Deutsches Biomasseforschungszentrum
gemeinnützige GmbH

DBFZ

# Annual Report 2023

## Directions

**By train:** to Leipzig main station. Take tram line 3/3 E (towards Taucha/Sommerfeld) as far as the Bautzner Strasse stop. Cross the street, leave the car park on the right and use the main entrance of the DBFZ (House 1, Torgauer Str. 116). Please check in at the front office.

**By car:** on the A 14 motorway. Exit at Leipzig Nord-Ost; follow signs for Taucha; then follow signs for Leipzig; then follow signs for Zentrum, Innenstadt. Turn off left after the “bft” filling station (see “By train” for further directions).

**By tram:** line 3/3 E towards Taucha/Sommerfeld; Bautzner Strasse stop (see “By train” for further directions).


Deutsches Biomasseforschungszentrum
gemeinnützige GmbH

DBFZ

# Annual Report 2023



# Table of Contents

# 1 Editorial

## Dear readers,

**Fig. 1:** The General Management of the DBFZ

The effects of Russia's brutal war of aggression against Ukraine are becoming increasingly clear. This was and is also associated with a variety of challenges for the DBFZ. We are very pleased that we were able to master these well with our highly committed team and continue to drive the positive development of the DBFZ in 2023. Special thanks go to all our partners (Supervisory Board, Research Advisory Council, project management organisations and project partners) for their tireless input and constructive collaboration!

Despite the difficult conditions mentioned above, the first part of the R&D roadmap (2021–2023) was successfully completed. The second part of the R&D roadmap (2024–2026) was designed and, following intensive discussions in the committees, was finally unanimously approved by the DBFZ's Supervisory Board in November 2023.

A particular highlight of the past year was the ceremony to mark the 15th anniversary of the DBFZ, at which the excellent development was particularly recognised by State Secretary Silvia Bender (BMEL) and State Minister Wolfram Günther (Saxon State Ministry for Energy, Climate Protection, Environment and Agriculture), among others. As planned when it was founded, the DBFZ has since developed into the central federal research institution in the field of energy and integrated material utilisation of renewable raw materials. We would like to thank everyone involved for the positive development of the past 15 years.

Major national and international projects such as "Pilot-SBG" and "ETH Soil" were successfully advanced in 2023. In addition, around 30 new third-party funded projects with a total volume of EUR 12.5 million were launched and scientific issues relating to the bioeconomy as a whole were increasingly addressed. In this way, we want to make a contribution towards a climate-neutral society in which renewable energies and a functioning circular economy are central pillars.

You will find a wealth of interesting information on this topic in this Annual Report 2023. On behalf of the entire DBFZ team, we hope you enjoy reading it and wish you all the best for the future.

**Prof. Dr. Michael Nelles**
Scientific Managing Director

**Dr. Christoph Krukenkamp**
Administrative Managing Director

## Highlights from 15 years of the DBFZ





























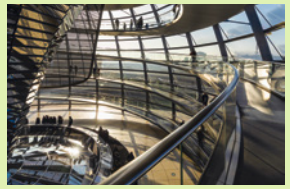


**Fig. 2:** Life and work at the DBFZ: Milestones in the institute's 15-year history

# 2 The DBFZ at a glance

## Mission

The DBFZ, founded in 2008, develops practical solutions along the value chains and cycles of biomass on the basis of the "Smart Bioenergy Approach"[1]. Through applied research and development (R&D) of technologies for the energetic and integrated material use of biomass, the DBFZ is making a significant contribution to the realisation of a climate-neutral society, which is to become a reality by 2050 at the latest. Thanks to its close networking with numerous partners from science, practice and society, the DBFZ has a special role to play in the development of rural areas and regions in Germany affected by the coal phase-out or other structural changes. Co-operation with international partners promotes the global transfer of knowledge and technologies.

## Target groups

The target groups of the R&D work are the specialised public and here in particular the energy industry, agriculture and forestry, the economy in the areas of bioenergy and bioeconomy as well as the end consumer with an interest in an environmentally and climate-friendly, economically viable and socially acceptable bioenergy supply. In addition to the Federal Ministry of Food and Agriculture, there are other relevant federal and state ministries as well as other governmental and non-governmental organisations in Germany and abroad.

[1] www.smart-bioenergy.com

## Co-Operations and services

New processes, procedures and concepts are developed in close co-operation with partners from business and industry as well as other research institutions on the basis of jointly acquired national and international research funding or on behalf of other research institutions. This is intended to promote the initiation and support of networks in industry and between industry and science. At the same time, networking takes place with research in the agricultural, forestry and environmental sectors, including with the departmental research of the Federal Ministry of Food and Agriculture (BMEL), large-scale non-university research (in particular with the Helmholtz Centre for Environmental Research), the state research institutions, selected universities and other German, European and international institutions in the field of biomass research.

→ **Further information:**
**www.dbfz.de/en/the-dbfz/mission-statement**
**www.dbfz.de/en/research/rd-networks**
**www.dbfz.de/en/services/research-with-companies**
**www.dbfz.de/en/research/research-infrastructure**

## Key figures 2023

**31**
Newly launched projects
(market and third-party funded projects)

**51**
Completed projects

**124**
Processed projects

**402,942 EUR**
Average project volume
of the projects launched in 2023

**275**
Employees
(as of: 31/12/2023)

**58**
Events
(internal/external)

**63**
Peer reviewed publications
(including 56 open access articles)

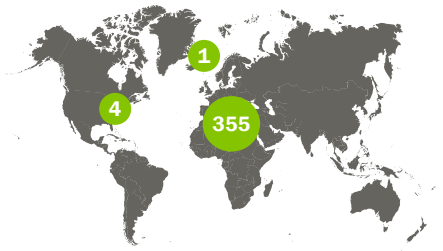
# 2.1 Project cooperation (EU and national)

## Project cooperation

Thanks to close research cooperation with numerous partners from science, industry and society, the DBFZ was able to further expand its position as a leading national research institution in the field of energy and integrated material utilisation of biomass last year. In total, more than 120 research projects were carried out in collaboration with scientific institutions and industrial partners in 2023. A project overview can be found in this annual report from page 137.

As part of 31 EU project collaborations with over 350 partners or as an active member and National Team Leader in leading international research networks such as the IEA Energy Technology Collaboration Programme, the European Energy Research Alliance (EERA) or the European Technology and Innovation Platform Bioenergy (ETIP Bioenergy),

**Main partners in EU cooperation**
(Number per country/region)




**KEY DATA**

**31 EU projects (FP7/Horizon2020/HEU)**

**355 partners:**
37 % Private-for-profit-Organisations
(Industry, SME)
21 % Research institutions
18 % Colleges and Universities
18 % Others (Associations, Agencies, Networks)
6 % Institutions under public law
(public administration)

**Funding for DBFZ:**
10.8 Mio EUR

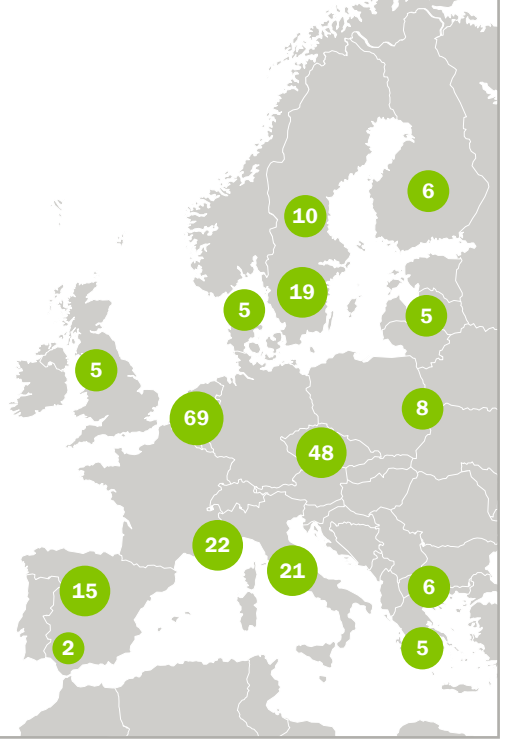



**Fig. 3:** International co-operation at EU level

the DBFZ is active in committee work and continues to expand its scientific networks at national and international level. An overview of the extensive committee and network activities can be found in this annual report starting on page 112.

## Publication output

Scientific project results and findings were published in 2023 together with co-authors from 65 institutions in 63 peer-reviewed publications and numerous popular science journals. The more than 150 publications with DBFZ involvement published each year in 2023 also included an increased number of 64 statements and position papers to inform interested practitioners and users as well as policymakers. With almost 180 presentations at scientific congresses and conferences, DBFZ employees presented the latest results and findings of bioenergy research and actively networked with the scientific community and interested members of the public. With a total of 338 publications, a new record was once again achieved in 2023. A detailed overview of the DBFZ's publications can be found in the appendix starting on page 141.

**Tab. 1:** Publication overview for the period from 2019–2023

| Publications | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|
| Book publications/ Editorships | 9 | 12 | 15 | 13 | 15[2] |
| Book articles | 5 | 37 | 14 | 23 | 13 |
| Journal articles (reviewed) | 57 | 70 | 62 | 58 | 63[3] |
| Journal articles | 10 | 11 | 11 | 17 | 16 |
| Contributions to conference proceedings | 44 | 27 | 31 | 33 | 43 |
| Presentations | 156 | 132 | 165 | 217 | 179 |
| Research data | 1 | 3 | 4 | 5 | 9 |
| **Total** | **282** | **292** | **302** | **308** | **338** |

[2] of which: 9 Monographs, 2 Editorships of collective works, 4 Editorships of conference proceedings
[3] of which: 56 open access articles



# 2.2 Scientific highlights and prizes

The market for edible mushrooms and alternative bio-materials is growing rapidly and offers the best conditions for a sustainable bioeconomy. The DBFZ project "MycoForm" (FKZ: 031B1323) investigated the cascade use of organic residues for the production of completely biogenic materials such as insulation boards and moulded packaging parts, which are kept in shape by fungal mycelium (the fine, thread-like structure that represents the actual fungal organism). The project focussed on agricultural residues (maize harvest residues, wheat straw) with considerable volume potential. The speciality here is the exclusive use of edible mushrooms and their cultivation, from which additional added value can be achieved through the production of food. The insights gained in this project are promising and provide the basis for large-scale implementation.

**Fig. 4:** Bioeconomy: from mushroom to moulded part

## Handover of REF4FU and Innofuels funding decisions

On 14 March 2023, scientists from the DBFZ's Biorefineries Department contributed to the success of the BMDV conference on "Renewable Fuels" with a keynote speech and received the funding decisions for the R&D project "REF4FU" (Refineries for Future) and the platform project "Innofuels" from Parliamentary State Secretary Oliver Luksic. In both projects, colleagues from the DBFZ are involved in the research projects with technical expertise in processes for renewable fuels, with evaluation issues and with the management of work packages and focal points.


© NOW GmbH, Picture: Franz Josef, Berlin

**Fig. 5:** Official handover of the funding decisions for the REF4FU and Innofuels projects

## Revised Resource Database goes online

Biogenic waste and residues harbour growing potential for a sustainable and bio-based economy. In a completely revised resource database, DBFZ scientists have provided extensive data on biomass potentials for Germany and the EU as a freely accessible database. The expanded database updates the known biomass data, summarises project results and has a modular design, so that further options are available. The new version also provides successive time series of biomass potentials, shows links between biomass and utilisation paths and offers considerably more graphical information overall. The web application is available free of charge to researchers, political representatives, companies and all interested parties at **www.dbfz.de/en/resource-database**.

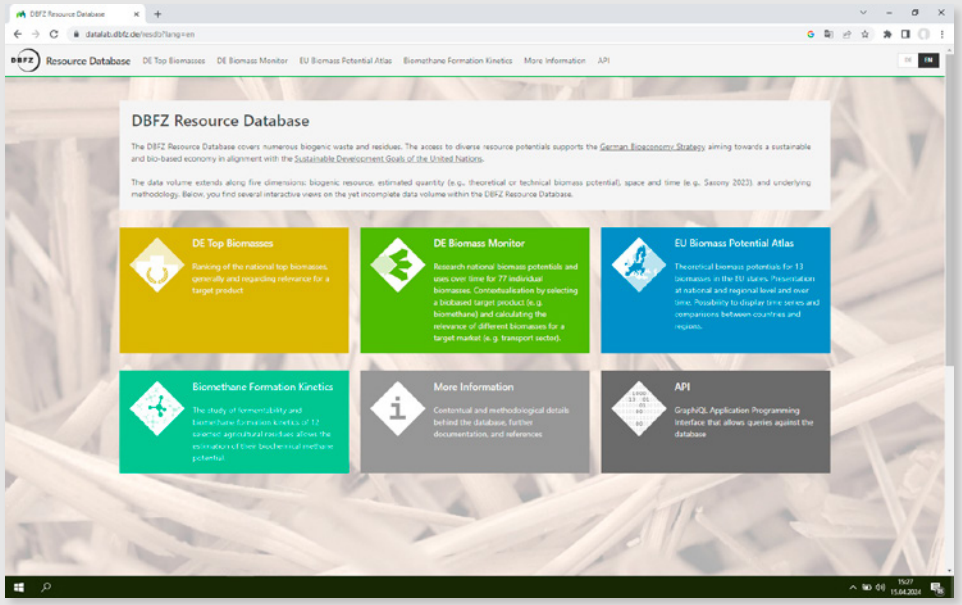



**Fig. 6:** Revised DBFZ Resource Database

## Successful authorisation of mixed hardwood/ wood pellets under the 1st BImSchV

The possibility of using renewable raw materials outside the specified list, as stipulated in Section 3 (1) No. 13 of the 1st BImSchV, was and is associated with uncertainties regarding emission and combustion behaviour, among other things. This has so far prevented any authorisation in Germany for small and medium-sized combustion plants. Against this background, the process was described as an example for the production of mixed hardwood-wood pellets and the one-year measurement programme for the fuel category described was carried out on one type of boiler. As a result, DBFZ scientists were able to demonstrate on the basis of measurements by the accredited ILK Dresden testing centre that the emission limit values of the 1st BImSchV and the LAI licensing requirements for mixed hardwood-wood pellets can be complied with in full-load operation with the firing system used, which has a rated thermal input of less than 100 kW. On this basis, this combination of fuel and the combustion technology described can be used throughout Germany within the scope of the 1st BImSchV.

**Fig. 7:** Successful authorisation of mixed hardwood-wood pellets

## Development: Catalyst from African residues rich in silicon

The research work of DBFZ doctoral student Clement Owusu Prempeh (Thermo-chemical Conversion Department) is investigating the use of agricultural residues in Africa for the production of high-quality and sustainable biogenic silica. Through the use of innovative extraction and modification processes, the study demonstrates the potential of these materials for advanced applications, particularly as a catalyst carrier in low-temperature methane combustion. The results not only offer a sustainable solution for the utilisation of biomass residues, but also underline the importance of their integration into catalytic processes, thus contributing to the development of environmentally friendly materials and processes.

→ **The results have been published as an open access paper:**
**www.mdpi.com/2079-4991/13/9/1450**

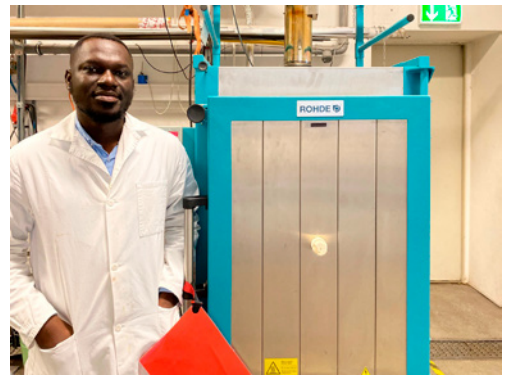



**Fig. 8:** Doctoral student Clement Owusu Prempeh

# Prizes, awards, appointments

## DBFZ scientists win the 2023 Biogas Innovation Award

At the 16th Biogas Innovation Congress in Osnabrück on 24/25 May 2023, forward-looking research approaches and technologies in the field of biogas were once again discussed. The annual presentation of the Biogas Innovation Award by the German Farmers' Association (DBV) also took place as part of the congress. For the first time, there were several winners in the science category. The EUR 3,000 silver innovation prize went to Dr. Nils Engler from the DBFZ for his research into measuring emissions from slurry or fermentation product storage under practical conditions, as well as to his DBFZ colleagues Dr. Britt Schumacher and Lukas Knoll.


© FNR/ Jessica Hudde

**Fig. 9:** Dr. Nils Engler receives the Biogas Innovation Award 2023

## PhD student Selina Nieß wins 2nd place at the "DGAW-WIKO" science congress

The scientific congress "DGAW-WIKO" is the doctoral colloquium of around 60 waste management professorships in German-speaking countries. In the 12th edition of the event on 9/10 March 2023, 20 contributions were initially selected from more than 70 submitted abstracts in a review process to be included in the programme as presentations. DBFZ doctoral student Selina Nieß (Biorefineries Department) took second place with her presentation on "From waste biomass to biofuel – suitable catalysts for direct biogas methanation". The award is endowed with prize money of EUR 1,000 and includes free participation in the DGAW-WIKO 2024 at TU Wien as well as a travel allowance.

## Groundbreaker Award 2023 for the EU project "Regatrace"

The EU project REGATRACE, which was supported by the DBFZ, received the Biogas Groundbreaker Award from the European Biogas Association (EBA) in November 2023. The research project focussed on laying the foundations for the efficient issuance and trading of biomethane/renewable gas certificates and supporting market development. A total of 16 partners from eleven different European countries are involved in REGATRACE. In the joint project, the DBFZ was entrusted with the integrated evaluation of the ecological and economic indicators of various technologies for the production of renewable gases.

→ **Further information:**
**www.regatrace.eu**




**Fig. 10:** Best poster award: Doctoral student Matthis Kurth

## Doc BIOENERGY: Doctoral student Matthis Kurth receives the Best Poster Award

DBFZ scientist and doctoral student Matthis Kurth (Biorefineries Department) won the prize for the best scientific poster at the 6th Doctoral Colloquium BIOENERGY on 18/19 September 2023 at HAWK Goettingen. The poster is entitled "Maxwell-Stefan Surface Diffusion Modelling on Nano-Porous Carbon Membranes" and describes a method in which a binary mass transfer model with a discretisation of three membrane layers can be created using Maxwell-Stefan surface diffusion and Knudsen diffusion using adsorption isotherms and single gas permeation experiments.

## Scientist Johanna Wiechen wins "Out of the Box" science competition

The winner of the creative competition "Out of the Box: The Science Competition" as part of the "Biomass to Energy" status conference was scientist Johanna Wiechen from the DBFZ. She impressed the jury with her imaginative presentation on the "Nutritional Value" project. In the project presented, nutrients are separated from fermentation residues using various processes and made transportable again in solid form. Nutrients can thus be discharged again at the places where they are needed. The three other participants in the competition, Dr. Caroline Autenrieth (University of Stuttgart), Dr. Franziska Müller-Langer (DBFZ) and Andreas Fuchs (University of Stuttgart), also scored highly with their cre-

**Fig. 11:** DBFZ scientist Johanna Wiechen (left) was the winner of the “Out of the Box” creative competition

ative contributions. The presentations were assessed by a jury according to comprehensibility, audience reaction and creativity.

### Professorships for DBFZ scientists Weinrich, Kretzschmar and Hartmann

Dr. Sören Weinrich (Biochemical Conversion Department) was appointed to the professorship of “Resource Management and Environmental Process Engineering” at Münster University of Applied Sciences in mid-2023. In addition to individual modules on process simulation and life cycle assessment, he teaches the fundamentals of process engineering as well as waste and recycling management. Dr. Jörg Kretzschmar (Biochemical Conversion Department) has also been appointed to a professorship at the Zittau/Görlitz University of Applied Sciences, where he has been working in the Faculty of Natural and Environmental Sciences in the field of environmental bioprocess engineering since September 2023. The long-standing head of the DBFZ research focus area “Catalytic Emission Control”, Dr. Ingo Hartmann, has held a one-year deputy professorship at the HTWK Leipzig, Department of Environmental Engineering, since the end of 2023.

**Fig. 12:** Professorships for DBFZ scientists Weinrich, Kretzschmar and Hartmann (from left to right)

## 2.3 Ecological responsibility: climate-neutral DBFZ

The DBFZ is pursuing ambitious goals with regard to environmentally conscious business practices. The centre’s aim is to achieve climate-neutral operations by 2030. With this in mind, numerous measures have been defined and implemented in recent years. Over the course of 2023, the DBFZ’s $CO_2$ emissions in 2019 were initially determined from various sources. The year 2019 also appears as a reference year in the climate framework negotiations (COP28) and is due to the fact that the coronavirus pandemic has distorted the figures with working from home and the virtual impossibility of business trips. The DBFZ’s emissions figures for 2019 are therefore as follows:

Overall, emissions totalled 1505 t $CO_2$eq, which corresponds to around 8 t per full-time equivalent. The biggest drivers here were lignite-fired electricity with 885 tonnes $CO_2$eq, heat generation from natural gas with a total of 250 tonnes $CO_2$eq and business trips with around 200 tonnes $CO_2$eq. Commuter traffic accounts for around 74 t $CO_2$eq.

A lot has happened since the reference year 2019. Electricity from lignite was switched to green electricity in 2020; this measure enabled the DBFZ to save around 885 t $CO_2$eq per year. In addition, three working groups were established to deal with the topics of “heat”, “electricity” and “mobility”. The work involves the implementation of a measurement, monitoring and heating concept, the establishment or reutilisation of solar systems on the DBFZ roofs and the implementation of the “DBFZ Climate Challenge”, in

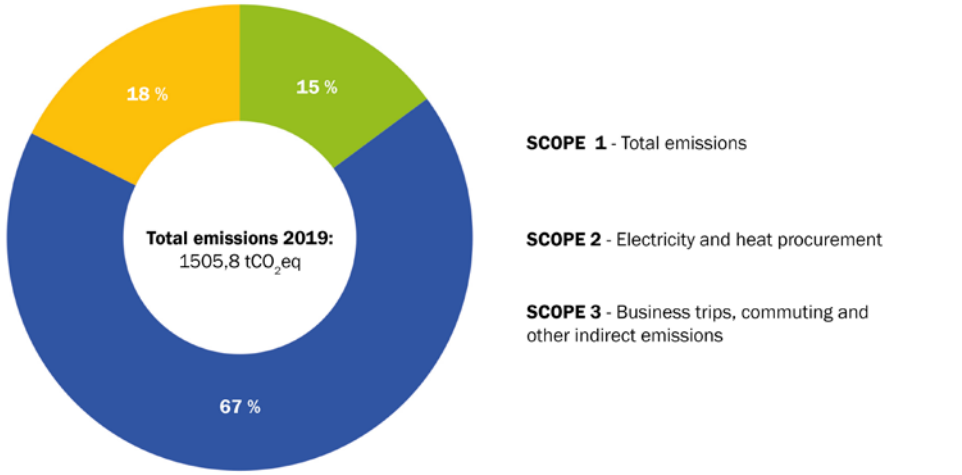



**Fig. 13:** The ecological footprint of the DBFZ in 2019


**Fig. 14:** Woodchip firing in the DBFZ technical centre

which twelve teams competed against each other in the first edition in 2022 to achieve the greatest possible reduction in emissions from commuter traffic.

For the current year 2024, the woodchip firing system is to be upgraded for continuous operation (probably from the end of February), which will further reduce the DBFZ's emissions considerably. There will also be a new edition of the aforementioned climate challenge. Compared to the first edition, four new activities are planned: a bicycle check including road safety issues in March, the "Climate-friendly to work" challenge in April, in which teams drawn by lot will compete for the greatest $CO_2$ savings and the lowest final $CO_2$ value, the (bicycle) kilometre collection in September parallel to Leipzig's city cycling event and the "public transport challenge" in November. Here, teams drawn by lot can explore the possibilities of the Central German Transport Association (MDV) to get to the DBFZ in a climate-friendly way.

Business trips and commuting remain the biggest emission factors. Employees should be made more aware of the extent to which travelling by air is really necessary or whether activities in the host country can be combined. In dialogue with other research institutions, the DBFZ is also developing compensation strategies for these unavoidable emissions, whereby the latest developments at EU level must also be taken into account.

**Contact**
**Dr. Sven Schaller**
E-mail: sven.schaller@dbfz.de

# 3
# Policy advice: Report from Berlin

One of the DBFZ's core tasks is to advise the German government on issues relating to biomass utilisation. As a scientific institution, the DBFZ also strives to make its research findings available to interested political stakeholders. In recent years, the DBFZ has further intensified its advisory services for political decision-makers in ministries and parliaments as well as for the specialised public. These services take the form of scientific statements, background or discussion papers as well as lectures and expert discussions.

## Key areas of policy advice in 2023

The DBFZ's advisory services in 2023 centred on supporting the responsible ministries in developing the National Biomass Strategy (NABIS). Together with other scientific institutions, the DBFZ provided extensive data on the current and future availability and utilisation of biomass, which forms a central basis for the development of strategic guidelines for biomass policy. In addition, two colleagues seconded to the Federal Ministry of Food and Agriculture supported the development of the NABIS as mediators between political and scientific expertise. The results of the advisory services will be made available to the public in the form of a scientific report at the same time as the NABIS is published.


**Fig. 15:** Discussion paper on the sustainability of wood energy

Another priority of policy advice in 2023 was the heating sector. The focus was on federal funding for efficient buildings (BEG) and the design of heat planning requirements for local authorities (WPG). For both laws, the DBFZ supported the German government in assessing the role biomass can play in the defossilisation of the heat supply, as well as in relation to detailed questions concerning special provisions for individual biomass technologies. Among other things, the DBFZ argued that biomass will continue to play an important role in the heating sector in the future, but that its use in areas that are difficult to defossilise, such as industrial heating, will be more important in the long term than its use in the building sector. Even there, however, limited use can make sense, especially in combination with other heating solutions such as heat pumps (so-called hybrid solutions).

Also relevant for the heating sector, but also for other fields of application, is the future role of forest bioenergy. The DBFZ has published a much-noticed discussion paper on this subject, in which climate effects, sustainability effects and political control options are analysed. The paper argues that the long-disputed question of how to measure the climate effects of wood energy is ultimately not decisive for sustainable utilisation. It is more important to eliminate market distortions on wood and energy markets so that wood cost-efficiently contributes to climate protection, for example by means of a $CO_2$ price, according to the authors.

© Bernd Lammel / bundesfoto

**Fig. 16:** Prof. Dr. Daniela Thrän (right) at the Bioeconomy Forum 2023

Policy advices were also provided in connection with the German Renewable Energy Sources Act. Here, for example, cost analyses were prepared in the course of the discussion about increasing the remuneration (maximum bid values). Other topics included green and biogenic hydrogen and its crediting in transport, the reduction of methane emissions from animal excrement, the law on the electricity price brake and biochar.

In addition to its statements and discussion papers, the DBFZ was also involved in numerous committees and events in 2023. In addition to activities in the International Energy Agency (IEA), these include participation in the German government's Bioeconomy Council, chaired by Prof. Dr. Daniela Thrän. The Bioeconomy Forum 2023 organised by the Bioeconomy Council enabled an important bridge to be built between science and politics, which was reflected in the participation of Federal Ministers Bettina Stark-Watzinger, Cem Özdemir and Robert Habeck.

### The services at a glance

_ Scientific monitoring of legislative and administrative legislative procedures
_ Support for political strategy development in the field of bioenergy/biomass strategy
_ Monitoring and impact assessment
_ Analysing the climate, energy, environmental and research policy framework for the bioeconomy

**→ Further information:**
**www.dbfz.de/en/services/policy-recommendations-and-advice**
**www.dbfz.de/en/press-media-library/more-publishments/statements-studies**

**Contact**

**Dr. Harry Schindler**
Phone: +49 (0)341 2434-557
E-mail: harry.schindler@dbfz.de

**Uta Schmieder**
Phone: +49 (0)341 2434-556
E-mail: uta.schmieder@dbfz.de

# 4 Interview on the Circular Economy

Sustainable climate and resource protection is one of the central and most pressing tasks for the future. Since the 1970s, global resource and energy consumption has significantly exceeded the world's ecological regeneration capacity. In 2023, the global ecological footprint was around 75 % too high; in Germany, it was around twice as high. If everyone lived as they do now, around three Earths would be needed for national resource consumption. The two most populous countries, each with a total of around 1.4 billion people, are therefore ahead of Germany in the climate protection balance with around 0.8 Earths (India) and China (around 2.4 Earths). Against this backdrop, the following applies: if Germany is to successfully achieve climate neutrality by 2045, as set out in the Climate Protection Act, Germany's energy supply must be completely converted to renewable energy sources over the next two decades in the interests of sustainable development and a functioning circular economy must be realised.

**Prof. Nelles: Germany likes to present itself as a pioneer in climate and resource protection. Does this image correspond to reality?**

**MICHAEL NELLES:** No, our material and energy consumption is still far too high. If we want to become climate-neutral by 2045, we need to tackle the most important areas of action quickly and consistently. In addition to the two central pillars of "100 % renewable energy system" and "circular economy", this also includes a resource-minimised lifestyle (reduced material and energy consumption as well as reduced consumption), otherwise

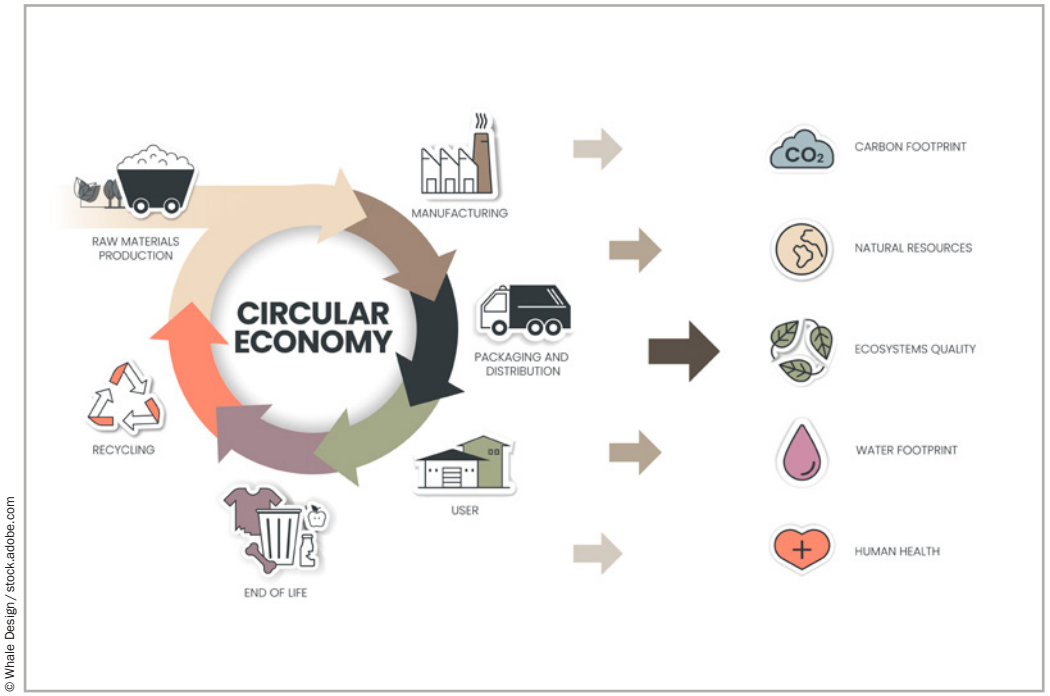





**Fig. 17:** Stages of the circular economy

we will not be able to achieve the goal of a climate-neutral society. Germany is currently operating in a linear economy/society and is unfortunately still a long way from a circular economy. As of 2023, the share of renewable energy in the energy system is just under 20 % and the circularity rate (CMU), i. e. the proportion of waste and residual materials that are fed into recycling plants, is only 12 %, which is far too low to achieve our ambitious goals.

