GLOBAL
BIOECONOMY
SUMMIT 2018

World Bioeconomy Exhibition

This brochure is CO_2-neutral and was printed on sustainable grass paper made out of 50 % fresh fibers from sun dried grass.

Vorwort

Bioeconomy is key to a sustainable economy reconciling humanity and nature – especially when the world will be home to 9 billion people. The transition to a biobased economy has to take place in a challenging context: We have to tackle climate change in a growth-driven economic environment, provide job opportunities along with access to healthy nutrition, and secure energy and health care for a growing population while better protecting biodiversity and the earth‘s vital resources. Now, we need to elaborate specific, sustainable solutions.

The bioeconomy can contribute significantly to achieving the Sustainable Development Goals. In doing so, bioeconomy cuts across economic sectors and due to innovations becomes intertwined with digitization. In the primary sector, bioeconomy fosters smart innovation in agriculture, forestry, energy, and fisheries. It aims to increase yields and productivity, while using bio-compatible inputs, protecting natural resources and reducing waste. Across industrial sectors, the bioeconomy develops novel eco-friendly processes, promotes cascaded and circular material flows and comes up with completely new product solutions. These activities result in opportunities for economic growth and a high quality of life. However, bioeconomy also has a demand side which entails societal change and requires adjustments from consumers toward more sustainable behavior that does not use up scarce resources or pollute the environment.

This exhibition is dedicated to bioeconomy and the Sustainable Development Goals. In four pavilions, it presents an exciting selection of bioeconomy innovations from around the world.

You are warmly invited to explore and, quite literally, get in touch with bioeconomy!

Prof. Dr. Joachim von Braun Prof. Dr. Christine Lang

Chairs of the German Bioeconomy Council

Zero Hunger & Health

Climate Action

Bioeconomy & SDGs

A recent survey among global experts revealed that bioeconomy is expected to contribute to achieving all of the seventeen Sustainable Development Goals (SDGs), and in particular to SDGs 1 & 2 (Zero Hunger & Good Health and Well-Being), SDG 9 (Industry, Innovation and Infrastructure), SDG 12 (Responsible Consumption and Production) and SDG 13 (Climate Action).

With a view to fighting hunger and malnutrition, for example, bioeconomy provides innovative products made from residues and food waste, novel sources of probiotics and essential nutrients, but also bio-based medicines and care products.

Biobased solutions contribute to sustainable industrialization and innovation. 3D printing, for example,

Responsible Consumption

Industry & Innovation

is enabled by biological materials and bio-inspired structures. Biodegradable packaging materials can be grown from mycelium or produced from starch. High-tech materials, such as break-resistant smartphone displays and waterproof textiles, can be biobased, non-toxic and renewable. By combining advances in the biosciences with digitization, new solutions emerge, such as smart farming apps that optimize water, herbicide and fertilizer consumption. With a view to climate action, bioeconomy involves renewable energy, using CO_2 as a feedstock and low-carbon production. Exploring algae as an alternative source of energy and food is one approach, using lightweight and renewable materials in sustainable transport, another. To encourage sustainable consumption, green brands develop many creative products that range from vegan leather bags based on residual pineapple leaves to dresses made of wood fibers and stationery items produced from local elephant dung or meadow grass.

Secretariat of the German Bioeconomy Council

Zero Hunger & Health

This is certainly one of the most important Sustainable Development Goals: ending hunger and all forms of malnutrition by 2030. About 815 million people suffer from hunger; this amounts to one in nine. Furthermore, one in three are malnourished. Apart from obvious physical consequences, hunger and malnutrition can also have serious effects on the mental development of children. Nutritious food in sufficient quantities is the foundation for human health and wellbeing. Bioeconomy holds promising approaches to resolving the nutrition and health challenges of the future. They range from circular economy approaches that avoid food waste, to energy-saving home growing systems and urban farming. Biobased innovation further provides novel protein sources and healthy food supplements as well as biological pharmaceuticals and medical treatments.

