FRAUNHOFER BIOECONOMY: THE CUTTING-EDGE OF INNOVATION AND TRANSFORMATION

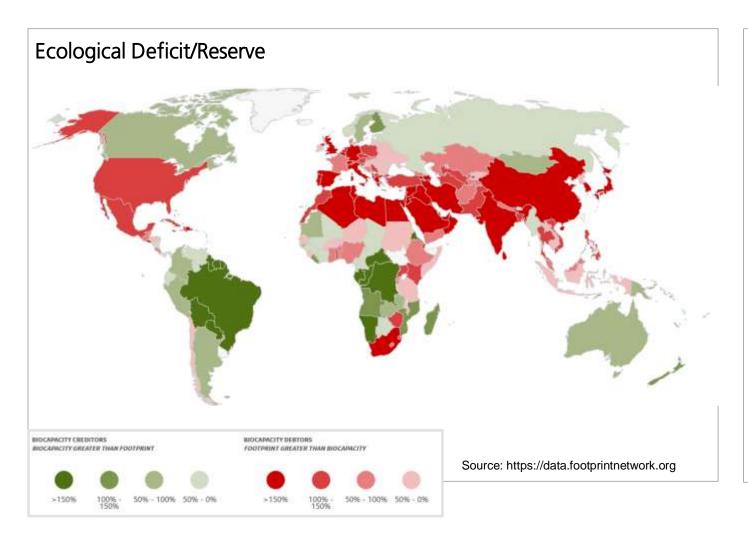
Dr. Markus Wolperdinger

Director, Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB



intern

- Global challenges
- The Fraunhofer strategy: Interdisciplinary research combining economy and ecology
- Fraunhofer IGB: Expert in Bioeconomy
- Bioeconomy success stories by Fraunhofer
- Strategies to address global challenges



Business-as-usual scenario

2050: World population: 9.8 billion



1.3 x more people



1.5 x greenhouse gas emissions



1.6 x demand for water



1.7 x demand for food



1.8 x demand for energy



2.0 x material resource extraction

Source: Databases from UN Organizations

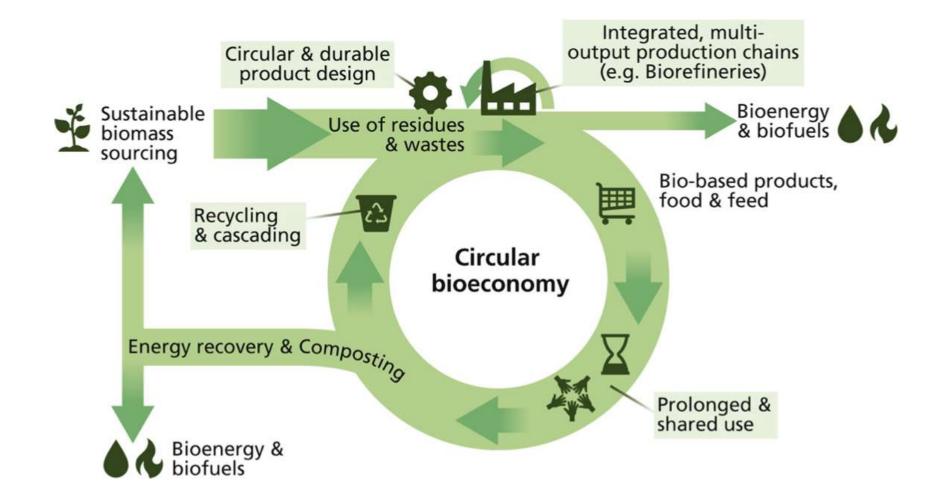
Country Overshoot Days 2021

When would Earth Overshoot Day land if the world's population lived like...



Global Earth Overshoot Day marks the date when humanity's demand for ecological resources and services in a given year exceeds what Earth can regenerate in that year. In 2021, it falls on July 29.