**After all, don't the Germans separate their waste like world champions? What's the problem?**

**MICHAEL NELLES:** In Germany, we have a waste management system that is very well developed by international standards and offers highly developed technical treatment options for all the main types of waste in the current linear economic system. Separate waste collection is a key prerequisite for high-quality recycling, but there is still considerable room for improvement here too, for example in the collection of organic waste. The basic prerequisite for a functioning circular economy is that the waste generated after the utilisation phase can also be repaired or recycled. The EU first introduced the right measures in 2019 with the "Green Deal" and in 2020 with the "Circular Economy Action Plan", which must now be implemented by the member states by 2030.

**You head the Chair of Waste and Material Flow Management at the University of Rostock and are Scientific Managing Director of the DBFZ. What significance do organic waste and residual materials have for the circular economy?**

**MICHAEL NELLES:** Organic waste and residues are a very important secondary resource for material and energy utilisation. Their utilisation does not compete with food production and, ideally, cultivated biomass can be largely replaced with low emissions. In this way, a significant contribution can be made to a cross-sector and sustainable energy supply. However, in order to utilise biogenic waste and residues efficiently and with low emissions, the challenge remains to tap into the still partially untapped potential and to develop adapted technical processes. This is a key focus of work both at the DBFZ and at my chair at the University of Rostock.

© berna_namoglu / stock.adobe.com

**Fig. 18:** Biogenic waste as an important secondary resource

**How high is the potential available for energy and material utilisation?**

**MICHAEL NELLES:** Germany currently produces around 240 million tonnes of biogenic waste and residues per year in the form of dry matter (real fresh matter > 400 million tonnes per year), which is available for environmentally friendly material and energy use. While biogenic waste is covered by the Closed Substance Cycle Waste Management Act (KrWG), biogenic residues largely originate from agriculture and forestry. The KrWG regulates a total of around 400 million tonnes, with construction waste being the largest waste stream at around 200 million tonnes. This mass comparison alone shows the potential of biogenic waste and residues in Germany.



"If Germany wants to successfully realise its goal of climate neutrality by 2045, as set out in the Climate Protection Act, the many good approaches in the coalition agreement must be put into practice quickly."

**What percentage of this could be used for the national energy supply?**

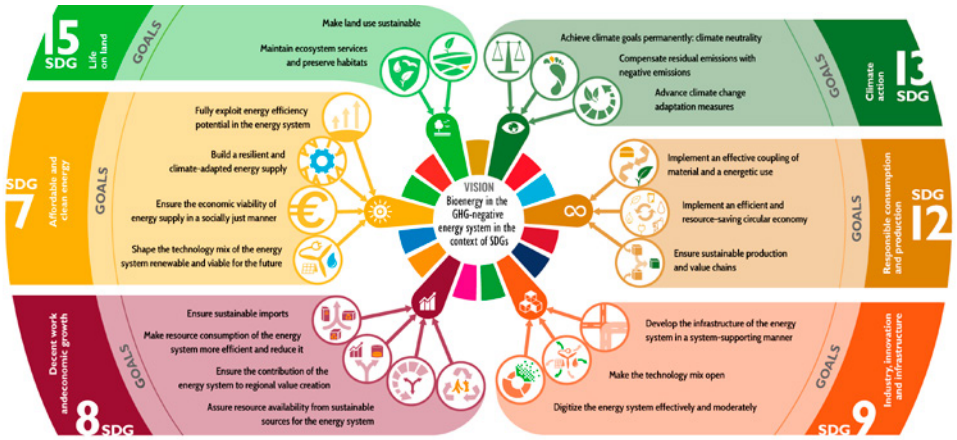
**MICHAEL NELLES:** Renewable energies accounted for just under 20 % of primary energy consumption (PEC) in 2023. Bioenergy makes the largest contribution to the PEC with around 11 %, although this is mainly through cultivated biomass and not yet through the energy recovery of biogenic waste and residues. The 240 million tonnes of dry matter of biogenic waste currently produced in Germany must be utilised more for energy recovery in the future. However, here too, it must first be examined whether partial material utilisation is not more sensible. In relation to today's energy consumption, around 10 % of our PEV could be covered by consistently utilising biogenic waste and residual materials for energy. This illustrates what we will have to achieve in the next 30 years! To the extent that we succeed in keeping these valuable raw materials in the cycle, companies will become less dependent on increasingly expensive and often fluctuating raw material imports. A functioning circular economy not only offers economic benefits, but also actively promotes climate protection.

**How can/must politicians support this process in your view?**

**MICHAEL NELLES:** If politicians wants to successfully realise Germany's goal of climate neutrality by 2045, as set out in the Climate Protection Act, the many good approaches in the coalition agreement must be quickly backed up with the necessary concrete measures and put into practice very quickly. Otherwise, the medium-term goal of reducing emissions by 65 per cent by 2030 compared to 1990 will certainly not be achieved. Progressive climate change, severe biodiversity loss and the current geopolitical crises already clearly show how important a secure and sustainable supply of energy and raw materials is, which is also reflected in the United Nations' Sustainable Development Goals.

**The Federal Government is currently working on the National Biomass Strategy (NABIS), which is due to be available in spring 2024. What are your expectations?**

**MICHAEL NELLES:** In recent years, biomass has increasingly come into focus as an important carbon source, on the one hand for reducing and binding $CO_2$ emissions, and on the other as the carbon source for the future bioeconomy. This will significantly increase the demand for biomass and the need for sustainable cascade and coupled utilisa-




© DBFZ, 2022

**Fig. 19:** Bioenergy in the context of the UN Sustainable Development Goals

tion in the future. Against this backdrop, a long-term strategy is certainly necessary and helpful in order to optimise the material and energy use of the limited biomass available in Germany in the future. However, overly compartmentalised regulations should be avoided here. This typically German approach to practical implementation can lead to high economic costs and undesirable developments that will not help us to protect the climate and resources. Unfortunately, it is currently impossible to seriously assess whether the NABIS can achieve the targets set and when it will be adopted. There is currently no technically/politically coordinated draft from the BMWK, BMEL and BMUV and the announced stakeholder process is also still pending, meaning that it is very unlikely that the NABIS will be adopted in spring 2024.

> “In newly industrialising countries such as China or India, which together account for almost 40 % of the world’s population, simple waste management measures can prevent more greenhouse gas emissions than Germany emits in total.”

**You are on the board of the most important waste management committees and associations. What issues do they pursue at national and international level?**

**MICHAEL NELLES:** At a national level, the German Association for Waste Management (DGAW) and the German RETech Partnership e. V. (RETech) should be mentioned in particular as an export network for the circular economy. The world’s leading university institutes in the waste and recycling industry are organised in the Waste Working Group (IWWG), while the International Solid Waste Association (ISWA) is the central practice-oriented network of the international recycling industry. Nationally, the focus is primarily on issues relating to the further development of the German waste management sector into a sustainable circular economy. Internationally, the aim is to initiate and support waste management developments and to contribute experience from Germany. There is plenty to do and the positive ecological effects are very high, especially in the large newly industrialising countries such as China or India, which together account for almost



**PROFILE**

**Prof. Dr. Michael Nelles** (born 1966) has held the Chair of Waste and Material Flow Management at the University of Rostock since 2006 and has been Scientific Managing Director of the DBFZ in Leipzig since 2012. At the same time, he is active in various waste management committees and associations (ReTech, DGAW, Iswa Germany) and has held various guest professorships at Chinese universities.

40 % of the world’s population. Simple waste management measures there can avoid more greenhouse gas emissions than Germany emits in total.

**Your chair at the University of Rostock organises the annual Rostock Biomass Forum in cooperation with the DBFZ, among others. What is the focus of this year’s conference?**

**MICHAEL NELLES:** As in previous years, we also want to increasingly consider material utilisation options as part of the Rostock Biomass Forum in order to make the most holistic contribution possible to the further development of the energy system and a bio-based circular economy on the path to climate neutrality. The 18th edition of the event will therefore be held under the motto “Bioenergy and bio-based materials for a climate-neutral future” and will take place on 20 and 21 June 2024 at the University of Rostock. We are looking forward to a large number of experts from science, business and politics and hopefully fruitful discussions on the topic, which should lead to a gain in knowledge for all and to new approaches to solutions.

**Thank you for the interview**

→ **Further information:**
www.retech-germany.net/en
www.iswa-germany.de
www.dgaw.de/en
www.iwwg.eu

# 5 The DBFZ's research focus areas

A large number of different research projects in the field of energy and integrated material biomass utilisation were successfully completed in 2023. Key research topics are realised at the DBFZ in five research focus areas. They ensure that important aspects of bioenergy and the bioeconomy can be mapped in the depth required for excellent research. The DBFZ's research focus areas are orientated towards current and future research policy challenges and framework conditions (e. g. the National Bioeconomy Strategy, the Mobility and Fuels Strategy, the EU Green Deal and the future National Biomass Strategy). Other important cornerstones for the scientific orientation of the research focus areas are the funding policy framework, the unique selling points in the research landscape and the DBFZ's excellent research infrastructure.

→ **Further information:**
**www.dbfz.de/en/research/research-focus-areas**

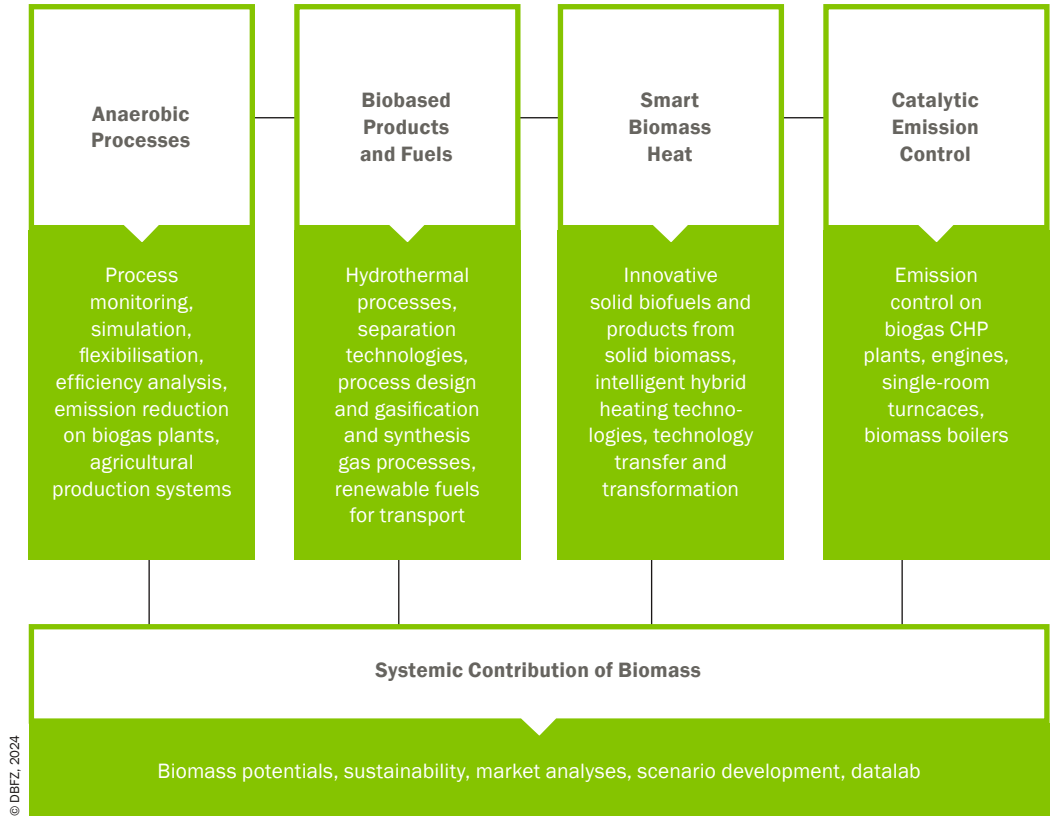



**Fig. 20:** The five research focus areas of the DBFZ

# 5.1 Systemic Contribution of Biomass

"As a renewable energy source, biomass can contribute to the transformation of the energy system towards climate neutrality. However, the availability of biomass is limited and at the same time in demand by many potential users. In the SoBio project, the goal was to develop a strategy for optimal energetic use of the limited available biomass in the future German energy system in the medium term up to 2030 and in the long term up to 2050."

**Dr. Kathleen Meisel**
Project Manager

## SOBIO – Scenarios for the optimal use of biomass in the energy system

Germany has set itself the goal of being climate-neutral by 2045. The German government is focussing primarily on reducing energy consumption, for example by using resources efficiently and increasing the share of renewable energy [1]. Biomass is a renewable energy source that is already making an important contribution to the energy transition. Biomass, especially biogas and solid biomass, contributed 11 % to German electricity generation in 2021. In terms of heat generation, woody biomass in particular, but also gaseous and liquid biomass, accounted for 14 % of the heat supply in 2021. In addition, biofuels contributed 7 % to the transport sector in the same year. The use of renewable energies saved 216.7 million tonnes of $CO_2$ equivalents in 2021. The use of biomass accounts for 34.4 % of this [2]. However, the availability of biomass is limited. It should therefore only be used in energy applications where it is the best option among alternative renewable energies. It should also be produced or supplied in a sustainable manner.

**KEYWORDS**

Biomass use
Bioenergy
Energy transition
Modelling
Energy system analysis



© Imagecreator / stock.adobe.com

**Fig. 21:** Climate neutrality through renewable energies

Numerous scientific studies [3–10] have developed long-term scenarios for achieving climate neutrality in Germany by 2045. In all of the studies analysed, biomass makes a contribution to this climate protection goal, albeit to varying degrees. In all studies, solid biomass is used in the long term for high-temperature applications in industry. Some studies see BECCS (bioenergy with carbon capture and storage) as a long-term option to achieve the 2045 carbon neutrality target. In the long term, biomass will play a smaller role than today in transport, electricity generation and heating in buildings, and in some sectors it will cease to play a role. Demand will be met by other renewable energy sources. In these studies, the use of biomass is primarily seen in the conversion of raw materials in industry. [3–10]. In all of these studies, neither the available biomass nor the conversion paths are presented in a very differentiated way, nor are they varied in scenarios. In contrast to these studies, this paper takes a very differentiated look at biomass, its energy conversion options and its optimal integration into the energy system.

In order to close the research gaps regarding the biomass integration into the energy system, the following research questions were addressed in the SoBio project:

i) What is the optimal role of biomass in the energy transition?
ii) What are the priority target markets for biomass in the electricity, heat and transport sectors?
iii) Which are the most competitive (bio) energy technologies and are there turning points?
iv) Which framework conditions have the greatest influence on the future role of bioenergy?

## Methods

The available biomass potential is decisive for the contribution of biomass to the energy system. In the SoBio project, a general distinction is made between residual and waste materials, energy crops from arable land and other biomass. The DBFZ's resource database [11] and the FNR's information on available areas for energy crops [12] are used to determine the potential for energy utilisation. The biomasses analysed can be roughly divided into woody/lignocellulosic, digestable and oily biomasses.

In order to determine the optimal energetic utilisation of this biomass in the future energy system, potential biomass uses in the electricity sector (residual load only), in the heating sector (residential and commercial buildings; low-, medium- and high-temperature industry and district heating networks) and in the transport sector (road passenger transport, light and heavy duty vehicles, aviation, rail transport, inland navigation and maritime shipping) are investigated.

In total, 20 different groups of domestic biogenic residues and waste materials, 15 types of energy crops, three other types of biomass (algae, paludiculture, log wood), 111 different bioenergy technologies and a total of 265 renewable and fossil energy technologies to cover the sector-specific energy demand are analysed.

The BenOpt model is used to derive the optimal utilisation of biomass in the energy system. BenOpt is a classic linear energy system optimisation model according to [13], which performs an optimal allocation of possible resource and technology options while simultaneously meeting demand in the electricity, heating and transport sectors and fulfilling long-term climate protection targets in various future scenarios. BenOpt requires a variety of data inputs for this. Essentially, these are biomass-specific potential quantities, prices for biomass and other energy sources, auxiliary materials and co-products, as well as data on the technology options such as capacities, efficiencies, costs and scenario framework data. Imports are also taken into account. Further information on BenOpt can be found in the publication by [14].

As the future of the energy system, including bioenergy, is unpredictable, the scenario development method is used [15]. While both medium-term (up to 2030) and long-term scenarios (up to 2050) are developed in SoBio, only the long-term scenarios are discussed below. Table 1 provides an overview of the long-term scenarios analysed. Compliance with the climate protection targets is assumed for all long-term scenarios. The reference scenario serves as a comparison scenario. Here, all parameters are set to base values, while at least one parameter in each of the long-term scenarios is set to a maximum or minimum value.

In scenario 1, the $CO_2$ price is raised very sharply to 500 €/t $CO_2$ by 2050. In Scenario 2, the technology push scenario, the $CO_2$ starting value of 150 €/t $CO_2$ by 2050 applies, as in Scenarios 3 and 4, but here the investment costs of all the technologies considered are set to their specific minimum and the efficiencies to the technology-specific maximum. In scenario 3, it is assumed that the use of biomass from cultivated areas as well as algae and paludiculture will be phased out by 2030 for political reasons. Only residual and waste materials form the biomass potential. Increased mobilisation is assumed here. Scenario 4 assumes maximum biomass potential. Here, the area under cultivation is doubled compared to today, an increased mobilisation of residual and waste materials and higher potentials of algae and paludiculture are assumed.



## Results

The modelling results show that the cost-optimal use of biomass is (i) in particular in sectors where direct electrification is not possible or only possible to a limited extent and at high costs, and (ii) in the electricity sector as a flexibility option to cover the residual load. In addition, the use of biomass for energy is the more competitive option for the transition to renewable energies in all sectors analysed due to its lower costs compared to the PtX options. The competitiveness of bio-

**Tab. 2:** Considered long-term scenarios with their essential characteristics

| 2050 scenario | Reference scenario | Sc. 1 | Sc. 2 | Sc. 3 | Sc. 4 |
|---|---|---|---|---|---|
| Designation | Reference | Politics \| high $CO_2$ price | Technology \| Push in Development | Biomass \| Only residues mobilization | Biomass \| Max. biomass availability |
| GHG target in million t $CO_2$ eq. (excl. negative emissions) | 0 | 0 | 0 | 0 | 0 |
| $CO_2$ price ETS in €/t | 150 | 500 | 150 | 150 | 150 |
| Residue availability (biomass-specific) | Base | Base | Base | Elevated | Elevated |
| Cultivated areas for bioenergy in million ha | 2.3 | 2.3 | 2.3 | 0 | 4.7 |
| Import residues/bio-KS; % of the domestic bioenergy potential | 50 | 50 | 50 | 50 | 100 |
| Import energy crops/ biofuels | Status quo 2020 | Status quo 2020 | Status quo 2020 | No imports | Status quo 2020 |
| Final energy consumption | UBA Greenlate | | | | |
| Investment costs (technology-specific) | Base | Base | Minimum | Base | Base |
| Efficiencies (technology-specific) | Base | Base | Maximum | Base | Base |

energy technologies is demonstrated by the fact that the available biomass will be used almost completely in all scenarios by 2050, in some cases in different applications in the energy system.

In the heating sector, the largest amount of biomass is used in the form of wood chips from wood residues and miscanthus for high-temperature industrial applications. In addition, firewood, mostly from small and very small private forests, continues to be used in wood stoves and pellets, primarily in hybrid systems with heat pumps in buildings. In the electricity sector, the the most cost-efficient option in the long term is the use of biogas from domestic fermentable residual and waste materials or maize as well as smaller amounts of waste wood in waste wood-fired CHP plants to flexibly cover the residual load. In the transport sector, the electrification of road and rail transport is proving to be the most competitive option, followed by biofuels and electricity-based fuels. In the long term, lignocellulose-based biomass and oily residues will be used as BtL (Biomass to liquid) and HEFA (hydroprocessed esters and fatty acids) in air transport at optimal cost and digestable and lignocellulose-based biomass as liquefied biomethane in shipping. These raw materials will still be competitive options in road transport until the mid-2040s, (see Figure 22).

The availability of biomass has the greatest influence on the modelling results (scenario 3 and 4). Without energy crops from agricultural land, fossil technologies remain in the energy system for longer. In addition, the use of or non-use of cultivated biomass influences the future industrial transformation. In scenario 1, 2 and 4 (no limited biomass availability),

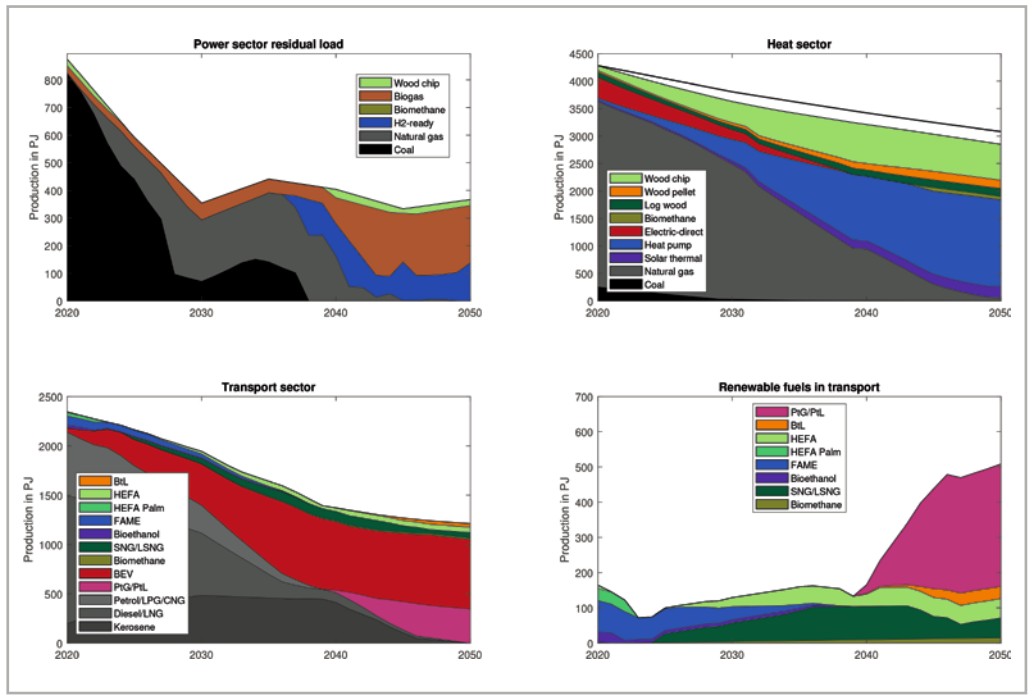



**Fig. 22:** Optimal use of biomass in the electricity, heat and transport sectors (in the reference scenario)



**Tab. 3:** Contribution of biomass to the electricity, heating and transport sectors in 2050

| Biomass in final energy in 2050 | Reference scenario | Sc. 1 | Sc. 2 | Sc. 3 | Sc. 4 | Status in 2021 |
|---|---|---|---|---|---|---|
| Heat in PJ | 1009 | 1009 | 892 | 470 | 1253 | 618 |
| Share of total in % | 32.7 | 32.7 | 28.9 | 15.2 | 40.6 | 37 |
| Electricity in PJ | 228 | 254 | 277 | 5 | 324 | 180 |
| Share of total in % | 6.9 | 7.7 | 8.5 | 0.1 | 9.8 | 11 |
| Transport in PJ | 161 | 161 | 171 | 184 | 255 | 124 |
| Share of total in % | 13.3 | 13.3 | 14 | 15 | 21 | 7 |
| Total in PJ | 1398 | 1424 | 1340 | 659 | 1832 | 922 |

the industrial demand for medium and high temperature could be covered solely with the available biomass. The absence of cultivated biomass would lead to an increased use of PtX options, which in turn would lead to higher costs for the energy transition and increased electricity consumption. Compared to a lower $CO_2$ price, a higher $CO_2$ price (Scenario 1) ensures a faster displacement of fossil fuels, but does not ensure more biomass in the energy system due to its limitations. A technology push (scenario 2) shows only a slight shift in biomass market shares (see Table 3).

## Perspectives

Biomass is not only in demand as a renewable energy source in the energy transition. It is also used as a renewable resource in the construction and chemical industry and as a substitute for peat. In addition, bioenergy is expected to play an important role in the future in the generation of negative emissions by capturing biogenic $CO_2$ emissions and injecting them underground. Against this background, the follow-up project SoBio II was launched in the second quarter of 2023 to investigate the optimal role of limited biomass in a climate-neutral economy. The analyses of the SoBio project will be extended to include the other potential biomass users mentioned above.

→ **Further information (german language):**
**www.dbfz.de/sobio**

## Sources


[1] The Federal Government, We're tripling the speed of the expansion of renewable energies, 2023. URL: https://www.bundesregierung.de/breg-de/schwerpunkte/klimaschutz/amendment-of-the-renewables-act-2060448

[2] Federal Ministry for Economic Affairs and Climate Action, Federal Ministry of Food and Agriculture, Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection, Eckpunkte für eine nationale Biomassestrategie (nabis), 2022. URL: https://www.bmwk.de/Redaktion/DE/Publikationen/Wirtschaft/nabis-eckpunktepapier-nationale-biomassestrategie.pdf?__blob=publicationFile&v=1

[3] Frank Peter, Die Rolle von Biomasse im klimaneutralen Deutschland, 17.01.2023

[4] Prognos, Öko-Institut, Wuppertal Institut, Towards a climate-neutral germany by 2045. How Germany can reach its climate targets before 2050, 2021. URL: https://static.agora-energiewende.de/fileadmin/Projekte/2021/2021_04_KNDE45/A-485 EW_213_KNDE2045_Summary_EN_WEB.pdf

[5] J. Günther, H. Lehmann, P. Nuss, K. Purr, F. Balzer, D. Drosihn, K. Ehlers, E. e. a. Fee, Resource-efficient pathways towards greenhouse-gas-neutrality - RESCUE. Summary report, 2019. URL: https://www.umweltbundesamt.de/sites/default/files/medien/376/publikationen/rescue_kurzfassung_eng.pdf

[6] Federation of German Industries - BDI, Climate paths 2.0 study – Recommendations for action: How to make our industrial country climate neutral, 2021. URL: https://english.bdi.eu/publication/news/climate-paths-2-0-studyrecommendations-for-action.

[7] dena, dena-lead study Aufbruch Klimaneutralität, 2021. URL: https://www.dena.de/fileadmin/dena/Publikationen/PDFs/2021/Abschlussbericht_dena-Leitstudie_Aufbruch_Klimaneutralitaet.pdf


© Uschi Dreiucker / pixelio.de




[8] Kopernikus-Projekt Ariadne, Deutschland auf dem Weg zur Klimaneutralität 2045: Szenarien und Pfade im Modellvergleich, 2021. URL: https://ariadneprojekt.de/media/2022/02/Ariadne_Szenarienreport_Oktober2021_corr0222_lowres.pdf

[9] F. Sensfuß, B. Lux, C. Bernath, C. Kiefer, B. Pfluger, C. Kleinschmitt, K. Franke, et al., Long-term scenarios for the transformation of the energy system in Germany iii: Summary report: 3 main scenarios, 2021. URL: https://www.langfristszenarien.de/enertile-explorer-wAssets/docs/LFS3-Kurzbericht_EN_formatiert-20211011.pdf

[10] F. Sensfuß, B. Lux, C. Bernath, C. Kiefer, B. Pfluger, C. Kleinschmitt, K. Franke, et al., Langfristszenarien für die Transformation des Energiesystems in Deutschland. Treibhausneutrale Szenarien t45, 2022. URL: https://www.langfristszenariende/enertile-explorer-wAssets/docs/LFS3_T45_Szenarien_15_11_2022_final.pdf

[11] DBFZ Deutsches Biomasseforschungszentrum gemeinnützige GmbH, Resource data repository, 2022. URL: https://webapp.dbfz.de/resources/?lang=en

[12] Fachagentur Nachwachsende Rohstoffe (FNR), Anbau nachwachsender Rohstoffe in Deutschland, 2022. Available online at: https://www.fnr.de/presse/pressemitteilungen/aktuelle-mitteilungen/aktuelle-nachricht/anbau-nachwachsender-rohstoffe-2021-konstant

[13] J. DeCarolis, H. Daly, P. Dodds, I. Keppo, F. Li, W. McDowall, S. Pye, N. Strachan, E. Trutnevyte, W. Usher, M. Winning, S. Yeh, M. Zeyringer, Formalizing best practice for energy system optimization modelling, Applied Energy 194 (2017) 184–198. DOI: 10.1016/j.apenergy.2017.03.001

[14] M. Millinger, K. Meisel, D. Thrän, Greenhouse gas abatement optimal deployment of biofuels from crops in Germany, Transportation Research Part D: Transport and Environment 69 (2019) 265–275. DOI: 10.1016/j.trd.2019.02.005

[15] K. Steinmüller, Grundlagen und Methoden der Zukunftsforschung, 1997. URL: https://steinmuller.de/en/zukunftsforschung/buecher/werkstattberichte/WB_21_Grundlagen.pdf


**PROJECT PROFILE**

**Duration:**
1/12/2019–30/04/2023

**Scientfic contact:**
Dr. Kathleen Meisel

**Project partner:**
Helmholtz Centre for Environmental Research – UFZ


**Funding bodies:**
Federal Ministry of Food and Agriculture

With support from

Federal Ministry of Food and Agriculture

by decision of the German Bundestag


## Research Focus Area "Systemic Contribution of Biomass"

The research focus area contributes to the development of sustainable bioenergy strategies at a national and international level. Here, regionally and globally available biomass potentials are determined and various biomass utilisation concepts are considered and evaluated. The overarching goal is to solve methodological and system engineering issues surrounding the efficiency and sustainability of biomass use from an economic, ecological and technical perspective, taking into account both the land resources used and the energy carrier-specific processing and conversion technologies. The combination of these aspects provides the basis for deriving strategies and recommended courses of action for policymakers and corporate decision-makers.