Food Cycle

Circular thinking plays a key role in the bioeconomy, especially when it comes to food waste. Almost one third of the global food production for human consumption gets wasted or lost – an estimated 1.3 billon tons each year. Bright minds think ahead and process fresh produce that is unfit for sale into smoothie powder, jams or dressings. Edible plant components are also often simply thrown away. Coffee fruits are a good example of this. Many companies see them as waste. Bio-entrepreneurs value the fruits and make low-allergen flour or vitalizing drinks from them. And what about sustainable tableware? No problem at all – wrap your sandwich in edible seaweed packs, eat your plant-based steak using wheat bran cutlery and a plate made from leaves. Drink your cold brew lupine coffee with a straw made from unmarketable apples. Bon appetit!

Zero Hunger & Health:

Functional/Novel Food

New biological and technological knowledge and processes provide opportunities for more sustainable food production, for ensuring the global food supply and for promoting consumer health. Bioeconomy products seek to fulfill one or more of these requirements. A sustainable protein supply is an important part of this. Animal-based food provides a high amount of protein, specifically vital amino acids; however, it also has significant adverse effects on the environment and climate. Animal-based food production is resource-intensive. Promising alternatives to these protein sources are plant-based food innovations and insect snacks. Both provide high amounts of essential amino acids, while having a much smaller environmental footprint. In addition, there is also innovative food that offers additional health benefits such as probiotics for humans and animals, and low-calorie sweeteners from natural resources, e.g. Finnish trees.

Zero Hunger & Health:

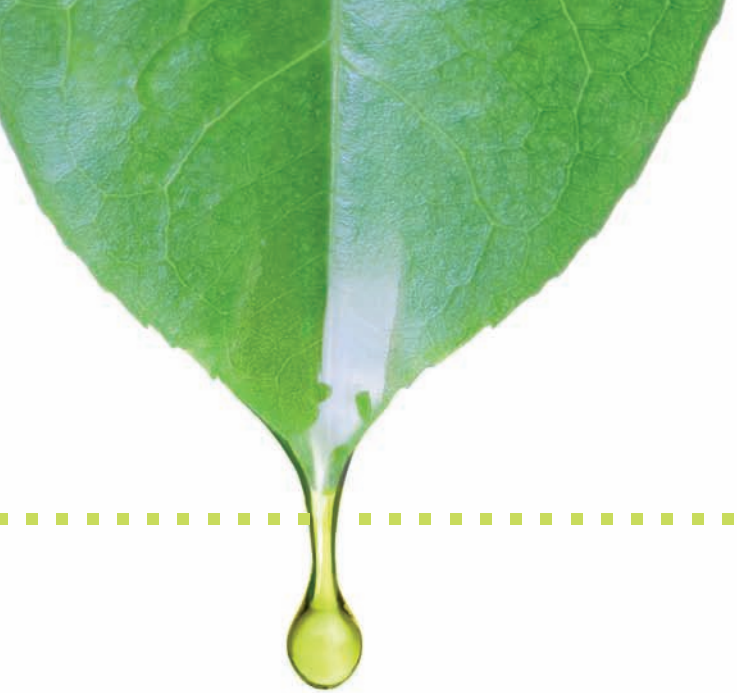
Food Cycle | Functional/Novel Food | Home Growing | Health/Sanitary

Home Growing

More than half of the world's population already lives in urban areas. By 2030, the number will probably increase to 5 billion. This process of increasing urbanization, particularly in Asia and Africa, will require an unprecedented level of resources and will have significant implications for the living conditions in cities. With regard to food security, new concepts are needed that supply the inhabitants with sufficient and affordable fresh food, while at the same time ensuring sustainable production and protection of ecosystems. Today, several urban farming approaches have emerged and seek to provide sustainable local solutions. Examples are rooftop and vertical gardening, honey production on skyscrapers or floating greenhouses. And how about growing food at home? You can cultivate nutritious mushrooms in a basket or grow fresh greens in a high-tech cube.

Zero Hunger & Health:

Food Cycle | Functional/Novel Food | Home Growing | Health/Sanitary



Health/Sanitary

Many of the world's oldest and most important medicines are made from plants. The countless examples extend from aspirin, which is made from willow, to artemisinin, a most effective malaria treatment derived from sweet wormwood. Traditional plant treatments play a major role in treating diseases in most developing countries. But plant-based drugs are by no means old-fashioned – quite the reverse. The alarming rise of drug-resistant infections and autoimmune diseases forces a rethink. More and more scientists combine the latest findings from biotechnology with rich ethnobotanical knowledge to develop new biobased drugs. Nature is also a rich and effective source for a large number of products in the medicine cabinet at home: manuka honey mouth and throat spray, omega-3 fish oil, a cough syrup made from an extract of the South African geranium and plant-based wipes for disinfection.