Circular, sustainable Bioeconomy provides solutions





© Fraunhofer IGB

intern

Bioeconomy is in line with important guiding principles



Source: United Nations



- Global challenges
- The Fraunhofer strategy: Interdisciplinary research combining economy and ecology
- Fraunhofer IGB: Expert in Bioeconomy
- Bioeconomy success stories by Fraunhofer
- Strategies to address global challenges

Fraunhofer Strategic Research Fields

Enhancing the Fraunhofer impact on society and across multiple sectors

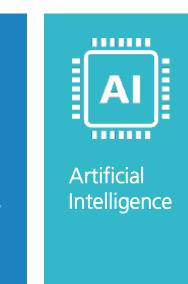














Energy transition accomplished

intern

Affordable healthcare

Fully circular economy

Security and resilient society

Digitalized value chain

Fraunhofer Group for Resource Technologies and Bioeconomy

System partner for sustainable resources economy and a healthy environment

Key Facts

Founded in 2021

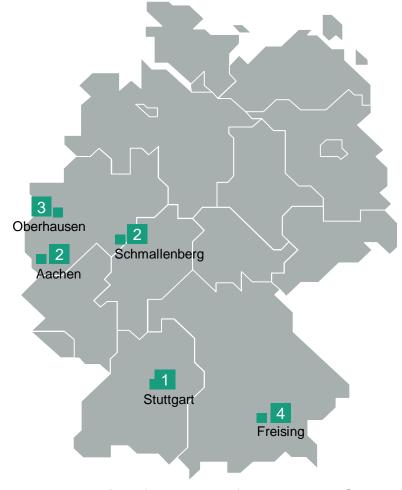
Staff: 1000

Total budget: € 155 million



Four Fraunhofer institutes

- Interfacial Engineering and Biotechnology IGB
- Molecular Biology and Applied Ecology IME
- 3 Environmental, Safety, and Energy Technology UMSICHT
- Process Engineering and Packaging IVV



Location of the four Fraunhofer institutes in Germany

Fraunhofer Bioeconomy activities – interdisciplinary cooperation

Clusters

EU projects Lighthouse projects High performance centers

Real labs Research factories

Market-oriented implementation

- Participation of industry
- Pilot plants
- PPP
- Spin-offs
- Start-ups

Lead marketoriented Fraunhofer Alliances

Lead market-oriented alliances

- New products for industry and consumers
- Industry-relevant processes and technologies

Impact sustainable industry

- Efficient processes and technologies
- Affordable, sustainable products
- Resilient value creation cycles
- Integrated circular economy
- Economic efficiency

Impact



Institutes as scientific and strategic pioneers Effectiveness externally, coordination internally Group for Resource Efficiency & Bioeconomy (UMSICHT, IGB, IME, IVV)