## Important reference projects and publications

**Project:** BeForce – Begleitforschung Bioenergie, Federal Ministry for Economic Affairs and Climate Action, 01/04/2021–31/03/2025 (FKZ: 03EI5400)

**Project:** BioZ-RP – Rahmenprojekt III: Life Cycle Assessment/Nachhaltigkeitsbewertung & Wirksamkeitsanalyse, Federal Ministry of Education and Research, 01/09/2022–31/08/2025 (FKZ: 03WIR5303)

**Project:** BRANCHES – Boosting Rural Bioeconomy Networks following multi-actor approaches, European Commission, 01/01/2021–31/12/2023 (GA 101000375)

**Project:** HARMONITOR – Harmonisation and monitoring platform for certification schemes and labels to advance the sustainability of bio-based-systems, European Commission, 01/06/2022–31/05/2025 (FKZ: GA 101060133)

**Project:** SOILLCA – Life Cycle Assessment of selected soil healths input, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), 22/11/2021–30/04/2023

**Publication:** Blümel, L.; Siegfried, K.; Riedel, F.; Thrän, D. (2023). "Are strategy developers well equipped when designing sustainable supply chains for a circular bio-economy?: Supporting innovations' market uptake in a PESTEL + I environment". *Energy, Sustainability and Society* (ISSN: 2192-0567), Vol. 13. DOI: 10.1186/s13705-023-00415-2

**Publication:** Günther, S.; Karras, T.; Semella, S. (2023). *Temporal and spatial mapping of the theoretical biomass potential of 13 residues across Europe*. Lecture held: 31st European Biomass Conference and Exhibition, Bologna (Italy), 05–08/06/2023

**Publication:** Jordan, M.; Meisel, K.; Dotzauer, M.; Schröder, J.; Cyffka, K.-F.; Dögnitz, N.; Schmid, C.; Lenz, V.; Naumann, K.; Daniel-Gromke, J.; Paiva, G. C. de; Schindler, H.; Aliabadi, D. E.; Szarka, N.; Thrän, D. (2023). "The controversial role of energy crops in the future German energy system: The trade offs of a phase-out and allocation priorities of the remaining biomass residues". *Energy Reports* (ISSN: 2352-4847), Nr. 10. S. 3848–3858. DOI: 10.1016/j.egyr.2023.10.055

**Publication:** Majer, S.; van Dam, J.; Fritsche, U. R.; Heukels, B.; Harris, Z. M.; Egnell, G. *Approaches to sustainability compliance and verification for forest biomass: Project report. IEA Bioenergy: Task 45* (2023). [s.l.]: IEA Bioenergy. 60 S. ISBN: 979-12-80907-25-7

**Publication:** Siegfried, K.; Blümel, L.; Riedel, F.; Moosmann, D.; Cyffka, K.-F.; Richters, M.; Reumerman, P.; Vos, J.; Matisons, M.; Thrän, D. (2023). Plating the hot potato: how to make intermediate bioenergy carriers an accelerator to a climate neutral Europe. In: Bari, I. de; Scarlat, N.; Grassi, A. (Hrsg.) *Papers of the 31st European Biomass Conference: Setting the Course for a biobased economy. Extracted from the Proceedings of the International Conference held in Bologna, Italy. 5–8/06/2023*. Florence (Italy): ETA-Florence Renewable Energies. ISBN: 978-88-89407-23-3. p. 814–815. DOI: 10.5071/31stEUBCE2023-5BO.4.4

**Publication:** Thrän, D.; Deprie, K.; Dotzauer, M.; Kornatz, P.; Nelles, M.; Radtke, K. S.; Schindler, H. (2023). "The potential contribution of biogas to the security of gas supply in Germany". *Energy, Sustainability and Society* (ISSN: 2192-0567), Vol. 13. DOI: 10.1186/s13705-023-00389-1

**Head of the Research Focus Area**
**Dr. René Backes**
Phone: +49 (0)341 2434-555
E-mail: rene.backes@dbfz.de

# 5.2 Anaerobic Processes

"In the joint 'KlimaBioHum' project, biowaste plants were analysed in terms of emissions in order to assess how the process of the plants – in particular the rotting process – can be designed to reduce emissions. Extensive measurement data was collected over the four years, giving the project team the largest database on GHG emissions from aerobic biowaste treatment. The findings show that the composting process is complex and that emissions depend on many interactions. However, the reduction in emissions was most evident in the active aeration (forced aeration) of digestate and composting material."

**Jaqueline Daniel-Gromke**
Project leader

## Climate protection-oriented organic waste use in agriculture (Climate BioHum)

The joint project "Climate protection-oriented biowaste utilisation in agriculture" (KlimaBioHum) focused on the development of a pilot version for climate protection quality assurance in the production and use of biowaste compost and fermentation products and the reduction of greenhouse gases through optimal process design. The project was carried out with partners from science and practice under the leadership of the Förderverband Humus e. V. (FVH) with the DBFZ and TERRA URBANA GmbH as project partners. The project comprised a total of four measurement campaigns for emission measurements at the plants in the period 2019–2022. Measurement phase 1 included emission measurements to record methane, nitrous oxide and ammonia at twelve selected biowaste plants. In measurement phases 2, 3 and 4, variations of the windrow were carried out at selected plants during operation in order to investigate the influence of various parameters (including windrow geometry, ventilation, conversion) on the emission behaviour. As the direct measurements of methane and nitrous oxide emissions are very complex in terms of measurement technology, the extent to which the recording of pore gases correlates with the emissions from the rotting process determined from the direct emission measurements was investigated.

**KEYWORDS**

Biowaste
emission measurements
GHG balance
composting
fermentation

The plant measurements focused on the following questions:

- How do the emissions from composting and fermentation differ?
- Which key parameters determine the emission behaviour of the rotting process?
- How do the emission measurements on the rotting process using wind tunnel measurements correlate with the pore gas measurements and how can easily measurable parameters for simplified field measurement methods be derived from this in practice?

The Magdeburg-Stendal University of Applied Sciences was involved as a subcontractor of the DBFZ for the analysis and evaluation of the pore gas composition of the rotting processes, including the windrow description and the laboratory analyses. Detailed evaluations of the correlations between the pore gas measurements and the wind tunnel measurements were carried out in close cooperation with Dr. Jürgen Reinhold (FVH).

### Methods

The DBFZ's tasks at the selected biowaste treatment plants included the following analyses:

- Material flow analysis of selected biowaste plants
- Emission measurements using wind tunnel measurements at twelve biowaste plants (1st measurement campaign) including a leakage search to record the main emission sources of the plants
- Investigation of the pore gas compositions of the compost by using measuring lances parallel to the direct emission measurements (subcontracted by Magdeburg-Stendal University of Applied Sciences)
- Analysis of the correlation between pore gas and wind tunnel measurements with the Förderverband Humus e. V. (FVH) and the Magdeburg-Stendal University of Applied Sciences
- GHG balancing of the analysed biowaste plants to evaluate the emission situation of the biowaste treatment plants and derivation of recommendations for action regarding measures to reduce emissions at biowaste treatment plants and approaches for the design of a quality assurance system in cooperation with the project partners

For the emission measurements, so-called hoods or wind chambers were used, which are placed on a section of the emission-active surface (here rent) (see Figure 23). The chambers thus encloses a defined, emission-active surface or volume. By determining a surface or volume-specific emission factor, the emission rate of the entire rent can be extrapolated. A flame ionisation detector (FID) from TESTA was used as a gas analyser to carry out the emission measurements, in particular on the biofilters (if present in anaerobic digestion plants) and the windrows, which enabled the selective determination of total C and methane C concentrations. Sampling was carried out via evacuated vails and laboratory analysis using a gas chromatograph (GC) and (FID) for methane and an electron capture detector (ECD) for nitrous oxide. Ammonia was analysed by wet chemical analysis in the lab.

**Fig. 23:** Test setup of the wind tunnel measurements with use of the FID on the rotting of fermentation plant A04 in June 2019

When analysing the parameter variations, emission reductions were particularly evident in the active aeration (forced aeration) of the windrows. Non-aerated and actively aerated windrows with variations in the input materials (fermentation product from anaerobic digestion and biowaste from composting) were analysed comparatively at plant A04. Figure 24 shows the GHG emissions in $CO_2$ equivalents in total and differentiated by type of greenhouse gas (methane, nitrous oxide and, as an indirect GHG gas, ammonia) of natural aeration (non-aerated) compared to forced aeration (active aeration) at plant A04. As a result, the windrow emissions with active aeration (forced aeration) are significantly lower for both the fermentation products (fermentation) and the biowaste (composting) than for the non-aerated windrows. The actively aerated windrows show significantly lower emissions in both cases.

Based on the actual directly measured and indirectly derivable emissions of the analysed composting processes and the information collected from the biowaste treatment plants, greenhouse gas balances were drawn up. The total GHG emissions were calculated on the following basis:

1) Measurement results of the emission measurements (measurement phase 1)
2) GHG emissions from the operation of the plants (operator information on energy requirements, nutrient content and properties of the compost and fermentation products based on the RAL annual certificates)
3) GHG savings resulting from the substitution effects (project team assumptions)

The total balance of emissions as the balance of GHG emissions and the emis-



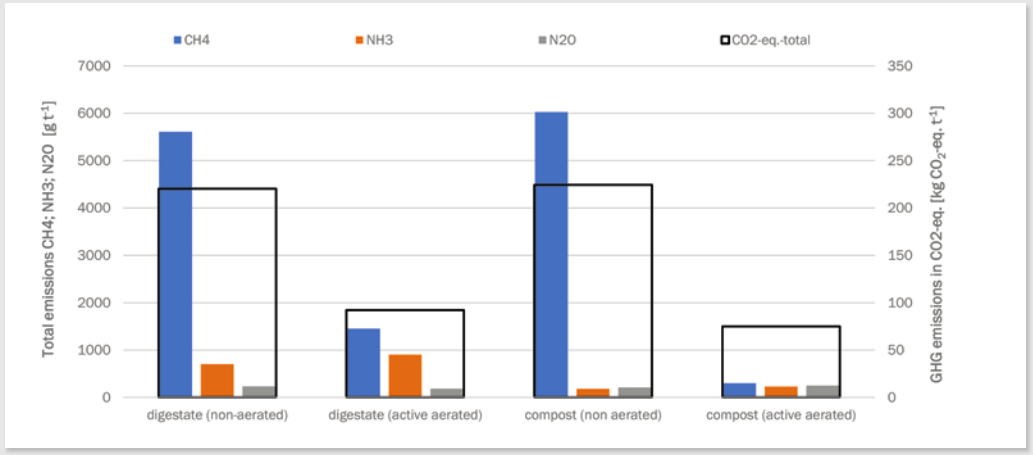



**Fig. 24:** Winter measurement phase A04; GHG emissions over the entire 6-week rotting period of aerated and non-aerated windrows of fermentation products and biowaste from composting in trapezoidal windrows.

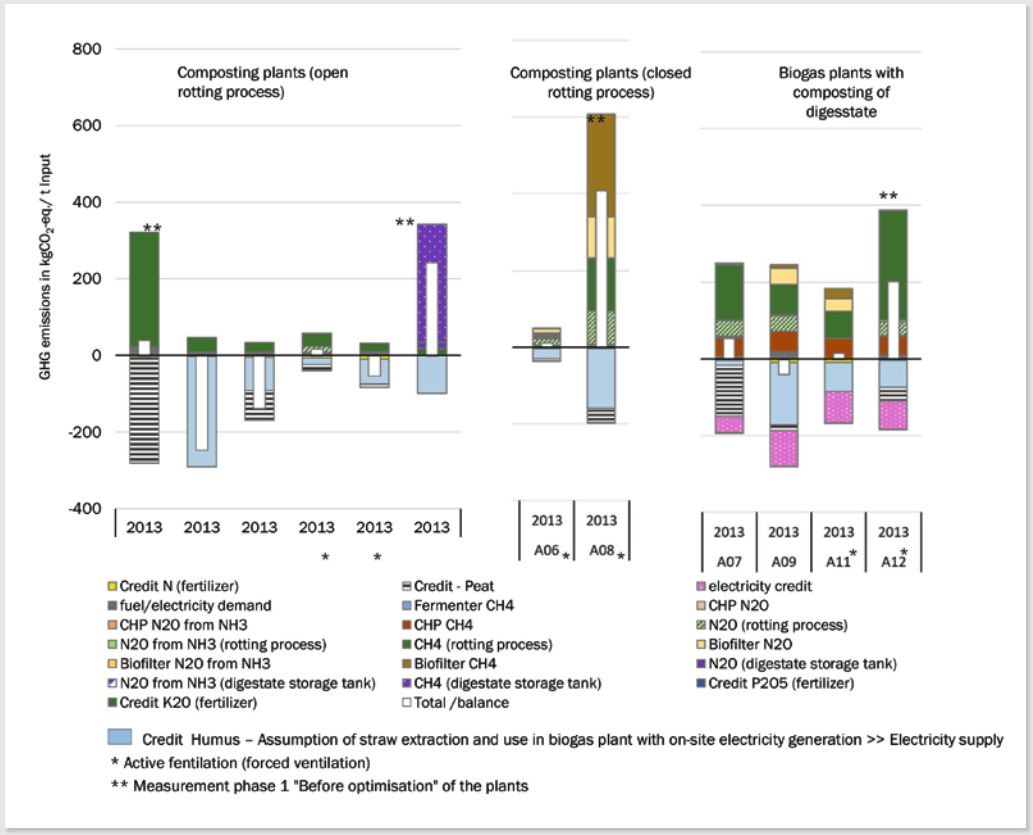



**Fig. 25:** Total GHG assessment of the biowaste plants analysed in the KlimaBioHum project (measurement phase 1) in kg $CO_2$ equivalents per tonne of input (GS = credits)

sion savings resulting from the substitution effects (utilisation pathway “straw extraction and use in biogas plants with on-site electricity generation”) are marked as a white sum bar in Figure 25. For almost all biowaste plants, the emission savings exceed the measured and determined GHG emissions or can almost be compensated for. Exceptions are plants A 01, A 10 b, A 08 and A 12, whose emissions shown here no longer correspond to the current status, as optimisation measures have already been taken as part of the project.

## Milestones/Challenges

Based on the emission measurements, relevant emission sources of the analysed biowaste treatment plants could be identified. Particularly high emissions were found at plants with high rotting emissions due to excessively high windrow heights (A 01), inadequate ventilation of the rotting process as a result of incorrect operational management (A 08, A 12) or open fermentation product storage facilities (A 10 b). High nitrous oxide emissions can result if very moist biowaste is used and an acid scrubber is not used upstream of the biofilter. Optimisations were already carried out at four plants during the course of the project. Overall, the plant emissions determined show a high range of around 22 (A 05) to 574 (A 08) kg $CO_2$ equivalents per tonne of input material, regardless of the type of composting. Fermentation plants have higher overall plant emissions compared to the composting plants analysed. The overall GHG balance has not yet been taken into account. Seasons can have a considerable influence on windrow emissions. The measured values from the winter measurement phases indicate significantly higher emissions than in summer (winter: higher humidity and lower temperatures).

The database was also used to create the GHG balances. An evaluation and limitation of greenhouse gas emissions requires a parallel evaluation and control of treatment processes and sufficient ventilation of windrows for aerobic decomposition. When analysing the parameter variations, significant reductions in emissions became apparent, particularly with active aeration (forced aeration) of the composting process. Actively ventilated windrows (forced ventilation) show significantly lower emissions compared to unventilated windrows (passively ventilated).

The current statistical analyses of the extensive data on the relationship between wind tunnel measurements and on-site field measurements have provided new technical knowledge for estimating GHG emissions from field measurements. This results in necessary extensions in the assessment of GHG emissions in climate protection. Climate-neutral biowaste treatment can generally be guaranteed if the plants are managed accordingly. An assessment and limitation of greenhouse gas emissions requires a parallel assessment and control of treatment processes and a sufficient aeration of windrows for aerobic composting.

## Perspectives

Very extensive measurement data (over 100 wind tunnel measurements, over 700 pore gas measurements) was collected in practical operations as part of the project. This means that the KlimaBioHum project team has the largest database on GHG emissions from aerobic biowaste treatment.

Significant optimisations have already been carried out at four plants during the course of the project, but can also be transferred to other biowaste plants. The database was also used to create the GHG balances and more detailed analyses regarding the correlation between simple field measurement methods and wind tunnel measurements in close cooperation with the project partners. Based on the statistical analysis of the measurement results at the analysed biowaste plants, it was possible to derive orientation values for the climate-friendly operation of biowaste treatment plants. These results are an enormous gain in knowledge, which can be used to further develop the basic framework for voluntary, plant-related climate protection quality assurance in biowaste treatment with the project partners on the basis of the results. At the same time, it is clear that considerable efforts are still required to transfer the results presented for climate protection quality assurance in the production of organic fertiliser from biowaste.

The optimisation approaches could also be applied to agricultural residues such as solid manure storage, as the storage of solid manure can also cause high GHG emissions. There is also a need for further R&D in this area.



**→ Further information:**
**Final report on the project:**
**DOI: 10.13140/RG.2.2.15158.27205**

**PROJECT PROFILE**

**Duration:**
1/10/2018–31/12/2022
(Utilisation of the project results in 2023/2024)

**Project partner:**
Förderverband Humus e. V.
(Project coordinator: Dr. Jürgen Reinhold);
TERRA URBANA GmbH,
Hochschule Magdeburg-Stendal
(Prof. Dr. Carsten Cuhls)

**Scientfic contact:**
Jaqueline Daniel-Gromke

**Project number:**
281B303316

**Funding body:**
Federal Ministry of Food and Agriculture

ptble
Projektträger Bundesanstalt für Landwirtschaft und Ernährung

With support from
Federal Ministry of Food and Agriculture
by decision of the German Bundestag

## Research Focus Area “Anaerobic Processes”

Processes that use microorganisms to convert biomass under anaerobic conditions are the basis of a large number of biotechnological processes for producing energy carriers and materials. The research focus area “Anaerobic Processes” is developing efficient and flexible processes, primarily for biogas production, that can meet the requirements of the future energy system.

Higher added value is achieved by coupling these with material utilisation processes. To this end, the research focus area is developing tools to monitor and control processes, concepts for flexible, low-emission plants and operating regimes, methods to evaluate and optimise efficiency, and processes to maximise material conversion, especially for difficult substrates.



## Important reference projects and publications

**Project:** BiberZym – Vergärung von lignifizierter Biomasse durch den Einsatz von Enzymkombinationen aus dem Verdauungstrakt des eurasischen Bibers, Federal Ministry of Food and Agriculture, 01/02/2023–31/07/2025 (FKZ: 2221NR031A)

**Project:** Kompost4Klima – Grüngutverwertung zur kombinierten Bereitstellung von biogener Wärme und Kompost: Bau eines Prototyp-Biomeilers zur Erzeugung von Wärme aus Kompost, Sächsische Aufbaubank – Förderbank (SAB), 01/07/2021–30/11/2023

**Project:** Pülpegas – Verbundvorhaben Pülpegas - Entwicklung einer Pilotanlage zur Vollverwertung von Weizenpülpe und automatisierte Systemintegration in die industrielle Stärkeproduktion, Federal Ministry for Economic Affairs and Climate Action, 01/05/2022–31/10/2025

**Project:** SEMPRE-BIO – SEcuring doMestic PRoduction of cost-Effective BIOmethane, European Commission, 01/10/2022–30/04/2026 (GA 101084297)

**Project:** STARCH2E – Support biogas project, Market project, 01/01/2023–30/09/2023

**Publication:** Daniel-Gromke, J.; Oehmichen, K.; Knoll, L.; Reinelt, T.; Matlach, J.; Vater, F.; Stinner, W.; Cuhls, C.; Reinhold, J. (2023). “Klimaschutzorientierte Bioabfallverwertung: Projektergebnisse aus dem Verbundvorhaben ‘KlimaBioHum’”. *Müll und Abfall* (ISSN: 0027-2957), Nr. 7. p. 398–405. DOI: 10.37307/j.1863-9763.2023.07.07.

**Publication:** Engler, N.; Schumacher, B.; Knoll, L. (2023). Emissionen aus der Gülle- oder Gärpodukt-lagerung unter Praxisbedingungen messen. In: *Biogas 2023: 16. Innovationskongress. Tagungsband 2023*. Hildesheim: ProFair Consult+Project GmbH. ISBN: 978-3-947777-08-2. p. 93–100.

**Publication:** Lenhart, M.; Pohl, M.; Sprafke, J. (2023). “Challenges and Potential of Anaerobic Digestion from Municipal and Agricultural Organic Waste in Ethiopia”. *Ethiopian Journal of Applied Science and Technology* (ISSN: 2220-5802), Nr. Special Issue 2. p. 33–41.

**Publication:** Meola, A.; Weinrich, S. (2023). Hybrid modelling of dynamic anaerobic digestion process in full-scale with LSTM NN and BMP measurements. In: *ESANN 2023: Proceesdings. 31st European Symposium on Artificial Neural Networks, Computational Intelligence and Machine Learning*. [online]. [s.l.]: i6doc.com publ. ISBN: 978-2-87587-088-9. p. 543–548. DOI: 10.14428/esann/2023.ES2023-133.

**Publication:** Wedwitschka, H.; Gallegos Ibáñez, D.; Reyes-Jáquez, D. (2023). “Biogas Production from Residues of Industrial Insect Protein Production from Black Soldier Fly Larvae Hermetia ilucens (L.): An Evaluation of Different Insect Frass Samples”. *Processes* (ISSN: 2227-9717), Vol. 11, Nr. 2. DOI: 10.3390/pr11020362.

**Head of the Research Focus Area**
**Dr. agr. Peter Kornatz**
Phone: +49 (0)341 2434-716
E-mail: peter.kornatz@dbfz.de

# 5.3 Biobased Products and Fuels

"Phosphate is an immensely important raw material, especially for agriculture. Phosphate is largely imported from politically unstable regions and its extraction causes massive environmental damage. In Germany, we are still sitting on a huge and yet largely untouched source in the form of biogenic residues. This is exactly where abonoCARE® comes in."

**Dr. Benjamin Herklotz**
Project leader

## abonoCARE® network – joint project 2: pollution reduction and phosphorus encouragement in fertilizer intermediate products

Organic residues represent a challenging waste stream. On the one hand, they contain valuable nutrients, but on the other hand they contain environmentally hazardous or harmful contaminants, such as heavy metals. By recycling these residues, the dilemma arises of either destroying the nutrients or exposing people and the environment to the dangers of the contaminants.

The abonoCARE® network (Figure 26) set itself the goal of developing innovative utilisation paths for organic residues in which nutrients are recovered and contaminants are separated and disposed of properly. In this

**KEYWORDS**

Organic residues
phosphate recovery
hydrothermal carbonisation (HTC)
membrane technologies
sewage sludge utilisation



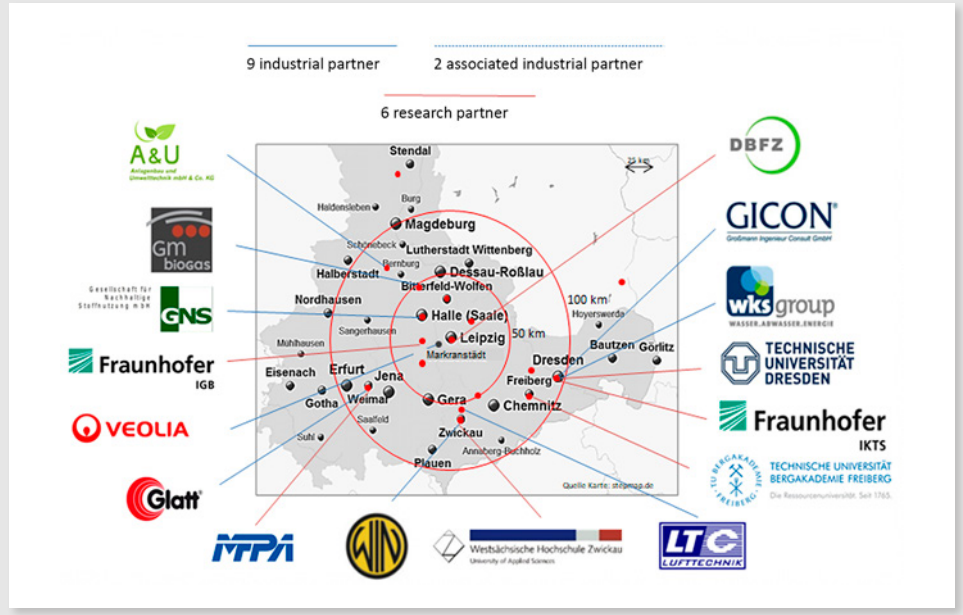



**Fig. 26:** Partner in the abonoCARE® network

context, the DBFZ focused on the recovery of phosphate from wastewater treatment and animal husbandry residues via hydrothermal carbonisation (HTC).

Phosphate is a finite and increasingly critical raw material that is of considerable importance for global nutrition, particularly as a component of fertiliser products. Certain organic residues such as sewage sludge, digested sludge from wastewater treatment and animal manure sometimes contain very high amounts of phosphate. The application to agricultural land therefore sometimes contributes to local over-fertilisation with negative environmental impacts. For these reasons, the amended Sewage Sludge Ordinance almost completely prohibits the application of sewage sludge from 2029 and requires sewage treatment plants above a certain size to recover phosphate instead. By 2023, the affected sewage treatment plants will have to demonstrate how they intend to fulfil the required phosphate recycling quotas.

Phosphate recovery can be realised via the HTC of such residual materials. While other, partly established processes focus, for example, on extracting phosphate from sewage sludge ash after incineration, which is sometimes energy-intensive [1], the DBFZ is pursuing the goal of mobilising phosphate directly during the HTC as part of abonoCARE®. During the HTC, the biogenic feedstock is broken down under increased temperature and pressure and phosphate is transferred to the aqueous phase. This process water is therefore rich in dissolved phosphate, which can be precipitated and purified, for example in the form of struvite – more precisely magnesium ammonium phosphate (MAP). In addition, a phosphate-depleted solid –

known as hydrochar – remains, which has a higher calorific value and a higher dry matter content than the biogenic feedstock. Due to the lower phosphorus content, this solid can still be thermally utilised in co-incineration plants. The use of acids is usually necessary to mobilise phosphate during HTC. However, the use of membrane technologies should reduce the need for acids.

Another aspect of the project was to improve the thermal drying of the solids after the HTC. Even if the HTC itself significantly improves the mechanical dewatering of the solids compared to the biogenic feedstock, subsequent thermal drying is still necessary for most applications. By utilising the increased temperature and pressure already present in a so-called hot dewatering process, mechanical dewatering carried out in this way should also benefit from the effects of thermal drying.

## Methods

The project focussed on the in-situ shift of the reaction equilibrium (EQ) of phosphate during the HTC. Two approaches were pursued: i) the acid-based EQ shift and ii) the membrane-based EQ shift. For the acid-based EQ shift, several experiments were carried out on a 0.5 L scale at the DBFZ as part of a statistical experimental design. Experiments were carried out with different acids such as sulphuric acid, acetic acid and citric acid in different concentrations at 180 °C [2]. The additional effect of so-called complexing agents on phosphate mobilisation before, during and after the hydrothermal treatment of digested sludge was also investigated [3]. These complexing agents are intended to form a coating around the released phosphate or other binding partners in order to protect phosphate from subsequent reincorporation into the hydrochar.

For the application of membrane-based EQ displacement, a membrane test bed (Figure 27) was planned, designed and realised as a supplement to an existing 10 L autoclave at the DBFZ with a total of five different operating modes [4]. These operating modes allow the autoclave to be emptied or the return of retentate (retained by the membrane), permeate (passed through the membrane) or fresh solutions such as water or acid. In this way, a variety of tests such as process water recirculation or subsequent acid addition can be carried out. The operating modes work equally well for removal of the liquid phase via an immersion tube or removal of the vapour phase from the headspace of the autoclave. After the membrane test stand was only ready for operation in October 2022, extensive commissioning tests were carried out. For this purpose, a zeolite membrane from project partner Fraunhofer IKTS was installed and digested sludge was introduced into a filter basket in the autoclave. The initially very slow separation by the ceramic membrane was continuously improved by further technical adjustments so that a fully functional and widely applicable test rig was created at the end of the project.

Several tests were also carried out to investigate hot dewatering. For this purpose, the process temperature of the HTC was primarily varied between 160 and 200 °C. In addition, the influence of the amount of acid (in this case sulphuric acid) and the solids content of the digested sludge used was investigated. The mechanical dewatering itself was then initially carried out at room temperature and ambient pressure. The experiments resulted in initial findings on the influence of the process parameters varied in the HTC on the mechanical dewatering of digested sludge.

As filters are also used in hot dewatering, potentially suitable and commercially available filter materials were screened. For this



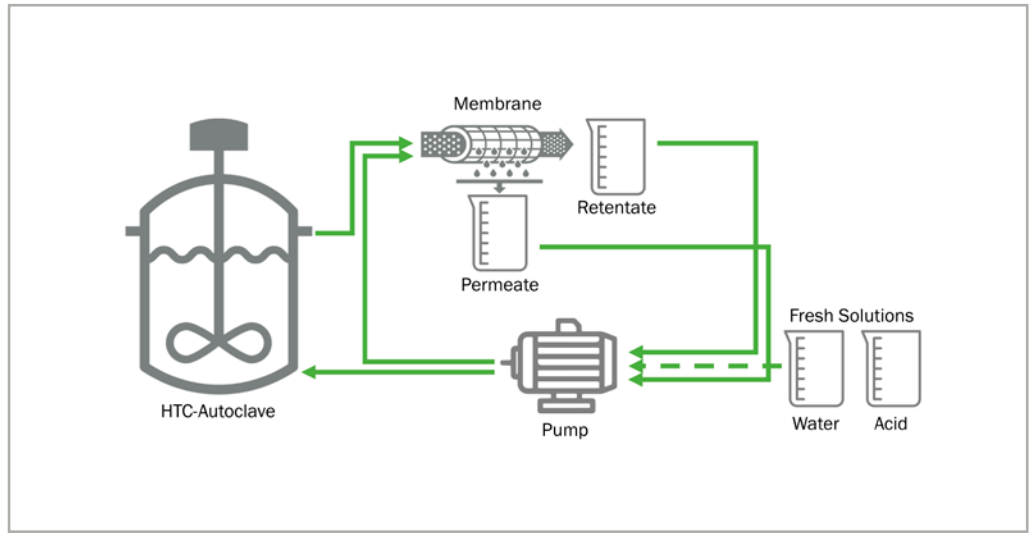



**Fig. 27:** Diagram of the membrane test bed

purpose, they were first exposed to different conditions (in particular temperature and pH value) and then hydrothermally treated digested sludge was passed over the pretreated filters again at room temperature. In addition, the residual particle load in the expired process water was determined in order to evaluate the filtration success.

## Milestones/Challenges

The laboratory tests on acid-based EQ shifting showed that the use of sulphuric acid and citric acid causes a concentration-dependent phosphate extraction. Acetic acid, on the other hand, can only extract a small amount of phosphate – regardless of the amount added and the resulting concentration. However, the underlying effects are very different. While sulphuric acid acts as a strong acid and phosphate therefore remains in solution, citric acid complexes potential phosphate mineralisers such as calcium, aluminium, iron or magnesium and thus prevents phosphate from recombining to form insoluble salts.

The use of a membrane-based EQ shift can lead to a significant reduction in the amount of acid used, as the continuous separation of the process water continuously removes phosphate from the system and thus influences the balance between phosphate in the solid and liquid phases. The laboratory-scale tests showed that the membranes are permeable to short-chain organic acids and water and retain components such as ethanol and long-chain organic acids. However, the initial tests also showed that the ceramic membranes gradually lose their selectivity due to the very acidic medium and that a separation effect is no longer achieved after a few applications. There is therefore a need for further research into other possible membrane materials that are suitable for use under these conditions and also enable appropriate separation.

The process parameter variation for the investigation of hot dewatering revealed a clear temperature dependency, so that higher production temperatures had a positive effect on the mechanical dewatering of

the resulting hydrochar. The effect of acid utilisation was even more pronounced. The use of sulphuric acid also had a pronounced, positive effect on mechanical dewatering. The effect of a higher process temperature was superimposed when sulphuric acid was used. The filter screening also revealed that stainless steel filters with mesh sizes smaller than 100 µm showed good overall stability and a good filtration result in the form of a low residual particle load in the filtrate.

The final economic evaluation of the acid-based process showed that the recovery of phosphate from sewage sludge using HTC is currently still quite expensive. Compared with processes that recover phosphate from the ash after sewage sludge incineration, for example, the costs of the acid-based HTC process are even higher. Nevertheless, it can be deduced that the costs for the HTC must be additionally covered by other advantages of the process. The resulting hydrochar was not initially taken into account in the economic analyses. It can be argued that the better properties of the char in terms of thermal utilisation compared to the sewage sludge itself also lead to possible revenues or at least to savings in disposal costs. A further, rather conservative assumption is that the energy requirements of the HTC process can be covered by burning the hydrochar itself. This assumption also leads to significantly lower costs for the process and consequently phosphate as the main product.