Climate Action

The facts are worrying: 2016 was the warmest year on record and also had the highest carbon dioxide concentration in the atmosphere. The oceans absorb large amounts of the additional CO_2 and also warm up. As a result, the Antarctic and Greenland ice sheets have decreased dramatically, worldwide coral bleaching has reached a new peak and global sea levels have risen about 8 inches in the last century. We have certainly achieved important successes in some areas, but experts agree that far more effort is needed to cut emissions and to mitigate the consequences of climate change. Bioeconomy can and has to make key contributions to climate protection. Biobased solutions typically contribute by using renewable resources and by cutting CO_2 emissions compared to using fossil fuels.

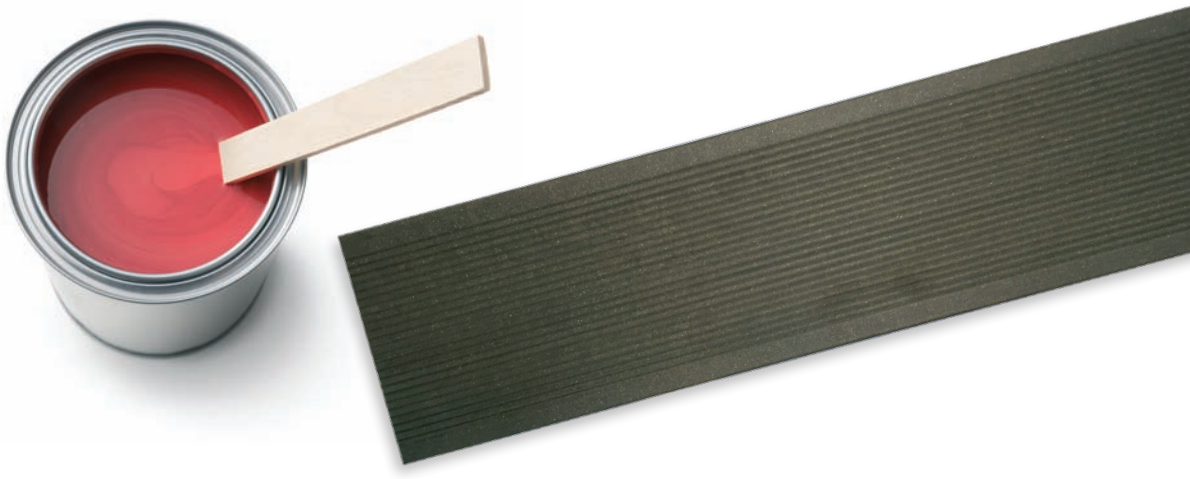
Clean Air

Bioenergy is a key component of renewable energy in both industrial and developing countries. Besides the development of non-food biofuels for transport, bioeconomy also targets improvements in the heat energy sector, which uses biogenic materials for decentralized heating and cooking. In many developing countries, households still work with outdated cooking stoves that generate extremely harmful emissions. Meanwhile, modern stoves are available that burn all kinds of biomass in a relatively safe and efficient way. While burning always generates emissions, the carbon footprint of modern bioenergy is considerably reduced compared to fossil fuels. One example is heating logs made from coffee grounds. Another possibility for reducing emissions is getting them out of the air. Greening cities, by installing huge moss walls for example, has been shown to reduce air pollution and to contribute to resilience and well-being.

CO_2 Reduction

The concentration of carbon dioxide in the atmosphere has been rising steadily, from around 330 ppm in the seventies to approximately 400 ppm today. The bioeconomy provides many solutions for reducing CO_2. One of them is mostly bright green and slippery –algae, true all-rounders. Algae can serve as a low-carbon energy source, as dye substances and they contain valuable nutrients for food and cosmetic products. They grow in salt or brackish water and can easily be cultivated in a bioreactor, circulating the water efficiently. Daylight, CO_2 and some nutrients ensure rapid and productive growth, regardless of season and location. Algae store the energy from light in the form of carbohydrates through photosynthesis. The mixture of algae and water can be drained from the transparent tubes and is usually separated by centrifugation.

