

# FRAUNHOFER BIOECONOMY: THE CUTTING-EDGE OF INNOVATION AND TRANSFORMATION

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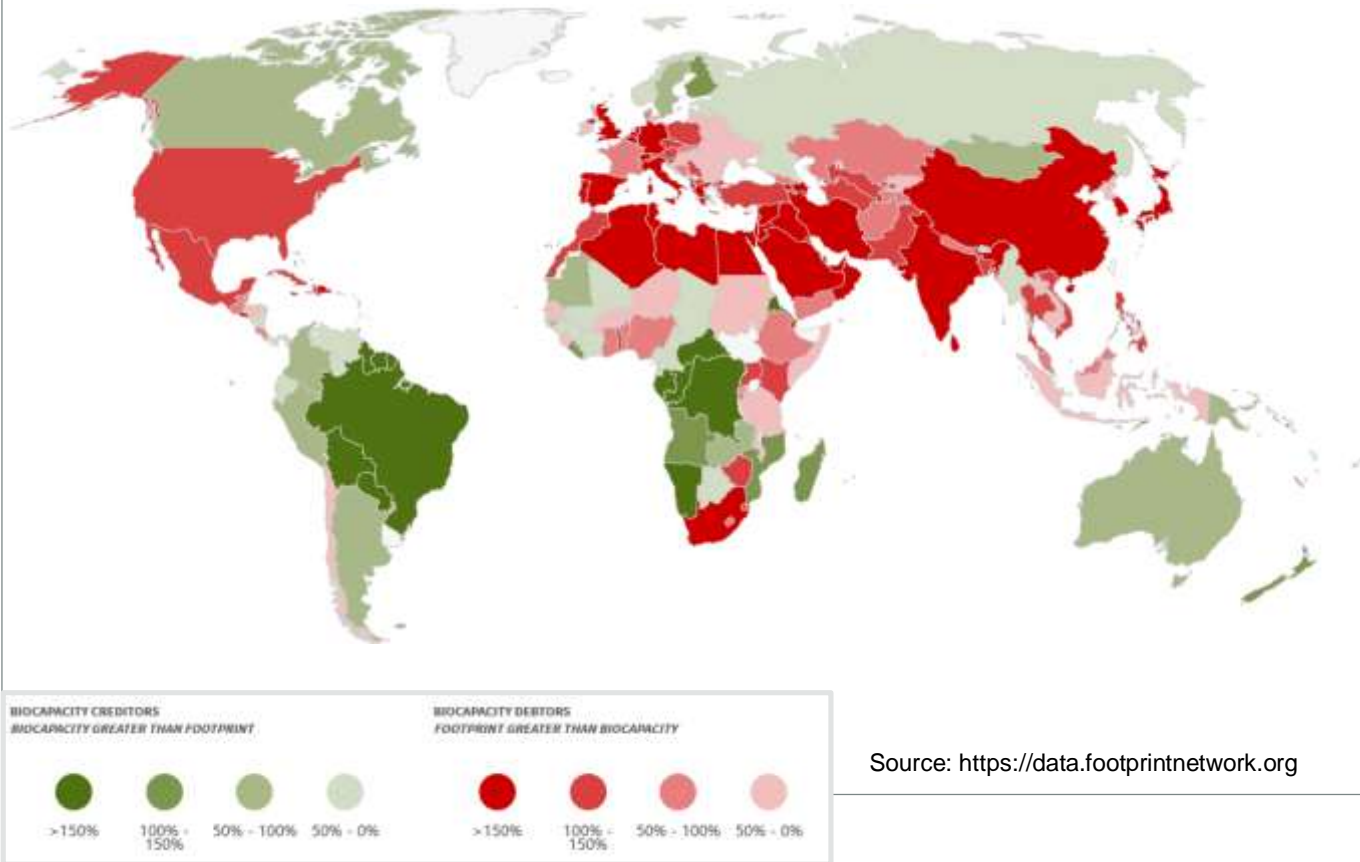
# AGENDA

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- 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