## Perspectives

Carrying out phosphate extraction under hydrothermal conditions offers a number of advantages over room temperature processes. In addition to improved phosphate mobilisation, a hygienised material with a higher calorific value and lower water content is produced almost in-situ, which can also be further thermally utilised in co-incineration plants.

The membrane test stand realised in the project is only suitable for the concentration of phosphate to a limited extent, but there are other possible applications here. These include, for example, the separation of other, sometimes volatile compounds for more targeted purification and the corresponding integration of initial downstream processes. The ability to analyse process water in a time-resolved manner during the experiments also offers a variety of new possibilities with regard to a better understanding of the underlying conversion mechanisms. By using other membranes, further research questions can also be addressed.

The results on improved mechanical dewatering of the hydrochar after the HTC are also being incorporated into the further development of a hot dewatering device. A suitable test stand is currently being developed at the DBFZ for this purpose, which will allow the effects of real hot dewatering at temperatures of over 100 °C to be investigated on a laboratory scale.

The results have also provided better insights into the behaviour of amino acids under hydrothermal conditions [5]. These findings can also be transferred to other, particularly protein-rich residues and biomass.

→ **Further information:**
**www.abonocare.de**



## Sources


[1] Körner, Paul; Röver, Lisa (2022): Ganz ohne Feuer. Phosphatextraktion aus Klärschlamm. In: Müll und Abfall (4), p. 190–196. DOI: 10.37307/j.1863-9763.2022.04.06.

[2] Körner, Paul; Röver, Lisa; Römerscheid, Stefan; Wirth, Benjamin (2020): Hydrothermale Phosphatextraktion aus Klärschlamm. abonoCARE-Conference. Leipzig, 05/03/2020.

[3] Röver, Lisa; Körner, Paul; Herklotz, Benjamin (2022): P-recycling via hydrothermal Carbonization and the use of complexing agents and acids. ESPC 2022. ESPP. Vienna, 20/06/2022.

[4] Röver, Lisa; Herklotz, Benjamin (2023): Konstruktion und Inbetriebnahme eines hydrothermalen Membranversuchsstandes. abonoCARE Final conference. Leipzig, 20/06/2023.

[5] Körner, Paul (2021): Hydrothermal Degradation of Amino Acids. In: ChemSusChem 14 (22), p. 4947–4957. DOI: 10.1002/cssc.202101487.


**PROJECT PROFILE**

**Duration:**
01/04/2019–31/12/2022
(Utilisation of the project results in 2023)

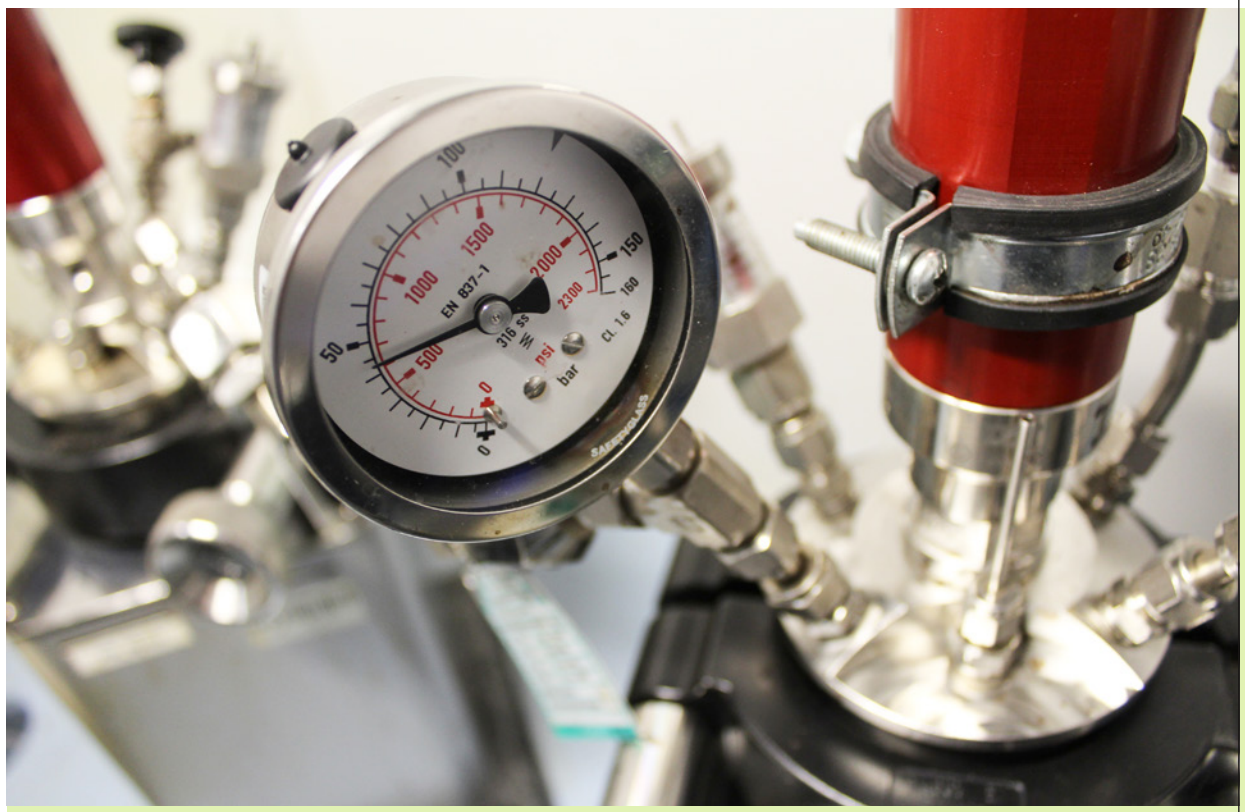
**Project partners:**
Fraunhofer Institute for Ceramic Technologies and Systems IKTS,
WIN Wartung und Instandhaltung GmbH Zwickau,
LTC – Lufttechnik Crimmitschau GmbH

**Scientific contact:**
Dr. Benjamin Herklotz/Lisa Röver

**Funding body:**
Federal Ministry for Education and Research

abonocare
organic residues to advanced nutrients.

SPONSORED BY THE
Federal Ministry of Education and Research




## Research Focus Area "Biobased Products and Fuels"

The overarching research goal of the research focus area "Biobased Products and Fuels" is to contribute to biorefinery concepts as part of a sustainable bioeconomy through the use of innovative technological approaches. Here, the process engineering equipment of the biorefineries technical centre is used and comprehensive methods for the multi-criteria technology assessment of individual processes and overall concepts for biorefineries are applied. A wide range of process engineering equipment and processes are used to map the complexity of the biorefineries. It is only through the meaningful combination of these process steps that biorefinery concepts emerge in which marketable products can be manufactured. For this reason, the technical equipment of the biorefineries technical centre is designed to be inter-compatible so that a wide range of processing chains for biogenic raw materials can be investigated. In addition, the focus is increasingly on the automated acquisition of measurement data and automated plant operation. Work is naturally done in accordance with high scientific standards using statistical experimental design and evaluation methods as well as process simulation, databases and software tools to evaluate the technology.

## Important reference projects and publications

**Project:** CapUp – Verbundprojekt: Chemikalienproduktion an Biogasanlagen - Upscaling eines Verfahrens zur Herstellung mittelkettiger Carbonsäuren aus regionalen Reststoffen, Sub-project: Up-Scaling und Bewertung der Downstream-Kaskade, Federal Ministry for Economic Affairs and Climate Action, 01/02/2023–31/07/2023 (FKZ: 13BDA30012)

**Project:** ELEVATOR – Elektrochemische Valorisierung furanreicher Prozessströme aus dem hydrothermalen Aufschluss landwirtschaftlicher Reststoffe, Federal Ministry of Food and Agriculture, 01/05/2023–30/04/2026 (FKZ: 2221NR027B)

**Project:** OpToKNuS – Entwicklung einer "Toolbox" basierend auf numerischen Modellen und Praxismessungen zur Auslegung bzw. Optimierung von thermochemischen Anlagen zur Energiebereitstellung aus alternativen Brennstoffen; Sub-project: Untersuchungen am DBFZ-Festbett-Laborvergaser, Federal Ministry for Economic Affairs and Climate Action, 01/01/2020–30/06/2023 (FKZ: 03KB163B)

**Project:** Pilot-SBG – Forschungs- und Demonstrationsvorhaben I Bioressourcen und Wasserstoff zu Methan als Kraftstoff, Federal Ministry for Digital and Transport, 01/09/2018–31/12/2023 (2 sub-projects)

**Project:** REF4FU – Erneuerbare Kraftstoffe aus grünen Raffinerien der Zukunft; Sub-Project 3, Federal Ministry for Digital and Transport, 01/12/2022–30/11/2025 (FKZ: 16RK24001C)

**Publication:** Etzold, H.; Röder, L.; Oehmichen, K.; Nitzsche, R. (2023). "Technical design, economic and environmental assessment of a biorefinery concept for the integration of biomethane and hydrogen into the transport sector". *Bioresource Technology Reports*, Vol. 22. S. 101476. DOI: 10.1016/j.biteb.2023.101476.

**Publication:** Klüpfel, C.; Herklotz, B.; Biller, P. (2023). "Influence of processing conditions and biochemical composition on the hydrothermal liquefaction of digested urban and agricultural wastes". *Fuel* (ISSN: 0016-2361), Nr. 352. DOI: 10.1016/j.fuel.2023.129016.

**Publication:** Köchermann, J.; Klemm, M. (2023). "Hydrothermal Reactive Distillation of Biomass and Biomass Hydrolysates for the Recovery and Separation of Furfural and Its Byproducts". *Industrial & Engineering Chemistry Research* (ISSN: 0888-5885), Vol. 62, Nr. 18. p. 6886–6896. DOI: 10.1021/acs.iecr.3c00259.

**Publication:** Röder, L. S.; Gröngröft, A.; Grünewald, M.; Riese, J. (2023). "Assessing the demand side management potential in biofuel production: A theoretical study for biodiesel, bioethanol, and biomethane in Germany". *Biofuels, Bioproducts and Biorefining* (ISSN: 1932-1031), Vol. 17, Nr. 1. p. 56–70. DOI: 10.1002/bbb.2452.

**Publication:** Yuan, B.; Braune, M.; Gröngröft, A. (2023). "Liquid-Liquid Extraction of Caproic and Caprylic Acid: Solvent Properties and pH". *Chemie Ingenieur Technik* (ISSN: 1522-2640), Vol. 95, Nr. 10. p. 1573–1579. DOI: 10.1002/cite.202200189.

**Head of the Research Focus Area**
**Dr.-Ing. Franziska Müller-Langer**
Phone: +49 (0)341 2434-423
E-Mail: franziska.mueller-langer@dbfz.de

# 5.4 SmartBiomassHeat

"The heat transition in private residential property will only work if the owners of residential buildings perceive renewable solutions such as grid-connected renewable heat, heat pumps, heat pump biomass hybrids or biomass firing systems as suitable and feasible for them. The heat transition check developed in the OBEN project is intended to encourage precisely this positive perception."

**Dr. Volker Lenz**
Project leader

## OBEN – Oil replacement biomass heating

At around 1,160 TWh/a (2022), heat consumption is the largest final energy consumer in Germany, far ahead of transport and electricity generation. With a share of over 80 % of natural gas, heating oil and coal, the heating transition is still deeply stuck in the fossil age [1]. The provision of low-temperature heat (< 110 °C) for heating buildings in the private household and the tertiary sector alone required around 640 TWh in Germany in 2022 [1]. While the heat pump technology has established itself as the most common heating solution for newly constructed residential buildings with a share of 57 % [2], coal, oil and gas are still the most common heating solutions for multi-family houses and heating system refurbishments in existing buildings. In fact, every gas or oil firing system installed today can technically still be operated in 2045. Therefore, there are only two options for Germany with regard to the goal of climate neutrality by 2045: (i) conversion to renewable gases or heating oils (from sustainably produced biomass or from renewable electricity) or (ii) the heating systems still functioning at that time must be taken out of service and replaced by another heat supply option.

**KEYWORDS**

Heating replacement
heat transition
tool
oil replacement
climate protection
knowledge transfer

At the start of the project "OBEN – oil replacement biomass heating" in 2019, the political agenda did not yet include the idea of banning the installation of fossil-fuelled oil or gas heating systems in residential buildings. In the meantime, the very extensive and very media-driven debate on the Building Energy Act (colloquially: Heating Act) has established the 65 % minimum proportion of renewable heat for new heating systems to be installed in the future. However, at the same time, the rejection of the issue in large parts of the population has been reinforced by the excessive polemics in the media and politics. With 19 million heating systems still to be replaced in the residential sector alone, subsidy programs such as the Federal Subsidy for Efficient Buildings (BEG) can only provide an impetus (otherwise around EUR 30 billion would be needed annually over the next ten years). Rather, the conviction of personal responsibility, coupled with a reduction in hardship for financially weak households, must be promoted. Against this backdrop, the aim of the OBEN project is to facilitate responsible climate protection behaviour.

### Methods

An essential first step of the project was a comprehensive obstacle analysis. To this end, literature analyses were combined with surveys, trade fair visits, personal discussions with stakeholders and feedback on interim results from the stakeholders involved. In the end, it was possible to obtain the summary of obstacles shown in Figure 28.

As a further key element of the project, a catalogue of measures for policymakers was developed from the list of obstacles, further literature results and discussions with stakeholders and discussed in a hybrid workshop at the DBFZ before finalisation. The corresponding statement paper can be viewed on the DBFZ website (see Further information).

In addition to these rather soft measures, specific obstacles in the market should be addressed. At the start of the project in 2019, neither interrupted supply chains nor the effects caused by Russia's attack on Ukraine in violation of international law were an issue. Solutions were to be provided that would allow a quick switch to pellets or other renewable heating options even in the event of an oil or gas boiler breakdown. Extensive research showed that, among other things, the preparatory work for the project had already enabled some manufacturers in the biomass combustion sector to bring standardised solutions onto the market that would allow a switchover in just a few days. There was also a company that offers completely online-capable pellet boiler installations, where customer service is only present online for commissioning. In conjunction with rapidly rising prices and interrupted supply chains, both of these factors led to a shift in the focus of implementation support from fast delivery solutions to a tool for influencing customer perception.

While a completely externally programmed solution was initially considered, discussions revealed that the basic idea of the so called "heat transition check" could also be implemented using an in-house solution with externally supplied templates. This process was finalised by the end of the project so that the roll-out could then take place.

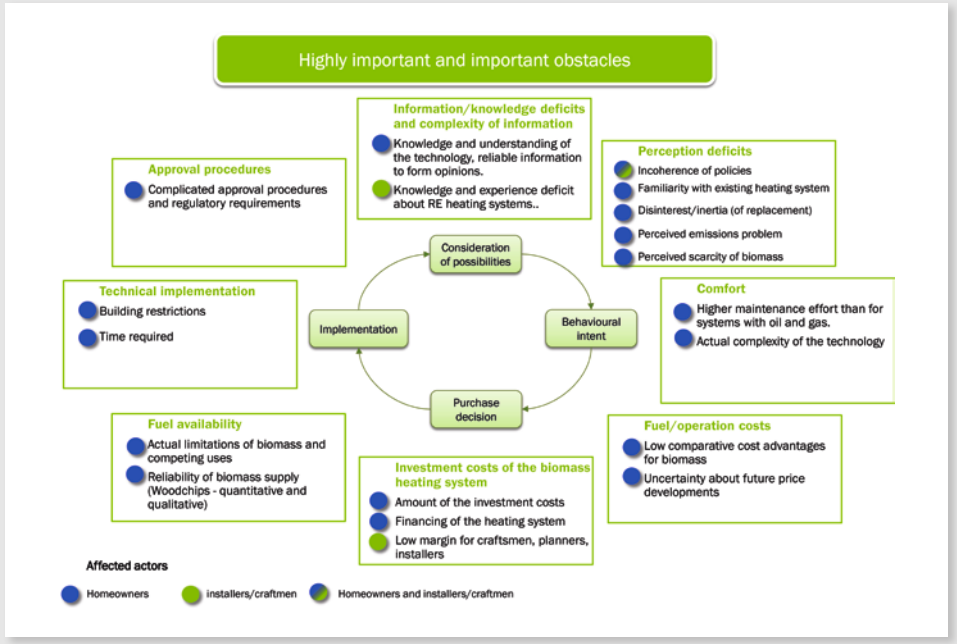



**Fig. 28:** Very important and significant obstacles in the decision-making process for replacing heating systems

## Milestones/Challenges

The picture shown in Figure 28 emerged from the obstacle analysis. A key finding is that there is extensive information on heating replacement on the Internet, but that this is not always easy to find and users find it difficult to assess the truthfulness and timeliness of the information. These and all other identified obstacles are subordinate to a central challenge: the perception deficit. In our pluralistic society with many individual positions and at the same time increasingly aggressive argumentation and even agitation against and rejection of other opinions, the impression often arises that there are no solutions for the future. This also applies to the issue of replacing heating systems. People are faced with considerable investments and fear that the legislator will intervene in their very private lives without understanding why the heating transition needs to happen much faster. The rapid switch from fossil fuels to renewable heat sources, which is absolutely necessary from a climate protection perspective, will bring individual changes for every single heating system owner (see Figure 28). At the same time, however, the entire heating construction industry, including fuel suppliers and chimney sweeps, will have to rethink and adapt to new areas of business and activity. This explains the rapid spread of negative experiences with renewable heating solutions as well as the associated feeling of many people that there is no feasible conversion option for them.



The heat transition check developed in the project (see Figure 29), presents the clearly existing technologies that have been established for years or decades and recommends them as suitable for the specific characteristics of the respective heating system owner. In addition to that, it is also important to support the heat transition in politics and in all other contributing bodies. See also the developed statement paper with recommendations for action to politicians (see Further information).


**Fig. 29:** Website Waermewendecheck.de (Your way to a new heating system)

Despite all the positive results of the OBEN project, the central challenge remains: in disregard of human rights, international law and climate protection, natural gas is and remains an absolutely simple, convenient and fundamentally cost-effective solution for providing energy on both a small and large scale. A rapid heating transition is therefore only possible if renewable heating solutions are only considered when the above disadvantages of

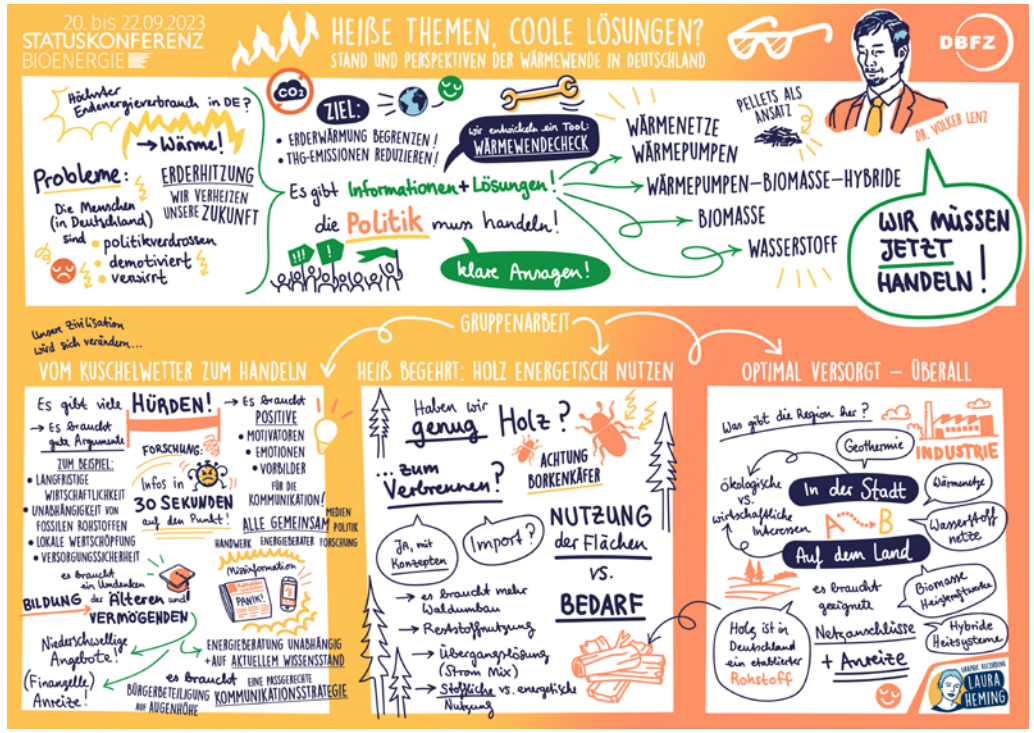



**Fig. 30:** Summary of the results of the OBEN World Café at the 2023 Status Conference


natural gas are taken into account. Effective $CO_2$ prices should have been established in the end customer sector some time ago, the German government should have imposed a surcharge on Russian natural gas in order to feed a financial fund for the consequences of the war that have now occurred and natural gas procurement should have been diversified much earlier and more broadly.

## Perspectives

The OBEN project has confirmed many of the known obstacles such as costs, security of supply, ease of use and installation effort, but at the same time has also differentiated the perception deficit from the supposed information deficit. This makes it possible to resolve the discrepancy between the abundance of helpful information, especially in the digital world, and the articulated feeling of many people that there is no renewable heating solution that works for them (see Figure 30).

The heat transition check was developed as an initial digital consultation to counter precisely this feeling without much effort. With a fundamentally positive idea of a solution for a renewable heating supply for their own heating system, owners can either tackle the concretisation and implementation of their own solution themselves or with the help of well-trained experts or expert systems. If this succeeds in shaping the basic perception of renewable heating solutions in a positive way, the number of units will also increase and prices will fall in the near future, which means that investment subsidies can be reduced or restricted to financially weak citizens.

The next steps involve publicising the tool and linking it to as many websites as possible. In addition, the information available on the DBFZ's framework page is to be continuously expanded in order to help people find helpful information online. In addition, however, the challenge for us as a society remains: we must become much faster in terms of climate protection and this requires much more appreciative discussion, willingness to compromise and working on joint solutions.

## Sources

[1] AGEE Stat, Umweltbundesamt: Zeitreihen zur Entwicklung der erneuerbaren Energien in Deutschland unter Verwendung von Daten der Arbeitsgruppe Erneuerbare Energien-Statistik (AGEE-Stat) (Status: September 2023)
[2] DeStatis Statistisches Bundesamt: Press release no. N034 dated 12 June 2023

**PROJECT PROFILE**

**Duration:**
01/09/2019–31/10/2023

**Scientfic contact:**
Dr. Volker Lenz/Daniela Pomsel

**Project number:**
03KB156

**Funding body:**
Federal Ministry for Economic Affairs and Climate Action/
Project Management Jülich GmbH

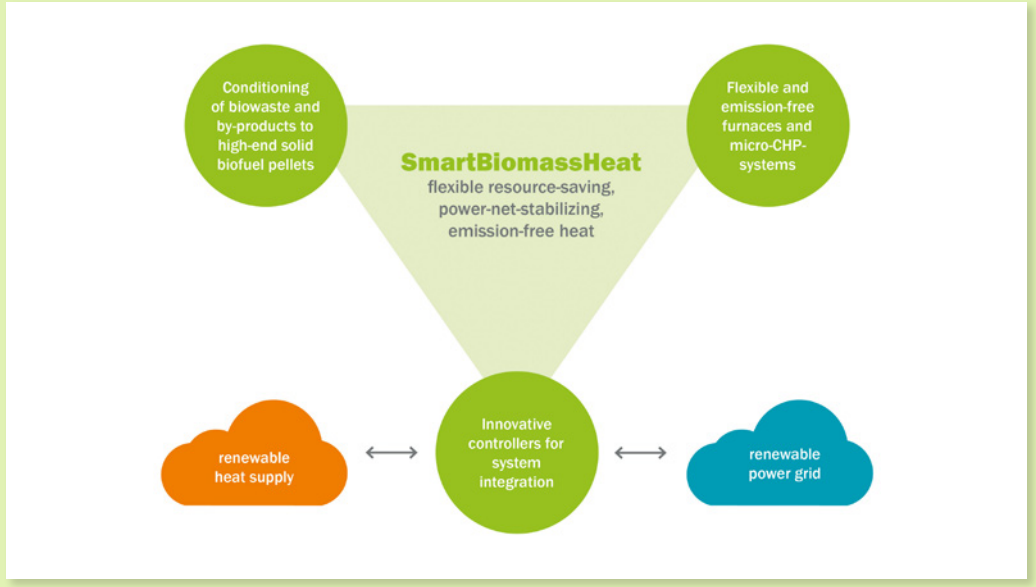
Supported by:

Federal Ministry for Economic Affairs and Climate Action

on the basis of a decision by the German Bundestag

→ **Further information (german language):**
www.dbfz.de/oben-oelersatz-biomasse-heizung
www.waermewendecheck.de
www.dbfz.de/oben/handlungsempfehlungen

→ **Further information:**
www.smartbiomassheat.com




## Research Focus Area “SmartBiomassHeat”

The research focus area concentrates on the small-scale, renewable supply of heat to buildings and building complexes up to villages and neighbourhoods using alternative renewable energy sources and smart heating technology networks that are based on biomass, primarily from residues, by-products and waste. The overarching goal is to make the best technological and economic use of all renewable heat sources through the flexible demand-oriented use of biomass-based heating technologies. The entire chain must be mapped, investigated (both on an individual basis and as a whole), simulated and optimised – from the refinement of biomass fuels via new conversion plants, to the integration of biomass heating systems in the heating and power grid. These biomass heating systems are also designed as future heat-power-cooling systems. By developing the necessary technical components and combining these with the development of control systems, these systems can be optimised for flexible operation as well as for efficient (smart) operation that is environmentally friendly, economic, safe, demand-oriented, flexible and sustainable. With the growing urgency of climate protection, the research focus area is increasingly focussing on the short-term effects of burning carbon-containing fuels. As a result, the levels of consideration are increasingly expanding to include linked material utilisation options for biomass before and after combustion. Extended material utilisation cascades, a more system-friendly integration of biomass combustion, including the provision of high-temperature heat, and the subsequent use of combustion residues such as ash and coal are being specifically researched.



## Important reference projects and publications

**Project:** BioBeton – Biomassebasierte und nachhaltige Herstellung von Betonprodukten, Federal Ministry for Economic Affairs and Climate Action, 01/01/2021–30/06/2023 (FKZ: KK5045102KI0)

**Project:** EBCNAM – Assessment of the Namibian NUST laboratory in order to introduce EBC aligned testing services for producers of biochar, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), 15/12/2022–31/10/2023

**Project:** ETH-Soil – Bodenverbesserung in Äthiopien durch die energetische und materielle Nutzung landwirtschaftlicher Rückstände mit besonderem Schwerpunkt auf Bildung und Ausbildung, Federal Ministry for Econimc Cooperation and Development (BMZ), 01/07/2021–31/12/2026

**Project:** MeBiKo – Metastudie Biokohle, Federal Ministry of Food and Agriculture, 18/07/2022–31/12/2023 (Inhouse)

**Project:** ZirkulierBar – Interkommunale Akzeptanz für nachhaltige Wertschöpfung aus sanitären Nebenstoffströmen Nährstoffwende – von linearer Sanitärspülung zur zirkulären Nährstoffverwertung, Federal Ministry of Education and Research, 01/07/2021–30/06/2024 (FKZ: 033L242H)

**Publication:** Adam, R.; Beneker, C.; Schröder, C.; Calmet, A.; Jung, E.; Kirsten, C.; Krause, A. *EU-Recht nutzen, um Märkte zu erweitern und Ressourcen zu schonen – ein Positionspapier zur Sanitär- und Nährstoffwende* (2023). Berlin et al.

**Publication:** Adam, R.; Pollex, A.; Zeng, T.; Kirsten, C.; Röver, L.; Berger, F.; Lenz, V.; Werner, H. (2023). “Systematic homogenization of heterogenous biomass batches: Industrial-scale production of solid biofuels in two case studies”. *Biomass and Bioenergy* (ISSN: 0961-9534), Nr. 173. DOI: 10.1016/j.biombioe.2023.106808.

**Publication:** Krüger, D.; Mutlu, Ö. Ç. (2023). “The Apeli: An Affordable, Low-Emission and Fuel-Flexible Tier 4 Advanced Biomass Cookstove”. *Energies* (ISSN: 1996-1073), Vol. 16, Nr. 7. DOI: 10.3390/en16073278.

**Publication:** Mutlu, Ö.; Jordan, M.; Zeng, T.; Lenz, V. (2023). “Competitive Options for Bio-Syngas in High-Temperature Heat Demand Sectors: Projections until 2050”. *Chemical Engineering & Technology* (ISSN: 0930-7516), Vol. 46, Nr. 3. p. 559–566. DOI: 10.1002/ceat.202200217.

**Publication:** Pollex, A.; Zeng, T.; Bandemer, S.; Ulbricht, A.; Herrmann, K.; Bräkow, D. (2023). “Characteristics of gasification chars: Results from a screening campaign”. *Biomass and Bioenergy* (ISSN: 0961-9534), Nr. 179. DOI: 10.1016/j.biombioe.2023.106962.

**Head of the Research Focus Area**
**Dr.-Ing. Volker Lenz**
Phone: +49 (0)341 2434-450
E-mail: volker.lenz@dbfz.de

# 5.5 Catalytic Emission Control

"MeKat aims to develop and investigate a sufficiently active and long-term stable catalyst for the total oxidation of methane in the exhaust gas of biogas CHP plants. The basis for this is biogenic silica, which is obtained from the energetic utilisation of biogenic residues and waste materials. In the course of the project, the catalyst development will also be considered under real conditions after upscaling starting from the laboratory scale."

**Dr. Bettina Stolze**
Project manager

## Development of a methane oxidation catalyst based on biogenic silica for the removal of methane in the exhaust gas of biogas CHP plants

The share of renewable energies in Germany's electricity and heating sector has risen steadily in recent years. Biogas plants, in which agricultural residues and renewable raw materials are converted into energy in combined heat and power plants (CHP), have played a significant role in this. Ideally, all combustible hydrocarbon-containing components are completely oxidised to carbon dioxide ($CO_2$) and water ($H_2O$) during the combustion of biogas. Under real conditions, however, unburnt and partially oxidised substances are always released during combustion processes, as in the case of biogas-fuelled

**KEYWORDS**

Catalytic emission control
Methane oxidation
Biogenic silica
Waste recycling
Decoupled active phase



CHP plants. Examples for these pollutants are carbon monoxide (CO), formaldehyde (HCHO), nitrogen oxides ($NO_x$) and methane ($CH_4$). The Technical Instructions on Air Quality Control (TA-Luft) stipulate legal limits for pollutant emissions, which were tightened in the 44th BImSchV ("Engine Ordinance" to the Federal Immission Control Act) in June 2019.

Corresponding emission limits cannot be met by internal engine (primary) measures alone due to the conflict of objectives between nitrogen oxide and hydrocarbon abatement, as engine settings that nitrogen oxide emissions result in an increase in hydrocarbon emissions and vice versa. For this reason, oxidation catalysts (CO, HCHO) and SCR catalysts ($NO_x$) are already available on the market as secondary emission reduction measures.

With the introduction of the 44th BImSchV, limit values for organic carbon emissions (total C) were set for the first time, which brought the topic of methane slip as the main component of these emissions more into the focus of research. Methane slip refers to the escape of significant quantities of unburned methane fuel gas into the atmosphere. Biogas inherently has a lower methane content (50–60 %) than natural gas, for example (> 95 %). The mixture is therefore less willing to ignite and in some cases misfiring can occur, as well as so-called "cold spots" during combustion. Both lead to methane slip, i. e. unburnt fuel being fed into the exhaust tract. In addition to the resulting effects on climate change, methane slip contributes to efficiency losses, as methane slip cannot be converted electrically or thermally without a catalyst and must therefore be counted as a loss. Catalytic post-combustion is a promising way of reducing these emissions and thus making a significant contribution to climate protection and resource efficiency. As methane oxidation catalysts developed to date do not yet have sufficient activity and stability for practical application, there is still a considerable need for research in this area.