Climate Action



Building Materials

Population increase and urbanization are related to a building boom, which consumes an increasing amount of resources and emits considerable greenhouse gases. According to some experts, the cement industry alone generates around 5% of global carbon dioxide emissions. Fascinating new bioeconomic concepts are on the horizon in architecture and the building industry: timber high-rise buildings, energy-positive, multipurpose and greened or recyclable houses. These concepts promise quality of living combined with a low resource footprint and more flexible use. In addition, many promising biobased building innovations have been developed which could contribute to decarbonizing the construction sector. One small company produces a bio-brick grown by employing microorganisms. The green material is as stable as conventional material. Other examples include patio floorings containing up to 75% meadow grass or wall paints made with nano-cellulose fibers from root vegetables.

Climate Action

Emission-free Mobility

The transport sector is responsible for around 14% of global carbon emissions. Besides contributing to climate change, high and increasing levels of air pollution, especially in urban areas, increase the risk of respiratory and heart diseases. It is estimated that about 2 million people die from air pollution every year. Some solutions to low-emission mobility are on the horizon: electric and hydrogen-powered vehicles, car- and bike-sharing concepts and prototypes of solar-powered cars, airplanes and ships. Besides modern biofuels, the bioeconomy contributes in particular to renewable and lightweight materials. A company in Dresden, for example, uses real wood veneer as the basis for lightweight tubular frames for bicycles. A Dutch firm prefers working with hemp. The creative team uses the strong fibers for the casing of an electric scooter. The result is a very lightweight, robust and stylish means of transport.

Climate Action

Clean Air | CO_2 Reduction | Building Materials | Emission-free Mobility

Responsible Consumption

According to the United Nations description, sustainable consumption and production aims at “doing more and better with less”, increasing net welfare gains from economic activities by reducing resource use, degradation and pollution along the whole lifecycle, while increasing quality of life. Bioeconomy clearly embraces all of these objectives. Bioeconomy seeks to use renewable resources efficiently instead of using scarce resources. In the paper, fashion and food industry, for example, residues are used for innovative materials, such as vegan leather or biological textiles. In the chemical and cosmetics industry, ecofriendly products, such as paints and detergents, are produced with biological resources and processes. Toxic materials can be replaced with biocompatible ingredients. New materials, such as algae, make cool products. It’s always worth walking the world with your eyes open...

Sustainable Leather

The leather industry plays an important role in the global fashion market. Conventional leather tanning often involves toxic or harmful substances, for example heavy metal salts such as chromium sulfate. If not managed and processed carefully, these substances cause harm to people and pollute the environment. Proper disposal of these products causes extra costs and requires expert know-how. Vegetable tanning methods are sustainable alternatives. Olive leaves, for example, contain secondary compounds which the plants use as a defense against pests. They form the basis for a biodegradable tanning agent. Another option is vegan leather that is made from agricultural residues like pineapple leaves or that can even be grown from mycelium. Both variants of vegan leather have the same characteristics as conventional leather: soft, water-repellent and extremely robust.

Responsible Consumption

Circular Materials

Circularity and the cascading use of resources are crucial elements of the bioeconomy. In a sustainable bioeconomy, the economy must use and process biological resources more efficiently than before, so that ideally more output and added value is created from each unit of input. Resources should be recycled following nature's example, where high-quality food and industrial products are obtained first before the by-products and residual products are used for base chemicals or even lifestyle products. There are a number of surprising solutions: paper notebooks made of elephant dung or meadow grass, accessories manufactured from organic salmon skin, a calendar made from agricultural waste and products dyed with colors obtained from waste.

Responsible Consumption

Sustainable leather | Circular Materials | Biological Textiles | Bio-Cosmetics

Biological Textiles

A majority of clothes are made from synthetic fibers like polyester, nylon and acrylic. According to experts, each cycle of a washing machine (filled with these clothes) could release several hundred thousand microscopic plastic fibers into the environment, particularly the rivers and oceans. The consequences are well-known: microplastics pollute and endanger the lives of animals and prevent marine ecosystems from working properly.
In the beginning, there were just a few small companies which offered sustainable fiber alternatives that were made from seaweed, eucalyptus, milk protein or even coffee ground fibers. Fortunately, large enterprises followed and now offer more and more textiles based on bamboo, soy protein and particularly wood. And it gets even better: a shoe company recently launched a sneaker that is made from algae foam.