# Global challenges and perspectives on sustainability

## Ecological Deficit/Reserve



## 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

# Global challenges and perspectives on sustainability

## 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.

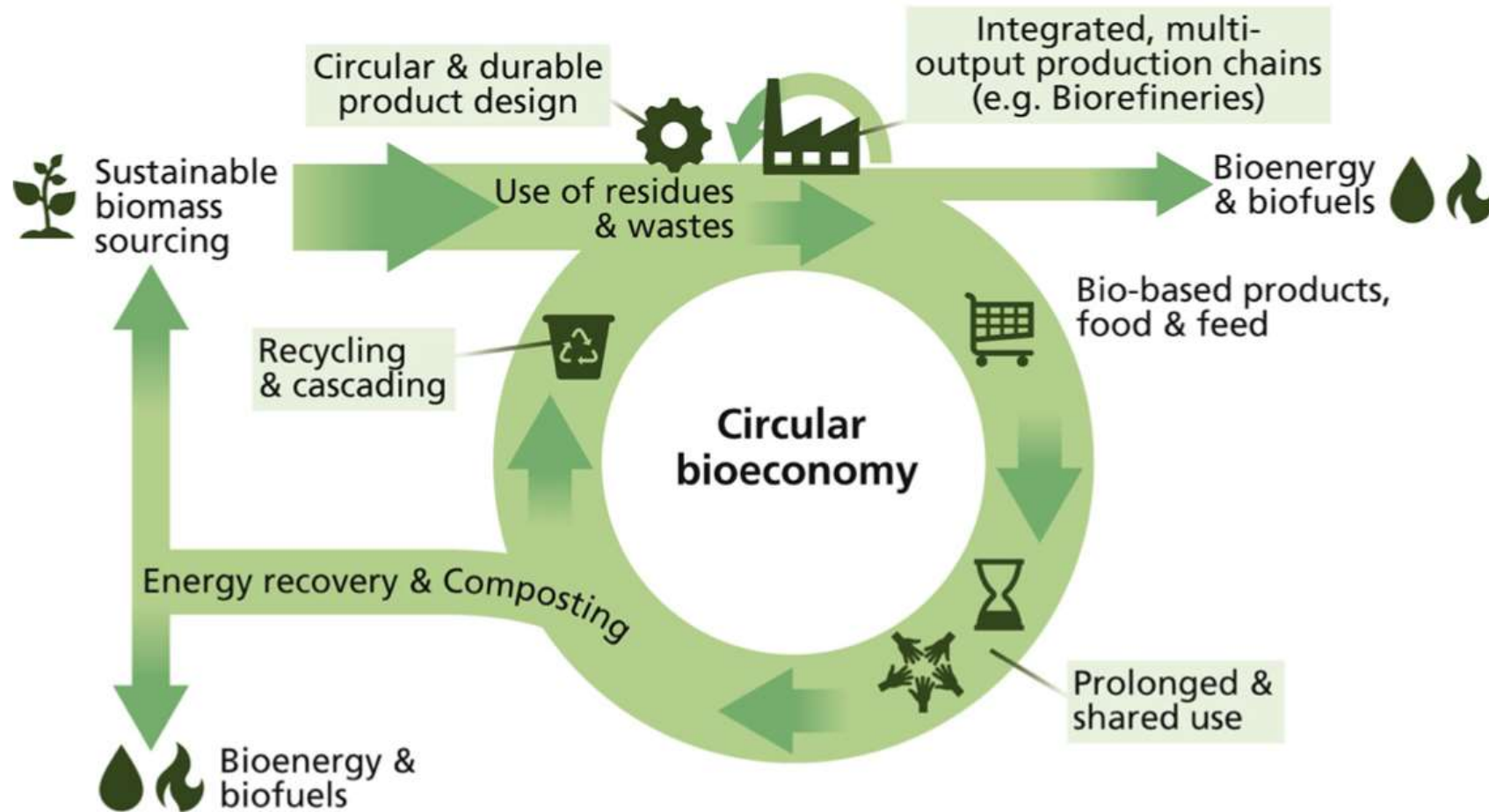


Source: National Footprint and Biocapacity Accounts, 2021 Edition  
data.footprintnetwork.org



