbonization of all economic sectors, will change plastic feedstock sourcing, petrochemical production lines as well as boundary condition for environmental impact assessments.

The bio-economy is discuss as one of the solution for the decarbonization of the chemical industry and subsequently the plastics production. It is often assumed that based petrochemical feedstock are considered CO2-neutral, because only the amount of CO2 absorbed during the growth of the plant is released. However, the carbon balance depends on various factors during the life-cycle of biobased materials. Whereas, for example, in the case of wood from residual and waste materials, essentially only emissions from transport and sometimes from processing have to be accounted for, in the case of cultivated energy crops a considerable amount of auxiliary and operating energy has to be expended on their provision, processing, conversion and use. This leads to emissions. In the cultivation of bioenergy crops, the greenhouse gas emissions of agricultural production must also be considered, especially of greenhouse gases other than CO2 (ARNOLD 2015, p. 493).

Another inherent problem is the land intensive cultivation of biobased feedstocks. The potential for biomass complying with sustainability criteria is limited (UBA 2019f, p. 28; 2013a, p. 52 ff.; 2013b, p. 7; ARNOLD 2015, p. 501). The area required for the cultivation of biomass as well as resources of transport and storage for plastic production are competing with other use sectors of bio-based feedstocks such as bioenergy and alternative fuels for mobility or last but not least food production.

The German Advisory Council on the Environment (SRU –Sachverständigenrat für Umweltfragen) developed a framework to rethink the waste hierarchy in terms of bridging the current gap between consumption, product and waste policies as well as the environmental alignment of CE measures and expand existing waste hierarchy by including:

1. Reduction of total RM input for products, infrastructure and services;
2. Production of "CE-compatible" goods (durable, pollutant-free, material-efficient, reparable, recyclable etc.);
3. Definition of binding targets for waste prevention and preparation for reuse;
4. Formulation of recycling targets and measures based on secondary raw material quality and safe removal of pollutants.

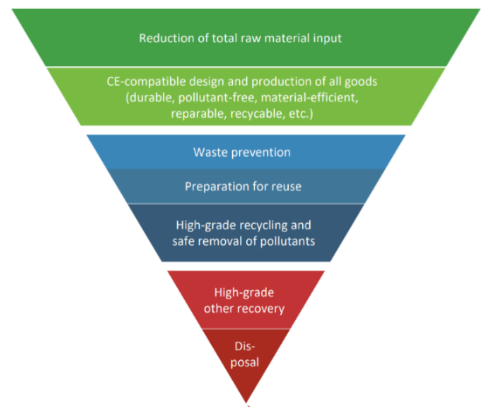

Figure 1: New extended CE Hierarchy proposed by SRU

This presentation will assess a managing options for plastics (incinerating, recycling or decarbonizing) relative to the extended CE hierarchy and will conclude that only a coherent set of measures on all levels of the hierarchy will deliver the urgent needed transition towards a sustainable material management and a circular bio-economy.

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VERA SUSANNE ROTTER, is professor at the Technische Universität Berlin, Faculty of Process Sciences and head of the Chair ‚circular economy and recycling technologies'.

Professor Rotter's main research areas are innovative separation technologies and circular economy concepts, product-oriented recycling strategies and producer responsibility, and integration of secondary raw material in value chains. With her team she works in national and international project consortia addressing the technologies and information management to support the recovery of raw materials from electronics, batteries, photovoltaic and vehicles. Further projects address the sustainable management of residual biomass in the NEXUS energy – agriculture and climate change mitigation - soil protection, i.e. in Vietnam und China. In the period 2016-2020 Prof. Rotter was appointed member of the German Advisory Council on the Environment (SRU) of the German federal government and lead author of the Chapter "Circular Economy: putting ideas in practice.