Fraunhofer Strategic Research Field Bioeconomy

Core institutes IGB, IAP, IVV

Economy → biotech, chemistry, agriculture

Society → consumers

Politics → decision makers, committees

Federal Ministries → BMBF, BMEL, BMWi

Research institutions → HGF, MPG, Leibniz

Associations, networks → VDI, VCI, BioD, NGOs

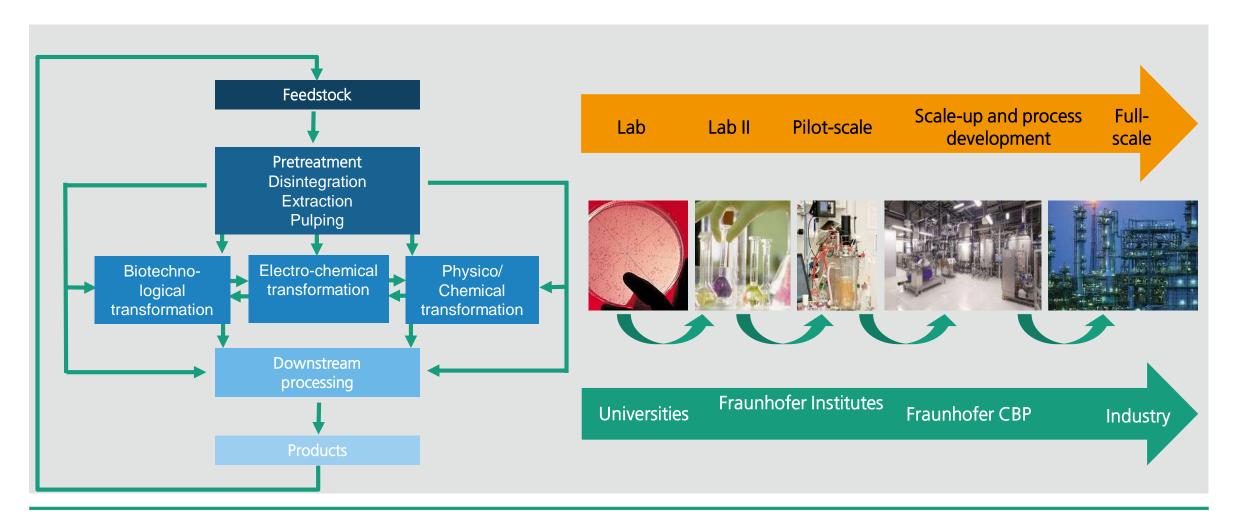
Technology-oriented bundling of competencies

- Cross-group cooperation
- Development of new processes and products
- Forecasting and roadmaps

- Global challenges
- The Fraunhofer strategy: Interdisciplinary research combining economy and ecology
- Fraunhofer IGB: Expert in Bioeconomy
- Bioeconomy success stories by Fraunhofer
- Strategies to address global challenges

Fraunhofer IGB: Expert in Bioeconomy

Solutions along the value chain from laboratory to industrial scale



Fraunhofer IGB: Expert in Bioeconomy

Scale-up at Fraunhofer CBP



- Global challenges
- The Fraunhofer strategy: Interdisciplinary research combining economy and ecology
- Fraunhofer IGB: Expert in Bioeconomy
- Bioeconomy success stories by Fraunhofer
- Strategies to address global challenges

Lignocellulose biorefinery

Sustainable use of renewable resources – wood to chemical products

Organic Lignin containing Cellulose Saccha-Glucose **Fermentation** acids Organosolv raw materials rification and purification Hemicellulose alcohols xylose digestion woods. barks. e.g. Ethanol/water Lignin Separation and **Binders** phenols Conversion agricultural purification aromatics residues carbon fibers

Pilot plant at Fraunhofer CBP

- Processing of up to 70 kg of wood / batch
- Balancing the material and energy cycles
- For scaling and implementation of
 - external processes for industrial customers
 - own process developments









Biobased polyamides from biogenic waste streams

Amorphous Caramid-R® and semi-crystalline Caramid-S® from terpenes





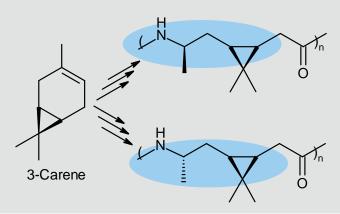


- Utilization of terpenes, a residual material generated in cellulose industry
- Biobased polymers with outstanding properties because of high variability in the chemical structure of terpenes