# Global challenges and perspectives on sustainability

## Circular, sustainable Bioeconomy provides solutions



# Global challenges and perspectives on sustainability

## Bioeconomy is in line with important guiding principles



Source: United Nations

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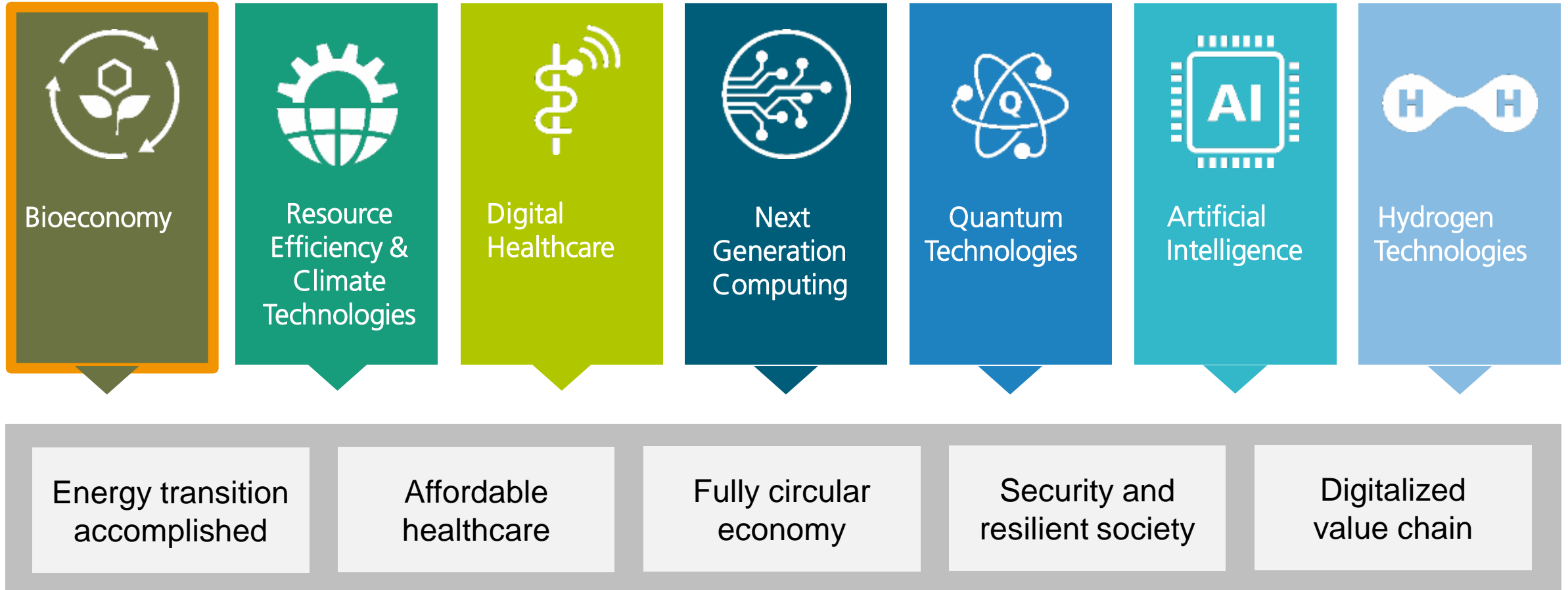
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# Fraunhofer Strategic Research Fields