The research project aims to develop a catalyst based on biogenic silica that minimises methane slip in the exhaust gas from biogas CHPs. The aim is to ensure compliance with existing and future limit values for methane emissions and to reduce overall methane emissions despite the expansion of renewable energies.

### Methods

For silicon dioxide to be used in catalysis, it must be available in the amorphous modification. Production is energy-intensive and requires the use of expensive chemicals. The price of the material depends on the purity of the product. The use of technical silicon dioxide as a catalyst carrier is therefore neither economical nor environmentally friendly. The project utilises the thermal conversion of biogenic residues to produce biogenic silica. This involves the cascade utilisation of rice husks, which would otherwise remain in the fields in the producing countries or be incinerated in an uncontrolled manner due to the prevailing disposal problem, thus causing environmental and health damage. Through thermochemical conversion in a boiler, the biogenic residues that are not in competition with food and animal feed production are utilised both energetically and materially, as both the heat released in the production process and the ash can be used as products.

The catalyst structure is based on the concept of decoupling metal and metal oxide on biogenic silica. Firstly, the catalyst is to be applied as a washcoat to α-aluminum oxide hollow spheres. Secondly, hollow spheres are to be produced from the powdered catalyst. These hollow spheres can be produced with a defined geometry and porosity.

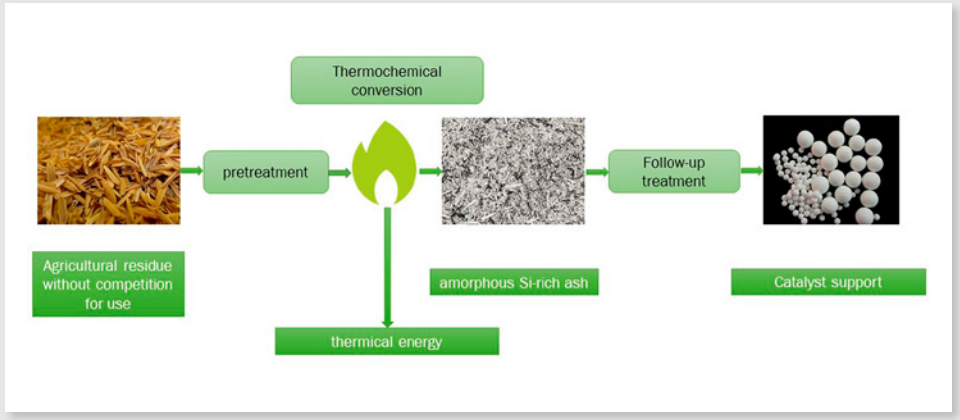



**Fig. 31:** Synthesis route of the catalyst carrier based on biogenic silica

The transfer of the catalyst into a monolitic state form will be the subject of research in the second year of the project. In preparation for this, the synthesis route of the catalyst was adapted and moulding and stability tests were carried out with the biogenic silica.

In the course of the project, the catalyst development will be modelled under real conditions, starting from the laboratory scale after upscaling. The investigations are to be carried out under practical conditions.

## Milestones/Challenges

The catalytic oxidation of methane to carbon dioxide (total oxidation) is a practicable approach to eliminating methane emissions. One difficulty is the low reaction rate under humid flue gas conditions and flue gas temperatures of CHP units of less than 450 °C. As the efficiency is decisive for the design of these systems, it is not possible to adjust or set the operating parameters in such a way that a higher exhaust gas temperature results. On the contrary, CHP manufacturers and operators are endeavouring to reduce the exhaust gas temperature in order to achieve higher efficiencies. However, catalytic converters typically used for exhaust gas aftertreatment (e.g. for vehicle engines) require temperatures above 450 °C in order to oxidise methane with sufficiently high conversion rates. Catalytic converters investigated to date, which are capable of achieving high methane conversion rates even at temperatures below 450 °C, are generally not very stable over the long term or are very sensitive to short-term temperature peaks. These can occur quite frequently in CHP units.

According to current research, Pd catalysts have proven to be the most active candidates for use at low temperatures [1]. Compared to metallic Pd, PdO is said to be the more active phase at lower temperatures. Consequently, $CeO_2$ is one of the most effective supports for palladium as it enhances catalytic activity through Pd reoxidation [2]. In laboratory studies, the water produced in total oxidation has been identified as a major cause of deactivation [3]. Investigations into decoupled Pd-$CeO_2$ systems by means of support on



porous glass showed a significantly improved resistance to water. The disadvantage so far has been the much more expensive industrial glass compared to the Pd component, so that industrialisation did not appear possible. In a joint project between the DBFZ and LIKAT, the replacement of the carrier component with inexpensive, biogenic silica was demonstrated in earlier work [4], which is the basic prerequisite for scaling up such new methane oxidation catalysts.

The rice husk ash could be produced with a purity of > 98 Ma.-% Silicon dioxide and a crystalline content < 1 wt.-% by appropriate pre-treatment of the starting material. The powdered biogenic silica is homogenised and converted into a solid in the form of a hollow sphere in order to be able to use the catalyst in real applications in biogas CHP plants. In addition to the aspect of weight reduction and material savings compared to a solid sphere, the structure also offers good modelling capability of the catalyst bed due to the adjustable and slightly fluctuating diameter distribution of the hollow spheres. Furthermore, the adjustable porosity and pore size distribution allow the catalyst carrier to be customised to the required conditions.

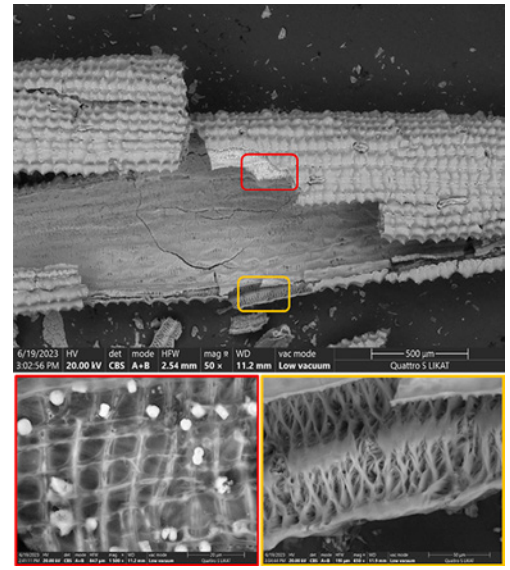



**Fig. 32:** Electron microscope image of rice husk ash



## Perspectives

The significant reduction in methane emissions targeted in the project makes a significant contribution to reducing greenhouse gases. This makes the use of biogenic residual and waste materials for energy generation ecologically justifiable. Biogas CHP plants are considered as an exemplary application in the project. However, this development can be extended to various types of plant for the energetic utilisation of biomass. With the possibility of effectively decreasing methane emissions, the spectrum of utilisable fuels based on biogenic residues and waste materials is expanded. The technical integration of the active and long-term stable catalyst must then be adapted accordingly.

The use of hollow spheres made of biogenic silica will be a novelty on the market for catalyst carriers. In combination with various active species, further catalysts can be developed for gas purification as well as for the production of basic organic chemicals. In addition, a catalyst that can activate methane is also conceivable for other applications. For example, there are currently no catalysts available on the market that can produce synthesis gas in dry reforming without auxiliary agents.

Making a methane oxidation catalyst available can promote its use in other technologies that contain methane. In this way, legal framework conditions could be adapted that would motivate the players in the various industries to reduce methane. Examples include the use in conventional natural gas

CHP plants, in vehicles that use methane as a fuel or for residual methane reduction from $CO_2$ exhaust gas in biomethane production.

## Sources


[1] Monai et al.; “Catalytic Oxidation of Methane: Pd and Beyond” EurJIC 2018(25) (2018) 2884-2893

[2] Colussi et al.; “Structure-activity relationship in $Pd/CeO_2$ methane oxidation catalysts” Chin. J. Catal. 41(6) (2020) 938-950

[3] Smith et al.; “Deactivation of Pd Catalysts by Water during Low Temperature Methane Oxidation Relevant to Natural Gas Vehicle Converters” Catalysts 5(2) (2015) 561

[4] Liu et al.; “Rice Husk Derived Porous Silica as Support for Pd and $CeO_2$ for Low Temperature Catalytic Methane Combustion” Catalysts 9(1) (2019) 26


**PROJECT PROFILE**

**Duration:**
1/1/2023–31/12/2025

**Scientfic contact:**
Dr. Bettina Stolze

**Project partner:**
Leibniz Institut für Katalyse e.V.,
Department of heterogeneous catalytic processes;
Hollomet GmbH;
Emission Partner GmbH & Co. KG

**Project number:**
03EI5456

**Funding body:**
Federal Ministry for Economic Affairs and Climate Action/ Project Management Jülich GmbH


Supported by:

Federal Ministry for Economic Affairs and Climate Action

on the basis of a decision by the German Bundestag


## Research Focus Area “Catalytic Emission Control”

The vision of a climate-neutral and sustainable bioeconomy – and the premises associated with this – place very high demands on the research focus area “Catalytic Emission Control” at pollutant-free bioenergy. In particular, increased use in the future of biogenic residues and waste materials in increasingly varying qualities represents a challenge for emission-free bioenergy. The focus here is on controlling the emissions of the combustion processes of bioenergy carriers through the use of and in combination with solid-state catalysts. An extensive abatement in the greenhouse gas methane ($CH_4$) and toxic volatile organic compounds (VOC), semi-volatile as well as low-volatile hydrocarbons, such as polycyclic aromatic hydrocarbons (PAH) and polychlorinated dioxins and furans (PCDD/PCDF), soot particles (carbon black), and nitrogen oxides ($NO_x$) is required. The objective of the research focus area is to investigate recyclable and cost-effective catalysts which are stable over a long time on stream and at high temperatures. These catalysts should contain no or a significantly lower amount of precious metals. In particular, combining catalysts with additional emission abatement processes needs to be investigated in detail.



## Important reference projects and publications

**Project:** ABiOx – Thermochemische Umwandlung von siliziumoxidreichen Biomasse-Rückständen zur Erzeugung von Wärme und Strom sowie der gekoppelten Erzeugung von mesoporösem biogenem Silica für die Materialanwendungen, Federal Ministry of Food and Agriculture, 01/10/2019–31/05/2023 (FKZ: 2819D0KA05)

**Project:** BioFeuSe – Neue Sensorik für die Prozessoptimierung von SCR-Verfahren und Partikelabscheidung an Biomasseverbrennungsanlagen, Federal Ministry for Economic Affairs and Climate Action, 01/07/2021–30/06/2024 (FKZ: 03EI54346A)

**Project:** OSchein – Erstellung von Schulungsmaterial zum richtigen Heizen mit Holz (Stove licence), Market project, 05/11/2021–30/06/2023

**Project:** PaCoSil – Verbrennung regionaler Reststoffe zur energetischen Nutzung von Biomasse mit gekoppelter Erzeugung von biogenem Silika für Feinstaubfilter-Prozesse, Federal Ministry for Economic Affairs and Climate Action, 01/07/2021–30/06/2024 (FKZ: 03EI5436A)

**Project:** UFP-MESS – Messung ultrafeiner Partikel aus Kleinfeuerungsanlagen, Market project, 27/07/2022–30/11/2025 (FKZ: 3721522050)

**Publication:** Formann, S., Hartmann, I., Stinner, S.: “Utilization and management strategies for biomass from phytoremediation or phytomining”, Lecture at the 21st Jena Remediation Symposium 2023: BioGeo interfaces under stress, Friedrich Schiller University Jena, 05–06/10/2023

**Publication:** Hartmann, I.; “Emissionsminderung an Holzfeuerungen durch Kombination von schulischen und technischen Maßnahmen”, Presentation at the Bioenergy 2023 status conference, Leipzig, 21/09/2023

**Publication:** Hartmann, I., Formann, S., König, M., Bindig, R., Stolze, B., Sittaro, F.-C., Schliermann, T.: “Study on the feasibility of in-situ extraction of biogenic silica from rice husks in the Mekong Delta”, Lecture and conference proceedings of the 17th Rostock Bioenergy Forum, University of Rostock, 15–16/06/2023

**Publication:** König, M.: “Emisiones de dióxido de azufre (SO2): Origen, características y disminución” Presentation at the webinar “Emisiones de dióxido de azufre (SO2): Normativa, medición y control”, University of Talca, Chile, 25/07/2023

**Publication:** Owusu Prempeh, C.; Hartmann, I.; Formann, S.; Eiden, M.; Neubauer, K.; Atia, H.; Wotzka, A.; Wohlrab, S.; Nelles, M. Comparative Study of Commercial Silica and Sol-Gel-Derived Porous Silica from Cornhusk for Low-Temperature Catalytic Methane Combustion. Nanomaterials 2023, 13, 1450. https://doi.org/10.3390/nano13091450

**Head of the Research Focus Area**
**Prof. Dr. rer. nat. Ingo Hartmann**
Phone: +49 (0)341 2434-541
E-mail: ingo.hartmann@dbfz.de

# 6 Promotion of young scientists




**Fig. 33:** 6th Doctoral Colloquium BIOENERGY at the HAWK in Göttingen

The DBFZ's doctoral programme, which has been running since 2013, offers doctoral students a wide range of opportunities to work on a topic in the field of bioenergy/ bioeconomy and apply the knowledge they have acquired in applied research. In the DBFZ's well-equipped laboratories, pilot plants and offices, they have access to state-of-the-art technology for practical work on their research topics. The professional supervision by experienced DBFZ scientists is an additional guarantee for high-quality doctoral supervision and research. Regular participation in high-ranking scientific events (e. g. Doctoral Colloquium BIOENERGY and DBFZ Annual Conference) introduces young doctoral researchers to the scientific community at an early stage. In addition, they are given the opportunity to consolidate their experience within the framework of committee work.

## 6th Doctoral Colloquium BIOENERGY at the HAWK in Göttingen

The sixth edition of the Doctoral Colloquium BIOENERGY took place on 18/19 September 2023 at the University of Applied Sciences and Arts Hildesheim/Holzminden/Göttingen (HAWK). A total of 42 participants from ten countries (Austria, China, Colombia, Germany,

BIOENERGY
DOC2023
6TH DOCTORAL
COLLOQUIUM BIOENERGY

Great Britain, India, Iran, Italy, Norway and Pakistan) were present and presented their new results and findings in more than 30 lectures, scientific posters and a stimulating get-in-touch session. In addition to a total of five sessions and a central poster exhibition, the conference programme was rounded off by a tour of the HAWK NEUTEC – Department of Sustainable Energy and Environmental Technology and the BioWärmeZentrum Stadtwerke Göttingen. The next event will take place on 24/25 September 2024 at the DBFZ in Leipzig.

**→ Further information:**
**www.doc-bioenergy.de**
**www.linkedin.com/showcase/doctoral-colloquium-bioenergy**

**Tab. 4:** Overview of doctorate figures (as at 1 February 2024)

| | |
|---|---|
| **Number of doctoral projects in 2023** | **55** |
| of which are supervised at the DBFZ | 34 |
| of which are supervised at the universities of Leipzig, Rostock and UFZ | 21 |
| of which were successfully completed | 7 |
| Further co-operation with national and international universities and universities of applied sciences in the context of supervising the above-mentioned doctoral projects | 11 |

## Doctoral Interview with Selina Nieß (Biorefineries Department)

**Hi Selina, you have been a doctoral student at the DBFZ since 2020. Can you explain in simple terms what your doctoral thesis is about?**

**SELINA NIESS:** Nothing could be easier! In my PhD thesis, I am investigating catalysts that convert the $CO_2$ in biogas into methane with the help of hydrogen. The aim is to process biogas into biomethane so that it can be used as a fuel, e.g. for heavy-duty transport.

**What were/are the biggest challenges when writing your dissertation?**

**SELINA NIESS:** For me, the test facility where I do my experiments is the biggest boss. When it runs, it runs well, but there have been a few problems in recent years that have caused delays. From the pressure vessel of a compressor pump being sucked dry by another test rig, causing an emergency shutdown of my system, to a measuring device with dirt deposited on its separation column, a number of unpredictable things have happened.

**Writing a doctoral thesis can be very tedious. How do you manage to motivate yourself?**

**SELINA NIESS:** One of my biggest motivators are the colleagues around me who are also doing their PhDs and started around the same time as I did. When I hear about new results or publications from my fellow doctoral students, I usually think that now is the time for me to step on the gas again. It also helps me from time to time to concretize the central theme of my work and to write down what still needs to be done. Most of the time it's more manageable than I expected.

**You won second prize at the "DGAW Wiko" doctoral colloquium in 2023. How important are such awards?**

**SELINA NIESS:** Of course, such awards are also a great motivation. In any case, it's nice to see that your own research is also of interest to other people and that the work you put into preparing a presentation, for example, is recognized in this way. Such awards are also certainly an eye-catcher on your CV.

**What added value did you gain from the DBFZ's doctoral program?**

**SELINA NIESS:** Through the PhD program, I was able to get to know the other PhD students at the DBFZ with their very different PhD topics in a relaxed atmosphere at the PhD coffee rounds. I especially like the annual doctoral colloquium. It's a good opportunity to practice presenting your own research results before you stand on stage with renowned scientists at major conferences.

**You plan to complete your thesis in 2024. What advice can you give future doctoral students?**

**SELINA NIESS:** Don't wait too long to publish your results if you are doing a cumulative PhD. The whole writing and publishing process can be quite lengthy. And most importantly, stick with it. Every dissertation has its ups and downs. That's completely normal.

**Thank you Selina and good luck for the future!**



© Privat

**Fig. 34:** Doctoral Student Selina Nieß

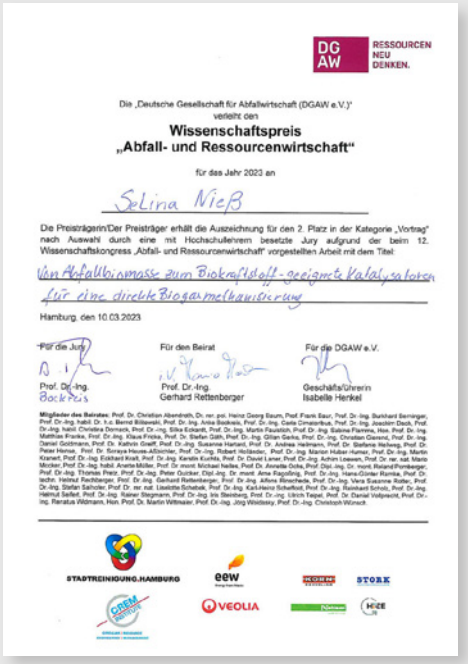



**Fig. 35:** Second prize at the 12th DGAW Scientific Congress "Waste and Resource Management"

# List of current doctorates at the DBFZ

(as at 31 January 2024)
* Successful completion in 2023

**Adam, Roman**
Investigation of the compaction of biomass by means of DEM simulation
Technical University of Berlin

**Bindig, René**
Method for the development of catalysts for emission reduction at combustion plants
Martin-Luther-University Halle-Wittenberg

**Chang, Yingmu**
Economic analysis and carbon emission reduction strategies of China's agricultural biogas and biomethane and strategies with regard to Germany's experience
University of Leipzig

**Delory, Felix**
Model-based monitoring of anaerobic digestion plants
Technical University of Berlin

**Dernbecher, Andrea***
Numerical investigation of emissions from small-scale biomass heating systems
Technical University of Berlin

**Dietrich, Sebastian**
Biogas upgrading to H-gas by direct synthesis of short-chain hydrocarbons
Technical University of Berlin

**Dotzauer, Martin**
Economic evaluation of policy instruments to achieve the expansion targets of bioenergy plants in the electricity sector with the help of object-oriented programming
University of Leipzig

**d'Espiney, Ana Careirra**
Bioenergy production optimization through complementary effluents management
University of Lisbon

**Gallegos, Daniela**
Optimization of ensiling fermentation of Elodea genus for biogas production
University of Rostock

**Gebhardt, Heike**
Heat grids 4.0 – options for the use of solid biomass in decarbonised heat grids
Technical University of Dresden

**Gökgöz, Fatih***
Development and optimization of off-grid biogas processing plants with integrated filling station technology for a local fuel supply with biomethane
University of Rostock

**Hahn, Alena**
The role of smart bioenergy in combination with $CO_2$ removal in decarbonisation scenarios
University of Leipzig

**Hellmann, Simon**
Process monitoring and advanced control of agricultural biogas plants
Technical University of Chemnitz

**Hirschler, Olivier**
Potential of renewable resources to replace peat as a substrate feedstock in German horticulture
University of Leipzig

**Karras, Tom**
Biomass supply costs for biogenic residues
University of Leipzig

**Klüpfel, Christan Paul**
Hydrothermal liquefaction of residual biomasses
Technical University of Berlin/Aarhus University, Denmark

**Köchermann, Jakob**
Hydrothermal production of furfural from biomass and biomass hydrolysates
Technical University of Berlin

**König, Mario**
Investigations on the development and application of novel SCR catalysts for nitrogen oxide reduction of exhaust gases from the thermo-chemical conversion of biogenic solid fuels
Martin-Luther-University Halle-Wittenberg

**Kurth, Matthis**
Operating conditions and mass transport descriptions of water-separating membranes in biorefinery processes
Technical University of Berlin

**Meola, Alberto**
Artificial Intelligence for process simulation of anaerobic digestion plants
University of Leipzig

**Muluneh, Mekonnen Betelhem***
Anthrosols of the Bale Mountains: Archives for reconstructing settlement chronology and intensity and interactions with fire and destruction of Erica vegetation on the Sanetti Plateau.
Martin-Luther-University Halle-Wittenberg

**Ngoumelah, Daniel Dzofou***
Electrochemical activity and stability of Geobacter spp. dominated biofilm anodes in anaerobic digestion
University of Leipzig

**Nieß, Selina**
Methanation catalysts for direct biogas methanation of upgraded biogas
Technical University of Berlin

**Nitzsche, Roy***
Adsorption and Membrane Filtration for the Separation and Valorization of Hemicellulose from Organosolv Beechwood Hydrolyzate
Technical University of Berlin

**Pouresmaeil, Shabnam**
Bioelectrochemical Power-to-Gas using bed electrodes based on biochar
University of Leipzig

**Prempeh, Clement Owusu**
Generation of silicon dioxide from biogenic residues for advanced applications
University of Rostock/University of Stellenbosch, South Africa

**Reinelt, Torsten**
Monitoring of spatially unknown and time-varying methane emissions at biogas plants
Technical University of Dresden

**Richter, Lukas**
Optimised energy management in an energy cell
Technical Unviersity of Dresden

**Richter, Sören**
Bioeconomy scenarios for Germany until 2050
University of Leipzig

**Röder, Lilli Sophia**
Implementation of demand side management in biorefineries
Ruhr-University Bochum

**Siol, Christoph**
Assessing new technologies for the circular bio-economy with combined environmental and economic LCSA
University of Leipzig

**Sumfleth, Beike**
Integrated assessment framework for sustainability certification of low indirect land use change risk biomass
University of Leipzig

**Undiandeye, Jerome Anguel***
Ensiling and Anaerobic Digestion of Plant Biomass for Energetic and Material Utilization
University of Rostock

**Weber, Svenja Nathalie**
Degradation and sorption behaviour of veterinary antibiotics and metabolites during anaerobic digestion of dry chicken manure
University of Rostock

**Wedwitschka, Harald**
Method development for feedstock characterisation for pit fermentation processes
University of Rostock

**Wilde, Kerstin**
Bioeconomy from an actor perspective
Martin-Luther-University Halle-Wittenberg

**Fig. 36:** "How to make it in Saxony": DBFZ doctoral students Clement Owusu Prempeh (left) and Daniel Dzfou Ngoumelah, at the summer party of Saxony's Minister President Michael Kretschmer (22 August 2023)

# List of ongoing doctorates with the cooperation partner Helmholtz Centre for Environmental Research GmbH – UFZ

(as at 31 January 2024)

**Chan, Katrina**
Modelling biomass energy use in sustainable agriculture and food scenarios
University of Leipzig

**Cheng, Zhe**
Fate and effects of antibiotics in anaerobic digestion systems
Technical University of Berlin

**Guerra-Blackmer, Elliot**
Microbiological strategies to mitigate foaming events in biogas reactors
University of Leipzig

**Kähl, Daniel**
Reduction of the inhibitory effects of propionic and butyric acid in methanation by promoting direct interspecies electron transfer
University of Leipzig

**Manske, David**
Monitoring Renewable Energy Landscapes in Germany: A spatial-systemic approach.
University of Leipzig

**Musonda, Frazer**
Modelling of Bioenergy and bioeconomy futures: The optimal allocation of biomass to competing sectors
University of Leipzig

**Sadr, Mohammad**
Modeling bio-based NETs in Germany considering regional perspectives
University of Leipzig

**Schäfer, Christina**
Engineering microbial communities for the conversion of lignocellulose into medium-chain carboxylates
University of Leipzig

**Strobel, Piradee**
Sustainable bioethanol development for an approach to circular economy in Thailand – an evaluation by multi-criteria decision making
University of Leipzig

**Welker, Matthias**
Governance Monitor – Tracking and assessing governance narratives for sustainability transformations
University of Leipzig

**Zeug, Walter**
A holistic life cycle sustainability assessment for bioeconomy regions – linking regional assessments, stakeholders and global goals
University of Leipzig



# List of ongoing doctorates with the University of Rostock

(as at 31 January 2024)

**Afrakoma Armoo, Ekua**
Closing the loop in a circular economy – sustainable compost product from fermentation residues
University of Rostock

**Al-Bewani, Rzgar**
Press water fermentation
University of Rostock

**Chaher, Nour El Houda**
Potential of Sustainable Concept for Handling Organic Waste in Tunisia
University of Rostock

**Daldrup, Markus**
Integration of a plant for the production of insect products into the material cycles at Gut Hülsenberg
University of Rostock

**Darmey, James**
Continuous process biogas production from municipal solid wastes from Ghana
University of Rostock

**Ender, Tommy**
A concept for the treatment and nutrient recovery of process waters from the hydrothermal carbonisation of wastes
University of Rostock

**Fröhlich, Janina**
Dynamic conversion of biogenic carbon dioxide with regeneratively produced hydrogen into a chemical energy carrie
University of Rostock

**Gievers, Fabian***
Comparative investigation and balancing of process chains for the production and use of vegetable coal
University of Rostock

**Kusuma, Angga**
Waste utilization as fuel and alternative material in Cement industry
University of Rostock

**Sarquah, Khadija**
Production of refuse derived fuels from municipal solid waste
University of Rostock

**Shahpasand, Masoud**
Development and implementation of different tailored regional models assuring best practice in waste management
University of Rostock

**Shettigondahalli Ekanthalu, Vicky**
Hydrothermal carbonization – A sustainable approach to treat and manage sewage sludge produced in Mecklenburg-Vorpommern
University of Rostock

**Vincent, Lynn**
Expansion of energy system modelling for Thuringia – survey of biomass potentials, expansion of bioenergy pathways, life cycle assessment
University of Rostock

**Weppel, Johanna**
Options for action for mechanical-biological waste treatment plants (MBA) against the background of future technical, social and legal framework conditions
University of Rostock

→ **Further Information:**
**www.dbfz.de/en/career/phd-program**

**Contact**
**Dr. Elena Angelova**
Phone: +49 (0)341 2434-553
E-mail: elena.angelova@dbfz.de

# 7 Science Communication: Press, Projects, Events

In 2023, DBFZ scientists actively contributed in a variety of ways to communicating the centre's knowledge and current research topics to the defined target groups (politics, business and the scientific community) and the general public, successfully contributing to the debate on the national energy transition as experts. In addition to the preparation of scientific publications, a continuous social media presence, press and media work and a large number of specialist and public events and guided tours for visitors, the DBFZ was also able to further expand the utilisation of results from individual research projects under its coordination.

## Press and Media

In the press/media area, a wide variety of media articles were generated in 2023, both on specific research projects and on DBFZ topics. Increasingly, DBFZ colleagues positioned themselves as experts on the topics of bioenergy and the bioeconomy. Scientific expertise was used in podcasts, panel discussions, video contributions on research projects and in print and online media. Media highlights of the year included a two-day shoot by Bayerischer Rundfunk on the "CapUp" project (programme "Gut zu wissen!"), a podcast with Dr. Peter Kornatz (Head of the Biochemical Conversion Department) on the topic of "What contribution can bioenergy make to the energy transition?", as well as appearances by Prof. Dr. Daniela Thrän (DBFZ/UFZ/University of Leipzig) on the programmes "Planet Wissen" and "Radio Eins" (Die Profis).

### DBFZ scientists in the media

**Fig. 37:** Scientist Maria Braune during filming with Bayerischer Rundfunk


**Fig. 38:** Aufgeladen (Recharged) – the energy podcast with Dr. Peter Kornatz


**Fig. 39:** Prof. Dr. Daniela Thrän on the tv show "Planet Wissen" (SWR)

→ **Further information:**
**www.dbfz.de/en/press-media-library/press**

## Project communication

In 2023, various communication formats, some of them new, were realised as part of selected research projects. The video feature “From hemp to composite material” shows the bioeconomy in practice using the example of natural fibres and the possible applications of hemp fibres and was created in the “BRANCHES” project. Another highlight in the field of bioeconomy was the communication support for the “Bioeconomy Workshop Saxony”. The series of events with a barcamp character aimed to open up the possibilities of the bio-based economy in Saxony for small and medium-sized enterprises (SMEs). Another “media product” was created as part of the “OBEN” research project (see page 34). The “Wärmewendecheck” information page is aimed at private households in Germany and aims to provide a quick and clear overview of sustainable heating systems for residential buildings.

→ **Further information (german language):**
**https://youtu.be/aVnZ9S008ys?si=C2IQ4F1G7YHogeSL**
**www.dbfz.de/werkstatt**
**www.waermewendecheck.de**

The aim of communication for the “Pilot-SBG” research and demonstration project, which has been running since 2018, is to promote professional dialogue with science and industry. To this end, the project website in particular has been comprehensively expanded as a central communication medium. In addition,


**Fig. 40:** Video feature “From hemp to composite material”


**Fig. 41:** Freely available focus booklets in the “Pilot-SBG” project



core processes and project objectives were presented with infographics, photos and videos. Central aspects of renewable methane in transport and the installed pilot plant were published in three detailed focus booklets. Great importance was attached to target group-orientated presentation (e. g. through graphic abstracts). Communication – as well as the announcement and documentation of scientific lectures and events – took place via social networks (Linkedin/Youtube). The commissioning of the pilot plant, which could take place in relevant parts in 2023, was also documented in detail (photos, time-lapse video) and communicated. Numerous guided tours promoted practical dialogue with the specialist audience.

→ **Further information:**
**www.dbfz.de/en/projects/pilot-sbg**


Thüringer Allgemeine

Würmer erzeugen Humuserde: Wissenschaftler aus Afrika informieren sich im Kreis Gotha über das Verfahren

01.09.2023, 16:00 Uhr • Lesezeit: 2 Minuten

Von Conny Möller

Günter Hebestreit, Vorsitzender des Wurmvereins Tambach-Diethar (rechts), zeigt den äthiopischen Gästen sowie Wissenschaftlerin Sophia Bothe (links), wie die kleinen Helfer die Humusproduktion auf Trab bringen.

