

# Germany

## Factsheet

This document provides an overview of Germany's initiatives and current state in the bioeconomy sector, highlighting regional policies, educational programmes, key trends, existing and expected sub-sectors, and opportunities for personal advancement in bioeconomy related fields.

## About the region

Germany is characterised by its pioneering National Bioeconomy Strategy, the first of its kind in Europe. In addition to this national strategy, the country has developed at least three Regional Strategies, each tailored to local specificities and needs.

The dominant sectors in Germany's bioeconomy include biobased fuels, biogas (especially from food processing), agriculture, and the chemical industry. Key subsectors and value chains include food products, electrical energy (from biogas), and hydrogen production. The implementation of these strategies is expected to integrate subsectors and orient value chains more regionally, resulting in greater sustainability and reduced CO2 emissions.

In the field of Bioeconomy Education, Germany has several policies focusing on sustainability. The Bioeconomy Council has developed and implemented a strategy for a knowledge-based bioeconomy, which is integrated into basic education at all levels, as well as in lifelong learning and vocational training.

## Thematic Orientation

### Existing Sub-Sectors

- Biobased fuels
- Biogas (from food processing)
- Agriculture
- Chemical industry
- Food products
- Electrical energy (biogas)
- Hydrogen production

### Key Trends Influencing Innovation

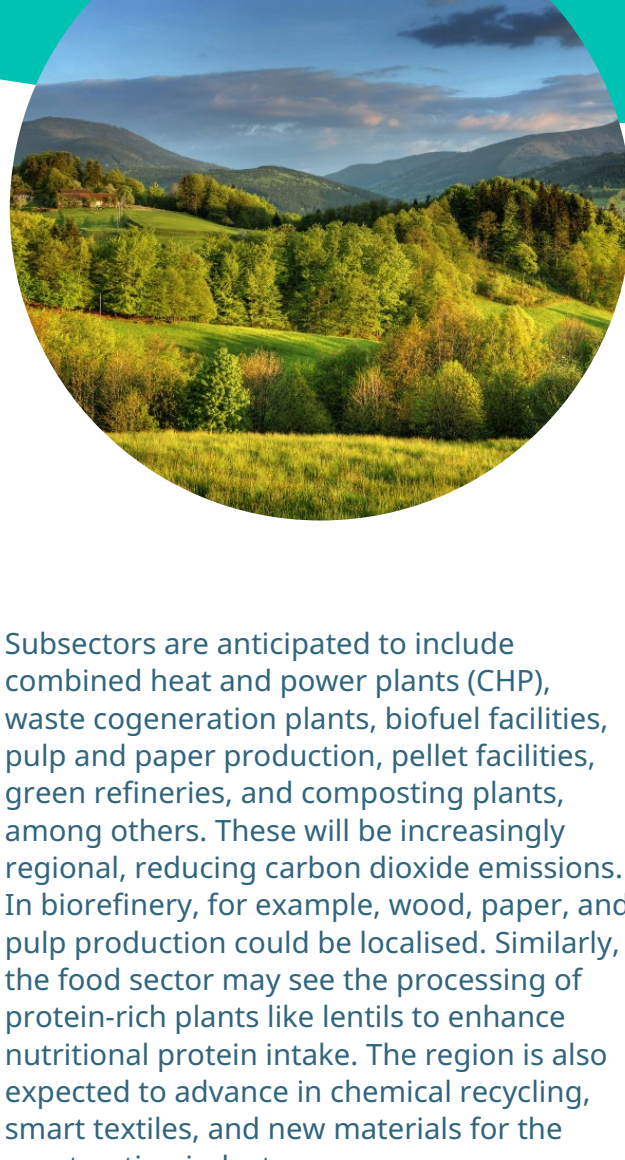
- Key trends in the region include a strong focus on renewable energies, the decarbonisation of industries, and the integration of digitalisation and artificial intelligence. Sustainable transportation and mobility are gaining momentum, alongside a growing emphasis on fostering local sourcing to reduce supply chain risks.

