

Joint vision for a global sustainable bioeconomy

In Brief: Bioeconomy makes people and planet better off, by pursuing an economic system which is based on sustainable economic growth, while reducing resource consumption and by protecting and regenerating ecosystems. Using science to add value to biological resources and biological processes, the bioeconomy embraces principles of renewability, and circularity.

The bioeconomy is the production, utilization, conservation, and regeneration of biological resources, including related knowledge, science, technology, and innovation, to provide sustainable solutions (information, products, processes and services) within and across all economic sectors and enable a transformation to a sustainable economy.¹⁵ The bioeconomy is not a static notion and its meaning is continually evolving. Since its origins in the late 1960s and 1970s, in which bioeconomics applied the laws of entropy to economic questions,¹⁶ the concept has further evolved in scope and in direction around the world.¹⁷

The bioeconomy aims at reconciling the needs of humans and nature. It pursues an economic system that is far superior to today's: one that strives for achieving the UN 2030 Agenda for Sustainable Development and its Sustainable Development Goals and one which is based on sustainable economic growth, which centers on improving human well-being and social equity, while reducing resource consumption and regenerating ecosystems. Bioeconomy activities enhance economic, social, and ecosystem resilience, allowing both urban and rural communities to thrive especially during economic crises. A global sustainable bioeconomy includes all levels of society and aims at improving the quality of life for all people, while respecting biophysical limits to economic growth.

Bioeconomy: a new economic vision inspired by nature

Nature serves as the greatest source of inspiration in the bioeconomy. Besides valuable, renewable material and energy resources, biology provides critical know-how on natural cycles, its system and processes. The life sciences explore such characteristics, abilities and functions of natural organisms in order to develop novel, high-value solutions and applications. At the moment, many bio-innovations are still in their infancy, but are already demonstrating promising solutions with clear social, health and ecological benefits. Pioneering examples in the health care sector comprise biological therapeutics e.g. in immuno-oncology, bio-degradable implants and sensors as well as bio-printed organs. In the textiles and fashion industry, bio-innovations contribute to sustainable materials and processes, e.g. biotechnologically produced spider silk, biobased water repellents or biobased dyeing and washing processes. In the IT sector, DNA has already been tested successfully for super-efficient data storage and cells have been merged with chips to diagnose air pollution. Bio-innovators in the food and feed industry have developed pro-biotic health products, new vegan protein options, high-value products from food waste and side-streams, as well as microbiome solutions for agriculture, such as microbial-based fertilizers, and for combating obesity and non-communicable diseases for better animal feed and human health. In industry, synthetic biology and applications of microbiome engineering not only result in advanced biomaterials, replacing plastics and steel, but also inspire more sustainable manufacturing processes. Biotechnology

[15] International Advisory Council of the Global Bioeconomy Summit 2018. (2018). Communiqué: Innovation in the Global Bioeconomy for Sustainable and Inclusive Transformation and Wellbeing. Available at https://gbs2018.com/fileadmin/gbs2018/Downloads/GBS_2018_Communique.pdf

[16] Nicholas Georgescu-Roegen is often considered the founder of "bioeconomics" with his work on "The Entropy Law and the Economic Process" (1971).

[17] German Bioeconomy Council. (2015). Bioeconomy Policy (Part II). Synopsis of National Strategies around the World. Available at https://bioekonomierat.de/fileadmin/international/Bioeconomy-Policy_Part-II.pdf

and related converging technologies provide remarkable potential to advance sustainable development and to accelerate job creation through innovative start-ups and global partnerships.¹⁸

Building a resilient, sustainable and innovative economy

A sustainable bioeconomy requires that we produce in a completely different way: circular instead of linear and by using science to add value to biological resources and biological processes. With its inspiration from nature, the bioeconomy fully embraces principles of renewability, circularity and cascaded resource use. The bioeconomy can be compatible with – and may contribute to – the development of a circular economy, where resources are used as long and as efficiently as possible, and waste is limited or repurposed. Sustainable bioeconomy development involves broadening our use of bioresources and including the conversion of bio-waste to useful products. The bioeconomy and circular economy both address sustainability and seek to optimize product design, material flows and resource efficiency while keeping a high level of functionality or adding new functionalities to materials. In fact, the recognition that the bioeconomy is deeply linked with circularity has become articulated under the concept of “Circular Bioeconomy.”¹⁹