Example: Polyamide (PA) from 3-carene

- High selectivity of polyamides
- Polyamides with high thermal stability



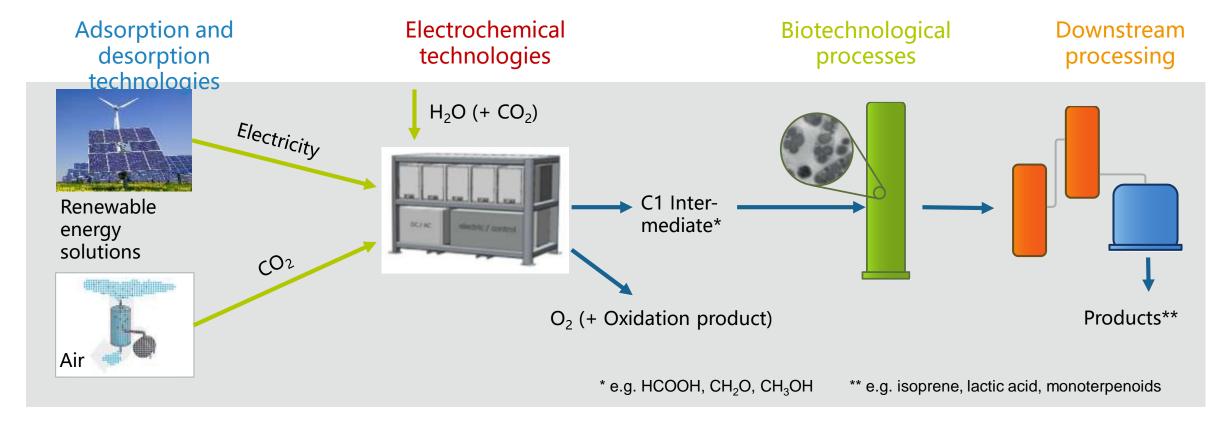
amorphous Caramid-R® transparent

semi-crystalline Caramid-S® not transparent

- Global challenges
- The Fraunhofer strategy: Interdisciplinary research combining economy and ecology
- Fraunhofer IGB: Expert in Bioeconomy
- Bioeconomy success stories by Fraunhofer
- Strategies to address global challenges

Save the climate

Make use of carbon dioxide as a raw material



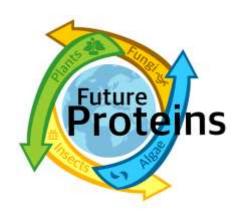
- New processes for recovering CO₂
 from air
- Combination and integration of electrochemical and biotechnological processes

Proof of economic viability



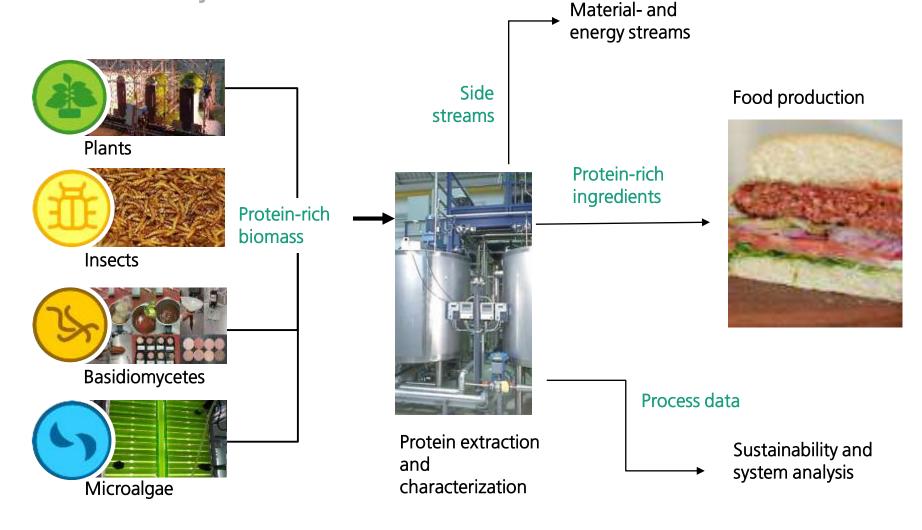
Feed the world

Fraunhofer "Future Proteins" Project



Coupled agricultural systems for resilient and resource-efficient production of highquality food proteins

Duration: January 2021 -December 2024





29

Summary

- Major global challenges
- We need a new understanding of sustainable value creation
- No fossil fuels and linear production but a circular and sustainable Bioeconomy
- Fraunhofer makes use of materials, structures and principles of living nature in technology in circular production models and sustainable products
- Bioeconomy is a key driver toward a sustainable and climate-neutral economic system
- Topics are: The utilization of CO₂, alternative protein sources, use of green H₂
- Sustainable solutions preserve resources and create prosperity at the same time

Thank you for your attention!



Dr. Markus Wolperdinger Director

markus.wolperdinger@igb.fraunhofer.de

Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB

Nobelstr. 12 | 70569 Stuttgart | Germany

www.igb.fraunhofer.de