### Expected Sub-Sectors / Value Chains

Key subsectors in the future by 2030:

- Agriculture
- Food Industry
- Chemistry
- Plastics
- Pharmaceuticals & Biotechnology
- Energy
- Energy Storage
- Paper Industry
- Textile Industry
- Construction Industry
- Building Materials
- Wood Processing
- Information and Communication Technology
- Logistics
- Mechanical Engineering

Expected value chains and products from these sectors will encompass food products, biobased packaging materials, electrical energy (biogas), hydrogen, and insulating materials.



### Opportunities for advancement (Growth, Career, Social etc.)

With a growing emphasis on various fields of bioeconomy, a diverse range of career opportunities and job profiles will need to be developed. There will be a significant demand for experts across multiple disciplines. In addition to the increasing number of sustainable jobs, there will also be a need for start-ups and businesses in this sector. Currently, major companies like Shell are already involved, and several innovative labs have been established by various stakeholders to support this emerging field.



## Governance, Education Levels & Skills

### Governance structure in adult education on Bioeconomy, or on the wider topic of sustainability (Higher Education, Vocational Training etc.)

- Existing initiatives in adult education focus on sustainability, with a need to align further education, training activities, and regional development to emerging needs.

- The Bioeconomy Council in Germany has implemented an internationally competitive strategy for a knowledge-based bioeconomy.

- The new National Bioeconomy Strategy, published in January 2020, aims to significantly contribute to the biobased economy in the Rhenish territory.

- Funding programmes are available through institutions like Fraunhofer Gesellschaft, Research Centre Jülich, Institute for Work and Technology (IAT) in Gelsenkirchen, and the University of Bonn.

- The Bioeconomy REVIER initiative seeks to transform the Rhenish Revier into a model region for sustainability, with existing funding programmes supporting various fields of bioeconomy.

- **Vocational Training**  
In Germany the Vocational Training Act Berufsbildungsgesetz (BBiG)

Federal Ministry for Economic Affairs and Energy (BMWi), in agreement with the Federal Ministry for Education and Research (BMBWF), issues training regulations for recognised training occupations.

### Organisation of Adult and Lifelong Learning

- In the Rhenish territory, 19 universities and technical colleges offer 238 courses related to bioeconomic fields such as Agricultural and Forest Sciences, Natural Sciences, Engineering, Energy and Supply Technology, Bioprocess Engineering, Economics, and Textile Technology.

- Vocational training programmes relevant to bioeconomy include roles such as biological-technical assistant, chemical technician, IT assistant, design assistant, energy engineering assistant, laboratory assistant, and food technology assistant, among others. These programmes often incorporate work-based learning, depending on whether they are company-based or college-based.

- Universities and colleges in the region, such as RWTH Aachen and Research Centre Jülich, offer specialised courses like "Sustainable Bioeconomy" and focus on training young professionals through the Bioeconomy Science Center (BioSC).

- Hochschule Niederrhein features the "Living Lab Bioeconomy" project, while the ecosign/Academy for Design integrates sustainability across its Bachelor's and Master's courses in Sustainable Design, covering areas like communication design, product design, and photo design.

- In life sciences, Springer Campus, in collaboration with the University of Mainz, provides high-quality certificate courses and training for laboratory professionals, utilising a flexible online learning platform.

- The Bioeconomy Science Center offers summer school courses targeting PhD students and early Post-Docs, focusing on bioeconomy topics.

- BLOOM (Boosting Bioeconomy Knowledge in Schools) provides training for teachers, offering new insights into bioeconomy and its applications in STEM education.

### Available Research on Bioeconomy Education

- Initiatives and studies related to bioeconomy are actively promoted and conducted by IAT Gelsenkirchen, Research Centre Jülich, and RWTH Aachen University.

- IAT has conducted research on the most needed levels and formats of bioeconomy education.

- The RWTH Institute for Technology and Innovation Management (University of Aachen) leads a consortium involving institutes from RWTH, Research Centre Jülich, a state-founded organisation, and the Technical University of Dortmund (TU Dortmund) in accompanying research.

- Further initiatives focus on knowledge transfer and exchange, including Geoverbund ABC/J12, a spin-off from Science Center Jülich, and BioRiver-Life Science in the Rhineland.

- The Biotechnology Cluster (CLIB) provides a platform for exchange between companies and firms, while CLUB CEPLAS focuses on plant science knowledge.

- The Fuel Science Center and PhenoRob are excellence clusters dedicated to agriculture.