Enhancing the Fraunhofer impact on society and across multiple sectors





# Fraunhofer Group for Resource Technologies and Bioeconomy

System partner for sustainable resources economy and a healthy environment

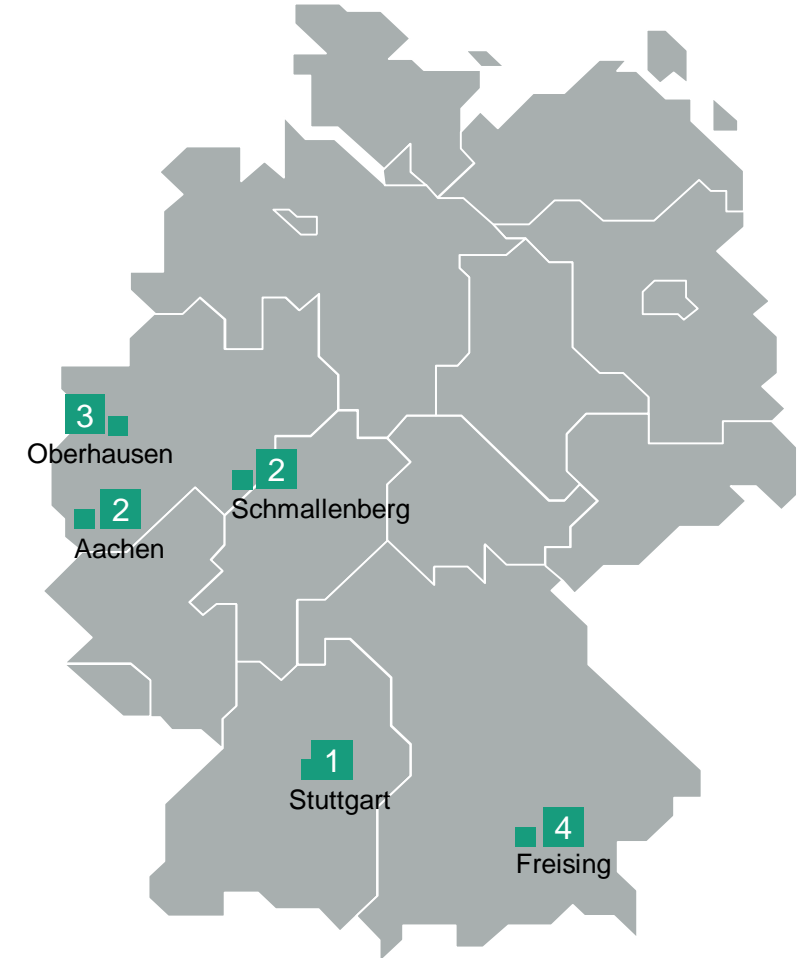
## Key Facts

- Founded in 2021
- Staff: 1000
- Total budget: € 155 million



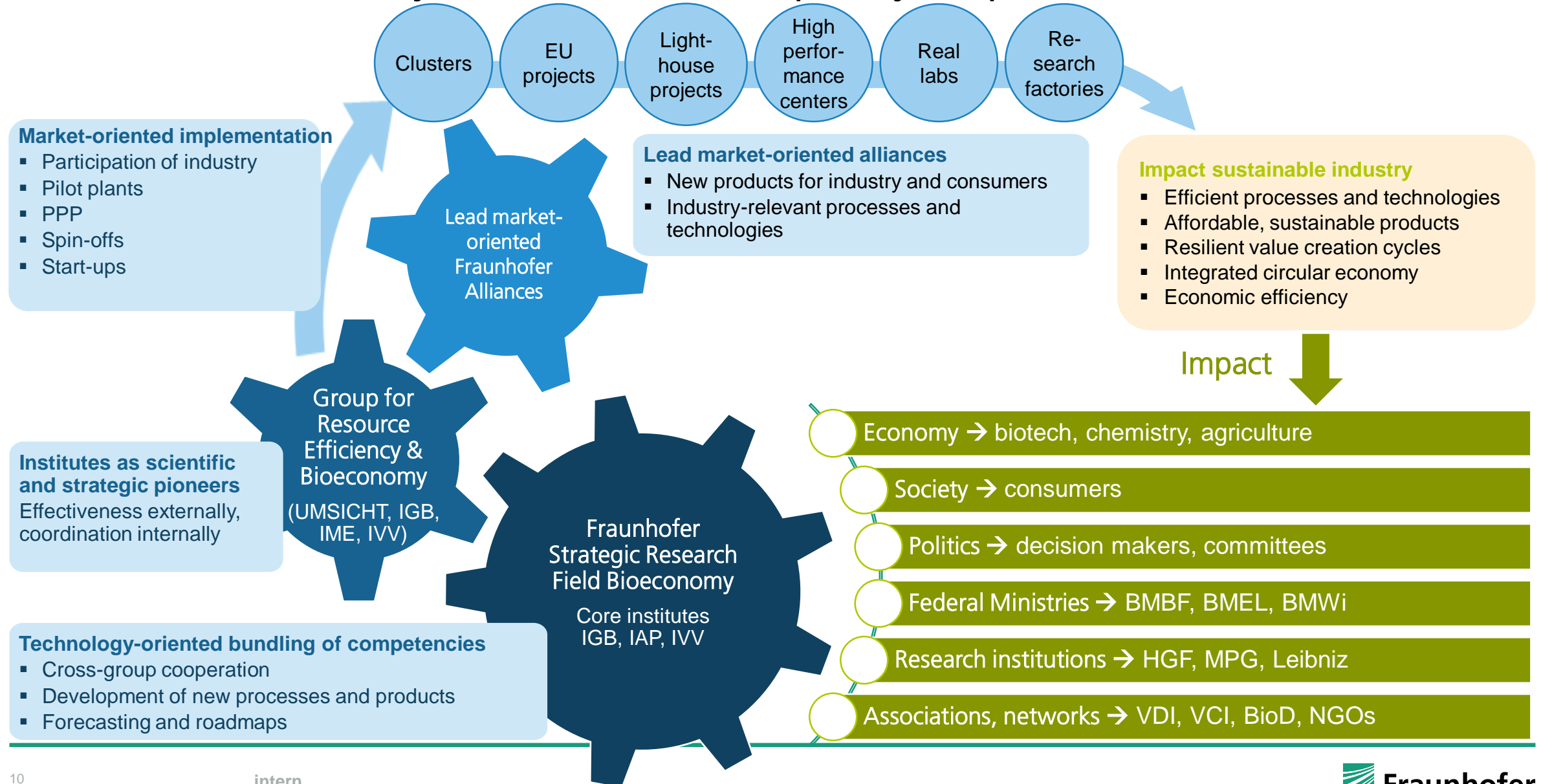
## Four Fraunhofer institutes

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



Location of the four Fraunhofer institutes in Germany