© Conny Möller

Tambach-Diethar. **Äthiopische Gäste besuchen die Wurmanlage in Tambach-Diethar. Lassen sich in ihrer Heimat auf diese Weise womöglich erschöpfte Böden wiederbeleben?**

© Conny Möller, Thüringische Landeszeitung, local edition Gotha

**Fig. 42:** 1st Study trip with Ethiopian scientists (reporting by Thüringer Allgemeine online)

Project-related science communication was also further expanded in an international context. The ETH-Soil project in Ethiopia was continuously supported and utilised in the media with short videos and a dedicated Linkedin channel. In particular, the focus was on social media support for a study trip by Ethiopian partners in Germany and Austria (including press coverage and photo documentation) and the Soil Symposium. This event on the topic of soil improvement with biochar-based organic fertilisers, among others, took place for the second time in the Ethiopian capital Addis Ababa and offered project managers, scientists and stakeholders the opportunity to communicate and expand networks. The symposium also helped to raise the profile of the project in Ethiopia.

ETH-SOIL

→ **Further information:**
**www.eth-soil.com**
**www.linkedin.com/showcase/eth-soil**


**Fig. 43:** New editions of the “DBFZ Report” publication series

## New publications: “DBFZ Report”

In 2023, four new issues were published as part of the scientific publication series “DBFZ Report”. In his dissertation, DBFZ doctoral student Roy Nitzsche dealt with the topic of “Adsorption and membrane filtration for the separation and valorisation of hemicellulose from organosolv beechwood hydrolysates”. His findings can be found in DBFZ Report No. 48. Issue No. 49 deals with the “MoreBio” project, which has been completed in 2023, and provides a comprehensive overview of the bioeconomy in the Central German and Lusatian mining areas. DBFZ Report No. 50 “Biogas production and utilisation in Germany” provides a comprehensive overview of the national stock of biogas and biomethane plants. In addition, the DBFZ Report No. 44 “Monitoring renewable energies in transport” was published in a revised and corrected edition as well as in an English-language version. All issues as well as annual reports, brochures and conference readers are available as free PDF downloads from the following addresses.

→ **Downloads:**
**www.dbfz.de/en/reports**
**www.dbfz.de/en/broschures**
**www.dbfz.de/ en/conference-reader**
**www.dbfz.de/en/annual-report**

**Contact**
**Paul Trainer**
Phone: +49 (0)341 2434-437
E-mail: paul.trainer@dbfz.de



## Event and visitors management

The year 2023 was characterised by a large number of internal and external events and event participations in the area of event and visitor management. In addition to organising numerous project meetings, workshops and in-house events, almost sixty external specialist events and event collaborations were also held, further increasing the DBFZ’s visibility in the scientific community. In addition, the DBFZ welcomed over 40 groups of guests totalling more than 740 people in 2023. Guests from ReTech, DGAW, the IEA Bioenergy Technology Collaboration Programme (Task 39) and the IEA Advanced Motor Fuels Technology Collaboration Programme (AMF TCP) as well as from more than ten colleges and universities (including Merseburg University of Applied Sciences, Leipzig University, TU Dresden, Martin Luther University Halle-Wittenberg, Münster University of Applied Sciences), Abilene Christian University (USA, Texas) and Anhui University (China) visited the DBFZ and gained an overview of the state of research in the field of bioenergy/bioeconomy.

## Event Highlights 2023

### Process measurement conference

The sixth edition of the english-language conference on process measurement technology in biogas plants (CMP) on 22/23 March 2023 focused on the requirements for measuring instruments, best practices and practical applications as well as new monitoring and control devices in the field of anaerobic fermentation. Around eighty participants took advantage of the face-to-face event to engage in intensive professional dialogue and networking. The next edition of the event will take place in 2025.

→ **Further information:**
**www.dbfz.de/cmp**

**Fig. 44:** 6th edition of the International Conference on Monitoring and Control of Anaerobic Digestion Processes

## Closing event of the “SoBio” strategy project

At a virtual closing event held jointly with the Helmholtz Centre for Environmental Research (UFZ) on 20 April 2023, around 360 scientists presented and discussed the results of the strategy project “SoBio – Scenarios for optimal biomass use in the energy transition” (see page 34). In addition to the presentation of the core results from the medium and long-term scenarios, various experts gave five-minute statements on selected topics relating to the integration of bioenergy in the energy system.

→ **Further information and results (german language):**
**www.dbfz.de/sobio**

## Anniversary event “15 years of DBFZ”

To mark the 15th anniversary of the DBFZ, an anniversary event was held at the DBFZ on 24 August 2023 with the participation of almost 230 internal and external guests. State Secretary Sylvia Bender from the Federal Ministry of Food and Agriculture accepted the invitation to Leipzig, and Wolfram Günther was also a guest at the DBFZ in his official function as Saxony’s State Minister for Energy, Climate Protection, Environment and Agriculture. In addition to keynote speeches and an exciting panel discussion, various science slams by DBFZ scientists were a particular source of enthusiasm.


**Fig. 45:** Panel discussions on the occasion of the company’s 15th anniversary (August 24, 2023)



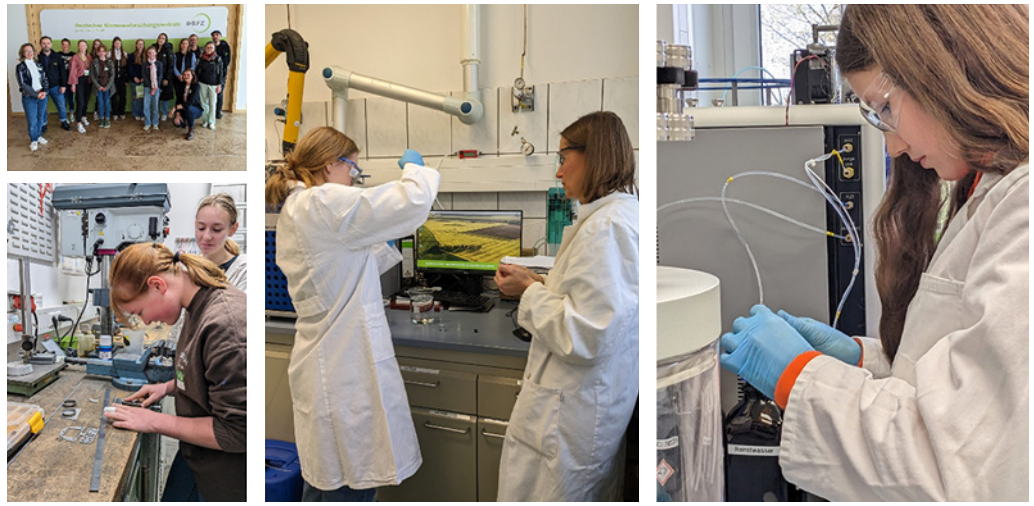


**Fig. 46:** Girls’ Day at DBFZ (April 27, 2023)

## Girls’ Day at the DBFZ

The DBFZ took part in the nationwide Girls’ Day on 27 April 2023 for the third time. The visit by six interested schoolgirls served to introduce potential careers in science. After an introduction to the work at the DBFZ, an exemplary presentation of a researcher’s CV and a tour of selected technical facilities and laboratories, the young visitors had the opportunity to gain an insight into the careers of “mechatronics engineer” and “chemical-technical assistant” under expert guidance in a practical section.

## Long Night of the Sciences

What is bioenergy, what does research at the DBFZ contribute to environmental protection and the energy transition and what potential does insect biomass, for example, harbour? These and other topics were the focus of the Long Night of Science, which took place for the first time on 23 June 2023 on the premises of the DBFZ. Over the course of the evening, almost 100 interested participants learnt about the work of the DBFZ through presentations, tours of the site, exhibitions and various hands-on activities.


**Fig. 47:** Lecture at the Long Night of Science: What potential do insects harbour?

## These and other exciting events await you:

**20/21 May 2024**
18th Rostock Biomass Forum – Bioenergy and bio-based materials for a climate-neutral future

**28 May 2024**
Leipzig biofuels expert talk
“It all depends on the raw material”

**4 June 2024**
12th Bioeconomy Conference 2024 at the DBFZ

**10 September 2024**
5th Biorefinery Day

**11/12 September 2024**
DBFZ Annual Conference 2024

**24/25 September 2024**
7th Doctoral Colloquium BIOENERGY

**6 November 2024**
Leipzig biogas expert talk

**12/13 November 2024**
8th Expert forum on hydrothermal processes

→ **You can find an overview of our events at**
**www.bioenergie-events.de**

**Contact**
**Katja Lucke**
**Nicole Wolf**
**Saskia Schönleiter**
**Bastian Kunau**
Phone: +49 (0)341 2434-1103
E-mail: veranstaltungen@dbfz.de

2024 DBFZ ANNUAL CONFERENCE

**Save the Date:**

## DBFZ Annual Conference 2024

The next DBFZ Annual Conference on “Multi-talented biomass: basic resource, carbon source and energy option” will take place on **11/12 September 2024** at the DBFZ in Leipzig and will be broadcast via livestream.

Up-to-date information can be found on the event website at **www.bioenergiekonferenz.de**

We look forward to your participation!

# 8 International activities

Scientific project work in an international (non-European) context is one of the DBFZ's main objectives. It is particularly important, to make the DBFZ's scientific expertise available to foreign partners and to initiate research collaborations. In addition to the joint processing of research projects, the exchange of doctoral students and the realisation of reciprocal research visits are also planned. A further aim is to establish cooperation with international universities and non-university research institutes and to consolidate and selectively expand non-European networks. This also includes initiating and arranging reciprocal visits and organising workshops and conferences.

## Memorandum of Understanding with PT.PLN Indonesia

Bioenergy is an important energy source in Indonesia – the development of scientific capacities is necessary, initially for co-combustion of biomass, but also for biogas applications, which are now to be developed in the country. PT PLN is the state-owned electricity company with an electricity production of more than 175 TWh (2015). With more than 50,000 employees, it is one of the 500 largest companies in the world. On 14 June 2023, an official Memorandum of Understanding (MoU) with representatives of PT.PLN was signed at the DBFZ under the


**Fig. 48:** Memorandum of Understanding with PT.PLN Indonesia (14 June 2023)

**Fig. 49:** Dr. Friederike Naegeli de Torres and Dr. Sven Schaller (last row, centre) in Berlin

coordination of Dr Sven Schaller. As part of the cooperation, employees of PT.PLN are to be trained in bioenergy technologies and, in the future, their own test laboratories are to be set up.

From 18–22 September 2023, five participants from various areas of PT. PLN took place. The aim of the training was to train colleagues in the conversion of coal-fired power plants to biomass. The agenda included explanations of the systemic contribution of biomass and the principles of large combustion plants for solid fuels (coal, biomass), the combustion of solid fuels, combustion systems and emissions, emission reduction and $CO_2$ capture. In addition to practical work (analyses according to standards), the lignite-fired plant in Lippendorf and the biomass power plant in Piesteritz were also visited.

## Waste-Management in Colombia: the DBFZ in Bogotá

The organic waste from the Colombian capital Bogotá harbours huge untapped potential. Every day, 3,500 tonnes of organic waste are produced. If 1,000 tonnes per day were used to produce methane alone, all 750 of the city's natural gas-powered buses could be fuelled with CNG. Despite a number of problems (including too much staff turnover, which requires constant capacity building, no space in the city for plants, no clear vision from the city administration to involve the private sector, etc.), both the members of the German RETech Partnership export network and Colombian companies see good opportunities to set up the first organic waste treatment pilots in Bogotá together with the DBFZ.



On 21 September 2023, DBFZ scientists Dr. Sven Schaller (Coordinator for International Knowledge and Technology Transfer) and Dr. Friederike Naegeli de Torres (Head of the Resources Working Group) presented project results on waste management in Berlin to representatives of the GIZ, senior employees of the Bogotá city administration and ministry employees from Colombia.

## Intercultural Communication: "International Lunch" Event Series

The DBFZ has steadily increased its international reputation since it was founded in 2008. This is reflected not only in the numerous projects abroad, but also in the growing number of visiting researchers, post-docs, doctoral students, Master's or Bachelor's students, student assistants and employees with an international background. In this context, the basic idea of the "International Lunch", which was introduced in 2019, is a meeting of all DBFZ employees who are interested in global contexts and want to report on their international experiences. The monthly event consists of a lecture on the cultural, historical and geographical characteristics of a country or region, special experiences, fascinating stories or the presentation of fascinating works of art from the respective home countries. The most important part of the event is a lunch with traditional food. This can be finger food, local specialities or culinary delicacies from faraway countries. All dishes are presented and tasted together. Fun, exchange and learning from others go hand in hand.

→ **Further information:**
**www.dbfz.de/en/international-lunch**

**Contact**
**Dr. Sven Schaller**
Phone: +49 (0)341 2434-551
E-mail: sven.schaller@dbfz.de

**Fig. 50:** Focus on Kurdistan and Kurdish culture at the International Lunch in March 2023

# 9 Knowledge and technology transfer



The DBFZ conducts applied research and development (R&D) in a large number of facilities, test beds and laboratories. The primary aim is to translate scientific findings from research projects into practical applications. Whether technological, in the form of an improved production process or a new product from biowaste, or knowledge-based, for example by providing information on available raw material potential or opinions on planned legislative changes: Research achieves impact when it reaches its respective target group.

## 9.1 Knowledge transfer

### Bioeconomy Workshops (TWBioS)

The “Bioeconomy Workshop Saxony” series of events asked industry representatives, researchers and networks in detail: What are Saxony’s strengths in the bioeconomy? The aim was to tap into the development opportunities of the bio-based economy in Saxony for application in small and medium-sized enterprises (SMEs). To achieve this, the project team developed a new event format and successfully implemented it in 2023 in the form of six interactive transfer workshops with a barcamp character. These brought together cross-sector networks, industry representatives and researchers to identify

**Fig. 51:** 4th Bioeconomy Workshop Saxony “From fibre to product”

needs and work on transfer goods that make sustainable business possible in Bavaria. The focus areas defined by the participants included digitalisation, natural fibres, the circular economy, bioprocesses and building with sustainable raw materials. The knowledge gained and the analyses of the innovation potential of the bio-based economy make it clear that the Free State of Saxony has a high bioeconomic potential that needs to be exploited.

→ **Further information (german language):**
**www.dbfz.de/werkstatt**

## Monitoring the bioeconomy strategy for the state of Brandenburg

The project “Priorities of a Bioeconomy Strategy for the State of Brandenburg (BÖ-StrBB)” aimed to support the development of a state bioeconomy strategy by taking stock of the bioeconomy and developing target images, measures and fields of action. In order to shed light on the status quo of the bioeconomy in the state of Brandenburg, existing development strategies and objectives related to the bioeconomy at EU, federal, other state and Brandenburg level were analysed together with the project partners IÖW and e-fect. In a total of five digital events, objectives, implementation paths and the necessary framework conditions and support structures for the draft measures were discussed and developed in key potential sectors that are particularly relevant for Brandenburg. As a result of the five workshops, initial draft measures were derived in the form of profiles on the topics of sustainable biomass production, regional biomass cycles, bioeconomy infrastructure, bioeconomy research and knowledge transfer as well as politics and society.

**Contact**
**Dr. Romy Brödner**
E-mail: romy.broedner@dbfz.de

**Fig. 52:** Workshop on the bioeconomy for the state of Brandenburg on (14 June 2023)

© Infra-Zeitz Servicegesellschaft mbH

**Fig. 53:** Zeitz chemical and industrial park

# 9.2 Technology transfer

## “Pülpegas” project develops pilot plant for the full use of wheat pulp

energy-intensive industry can achieve great added value and efficiency gains through synergies in chemical parks. However, bioenergy plants have so far rarely been directly integrated into continuous processes in the industrial environment. In the joint project “Pülpegas” (FKZ: 03EI5442), funded by the Federal Ministry for Economic Affairs and Climate Action, this problem area is to be addressed by developing and demonstrating wheat pulp mono-fermentation on an industrial scale and by developing and implementing an innovative industrial biogas plant with a capacity of up to 60 GWh/year at the Zeitz site in the long term.

In the joint project carried out by Infra-Zeitz Servicegesellschaft mbH and the DBFZ in collaboration with the Max Rubner Institute (MRI), a reference biogas plant should be created for the complete material and energy utilisation of wheat pulp residue on the basis of industrially relevant test results. An additional goal was to recover approx. 11,000 tonnes of $CO_2$ per year from the biogas produced as a basic chemical for further use. Further project objectives were to quantify the $CO_2$ reduction by avoiding transport, to integrate the process into continuous production processes, to research the usability of other pulp components (in this case fibre as a nutritional supplement) and to increase the Zeitz site’s own energy supply.

The scientific collaboration with the project partner DBFZ served to optimise the process and close knowledge gaps in the fermentation of wheat pulp on an industrial scale. To this end, the DBFZ carried out practical trials on various scales. On the one hand, these were laboratory tests to identify the appropriate process temperature, and on the other hand, the planning principles for the realisation of the industrial biogas plant were researched as part of tests at the DBFZ’s research biogas plant (FBGA).

**Contact**
**Karen Deprie**
E-mail: karen.deprie@dbfz.de

## Industry cooperations in 2023 (selection)

**→ Collaborative project with SMEs**
Optimised residue-based insect production; product development of biolubricants based on insect fats
**#BioLube**

**→ Measurements**
on a large number of different biomass heating stoves for scientific advice on future industrial developments

**→ Studies and counselling**
on the combustion of solid biomass and the implications for chambers of commerce and companies

**→ Scientific input**
for the improvement of tiled stoves

DBFZ

**→ Joint project with large companies**
Development of a pilot plant for the complete utilisation of wheat pulp and automated integration into industrial starch production.
**#Puelpegas**

**→ Processing**
of fermenter broths and fermentation residues for six different companies in the chemical, sugar and methane industries

**→ Scientific advice**
on the integration of catalysers in fireplaces

**→ Expert advice**
on boundary conditions and trends in the field of biorefineries and renewable fuels for three well-known companies from the energy and mechanical engineering industries

**→ Certification**
for biomass-based heat for the heat and electricity provider of a major city

**→ Fuel analysis and compacting tests**
incl. combustion tests for fuel traders



Biomass to energy

# 9.3 BMWK research programme “Biomass to Energy”

The “Energetic use of biogenic residual and waste materials” research programme (part of the Federal Government’s energy research programme) is financed by the Federal Ministry for Economic Affairs and Climate Action (BMWK). The research programme is the scientifically accompanied by a special project called “Biomass to Energy”, which has already been awarded to the DBFZ several times in succession. The accompanying research team is currently supervising approximately 70 research projects in this areadealing with the versatile energy potential of biogenic residual and waste materials. The support team is also responsible for coordinating the Bioenergy Research Network which is initiated by the Federal Ministry for Economic Affairs and Climate Action (BMWK) as well. The aim is to create cross-project scientific added value and facilitate the transfer of valuable results to society and the energy market.

The specific tasks of the accompanying research include scientific monitoring, networking and science communication. On a smaller scale, the team has been hosting the ’Bioenergy Talk’ once a month since 2023 for online exchange, has organized workshops, published projects results in multiple formats and coordinated, political statements. For example, a consultation paper on the new edition of the energy research programme was published in 2023. This paper was initiated by the team of the accompanying research and realized with the help of numerous bioenergy experts. In addition to the accompanying research project, the DBFZ is represented with 14 topical research projects in the programme “Energetic use of biogenic residual and waste materials”.

**→ Further information:**
www.energetische-biomassenutzung.de/en
www.forschungsnetzwerke-energie.de

## Highlights from the accompanying research




**Fig. 54:** BMWK funding area “Biomass to Energy” in 2023

# 11th Status Conference Bioenergy

At the 11th Bioenergy Status Conference in Leipzig from 20–22 September2023, more than 150 scientists from the Bioenergy Research Network came together with representatives from business and politics to discuss the exciting potential of biogenic residues and waste materials for the energy transition. In over forty lectures, five workshops and a poster session, researchers and companies presented research successes and current scientific issues.

In his keynote speech, Timo Haase, energy research funding referee at the BMWK, described the use of biogenic residual and waste materials for energy as a valuable piece of the puzzle for a resilient energy system and thanked the participants in the Bioenergy Research Network for their important input. The results will also be incorporated into the BMWK's new energy research programme, which is currently being worked on.

In the future, covering the high-temperature heat requirements of industrial processes will be an important development task. For this reason, the funding of research and development projects in the field of bioenergy will continue at the usual level, said Haase.

The project manager of the accompanying research team, Prof. Dr. Daniela Thrän, also drew a positive conclusion from the event and the work to date in the research programme: "Our aim with the status conference was to evaluate research results, bring together different perspectives, develop ideas and jointly shape the future of bioenergy in the energy transition. The basis for this is provided by technologies and concepts for biogenic residues and waste materials that have been developed in the BMWK's research programme over the last few decades and are not only intensively discussed in the Bioenergy Research Network, but are also specifically supported in their rapid market launch. With events such as the status conference, we have created an excellent platform for this and, in my view, achieved very good results."

The next Bioenergy Status Conference is expected to take place in autumn 2025.

**Fig. 55:** 11th Bioenergy Status Conference at KUBUS in Leipzig (20–22 September 2023)

**→ The conference reader in german language is available as a free download:**
**www.energetische-biomassenutzung.de/publikationen/tagungsreader**

## Scientfic contact

**Prof. Dr. Daniela Thrän**
Project management
Phone: +49 (0)341 2434-435
E-mail: daniela.thraen@dbfz.de

**Tina Händler**
Project coordination
Phone: +49 (0)341 2434-554
E-mail: tina.haendler@dbfz.de

**Anna Flora Schade**
Communication
Phone: +49 (0)341 2434-597
E-mail: Anna.Flora.Schade@dbfz.de

# 10 Science-Based Services

As a research institute with predominantly applied research, the DBFZ strives for close cooperation with project partners from industry and offers extensive contract research as well as a wide range of science-based and technical services for this purpose. These go beyond the DBFZ's five main research focus areas and are aimed equally at politics and industry, associations, experts and committees. The content is processed in an interdisciplinary and cross-departmental manner so that the entire expertise of the DBFZ can be used comprehensively and efficiently for the following advisory and technical services.

## Science based services

_ Market analyses and data provision
_ Technical, economic and ecological evaluation
_ Concept and process development and optimisation
_ Scientific support of R&D projects

→ **Further information:**
**www.dbfz.de/en/services/science-based-services**

In addition, the DBFZ offers a special R&D infrastructure in the three technical research areas of biochemical conversion, thermo-chemical conversion and biorefineries. The technical-scientific services are aimed at plant and mechanical engineering companies, process development companies, plant operators and other R&D companies and organisations. It is also possible to integrate the services of the analytical laboratory (chemical composition and fuel properties of solid biofuels, biogas substrates, liquid fuels, by-products from agriculture and forestry and other biogenic residues and waste materials as well as their conversion products such as ashes, filter dusts, HTC coals and process waters) within the framework of research projects.

## Technical-scientific services

### Biochemical Conversion Department:

_ Market analysis (based on the annual operator survey, among other things), forecasting and strategy consulting.
_ Scientific support for the development of plant components
_ Balancing and evaluation of processes with regard to efficiency, technical feasibility and economy
_ Characterization of substrates for biochemical conversion (digestibility, gas potentials, etc.)
_ Biogas process analysis and characterization of biochemical processes, mainly anaerobic processes
_ Test implementation (batch and continuous tests, microbial electrochemical tests)
_ Concept development for specific site conditions
_ Determination of energy quantity (electricity, heat) and identification of optimisation potentials

### Thermo-chemical Conversion Department:

_ Development and characterization of solid biogenic fuels and raw materials including pretreatment, additives and compaction
_ Combustion tests and comparative classification of the combustion properties of furnaces and fuels

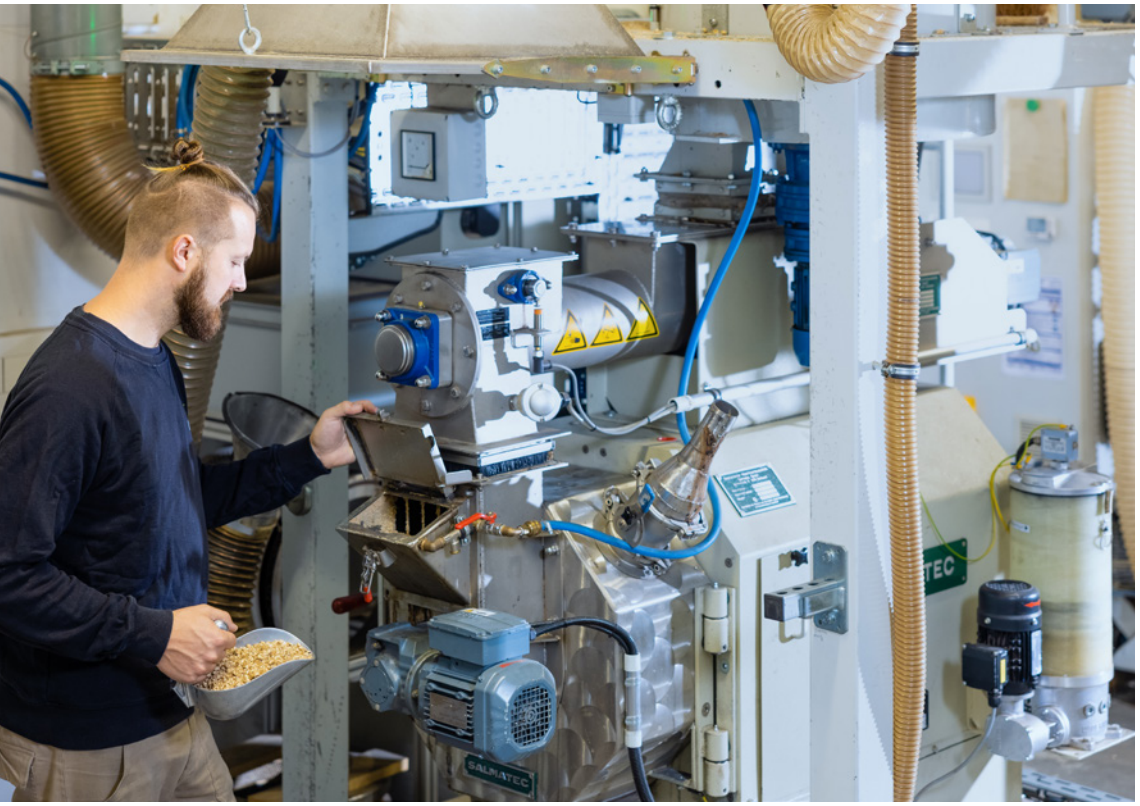


**Fig. 56:** Working in the fuel conditioning lab of the DBFZ

_ Separator measurement with regard to dust emissions
_ Investigation of catalyst technology
_ Catalyst investigations on the test bed and in practice with regard to efficiency and emissions
_ Catalyst screening in model and real gas
_ Catalyst characterisation by physisorption and chemisorption measurements
_ Catalyst synthesis
_ Innovative concept development for integrated renewable heat systems
_ Simulation of renewable heat solution options

## Biorefineries Department:

Pilot plant trials to:
_ Thermochemical biomass digestion
_ Hydrothermal synthesis, carbonization and liquefaction
_ Hydrotreatment of biogenic oils
_ Fixed bed gasification
_ Syngas process
_ Gas cleaning
_ Solid-liquid/liquid-liquid separation process for biogenic valuable materials from aqueous media

→ **Further information:**
**www.dbfz.de/en/services/technical-and-scientific-services**



**Tab. 5:** Tabular overview of the contact persons in the laboratories, test beds and technical facilities of the DBFZ

| Department | Description | Contact person |
|---|---|---|
| **Biochemical Conversion Department** | Research Biogas Plant | Florian Geyer<br>E-mail: florian.geyer@dbfz.de<br>Christian Krebs<br>E-mail: christian.krebs@dbfz.de |
| | Biogas lab | Dr. Nils Engler<br>E-mail: nils.engler@dbfz.de<br>Katrin Strach<br>E-mail: katrin.strach@dbfz.de |
| | Emission measurement | Lukas Knoll<br>E-mail: lukas.knoll@dbfz.de |
| **Thermo-chemical Conversion Department** | Combustion lab | Michael Junold<br>E-mail: michael.junold@dbfz.de |
| | Fuel conditioning lab | Dr. Claudia Kirsten<br>E-mail: claudia.kirsten@dbfz.de |
| **Biorefineries Department** | Biorefineries Technical Centre | André Hermann<br>E-mail: andre.herrmann@dbfz.de |
| **Bioenergy Systems Department** | Databases/Research data | Dr. Marco Selig<br>E-mail: marco.selig@dbfz.de |
| | Assessment methods | Stefan Majer<br>E-mail: stefan.majer@dbfz.de |
| | Potential analyses | Dr. Friederike Naegeli de Torres<br>E-mail: friederike.naegeli@dbfz.de |
| **All departments** | Analytical lab | Dr. Jana Mühlenberg<br>E-mail: jana.muehlenberg@dbfz.de<br>Igor Adolf<br>E-mail: igor.adolf@dbfz.de |

**Scientfic contact**
**Karen Deprie**
Phone: +49 (0)341 2434-118
E-mail: karen.deprie@dbfz.de

# 11
# Networks, Research Associations and Commitee work

**Fig. 57:** Meeting of the IEA Bioenergy Task 40 in Utrecht with DBFZ scientists Christiane Hennig (centre) and Nora Lange (right) (12–14 September 2023)

The DBFZ is a member of numerous networks and research associations related to the bioeconomy and bioenergy. Strong networking within the national and international research landscape and with industry is highly relevant in order to be able to solve the complex challenges of the energy and raw materials transition comprehensively and sustainably.

## IEA Bioenergy and EERA Bioenergy

The IEA Bioenergy is an organisation founded by the International Energy Agency (IEA) in 1978 with the aim of improving international cooperation and the exchange of information on bioenergy research. Members of the IEA Bioenergy Working Groups (Tasks) are around 200 scientists from OECD and non-OECD countries who come together for three-year work programmes. The IEA Bioenergy triennium (2022–2024) has been successfully supported by DBFZ colleagues in 5 (of 11) working groups since 2009. The DBFZ has also been a full member of the European Energy Research Alliance (EERA) since the end of 2019 and is thus even more closely involved in European bioenergy research. The overarching goal of the EERA Bioenergy is to develop into a solid research and development instrument to assess the research challenges and priorities defined for bioenergy in the roadmap of the European Union's Strategic Energy Technology Plan (SET Plan).

Further activities take place in various networks, clusters and associations, mainly focussing on the exchange between science, business and administration (see overview of committee activities).

IEA Bioenergy
Technology Collaboration Programme

## Scientific cooperation with universities and research institutes

Scientific cooperation with universities and other research institutions has been an essential part of the DBFZ's network activities from the very beginning. The focus is on realising the defined research objectives within the framework of applied research and development (R&D). There is a long-standing cooperation with the neighbouring Helmholtz Centre for Environmental Research – UFZ on issues relating to the system evaluation of bioenergy and the microbiological basis of biochemical processes. In the field of energy recovery from organic waste and residues, a strategic collaboration between the DBFZ's research focus areas and the Rostock Chair of Waste and Material Flow Management (ASW), represented by the Scientific Managing Director of the DBFZ, Prof. Dr. Michael Nelles, has been initiated.