- Real laboratories ("Reallabore") have been established by Research Centre Jülich to advance practical research and innovation.

### Main Training, Retraining or Lifelong Learning on Sustainability

- Blindow Schools GmbH, an institute in Bückeberg, Germany, offers vocational training to become a state-certified environmental protection technician (Umweltschutztechniker) with a focus on environmental and process engineering.

- Springer Company provides specialised training programmes for company employees.

- The Bioeconomy Center in the Rhenish territory in Jülich offers adult training and further education programmes, including promotional offers and post-doc studies.

- RWTH Aachen University, Heinrich Heine University Düsseldorf, Friedrich Wilhelm University Bonn, and Research Center Jülich offer summer schools for PhD students and advanced Master's students.

### Available Research on Bioeconomy skills needed

- The IAT study highlights the most urgently needed skills in the Rhenish territory, as identified in the "Bioeconomy Study: Potential in the Rhenish Area – Knowledge and Education." The study emphasises that the most critical areas for training include chemistry, agriculture, biology, process technology, economics, and information technology, based on insights gathered from interviews and research.

## Linking Art & Bioeconomy Education

### Bioeconomy education in which Art concepts are applied

- **Art to simulate the Bioeconomy needed skills**

- In the project Look@BioEconomy: Bioeconomy is being perceived from the perspective of art and design. The project is being conducted by the Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB.

- **Art to address different learning styles and facilitate inclusion of marginalised people**

- No available examples

- **Inspirational case studies and formats from art and design to educate in the Bioeconomy**

- The **NaturFutur project**, a collaboration between the Museum of Natural History and Bioökonomie.de, an initiative of the Federal Ministry of Education and Research, focuses on various aspects of the bioeconomy. The project features an interactive augmented reality exhibit that provides diverse perspectives on the bioeconomy, allowing visitors to embark on a digital voyage of discovery. This innovative experience is complemented by a wide array of exhibits that encourage further discussion and exploration. Artistic interventions are also integrated into the exhibit, offering new stimuli and fostering thought-provoking experiments.

- **Injection of the Bioeconomy in design, art, architecture, etc.**

- The University of Stuttgart's Institute for Supporting Structures and Structural Design, in collaboration with the TRR 141 "Biological Design and Integrative Structures," has launched the "Architecture Meets Biology" initiative.

- This DFG-funded project, involving the University of Stuttgart, the Universities of Tübingen and Freiburg, and the Fraunhofer Institute for Building Physics IBP, explores the application of biological principles in construction. Through computer-based simulations and advanced manufacturing techniques, the research center investigates the design and functional innovations enabled by this bionic approach.

## Marginalised Groups

There are currently no specific reports or documented opportunities for including marginalised or disadvantaged groups in the Bioeconomy sector. The main needs for integrating these individuals involve providing accessible tasks, such as harvesting and food production. Issues like unequal power dynamics and decision-making remain unaddressed in policy strategies. Additionally, there are no existing educational or development activities aimed at their inclusion in Bioeconomy activities.



### STRENGTHS

- National Bioeconomy Strategy aligned with the EU.
- Regional strategies tailored to specific areas.
- Innovation-driven competitiveness.
- Diverse and expanding sectors.
- Growing job opportunities.
- Established bioeconomy education policies.
- Involvement at all education levels.
- Lifelong learning and vocational training options.
- Strong links between bioeconomy and art institutions.

### WEAKNESSES

- No assessment of bioeconomy strategy implementation.
- Underutilised resources and products.
- Misalignment with socioeconomic priorities.
- Lack of specific educational strategies for bioeconomy.
- Fragmented activities and lack of coordination.
- Marginalised groups not identified or supported.

## SWOT Analysis

### OPPORTUNITIES

- Expansion into new sectors with emerging technologies.
- Building strategic alliances.
- Leveraging digital infrastructure.
- Attracting private investment.
- Enhancing specialised education.
- Strengthening Germany's leadership in bioeconomy education.

### THREATS

- Resource depletion by 2050.
- Overfocus on biobased sectors, neglecting energy.
- Risk of brain drain.
- Lack of support for marginalised groups could lead to social and economic issues.

### Consortium



For more detailed information, visit Germany regions page in our website.



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