# Fraunhofer Bioeconomy activities – interdisciplinary cooperation



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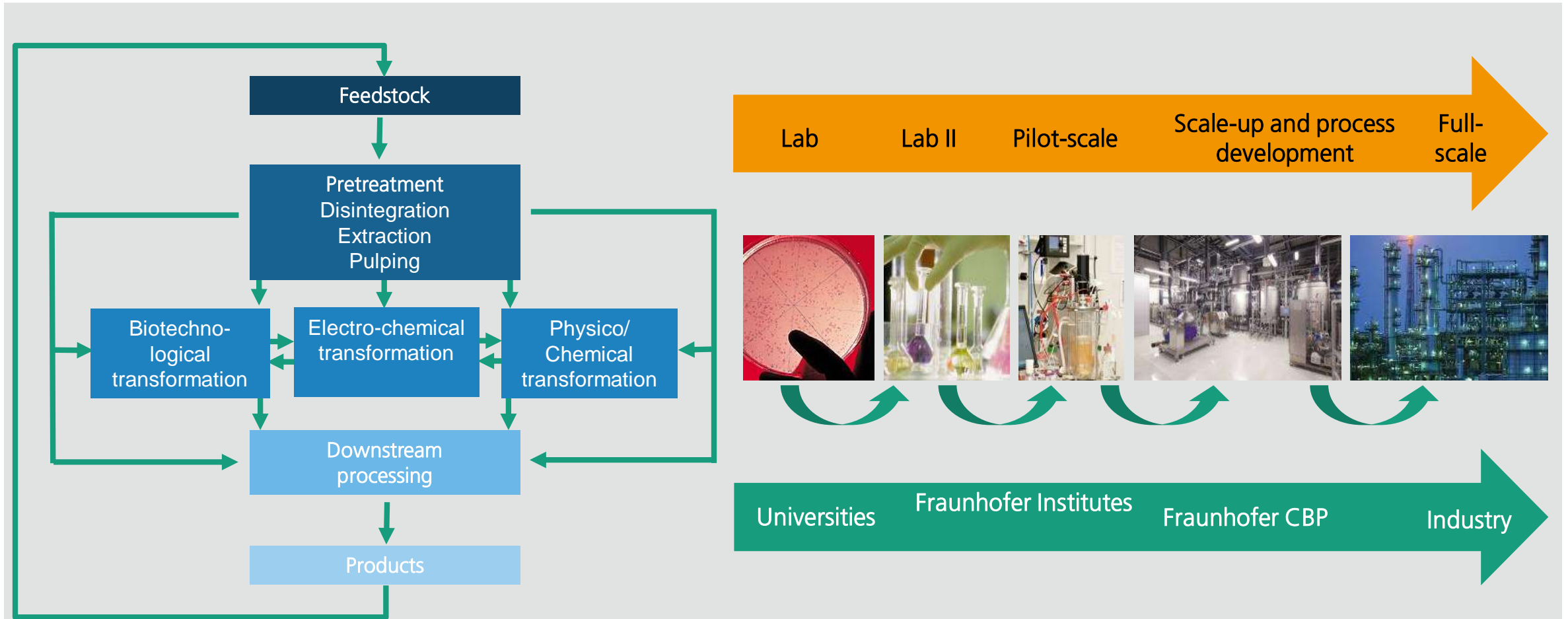
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# Fraunhofer IGB: Expert in Bioeconomy

Solutions along the value chain from laboratory to industrial scale



# Fraunhofer IGB: Expert in Bioeconomy

## Scale-up at Fraunhofer CBP



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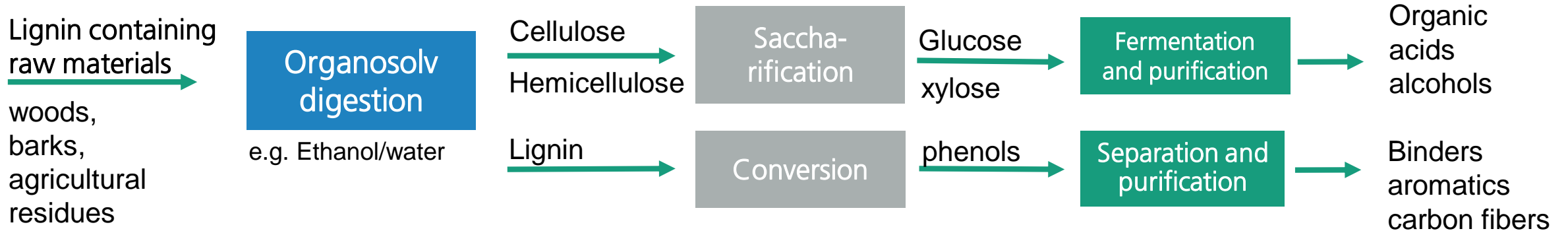
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# Lignocellulose biorefinery

Sustainable use of renewable resources – wood to chemical products



## 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<sup>®</sup> and semi-crystalline Caramid-S<sup>®</sup> from terpenes

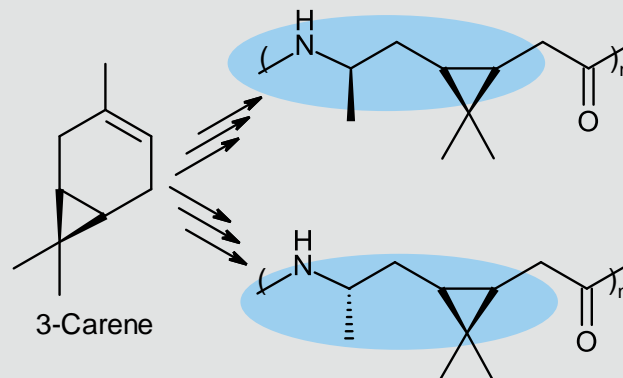


- Utilization of terpenes, a residual material generated in cellulose industry
- Biobased polymers with outstanding properties because of high variability in the chemical structure of terpenes