HTWK Hochschule für Technik, Wirtschaft und Kultur Leipzig

UNIVERSITÄT LEIPZIG

Universität Rostock Traditio et Innovatio

DBFZ scientists contribute significantly to the visibility of the DBFZ and the expansion of scientific networks through lecturing at a total of 13 universities and colleges (including Leipzig University, Rostock University, Chemnitz University of Technology, Dresden University of Technology, Anhalt University of Applied Sciences, Merseburg University of Applied Sciences and Leipzig University of Applied Sciences). Co-operation with non-European countries, particularly China, has been continuously expanded in recent years. DBFZ scientists work as visiting professors at the University of Hefei and other renowned universities in China.

## Committee activities of DBFZ scientists

DBFZ scientists are represented as experts in a wide range of scientific bodies, advisory boards, working groups, networks and committees as well as (visiting) professors in Germany and abroad. The aim of the committee work is to achieve an intensive exchange with the scientific community.

| Commitee | Function | Country | Since |
|---|---|---|---|
| Association for the Promotion of Exhaust Aftertreatment Technologies for Combustion Engines (FAD) | Member of the Advisory Board | Germany | 2013 |
| Austrian Biomass Association | Member of the scientific committee | Austria | 2022 |
| Aviation Initiative for Renewable Energy in Germany e. V. (aireg) | Member of the Advisory Board | Germany | 2011 |
| BioEconomy Cluster of BioEconomy e. V. | Member of the Board | Germany | 2012 |
| Bioeconomy Council – independent advisory body for the federal government | Co–Chair | Germany | 2021 |
| Biomass to Power and Heat | Member of the Programme Committee | Germany | 2014 |
| Chinese-German Biomass Research Centre (C-DBFZ) in cooperation with the Chinese Academy of Agricultural Engineering (CAAE), Beijing, and the C-DBFZ Anhui (University of Hefei) | German Coordinator | China/ Germany | 2017 |
| Circular Economy 4 Africa | Member of the Executive Board | Germany | 2020 |
| German Association for Waste Management e. V. (DGAW) | Member of the Executive Board | Germany | 2014 |
| German Bioenergy Association e. V. (BBE) | Member of the Advisory Board | Germany | 2012 |
| Doctoral Colloquium BIOENERGY | Member of the Executive Board/Member of the Programme Advisory Board | Germany | 2018 |
| Energy and Climate Protection Advisory Council of the Saxon State Ministry for Energy, Climate Protection, Environment and Agriculture (SMEKUL) | Member | Germany | 2021 |
| Energy and Environment Foundation Leipzig | Member of the Board of Trustees | Germany | 2013 |
| European Biogas Association (EBA) | Member of the Scientific Advisory Board | Belgium | 2019 |
| Export initiative RETech "Recycling & Waste Management in Germany" of the German Federal Government (BMUV, BMWK, BMZ) | Member of the Board and Head of the China Working Group | Germany | 2014 |
| Helmholtz Centre for Environmental Research – UFZ | Member of the Scientific Advisory Board | Germany | 2013 |
| IEA Bioenergy, Task 37 "Energy from Biogas" | Member | International | 2019 |
| IEA Bioenergy, Task 39 "Biofuels to Decarbonize Transport" | German Management | International | 2014 |

| Commitee | Function | Country | Since |
|---|---|---|---|
| IEA Bioenergy, Task 40 “Deployment of biobased value chains” | Co-task leader, German Management | International | 2019 2009 |
| IEA Bioenergy, Task 44 “Flexible bioenergy and system integration” | Co-task leader, German Management | International | 2019 |
| IEA Bioenergy, Task 45 “Climate and sustainability effects of bioenergy within the broader bioeconomy” | German Management | International | 2019 |
| Institute for Non-Classical Chemistry e. V. at the University of Leipzig (INC) | Member of the Advisory Board | Germany | 2013 |
| International Solid Waste Association (ISWA) | Coordinator of Germany’s activities | Netherlands | 2022 |
| LaNDER$^3$–Hochschule Zittau/Görlitz | Member of the Advisory Council | Germany | 2017 |
| Mecklenburg-Western Pomerania Business and Science Strategy Council (including Board of Field of Action 1) “Hydrogen Technologies and Renewable Energies” of the RIS 2021-2026 of the State Government of Mecklenburg-Vorpommern | Member | Germany | 2014 |
| Mecklenburg-Western Pomerania State Energy Council | Member and Head of the F&L Working Group | Germany | 2012 |
| Renewable Energies Research Association (FVEE) | Member of the Board of Directors | Germany | 2015 |
| Renewable Energies Research Association (FVEE) | Expert on bioenergy (electricity, heat, fuels) | Germany | 2016 |
| Research Steering Committee of the Federal Ministry of Food and Agriculture (BMEL) | Member | Germany | 2012 |
| Thuringian Ministry for the Environment, Energy and Nature Conservation | Member of the Scientific Advisory Board for Climate Protection and Climate Impact Adaptation | Germany | 2019 |
| verbio Biofuel and Technology “Straw in the Tank” Conferences | Member of the Scientific Advisory Board | Germany | 2017 |
| Scientific journal “Müll & Abfall” | Member of the Advisory Council | Germany | 2007 |
| Yes-Programm “Young Entrepreneurs in Science” | Member | Germany | 2021 |



## Professorships

| Commitee | Function | Country | Since |
|---|---|---|---|
| Department of Energy, Buildings, Environment (teaching and research area: process engineering, waste and recycling management), University of Applied Sciences Münster | Professorship | Germany | 2023 |
| Faculty of Agricultural and Environmental Sciences, University of Rostock | Professur | Germany | 2006 |
| Faculty of Energy and Environmental Science, Shenyang Aviation University | Visiting Professorship | China | 2011 |
| Faculty of Environmental and Biotechnology, Hefei University | Visiting Professorship | China | 2002 |
| Faculty of Natural and Environmental Sciences, University of Applied Sciences Zittau/Görlitz | Professorship | Germany | 2023 |
| Institute for Infrastructure and Resource Management, Chair of Bioenergy Systems, University of Leipzig | Professorship | Germany | 2011 |
| Institute for Renewable Energy, Petroleum University Beijing | Professorship | China | 2014 |
| Leipzig University of Applied Sciences (HTWK Leipzig) | Professorship | Germany | 2020 |
| National Centre of International Scientific and Technological Bioenergy Research (iBEST), Chinese Agricultural University (CAU), Beijing | Associate Professor | China | 2017 |

## Working Groups

| Commitee | Function | Country | Since |
|---|---|---|---|
| Agru Interlaboratory Test, Board of Trustees for Technology and Building in Agriculture (KTBL) | Member | Germany | 2018 |
| Bioeconomy WG of the Structure-Related Commission on Technology Assessment and Design (Saxon Academy of Sciences in Leipzig) | Member | Germany | 2020 |
| BMWK Dialogue Platform “Industrial Bioeconomy”, WG4 “Communication” | Member | Germany | 2021 |
| DECHEMA | | Germany | |
| – Expert Group “Industrial Use of Renewable Resources” | Member | | 2020 |
| – Expert Group “Measurement and Control in Biotechnology” | Member | | 2018 |
| – ProcessNet–Sustainable Production, Energy and Resources (SuPER), “Alternative Fuels and Combustibles”* | Member | | 2014 |
| – ProcessNet–Sustainable Production, Energy and Resources (SuPER), “Energy Process Engineering”* | Member | | 2015 |

| Commitee | Function | Country | Since |
|---|---|---|---|
| EERA Bioenergy; | | EU/Belgium | |
| Subprogramme | | | |
| 1: Sustainable production of biomass | Member | | 2019 |
| 2: Thermochemical platform | Member | | 2019 |
| 3: Biochemical platform | Member | | 2019 |
| 4: Stationary bioenergy | Member | | 2019 |
| 5: Sustainability/Techno-economic analysis/ Public acceptance | Member | | 2019 |
| European Biofuels Technology Platform (ETIP Bioenergy) | | EU/Belgium | |
| WG1 Biomass availability | Member | | 2007 |
| WG4 Policy and Sustainability | Member | | 2008 |
| German RETech Partnership “Recycling & Waste Management in Germany” | Member of the International Working Group (Emerging and Developing Countries) | Germany | 2017 |
| Taskforce Biomethane | Member | EU/Belgium | 2022 |
| WG Biogas of VGB PowerTech e. V. | Member | Germany | 2019 |
| WG “Drive systems for agricultural machinery” (KTBL) | Member | Germany | 2022 |
| WG on Substance-Specific Waste Treatment (ASA) e. V. | Member of the Advisory Board | Germany | 2009 |
| WG “Library concepts” of the BMEL departmental research institutions | Member | Germany | 2016 |
| WG “OpenAgrar” of the BMEL departmental research institutions | Member | Germany | 2016 |
| “WIR!” Innovation cluster Waste to Value | Member | Germany | 2022 |

* ProcessNet is an initiative of Dechema and VDI-GVC



## Networks/associations/platforms (a selection)

| Commitee | Function | Country | Since |
|---|---|---|---|
| BioEconomy e. V. | Member | Germany | 2012 |
| BioWEconomy of the European Commission | Member Core Group/ Initiators | EU/Belgium | 2020 |
| Committee on the Sustainability of Biofuels and Bioliquids of the European Commission | Member | EU/Belgium | 2017 |
| DENA (German Energy Agency) Biogas partner – the platform for biogas feed-in | Member, Advisory Board Platform for Sustainable Heavy Goods Transport | Germany | 2017 |
| DFBEW German-French Office for the Energy Transition | Member | Germany/ France | 2016 |
| Energy Committee of the Leipzig Chamber of Industry and Commerce (IHK) | Member | Germany | 2016 |
| Energy Saxony e. V. | Member | Germany | 2013 |
| European Biogas Association (EBA) | Member | EU | 2023 |
| Förderverband Humus e. V. (FVH) | Member of the Scientific Advisory Board | Germany | 2019 |
| International Waste Working Group (iwwg) | Management Board | International | 2023 |
| Network Energy and Environment e. V. (NEU e. V.) – Bioenergy Cluster | Member of the Advisory Board | Germany | 2014 |
| Network for Carbon Cycle Economy (NK2) | Member | Germany | 2019 |
| PREVENT Waste Alliance | Member | Germany | 2020 |
| Renewable Energies Research Association (FVEE), Hydrogen expert committee | Member | Germany | 2020 |
| Sustainable Development Solutions Network (SDSN) of the German Development Institute | Member of the Extended Steering Committee | Germany | 2016 |

**Fig. 58:** FVEE Annual Conference “Research for a resilient energy system in times of global crises” (10/11 October 2023)

## DIN/ISO – Standard Committees (a selection)

| Commitee | Function | Country | Since |
|---|---|---|---|
| Association of German Engineers e. V. (VDI) | | Germany | |
| – VDI 3670 “Flue gas cleaning – downstream dust abatement equipment for small combustion plants for solid fuels” | Chairman | | 2014 |
| – VDI 3670: “Flue gas cleaning – downstream dust abatement equipment for small combustion plants for solid fuels” | Member | | 2014 |
| – VDI 4630 “Fermentation of organic substances – substrate characterisation, sampling, substance data collection, fermentation tests” | Member of the Policy Committee | | 2019 |
| – VDI 4635 “Power-to-x: $CO_2$ provision” | Member | | 2020 |
| CEN–European Committee for Standardization TC 454 Algae and algae products | Chairman WG 3 “Productivity” | Belgium | 2015 |
| German Institute for Standardisation e. V. (DIN) | | Germany | |
| – Municipal Technology Working Committee (NKT), NA 051 BR 05 SO “Autonomous sanitary facilities” | Contributors | | 2023 |
| – Working committee “Requirements for liquid fuels” NA 062-06-32 AA | Member | | 2020 |
| – Working committee “Liquefied gases, requirements and testing” NA 062-06-31 AA | Member | | 2021 |
| – “Dust separator testing” working group DIN 33999 | Member | | 2012 |
| – “Biogas” working committee NA 032-03-08 AA | Member | | 2015 |
| – Working committee “Pyrogenic carbons” NA 062-02-85 AA | Chairwoman | | 2021 |
| – Working committee “Biogenic solid fuels” NA 062-05-82 AA | Member | | 2019 |



| Commitee | Function | Country | Since |
|---|---|---|---|
| International Organization for Standardization (ISO) | | Switzerland | |
| – ISO 19867-1:2018 Part 1 “Clean cookstoves and clean cooking solutions” | Contributors | | 2023 |
| – ISO TC 238 Solid Biofuels WG 1 “Terminology” | Convenor | | 2022 |
| – ISO TC 238 Solid Biofuels WG 2 “Fuel specifications and classes” | Task leader | | 2020 |
| – ISO TC 238 Solid Biofuels WG 7 “Safety of solid biofuels” | Member | | 2019 |
| – ISO/TC 238 Task Group 1 “Biochar” | Member | | 2021 |
| – ISO TC 255 Biogas WG 1 “Terms, definitions and classification scheme for the production, conditioning and utilization of biogas” | Member | | 2015 |
| VDI/DIN Commission on Air Pollution Control (KRdL) | | Germany | |
| – WG 3933 “Production of biomass carbonisates” | Member | | 2013 |
| – Committee for Basic Guidelines “Bioeconomy, bio- Contributor 2021 logical transformation – terms, methods, definitions” | Contributor | | 2021 |
| – Guideline Preparation Committee VDI 3475 Sheet 8, “Emission Reduction; Digestate Treatment Plants” | Chair | | 2021 |
| – Guideline Preparation Committee VDI 3475 Sheet 9 “Emission Reduction; Manure Processing Plants” | Chair | | 2021 |

**Scientfic contact**
**Dr. Elena H. Angelova**
Phone: +49 (0)341 2434-553
E-mail: elena.angelova@dbfz.de

# 12 Structure and organisation

An organisational structure of four research departments has been established at the DBFZ to handle the diverse research tasks. While the Departments of Biochemical Conversion, Thermo-Chemical Conversion and Biorefineries mainly work on applied research tasks in the field of bioenergy and bioeconomy, the Bioenergy Systems Department develops policy recommendations, as well as potential analyses, acceptance studies, various scenarios for biomass use and database-based web applications. In cooperation with the Helmholtz Centre for Environmental Research (UFZ), two departments are also working on the topics of bioenergy (systems analysis) and microbiology of anaerobic systems (MicAS).

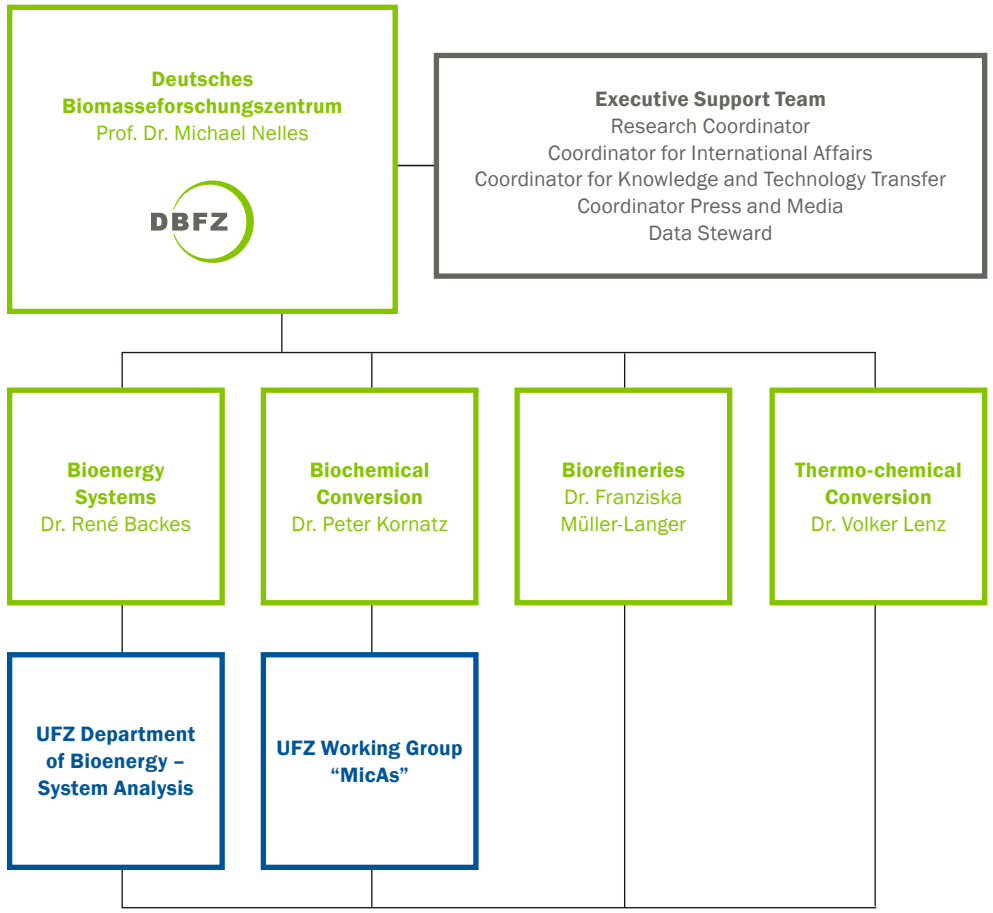



**Fig. 59:** The four research departments of the DBFZ, the executive support team and the two cooperation departments with the Helmholtz Centre for Environmental Research (UFZ)/ Status: 31/12/2023

# 12.1 Management, staff units and controlling bodies

Since its founding in 2008, the DBFZ has been managed equally by two managing directors, who have divided the tasks between the areas of research and administration. The DBFZ's most important scientific goals are defined in close cooperation with the heads of the five research focus areas and the executive support team, and are evaluated and further developed in regular strategy meetings together with the Supervisory Board and the Research Advisory Council.

## The General Management

**Scientific General Management**
**Prof. Dr. mont. Michael Nelles**
Phone: +49 (0)341 2434-112
E-mail: michael.nelles@dbfz.de

**Administrative General Management**
**Dr. rer. nat. Christoph Krukenkamp**
Phone: +49 (0)341 2434-111
E-mail: christoph.krukenkamp@dbfz.de



## Heads of the Research Focus Areas

**Systemic Contribution of Biomass**
**Dr. rer. nat. René Backes**
Phone: +49 (0)341 2434-555
E-mail: rene.backes@dbfz.de

**Anaerobic Processes**
**Dr. agr. Peter Kornatz**
Phone: +49 (0)341 2434-716
E-mail: peter.kornatz@dbfz.de

**Biobased Products and Fuels**
**Dr.-Ing. Franziska Müller-Langer**
Phone: +49 (0)341 2434-423
E-mail: franziska.mueller-langer@dbfz.de

**SmartBiomassHeat**
**Dr.-Ing. Volker Lenz**
Phone: +49 (0)341 2434-450
E-mail: volker.lenz@dbfz.de

**Catalytic Emission Control**
**Prof. Dr. rer. nat. Ingo Hartmann**
Phone: +49 (0)341 2434-541
E-mail: ingo.hartmann@dbfz.de

# Executive Support Team

**Research Coordinator**
**Dr. rer. nat. Elena H. Angelova**
Phone: +49 (0)341 2434-553
E-mail: elena.angelova@dbfz.de

**Coordinator for International Knowledge and Technology Transfer**
**Dr. rer. pol. Sven Schaller**
Phone: +49 (0)341 2434-551
E-mail: sven.schaller@dbfz.de

**Coordinator for Knowledge and Technology transfer**
**Karen Deprie**
Phone: +49 (0)341 2434-118
E-mail: karen.deprie@dbfz.de

**Coordinator Press and Media**
**Paul Trainer**
Phone: +49 (0)341 2434-437
E-mail: paul.trainer@dbfz.de

**Data Steward**
**Dr. rer. nat. Torsten Thalheim**
Phone: +49 (0)341 2434-136
E-mail: torsten.thalheim@dbfz.de



# Controlling bodies

## The Supervisory Board

The Supervisory Board, which is chaired by the Federal Ministry of Food and Agriculture (BMEL), makes the substantive and organisational decisions for the strategic and organisational development of the DBFZ. Other members are the Federal Ministry of Education and Research (BMBF), the Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection (BMUV), the Federal Ministry for Digital and Transport (BMDV), the Federal Ministry for Economic Affairs and Climate Action (BMWK) and the Saxon State Ministry for Energy, Climate Protection, Environment and Agriculture (SMEKUL).

The Supervisory Board met at the DBFZ on May 16 and November 14, 2023.

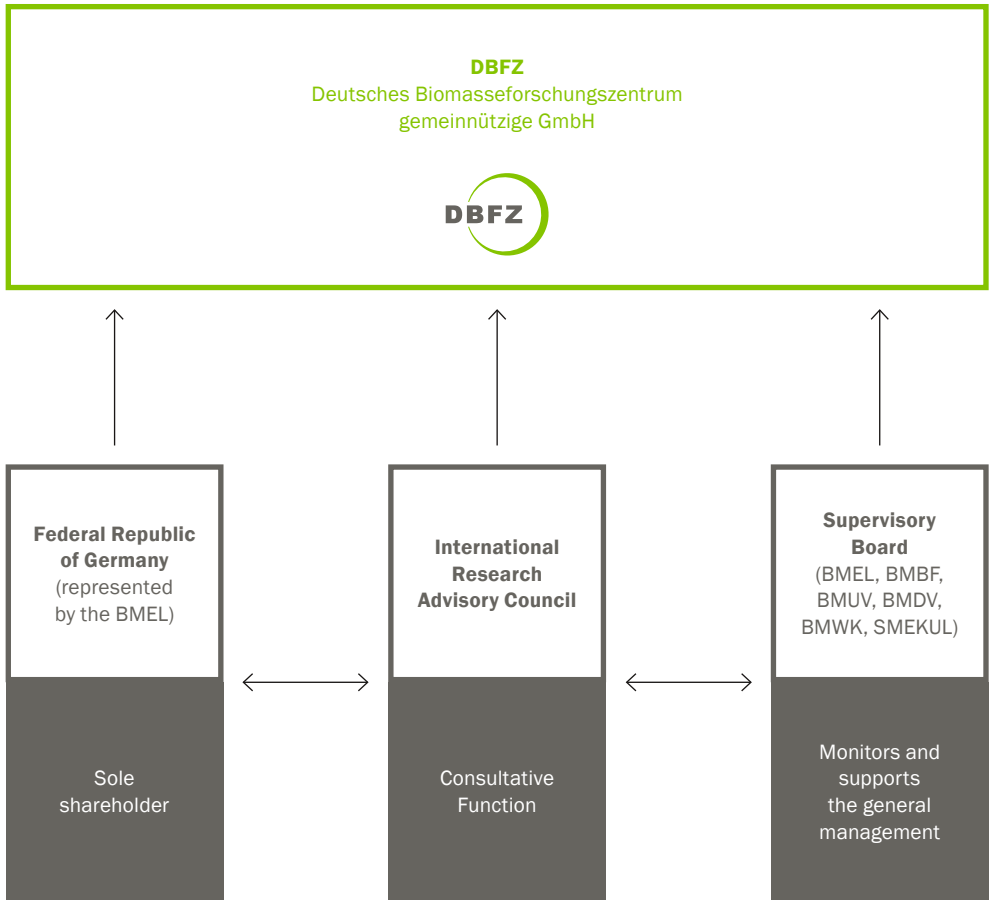



**Fig. 60:** The controlling bodies of the DBFZ

## The representives of the Supervisory Board (as of: 1 Februar 2024)

**Olaf Schäfer (Chairman)**
MinDirig.
Head of Sub-Department “Climate protection, biodiversity, sustainability and bioeconomy” Federal Ministry of Food and Agriculture

**Katharina Schwarz (from May 1, 2024)**
MinDirig’in
Head of working group NII5, Natural and environmental affairs in genetic engineering and the bioeconomy Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection

**Daniel Gellner**
Head of Department 3 “Agriculture”
Saxon State Ministry for Energy, Climate Protection, Environment and Agriculture

**Dr. Christine Falken-Großer**
MinDirig’in
Head of Unit IIA7 – Hydrogen Policy, National Hydrogen Strategy Federal Ministry for Economic Affairs and Climate Action

**Dr. Kerstin Zimmermann**
Senior Government Councillor
Department 7 (Provision for the Future), Department 722 “Energy, Hydrogen Technologies”
Federal Ministry of Education and Research

**Birgit Breitfuß-Renner**
MinDirig’in
Subdepartment G1, Policy Issues and Strategies for Passenger and Freight Transport
Federal Ministry for Digital and Transport


**Fig. 61:** Annual Meeting of the Research Advisory Council at the DBFZ (26 September 2023)

## The Research Advisory Council

The Research Advisory Council, made up of nationally and internationally renowned bioenergy experts, has been advising the DBFZ on the direction of its diverse scientific activities since it was founded in 2008. The advice of the Advisory Council ensures that the research carried out with institutional funding is scientifically sound and highly relevant to the current and future use of bioenergy in the energy system. The term of the current research advisory council is 2023–2026.

**Tab. 6:** Representives of the Research Advisory Council (as of 1 February 2024)
* appointed on January 1, 2024

**Chiaramonti**, Prof. Dr. David
Polytechnic University of Turin – DENERG – Department of Energy “Galileo Ferraris”; RE-CORD – Renewable Energy Consortium for Research and Demonstration | Turin, Italy

**Dong**, Prof. Dr. Renjie (Deputy Chairman)
China Agricultural University (CAU) – National Center for International Research of BioEnergy Science and Technology | Bejing, China

**Dornack**, Prof. Dr. Christina (Chair woman)
Technical University Dresden – Institute of Waste Management and the Circular Economy | Dresden, Germany

**Hartmann**, Dr. Hans
Technology- and Support Centre (TFZ) at the Competence Centre for Renewable Resources | Straubing, Germany

**Kemfert**, Prof. Dr. Claudia
German Institute for Economic Research (DIW) | Berlin, Germany

**Kothe,** Prof. Dr. Erika
Friedrich Schiller University Jena, Professorship for Microbial Communication | Jena, Germany

**Moos**, Prof. Dr. Ralf*
University of Bayreuth, Faculty of Engineering | Bayreuth, Germany

**Murphy**, Prof. Dr. Jerry
University College Cork – Professorship of Civil Engineering | Cork, Ireland

**Thiffault**, PhD Evelyne
Laval University – Department of Wood and Forest Sciences | Québec, Canada

**Thrän**, Prof. Dr. Daniela*
Helmholtz Centre for Environmental Research – UFZ | Leipzig, Germany

**Wagemann**, Prof. Dr. Kurt
DECHEMA – Society for Chemical Engineering and Biotechnology | Frankfurt am Main, Germany

**Walter**, Prof. Dr. Arnaldo
University of Campinas – Department of Energy | Campinas, Brazil

# 12.2 Financial statement

The DBFZ was founded in 2008 as an institutional funding recipient in the BMEL's business area as a limited liability company and is recognised as a non-profit organisation in accordance with Section 52 (2) No. 1 of the German Fiscal Code (AO). The aim is to utilise public research funding flexibly and transparently and to be able to work in a research and advisory capacity on behalf of third parties. The DBFZ is financed by institutional shortfall funding from the Federal Ministry of Food and Agriculture and by competitively acquired project grants, contract research and services. In 2023, the DBFZ received 12.6 million euros in funding from the BMEL. In addition, around 16.5 million euros in third-party funding was raised (see Figure 62). On the expenditure side, personnel costs were in the foreground at 15.5 million euros. Other expenditure included 8.1 million euros for material expenses and 1.6 million euros for investments.

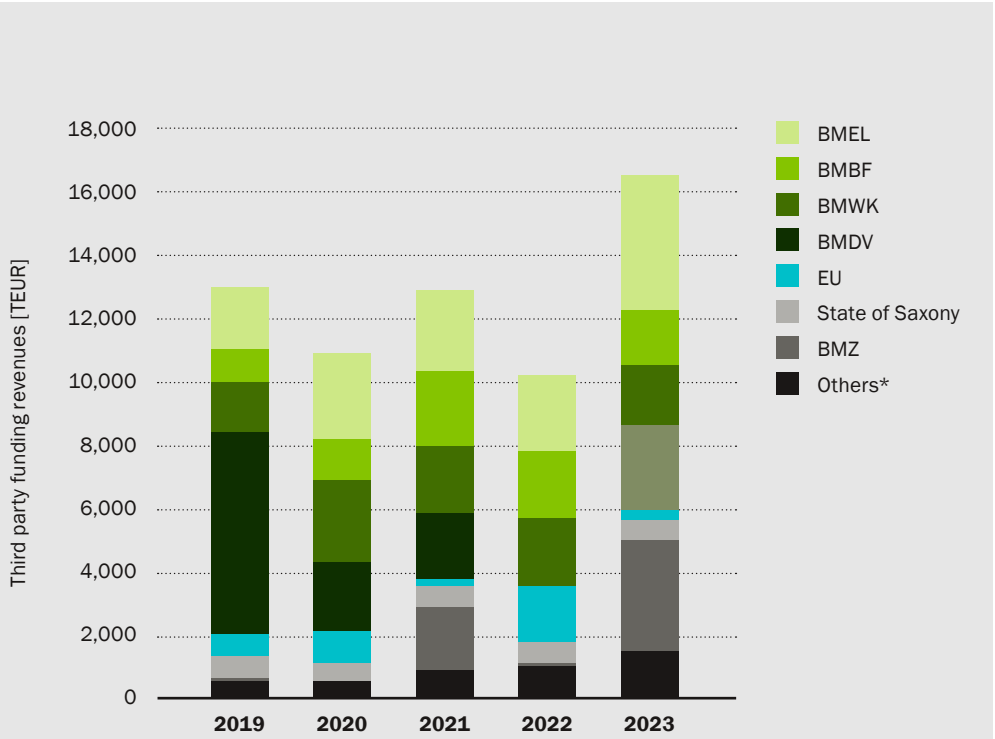



**Fig. 62:** Overview of third-party funding revenue from 2019–2023 (preliminary figures)
* Contract research and scientific services from private and public clients



# 12.3 Personnel/Training

As at 31 December 2023, 275 people were employed at the DBFZ. Of these, 211 people (including staff positions) were employed in the scientific/technical area and 64 people in the administration area (including the infrastructure and property management departments and IT). In 2023, the DBFZ again supervised a large number of projects. A total of seven internships and student research projects as well as 33 bachelor's, master's and diploma theses were supervised. In addition, a total of 28 guest scientists, foreign interns and scholarship holders worked at the DBFZ.