Bio-Cosmetics

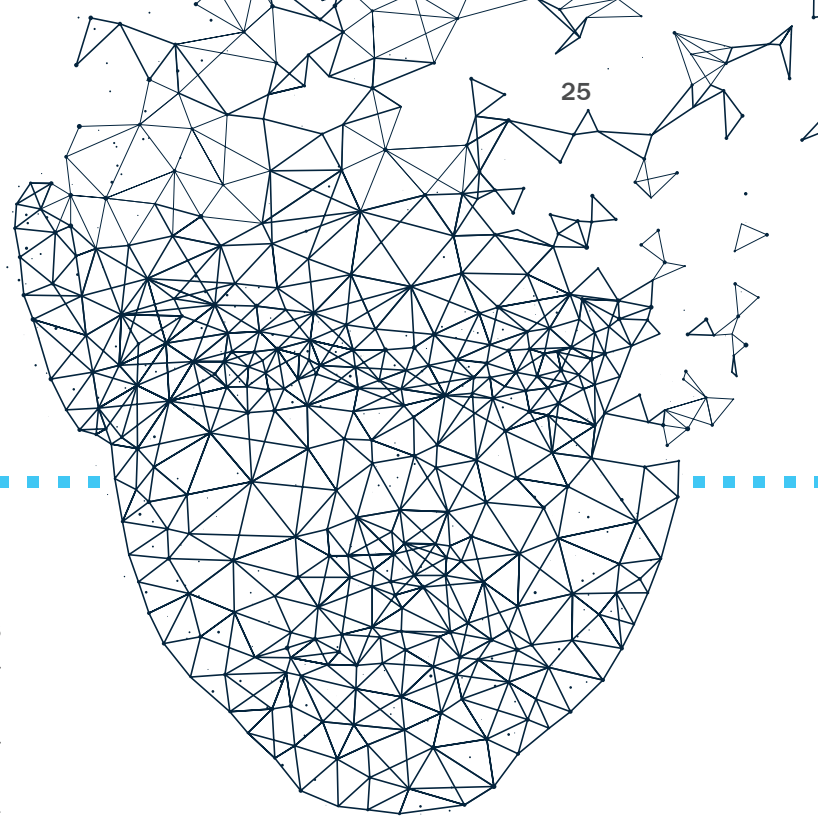
Conventional cosmetic products use chemical substances, some of which can cause harm to the environment, for example microplastics, triclosan or dioxane which change the biochemistry of fish and aquatic plants. Sustainability and biocompatibility, however, are becoming more important for consumers and the market for natural cosmetics is growing year on year. On the one hand, this implies an increase in traditional products based on natural substances like olive or coconut oil or beeswax. On the other hand, biotechnology has impacted the sustainable cosmetic field in many ways and produces items with new features. One example is a face cream based on fermented ingredients of rice and soybeans that brighten skin. A snail filtrate moisturizes the skin and a breathable nail color has been developed based on vegan silk and an extract of algae that is both antibacterial and regenerating.

Responsible Consumption

Sustainable leather | Circular Materials | Biological Textiles | Bio-Cosmetics

Industry & Innovation

Innovation and infrastructure lay the foundations for industrial development, high-quality jobs and economic growth. There is a growing need and market for more sustainable services and products that provide social, technical and ecological benefits. Bioeconomy research and development has already resulted in exciting and innovative goods that are biocompatible, use fewer resources and protect climate and nature. Promising examples are sustainable packaging materials or bulk chemicals and high-tech textiles, based on biological processes and made with innovative renewable materials.Bioeconomy further promotes innovation in industry and infrastructure development, for example by boosting new IT and digital solutions. Additive manufacturing, such as 3D printing is greatly facilitated by biological materials and by applying biological knowledge of efficient structures. Bionics also uses expertise from natural solutions and translates it into engineering.



