

The Renewability of Societal Resources: Summary

In the opening talk **Peter Moser** gave an overview over the global consumption of resources of all categories, i.e. mineral resources, energy resources and bio resources and showed that the resources consumption has roughly doubled since 1990. The drivers behind this enormous increase are the massive global gross domestic product growth and the population increase. In terms of the different specific developments in the various geographic and economic zones on the planet it was shown, that there is a direct correlation between the development status of a country and the amount and type of its resource consumption. In the outlook on the future development of resource needs, he established a connection to the Sustainable Development Goals and to the opportunities to re-gain resources from old products and garbage through recycling. If radical new solutions are not developed, the resources need will again double in the next thirty years. Secondary Resource availability from recycling will be still rather limited in the next decades, as the in-stock use of materials is causing a long, several decades lasting delay between the resource input into an economy and their availability for recycling.

The topic Material Stock Patterns for the transformation to a Sustainable Society was addressed by the second speaker, **Mr. Helmut Haberl**. He explained that a transformation towards sustainability requires far-reaching changes in the patterns of societies' use of biophysical resources. He argued for a material stock–flow–service nexus approach focused on the analysis of interrelations between material and energy flows, socioeconomic material stocks (“in-use stocks of materials”) and the services provided by specific stock/flow combinations. This concept builds on recent empirical efforts showing that the fraction of the global socioeconomic material inflows added to stocks each year has risen from 20% to over 50%, suggesting the emergence of global “stockpiling” societies. Currently, socioeconomic material stocks are in a similar magnitude as the total standing biomass of plants on land, and they have grown with GDP increase for over a century. The presentation showed that analysing the relations between stocks, flows and services will allow to develop highly innovative indicators of eco-efficiency and society-nature interaction and will open new insights understanding the biophysical foundations of sustainability transformations.

As a first part of his talk about energy resources and their renewability from a systemic perspective, the third speaker **Mr. Udo Bachhiesl**, stressed the importance of a stable energy supply as a prerequisite for sustainable development. In the light of a growing population and economies, strongly driving the increase in energy need and thus also CO₂ emissions, a sustainable energy supply is going to be a huge challenge. While today still a big share of the energy needed is supplied by fossil fuels like oil, coal and natural gas, new renewable supply systems with different supply characteristics will gain an important share in the supply systems in the future. The big advantage of most of the new renewable energy systems is, that they directly produce electric energy. With this paradigm shift from a mainly fossil fuel based to a renewable energies based supply system, electricity and energy efficiency will play a more important role in the future. However this paradigm shift is also resulting in a

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considerably shorter replacement cycle of power plants as renewable power plants, e.g. wind mills and solar cells, have a shorter lifetime.

The fourth speaker **Mr. Hans-Peter Kaul** addressed the topic of the bio resource availability in 2050 with a focus on food supply. He raised the question if there will be enough food, feed, fibre and fuel in the future. He showed that bio resources are inevitably of crucial importance for human and animal nutrition. While forest biomass, i.e. wood, traditionally is used for energy or industrial purposes only, recently a strongly increased demand for bio resources also from agriculture for energy or material uses was observed. Therefore, an important aspect is how much bio resources will be available beyond food and feed, i.e. for “fibre and fuel” in the future. In conclusion, food and feed will stay the primary applications of agricultural biomass, and their production needs a sustainable intensification. For material use the further development of bio refineries and recycling processes is essential. Biomass for bioenergy („fuel“) will have some importance in the future energy mix, but only as a supplement and primarily at the “end of the line” of bio resource cycles.

The last speaker **Mr. Michael Tost** presented the topic Raw Materials Supply in the frame of the planetary boundaries. The industrial revolution and especially the “great acceleration” of economic growth after World War II, based on neoclassical, market based economic principles, meant that demand for raw materials has been growing exponentially and will continue to do so, based on forecasts from organisations such as the OECD or The Economist. This “great acceleration” has moved the planet from an “empty world” to a “full world” and such growth cannot be sustained in a closed system, as is the case with planet Earth. On the basis of two examples, the Planetary Boundaries and The World in 2050, bio-physical boundaries were explained and required changes to be considered in our societal and economic systems were addressed.

In summary it can be concluded from all the presentations that with respect to population growth and global wealth increase expected in the next decades, a radical change of the society’s resources demand is needed. Based on today’s consumption patterns, a doubling of today’s resources needs will occur within 30 years. Such a huge amount of resources cannot be supplied anymore within the boundaries of our planet. Recycling and a development towards a circular economy are not the solution as the long in-stock use of the resources will delay the availability of secondary resources as a main supply channel for the next decades.

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