Example: Polyamide (PA) from 3-carene

- High selectivity of polyamides
- Polyamides with high thermal stability



amorphous Caramid-R<sup>®</sup>  
transparent

semi-crystalline Caramid-S<sup>®</sup>  
not transparent



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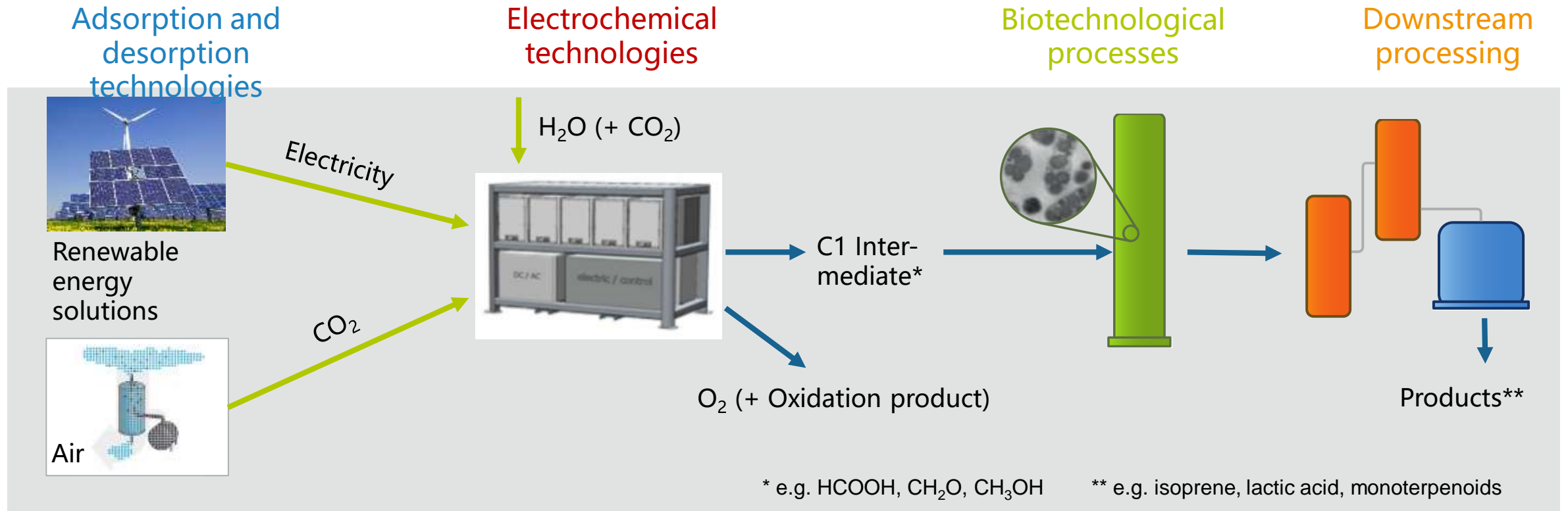
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# Save the climate

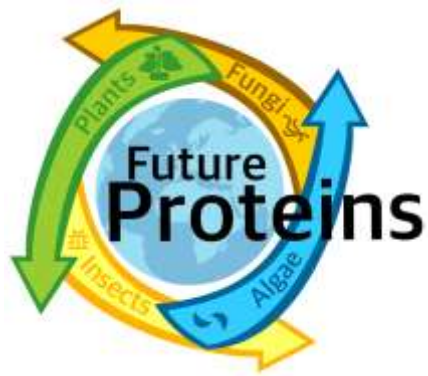
## Make use of carbon dioxide as a raw material



- New processes for recovering CO<sub>2</sub> 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 high-quality food proteins