Digitization

Combining the life sciences and biotechnology with information and communication technologies offers extensive opportunities for green growth, for example in robotics, medical engineering, environmental technologies, precision agriculture and plant breeding as well as in process and computer technology. In agriculture, GPS, big data services and relevant mobile apps will become essential farming tools for reducing water and fertilizer consumption and optimizing crop yield. Smart advice can also help farmers to improve animal welfare and optimize feeding. Digitization is expected to revolutionize the industrial sector. The exhibition showcases additive manufacturing. 3D printing frequently uses biobased filaments based on maize starch, wood fibers or even coffee grounds to produce delicate or organic shapes and prototypes that could not be produced otherwise. Such new structures typically use less material and provide desired benefits, such as stability, viscosity and energy efficiency.

Bionics

Bioeconomy goes beyond using renewable resources for the energy, food or chemical industry. Thinking and acting bioeconomically also means knowing nature, its diversity and its benefits. Bionics analyzes nature's inventions, takes the best from it and transfers this to engineering and technical applications. A prominent example of bionics is the self-cleaning effect of the lotus flower which has been applied to building facades, windowpanes and textiles. But there are even more exciting examples: the desert beetle's hardened body surface serves as role model for a color's surface structure. Applied on a house wall, the facade is protected from moisture and dirt. Another bionic example is the waterlily pad. Its filigree structure and lightweight design has been applied to aircraft construction.

High-tech Materials

Bioeconomy research and development contribute to high-tech solutions and products that are based on the convergence of biotechnologies with sensor technology, nanotechnology, information technology and cognitive technologies. Products in these categories often provide completely new features and yet are sustainable. A suitable example of this is a biobased engineered plastic smartphone display made from plant-derived isosorbide. The material offers higher resistance to impact, heat and weather than conventional plastics. It has even been applied to a car body. In the medical sector, new materials based on biotechnologically derived cellulose ensure a healing microclimate on wounds and dressings which can be removed painlessly. The textile industry also has confidence in new biobased high-tech fibers, such as a plant-based waterproof outdoor material that is up to three times more durable than existing non-fluorinated repellents.

Packaging

In the EU, the packaging waste per capita is estimated to add up to nearly 170 kg per year. Plastics account for approximately one fifth of this amount. It is estimated that around 50% is single-use plastic. The majority of plastic waste often ends up in landfills and, even worse, in the environment. The consequences of these habits are now visible for everyone: rivers, coastlines and seas are polluted, marine animals perish torturously because of the plastics in their stomachs, arable land and soils are contaminated by plastics. However, a fundamental change is taking place. Many countries have already banned single-use plastic bags or are planning to do so. The bioeconomy seeks to develop biobased solutions: e.g. packaging materials and straws based on food waste, transport boxes grown from mycelium and also bioplastic bags, which dissolve in warm seawater.

This exhibition has been developed and implemented by BIOCOM, a bioeconomy-focused communication company.
For any inquiries, please contact Dr. Boris Mannhardt (b.mannhardt@biocom.de).

Imprint

Production
Secretariat of the German Bioeconomy Council
c/o BIOCOM AG
Lützowstraße 33–36
10785 Berlin

Editor
Beate El-Chichakli, Kristin Kambach

Photo credits
BIOCOM AG (p 15, board; p 28), Van.Eko (p 16), Maravillas Bags (p 19), Royal Blush (p 20)
fotolia.com: saicle (cover), Jag_cz (p 4, 12), zapp2photo (p 5, 24), freshidea (p 7), sommai (p 8), Xavier (p 9, salad), womue (p 9, mushrooms), Claudia Paulussen (p 13), Gordana Sermek (p 21), logo3in1 (p 22), liuzishan (p 25), abramsdesign (p 26), Gorodenkoff (p 29)
istockphoto.com: MokJinYoung (grass letters, cover), Merinka (p 4, 6), Aliseenko (p 5, 16), MoustacheGirl (p 10), Rawpixel Ltd (p 11), Floortje (p 15, paint), Josef Friedhuber (p 17), monkeybusinessimages (p 23), mrgao (p 27)

Print office
Heenemann GmbH & Co. KG, Berlin

Berlin, April 2018

www.gbs2018.com