Both concepts have a common interface. The concept of a sustainable bioeconomy, however, goes beyond that of the circular economy.²⁰ The bioeconomy aims for more disruptive innovation, a “biologization of the economy”, which comprises social and high-tech innovations and the development of completely new solutions, services, and products that combine sustainability with increased consumer benefit and thus enable new lifestyle concepts. Start-ups around the world are pioneering innovative, resource-efficient and sustainable protein production through the development of nutrient-rich products from algae to insects or by biotechnological manufacturing in microorganisms using CO₂ as a carbon feedstock. Large consumer goods companies are including biobased product innovations in their portfolios, from materials and packaging, functional textiles, to cosmetics and children’s toys. New processes and technologies such as biobased 3D printing, biomimicry, bionics and robotics, the large-scale technical use of CO₂ or biomanufacturing with cell-free systems are increasingly applied and embedded in new industrial and urban concepts. Elements of bio-principled cities, including algae houses, wooden buildings, waste-processing systems, insect farms, or urban and indoor farms, can be increasingly found all over the world. The bioeconomy also offers opportunities for synergies between the two concepts, where new ideas are needed to solve problems of plastics, degradability and human health.

A sustainable bioeconomy not only offers completely new solutions, but also the chance to reimagine age-old traditions and value chains in agriculture, forestry, and fisheries. It thus can also be seen as a tool to revitalize rural communities and to restructure industrial regions, such as former coal districts, by using new decentralized manufacturing approaches and thereby supporting the creation of new and sustainable, but also high-quality jobs for the future.

A sustainable bioeconomy addresses not only aspects of sustainable production, economic growth and employment, but is more and more determined by sustainable consumption and sustainable lifestyles. The bioeconomy includes producers and consumers alike. The vision of a sustainable bioeconomy is to advance technological progress and efficiency gains through science, technology and innovation. This puts the bioeconomy at the center of a new industrial strategy.

[18] International Advisory Council of GBS2018. (2018). Communiqué of the Global Bioeconomy Summit 2018, Available at https://gbs2018.com/fileadmin/gbs2018/Downloads/GBS_2018_Communique.pdf

[19] See, for example, Philp, J. & D. Winickoff (2018), or Carus, M. & L. Dammer (2018). See also the conference “Sustainable and Circular Bioeconomy, the European Way” (22 October 2018, Brussels) <https://op.europa.eu/en/publication-detail/-/publication/f57a0695-04d9-11e9-adde-01aa75ed71a1/language-en/format-PDF/source-84695789>

[20] “In a circular economy the value of products and materials is maintained for as long as possible; waste and resource use are minimized, and resources are kept within the economy when a product has reached the end of its life, to be used again and again to create further value.” See European Commission. (2015). Circular Economy Package: Questions & Answers. Available at https://ec.europa.eu/commission/presscorner/detail/en/MEMO_15_6204 [09.11.2020].

BIOECONOMY



Nature provides
Natural systems and processes

Maintain

Reduce

Embrace principles of circularity and cascaded resource use

Self organizing

Self-Repair

Diverse

Self-replication

Circular

H₂O

Efficient

O₂

Adaptive

CO₂

Regenerative

N

Nature



Biotech



Life Science



Biorefinery



Digitalization/
Converging Tech

**Bioknowledge/
Bioprocesses**

Science & Technology



Animals



Plants



Waste



Microorganism

Bioresources



Nature provides

- Renewable energy and materials
- Biodiversity

Recycle



Reuse



Apply

Special qualities of biological resources & processes for the benefit of humans and nature



Unlock potential

Biobased products Social and tech innovations



New Jobs Biobased service

Sustainable solutions and consumption



Consumer



Agriculture



Processing-ind. manufacturing



Fishing



Forest

Sustainable Economy

Inclusivity

Achieving SDGs

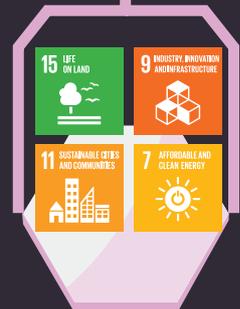
Improving human well being & social equality

Reducing resource consumption and building up ecosystems

Creativity

Renewability

Circularity



Government