Duration: January 2021 – December 2024



Plants



Insects

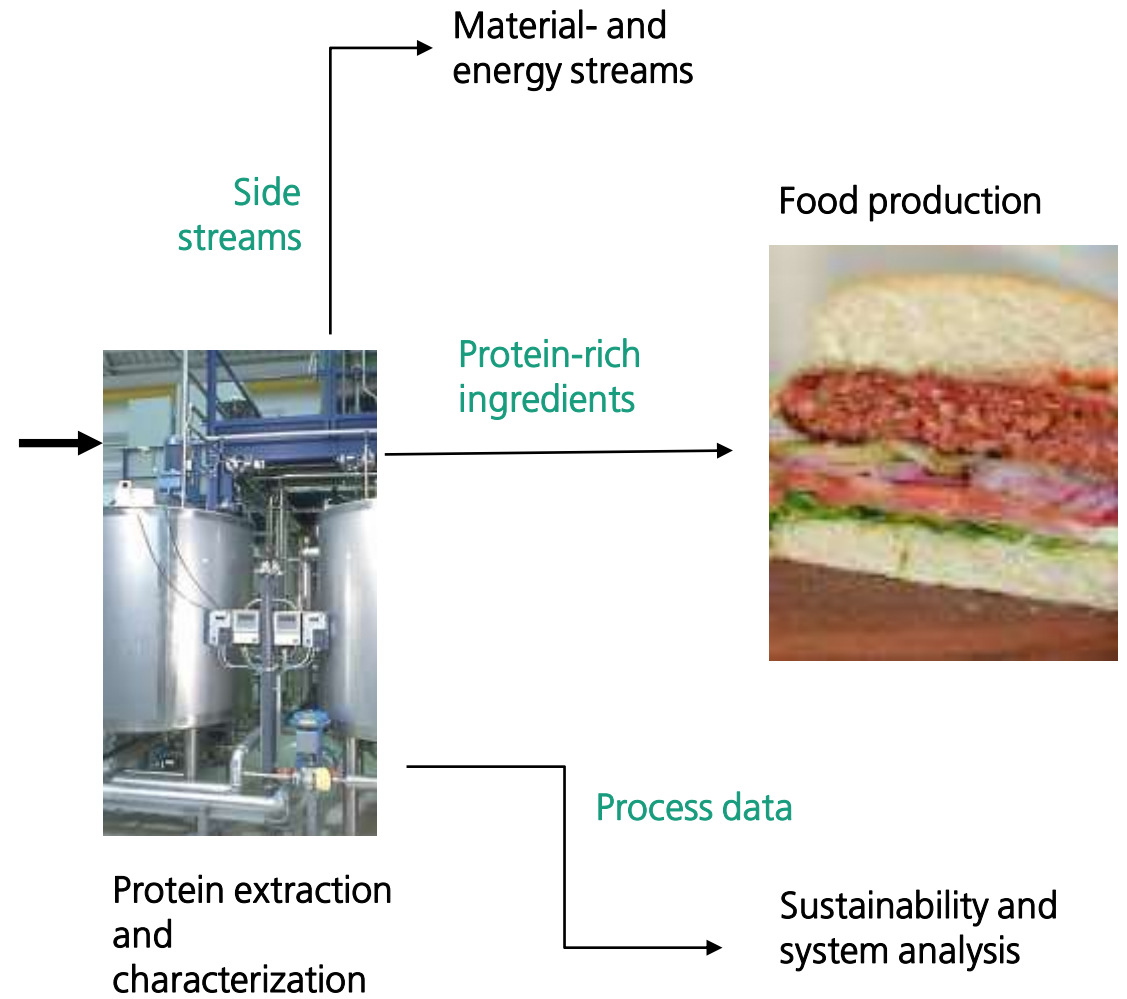


Basidiomycetes



Microalgae

Protein-rich biomass



# 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 CO<sub>2</sub>, alternative protein sources, use of green H<sub>2</sub>
- Sustainable solutions preserve resources and create prosperity at the same time

# Thank you for your attention!



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