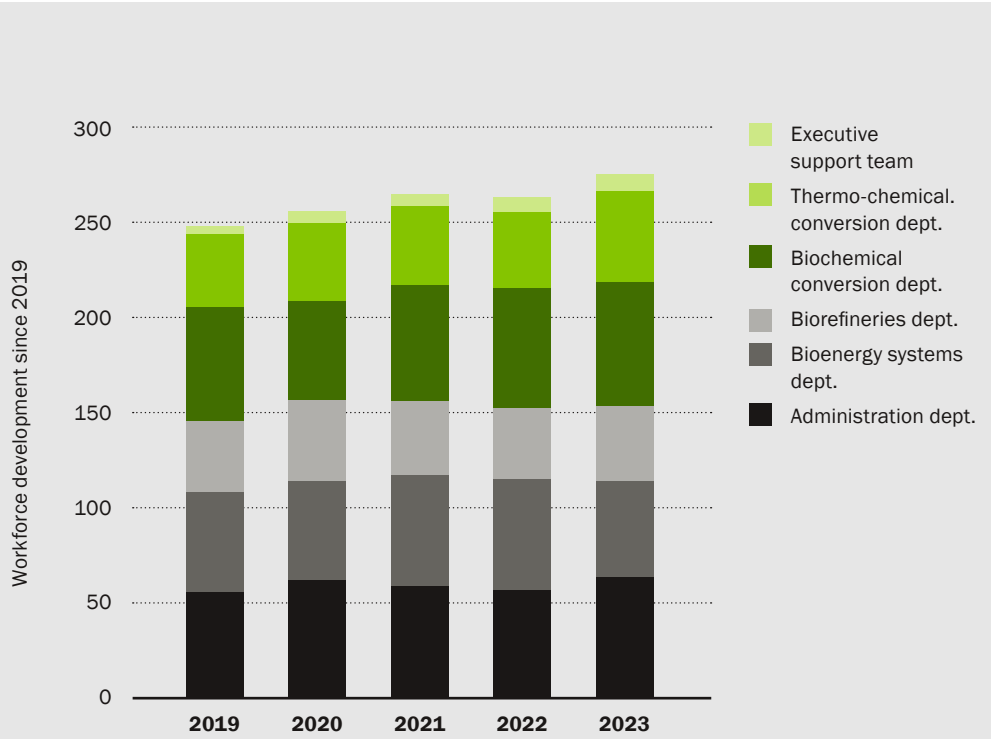



**Fig. 63:** Personnel development at the DBFZ (as of 31 December 2023)

**Workforce by department**

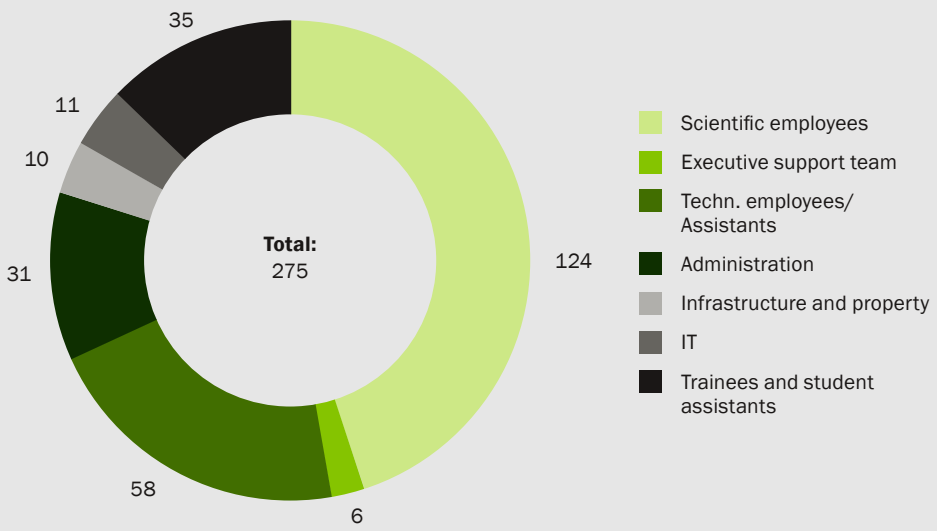



**Fig. 64:** Number of employees by area (as of 31 December 2023)

**Supervised practical training and study projects**

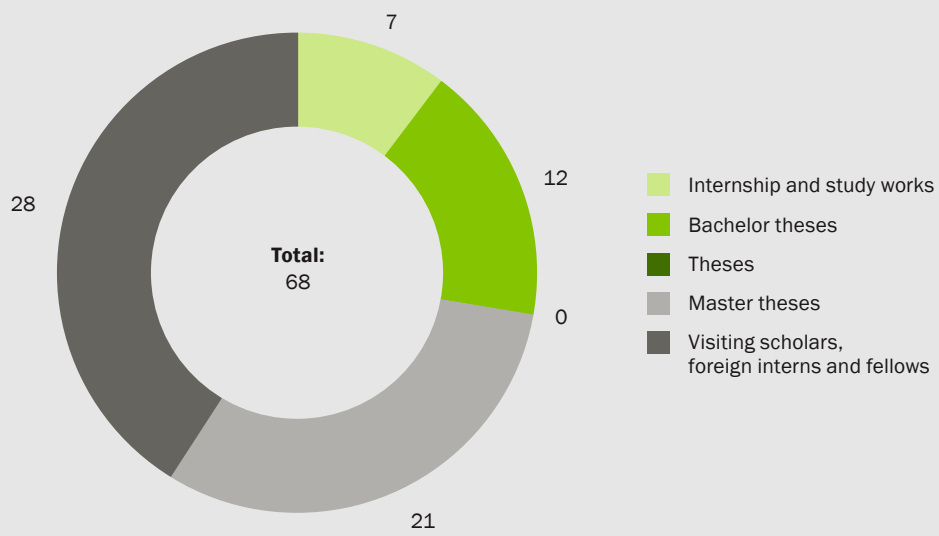



**Fig. 65:** Overview of work supervised at the DBFZ in 2023 (as of 31 December 2023)



## Trainees at the DBFZ

The DBFZ has been a training centre since it was founded in 2008. By the end of 2023, a total of 40 trainees, retrainees and students on dual study programmes had successfully completed their training. In 2023, eleven trainees were undergoing training in the professions of “event management assistant”, “office management assistant”, “electronics technician for industrial engineering”, “chemical laboratory technician” and “mechatronics technician”. The DBFZ was a practical partner for five students at the Berufsakademie Sachsen (Saxony University of Cooperative Education) studying “Computer Science”, “Controlling” and “Laboratory and Process Engineering – Environmental, Chemical and Radiation Technology”.

“What I particularly like about my training is supervising events where researchers from all over the world are working to make our world a better place.”

**Noel Gunia**
Trainee

→ **Further information:**
**www.dbfz.de/en/career/**
**www.dbfz.de/en/career/professional-qualification**

**Fig. 66:** Noel Gunia, 1st year event management trainee

# 12.4 Certification/Audit

## DIN EN ISO 9001

The DBFZ has been certified in accordance with DIN EN ISO 9001 since the institute was founded in 2008. The focus is on quality assurance of scientific work, regular review and optimisation of internal and external processes and supporting staff in the implementation of internal quality standards. The DBFZ successfully completed recertification in 2023 without any deviations. As part of the audit, the DBFZ regularly receives suggestions for improvement, which the DBFZ continuously and consistently implements and develops further. An annual audit is carried out to check whether the quality management system continues to meet the requirements.

## Work and family

The DBFZ has held the berufundfamilie (work and family) certificate since 2014. The award of this certificate certifies that the employer has successfully undergone the auditing process and has developed company-specific goals and measures for the design and further development of a family- and life-phase-conscious personnel policy.

The audit cycle was completed in 2023 with the successful conclusion of the dialogue process. As a result, a programme of action was developed with the aim of ensuring that the DBFZ's existing and future HR policy measures continue to strike a balance between the employer's operational interests and the family, professional and private interests of employees. Future measures include stabilising the adaptation of flexible working conditions and establishing a permanent workplace health promotion programme.

ISO 9001 zertifiziert

Zertifikat seit 2014
audit berufundfamilie

# 13 Appendix: Projects and Publications



Major projects and publications from 2023 are listed below to illustrate the current working areas of the DBFZ. The language of the title reflects the language of the projects/publication.

## Projects (a selection)

**Federal Ministry of Food and Agriculture (BMEL)**

ABiOx – Thermochemische Umwandlung von siliziumoxidreichen Biomasse-Rückständen zur Erzeugung von Wärme und Strom sowie der gekoppelten Erzeugung von mesoporösem biogenem Silica für die Materialanwendungen, Bundesministerium für Ernährung und Landwirtschaft, 01.10.2019–31.05.2023 (FKZ: 2819D0KA05)

AntbioHK – Auswirkungen des verstärkten Einsatzes von Geflügelexkrementen in BGA auf die Belastung der Gärreste mit Antibiotika, Bundesministerium für Ernährung und Landwirtschaft, 01.05.2022–30.11.2024 (FKZ: 2221WD002A)

BCLOOKUP – Pyrolyse sekundärer landwirtschaftlicher Biomassen: Datenbank zu Pflanzenkohle-Eigenschaften und agronomische Bewertung, Bundesministerium für Ernährung und Landwirtschaft, 01.09.2023–31.08.2029 (FKZ: 2823HUM005)

BiberZym – Vergärung von lignifizierter Biomasse durch den Einsatz von Enzymkombinationen aus dem Verdauungstrakt des eurasischen Bibers, Bundesministerium für Ernährung und Landwirtschaft, 01.02.2023–31.07.2025 (FKZ: 2221NR031A)

BioSim – Nachwuchsforschergruppe zur modellbasierten Zustandsüberwachung und Prozessführung an Biogasanlagen, Bundesministerium für Ernährung und Landwirtschaft, 01.11.2020–31.12.2025 (FKZ: 2219NR333)

BIOSTRAT – Bausteine für eine Biomassestrategie: Biomassepotenziale und Erwartungen an ihre künftige Nutzung, Bundesministerium für Ernährung und Landwirtschaft (Inhouse), 20.01.2023–30.09.2023

Effektor – Kontinuierliche Überwachung der technischen Effizienz von Biogasanlagen, Bundesministerium für Ernährung und Landwirtschaft, 01.10.2019–30.06.2023 (FKZ: 22038018)

ELEVATOR – Elektrochemische Valorisierung furanreicher Prozessströme aus dem hydrothermalen Aufschluss landwirtschaftlicher Reststoffe, Bundesministerium für Ernährung und Landwirtschaft, 01.05.2023–30.04.2026 (FKZ: 2221NR027B)

EmMinA – Emissionsminderung bei der Biogasaufbereitung, -verdichtung und -einspeisung. Teilvorhaben1: Quantifizierung und Minderung von Methanemissionen an Biogasaufbereitungsanlagen in der Praxis, Bundesministerium für Ernährung und Landwirtschaft, 01.09.2021–29.02.2024 (FKZ: 2220NR151A)

FlexApp – Fütterungsmanagement für flexible Biogasanlagen im Praxisbetrieb; Teilvorhaben 1: Anlagesimulation und ökonomische Bewertung, Bundesministerium für Ernährung und Landwirtschaft, 01.01.2023–31.12.2024 (FKZ: 2221NR043A)

FlexiMod – Weiterentwicklung eines modellbasierten Prognosetools für die flexible Biogaserzeugung in großtechnischen Biogasanlagen; Teilvorhaben 2: Datenaufbereitung und Weiterentwicklung bestehender Simulationsmodelle unter Berücksichtigung praxisnaher Prozessüberwachungstechnik, Bundesministerium für Ernährung und Landwirtschaft, 01.08.2020–31.03.2023 (FKZ: 2219NR313)

GülleKOM – Kombiverfahren zur Gülleaufbereitung, Bundesministerium für Ernährung und Landwirtschaft, 01.11.2021–31.10.2024 (FKZ: 2220WD004)

Güllemon – Wirkungsmonitoring der BMEL/FNR Investitionsförderrichtlinie-Wirtschaftsdünger, Bundesministerium für Ernährung und Landwirtschaft, 01.08.2022–31.12.2024

GÜLLEPROSPEKT – Entwicklung und Erstellung eines Manuskripts zur Herstellung einer Broschüre zur Vergärung von Wirtschaftsdünger in landwirtschaftlichen Biogasanlagen, 01.12.2023–30.06.2024 (FKZ: 223WD002A)

HYTORF2 – Herstellung und Bewertung von Torfersatzstoffen auf Basis der hydrothermalen Umwandlung aus biogenen Restoffen, Bundesministerium für Ernährung und Landwirtschaft, 01.11.2022–31.10.2025 (FKZ: 2221MT014A)

KIDA – Umsetzung der Maßnahme „KI- und Daten-Akzelerator“, Bundesministerium für Ernährung und Landwirtschaft, 01.03.2022–31.12.2025

LangEFel – Langzeitmonitoring und Funktionalität von Staubabscheidern für Einzelraumfeuerungen im Feld, Bundesministerium für Ernährung und Landwirtschaft, 01.01.2023–31.12.2025

MeBiKo – Metastudie Biokohle, Bundesministerium für Ernährung und Landwirtschaft, 18.7.2022–31.12.2023 (Inhouse)

MEMO – Methanemissionsmodell für offene Gärprodukt-/Güllelager, Bundesministerium für Ernährung und Landwirtschaft, 01.11.2021–31.10.2024 (FKZ: 2220WD003X)

MethaMin – Minimierung von Methanemissionen bei der Lagerung von Wirtschaftsdüngern; Teilvorhaben 1: Anlagenauswahl, Emissionsmessungen und Bewertung, Bundesministerium für Ernährung und Landwirtschaft, 01.10.2022–30.09.2025 (FKZ: 2221WD004A)

MoBi_II – Aufbau eines systematischen Monitorings der Bioökonomie – Konsolidierungsphase; Teilvor-

haben 2: Aktualisierung Reststoffmonitoring, Bundesministerium für Ernährung und Landwirtschaft, 01.11.2021–31.10.2024 (FKZ: 2221NR062B)

Nährwert – Technisch unterstütztes Nährstoffmanagement im Verbund mit Biogasanlagen und Anbauregionen, Bundesministerium für Ernährung und Landwirtschaft, 01.07.2021–30.06.2024 (FKZ: 2220NR255A)

Nred – Verstärkte energetische Nutzung stickstoffreicher landwirtschaftlicher Abfallstoffe durch biologische Stickstoffreduzierung, Bundesministerium für Ernährung und Landwirtschaft, 01.11.2019–30.04.2023 (FKZ: 22042118)

oNIRedu – Emissionsminderung durch angepasste Kesselsteuerung auf der Basis von Daten aus der kontinuierlichen inline-NIR-Brennstoffanalyse, Bundesministerium für Ernährung und Landwirtschaft, 01.07.2019–31.01.2023 (FKZ: 22033218)

PaplGas2 – Biomethan & Torfersatzstoff aus Pappelholz – 2. Phase, Bundesministerium für Ernährung und Landwirtschaft, 01.12.2021–30.11.2023 (FKZ: 2221MT017A)

Sensomix – Entwicklung und Erprobung sensorbasierter Rührsysteme in Biogasanlagen zur Steigerung der Effizienz und Prozessstabilität bei einer lastflexiblen und bedarfsgerechten Biogasproduktion, Bundesministerium für Ernährung und Landwirtschaft, 01.05.2020–31.12.2023 (FKZ: 2219NR387)

TRANSBIO – Transferarbeitsgruppe für Bioenergieanlagen im zukünftigen Energiesystem, Bundesministerium für Ernährung und Landwirtschaft, 01.05.2021–30.04.2024 (FKZ: 2220NR128A)

WDSonic – Steigerung der Effizienz der Wirtschaftsdüngervergärung durch Einsatz von Ultraschall-Desintegrationsverfahren, Bundesministerium für Ernährung und Landwirtschaft, 01.05.2023–30.04.2025 (FKZ: 2222WD105B)

**Federal Ministry for Economic Affairs and Climate Action (BMWK)**

BeForce – Begleitforschung Bioenergie, Bundesministerium für Wirtschaft und Klimaschutz, 01.04.2021–31.03.2025 (FKZ: 03EI5400)

BEniVer – Verbundvorhaben: Begleitforschung Energiewende im Verkehr – Teilvorhaben: Ermittlung von Rohstoffpotentialen strombasierter Biokraftstoffoptionen und ökologische Bewertung von biokraftstoffbasierten Referenzszenarien, Bundesministerium für Wirtschaft und Klimaschutz, 01.06.2018–31.03.2023 (FKZ: 03EIV116C)

BioBeton – Biomassebasierte und nachhaltige Herstellung von Betonprodukten, Bundesministerium für Wirtschaft und Klimaschutz, 01.01.2021–30.06.2023 (FKZ: KK5045102KI0)

BioFeuSe – Neue Sensorik für die Prozessoptimierung von SCR-Verfahren und Partikelabscheidung an Biomasseverbrennungsanlagen, Bundesministerium für Wirtschaft und Klimaschutz, 01.07.2021–30.06.2024 (FKZ: 03EI54346A)

BIOKRAFT – Rohstoffverfügbarkeit von holzartiger Biomasse zur Produktion von Biokraftstoffen in DE und EU, Bundesministerium für Wirtschaft und Klimaschutz, 20.01.2020–31.03.2023

CapUp – Verbundprojekt: Chemikalienproduktion an Biogasanlagen – Upscaling eines Verfahrens zur Herstellung mittelkettiger Carbonsäuren aus regionalen Reststoffen, Teilvorhaben: Up-Scaling und Bewertung der Downstream-Kaskade, Bundesministerium für Wirtschaft und Klimaschutz, 01.02.2023–31.07.2023 (FKZ: 13BDA30012)

CarboFe – Entwicklung und Validierung eines innovativen Eisen-Kohlenstoff Präparates zur Gasreinigung und Effizienzsteigerung des Biogasprozesses, Bundesministerium für Wirtschaft und Klimaschutz, 01.01.2023–31.12.2025 (FKZ: 03EI5453)

FLXsynErgy – Flexible und vollenergetische Nutzung biogener Rest- und Abfallstoffe: Faulungen und Biogasanlagen als Energieverbraucher, -speicher und -erzeuger, Bundesministerium für Wirtschaft und Klimaschutz, 01.10.2020–30.09.2023 (FKZ: 03EI5420C)

Greenfee – Green Feedstocks for a Sustainable Chemistry – Energiewende und Ressourceneffizienz im Kontext der dritten Feedstock-Transformation der chemischen Industrie (GreenFeed), Bundesministerium für Wirtschaft und Klimaschutz, 01.03.2022–28.02.2025 (FKZ: 03EI5003C)

H2Verg – Wasserstoff aus der Vergasung von Biomasse-Feldmessungen, Ermittlung von Anwendungsbedingungen und Prozessbewertung, Bundesministerium für Wirtschaft und Klimaschutz, 01.08.2022–31.07.2025 (FKZ: 03EI5445A)

HanfNRG – Untersuchungen der energetischen Nutzungsoptionen von Hanffaserreststoffen zur exemplarischen Einbindung in das Energiekonzept eines Verarbeitungsstandorts, Bundesministerium für Wirtschaft und Klimaschutz, 01.10.2022–30.09.2025 (FKZ: 03EI5448)

KeVergAv – Bestimmung von brennstoffspezifischen Kennzahlen zum Vergasungs- und Ascheverhalten, Bundesministerium für Wirtschaft und Klimaschutz, 01.02.2021–31.03.2024 (FKZ: 03EI5416)

KonditorGas – Industrielle Prozesswärmeerzeugung durch katalytische Konditionierung von biomassebasierten Synthesegasen; Teilvorhaben II: Katalytische Konditionierung von Synthesegasen aus der autothermen Vergasung, Bundesministerium für Wirtschaft und Klimaschutz, 01.09.2020–31.05.2024 (FKZ: 03EI5417B)



MeKat – Entwicklung eines Methanoxidationskatalysators auf Basis von biogenem Silika für die Entfernung von Methan im Abgas von Biogas-BHKW, Bundesministerium für Wirtschaft und Klimaschutz, 01.01.2023–31.12.2025 (FKZ: 03EI5456A)

MoBiFuels – Analyse und Beseitigung von Markthemmnissen von technisch modifizierten Bioenergieträgern, Bundesministerium für Wirtschaft und Klimaschutz, 01.11.2018–30.04.2023 (FKZ: 03KB136A)

OBEN – Öl-Ersatz Biomasse Heizung, Bundesministerium für Wirtschaft und Klimaschutz, 01.09.2019–31.10.2023 (FKZ: 03KB156)

OpToKNuS – Entwicklung einer „Toolbox“ basierend auf numerischen Modellen und Praxismessungen zur Auslegung bzw. Optimierung von thermochemischen Anlagen zur Energiebereitstellung aus alternativen Brennstoffen; Teilvorhaben: Untersuchungen am DBFZ-Festbett-Laborvergaser, Bundesministerium für Wirtschaft und Klimaschutz, 01.01.2020–30.06.2023 (FKZ: 03KB163B)

PaCoSil – Verbrennung regionaler Reststoffe zur energetischen Nutzung von Biomasse mit gekoppelter Erzeugung von biogenem Silika für Feinstaubfilter-Prozesse, Bundesministerium für Wirtschaft und Klimaschutz, 01.07.2021–30.06.2024 (FKZ: 03EI5436A)

Pülpegas – Verbundvorhaben Pülpegas – Entwicklung einer Pilotanlage zur Vollverwertung von Weizenpülpe und automatisierte Systemintegration in die industrielle Stärkeproduktion, Bundesministerium für Wirtschaft und Klimaschutz, 01.05.2022–31.10.2025

TRANSBIB – Nationales Transfer- und Beschleunigungsnetzwerk Industrielle Bioökonomie, Bundesministerium für Wirtschaft und Klimaschutz, 01.10.2023–30.09.2026, (FKZ: 13BDI10019)

**Federal Ministry for Education and Research (BMBF)**

AltCell – Alternative Cellulosequellen für künstliche Cellulosefasern, Bundesministerium für Bildung und Forschung, 01.08.2023–31.07.2025 (FKZ: 03WIR3806C)

BiogeniV – Starterprojekt BV-3 Basiskonzept Bioraffinerie: Analyse und Bewertung der Reststoffe zur Nutzung in einer Vergasungsanlage, Bundesministerium für Bildung und Forschung, 01.12.2022–30.11.2023 (FKZ: 03WIR4903C)

Biolube – Entwicklung biobasierter und biologisch abbaubarer Hochleistungsschmierstoffe auf Basis von Insektenfett für die industrielle Anwendung, Bundesministerium für Bildung und Forschung, 01.05.2021–30.04.2024, (FKZ: 031B1111B)

BioNET – Biomasse-basierte Negativ-Emissions-Technologien, Bundesministerium für Bildung und Forschung, 01.01.2022–31.12.2024 (FKZ: 01LS2107B)

BioZ-RP – Rahmenprojekt III: Life Cycle Assessment/Nachhaltigkeitsbewertung & Wirksamkeitsanalyse, Bundesministerium für Bildung und Forschung, 01.09.2022–31.08.2025 (FKZ: 03WIR5303)

E-Boot II – Entwicklung einer Ernteprozesskette mit Erntetechnologie zur umweltschonenden Ernte von Wasserpflanzen, Bundesministerium für Bildung und Forschung, 01.08.2021–30.07.2024 (FKZ: 031B1095)

LabTogo – Aufbau von Forschungskapazitäten und Demonstration von Technologien zur Nutzung der Biomassepotenziale in Togo, Bundesministerium für Bildung und Forschung, 02.01.2020–31.12.2023

MycoForm – Formteile und Dämmstoffe auf Basis von organischen Reststoffen und Speisepilzen, Bundesministerium für Bildung und Forschung, 01.01.2023–31.12.2023 (FKZ: 031B1323)

ProPec – WIR! – BioZ Maßgeschneiderte Pektine aus Zuckerrüben, Bundesministerium für Bildung und Forschung, 01.04.2023–31.03.2024, (FKZ: 03WIR5312C)

STROHase – Silierung Trockener Restströme: Optimierung der Hydratisierung durch NSPasen, Bundesministerium für Bildung und Forschung, 01.04.2023–31.03.2026 (FKZ: 031B1373C)

SYMOBIO2 – Konsolidierung des Systemischen Monitorings und der Modellierung der Bioökonomie, Bundesministerium für Bildung und Forschung, 01.01.2022–31.12.2024 (FKZ: 0311129C)

VFAsense – Entwicklung eines praxistauglichen mikrobiellen elektrochemischen Sensormoduls zur hochaufgelösten Prozessüberwachung anaerober Bioprozesse, Bundesministerium für Bildung und Forschung, 01.10.2022–30.09.2023 (FKZ: 031B1312)

WaSSGhan – Hybrid Waste to energy as a sustainable Solution for Ghana, Bundesministerium für Bildung und Forschung, 01.01.2020–31.12.2023 (FKZ: 03SF0591D)

ZirkulierBar – Interkommunale Akzeptanz für nachhaltige Wertschöpfung aus sanitären Nebenstoffströmen Nährstoffwende – von linearer Sanitärspülung zur zirkulären Nährstoffverwertung, Bundesministerium für Bildung und Forschung, 01.07.2021–30.06.2024 (FKZ: 033L242H)

**Federal Ministry for Digital and Transport (BMDV)**

Pilot-SBG, Phase 1a – Forschungs- und Demonstrationsvorhaben | Bioressourcen und Wasserstoff zu Methan als Kraftstoff – Konzeptionierung und Realisierung einer Anlage im Pilotmaßstab, Bundesministerium für Digitales und Verkehr, 01.09.2018–31.12.2023

Pilot-SBG, Phase 1b – Forschungs- und Demonstrationsvorhaben I Bioressourcen und Wasserstoff zu Methan als Kraftstoff – Forschungsbetrieb und Konzeptoptimierung einer Anlage im Pilotmaßstab, Bundesministerium für Digitales und Verkehr, 01.01.2023–31.12.2026
REF4FU – Erneuerbare Kraftstoffe aus grünen Raffinerien der Zukunft; Teilvorhaben 3, Bundesministerium für Digitales und Verkehr, 01.12.2022–30.11.2025 (FKZ: 16RK24001C)
INNOFUELS – Vernetzung, Weiterentwicklung und Rahmenbedingungen zum Hochlauf strombasierter Kraftstoffe und fortschrittlicher Biokraftstoffe, Bundesministerium für Digitales und Verkehr, 01.02.2023–31.08.2026 (FKZ: 16RK34002F)

**EU Projects**

BIOMETHAVERSE – Demonstrating and Connecting Production Innovations in the Biomethane Universe, European Commission, 01.10.2022–31.03.2027 (GA 101084200)
BRANCHES – Boosting Rural Bioeconomy Networks following multi-actor approaches, European Commission, 01.01.2021–31.12.2023 (GA 101000375)
CAFIPLA – Pretreatment of organic waste for application of the carboxylic acid and fiber platform, European Commission, 01.06.2020–31.05.2023 (GA 887115)
CARINA – CARinata and CamelINA boosting the sustainable diversification in agricultural production systems, European Commission, 01.11.2022–31.10. 2026 (GA 101081839)
GreenMeUp – GREEN bioMEthane market UPtake, European Commission, 01.08.2022–31.07.2025 (GA 101075676)
HARMONITOR – Harmonisation and monitoring platform for certification schemes and labels to advance the sustainability of bio-based-systems, European Commission, 01.06.2022–31.05.2025 (FKZ: GA 101060133)
ICARUS – International cooperation for sustainable aviation biofuel, European Commission, 01.10.2023–30.09.2026 (FKZ: 101122303)
MUSIC – Market Uptake Support for Intermediate Bioenergy Carriers, European Commission, 01.09.2019–28.02.2023 (GA 857806)
SEMPRE-BIO – SEcuring doMestic PRoduction of cost-Effective BIOmethane, European Commission, 01.10.2022–30.04.2026 (GA 101084297)
SUSTRACK – Supporting the identification of policy priorities and recommendations for designing a sustainable track towards circular bio-based systems, European Commission, 01.11.2022–31.10.2025 (GA 101081823)

**Other funding bodies**

ABBER – Recherche des Nachrüstungspotentials zur Partikelminderung bei Kaminöfen, Marktprojekt, 01.04.2023–30.06.2023
AGEEstat – Wissenschaftliche Analysen zu ausgewählten Aspekten der Statistik erneuerbarer Energien und zur Unterstützung der Arbeitsgruppe Erneuerbare Energien Statistik, Marktprojekt, 01.04.2019–15.10.2024
bEONergy – Rolle von Bioenergie in einem dekarbonisierten Energiesystem, Marktprojekt, 01.12.2023–31.05.2024
Bio2x – Metaanalyse zu nachhaltigen Biomassepotenzialen für die Mineralölwirtschaft, Marktprojekt, 01.06.2023–31.12.2023
BioEL – Biomassepotenziale für eine nachhaltige Energieversorgung, Marktprojekt, 14.09.2022–31.07.2023
Biogasn – Potentiale einer reststoffbasierten Biogasproduktion für einen klimaverträglichen, nährstoffeffizienten und strukturvielfältigen Ackerbau, Marktprojekt, 01.06.2023–31.12.2023
BioS – Transferwerkstätten „Innovationspotenziale der Bioökonomie in Sachsen“, Sächsische Aufbaubank – Förderbank (SAB), 01.05.2021–31.10.2023
BiPowInd – Training on the thermal convesion of coal-fired power lants ot biomass firing, Marktprojekt, 18.08.2023–10.10.2023
BOGOTA-1 – Strategisches Management organischer Abfälle in Bogotá, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), 01.12.2020–28.02.2023
BÖ-STRBB – Erarbeitung wesentlicher Schwerpunkte einer Bioökonomie-Strategie für das Land Brandenburg, Marktprojekt, 01.12.2022–15.12.2023
BÖStrBB2 – Begleitung der Bioökonomie-Strategie für das Land Brandenburg, Marktprojekt, 01.09.2023–31.05.2024
CharMeth – Concept study for gas cleaning and methane synthesis applying gas from wood pyrolysis, Marktprojekt, 24.04.2023–15.08.2023
CoFire3 – Begutachtung der Biowärmebereitstellung, Marktprojekt, 01.05.2019–31.12.2023
EBCNAM – Assessment of the Namibian NUST laboratory in order to introduce EBC aligned testing services for producers of biochar, Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), 15.12.2022–31.10.2023
EEGMON – EEG-Monitoring Erfahrungsbericht, Marktprojekt, 06.08.2020–05.08.2023
ETH-Soil – Bodenverbesserung in Äthiopien durch die energetische und materielle Nutzung landwirtschaftlicher Rückstände mit besonderem Schwerpunkt auf Bildung und Ausbildung, Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (BMZ), 01.07.2021–31.12.2026
Grundi – Literaturstudie zu Speicherfeuerstätten, Marktprojekt, 21.02.2022–31.12.2023
H2India – Einordnung der Wasserstofferzeugung aus Biomasse in Indien, Gesellschaft für internationale Zusammenarbeit, 01.08.2022–31.01.2023
IEA-LLBF – Report IEA Task 39 – TCP Bioenergy-Lessons learned biofuels, 01.04.2021–31.10.2023
IEA T37 – IEA Energy from Biogas, Marktprojekt, 20.09.2016–31.12.2024
IEA T40 – IEA Bioenergy Task 40 Deployment of biobased value chains 2022–2024, Marktprojekt, 01.01.2022–31.03.2025
IEA T44 – IEA Bioenergy Task 44 Flexible Bioenergy and System Integration 2022–2024, Marktprojekt, 01.01.2022–31.03.2025
IEATask – Report IEA, Marktprojekt, 20.09.2016–31.12.2024
H2Synergies – IEA Bioenergy TCP, ITP Synergies in the deployment of green hydrogen and biobased value chains, Marktprojekt, 01.11.2023–31.12.2024
KFA13.0 – Voruntersuchungen zur Herstellung und Verbrennung von Bagassepellets in einer Kleinfeuerungsanlage, Marktprojekt, 20.10.2022–01.02.2023
KFA13.BB – Voruntersuchungen zur Herstellung und Verbrennung von Bagassepellets in einer Kleinfeuerungsanlage, Marktprojekt, 17.05.2023–31.10.2023
Kompost4Klima – Grüngutverwertung zur kombinierten Bereitstellung von biogener Wärme und Kompost: Bau eines Prototyp-Biomeilers zur Erzeugung von Wärme aus Kompost, Sächsische Aufbaubank – Förderbank (SAB), 01.07.2021–30.11.2023
KontiGSK – Kontinuierlicher Gärtest Gerstenspelze und Gerstenkleie, Marktprojekt, 14.06.2022–31.08.2023
KontiUFZ – Kontinuierlicher Betrieb von 2 Laborreaktoren, Marktprojekt, 01.03.2022–31.08.2023
LCAMünch – LCAMünch – Ökobilanz Holzkraftwerk, Marktprojekt, 01.08.2022–31.08.2023
MethVers – Untersuchung eines Katalysators, Marktprojekt, 14.09.2023–31.12.2023
NAMBRIK – Emissionsmessungen an einem mit Holzbriketts betriebenen Kaminofen, Marktprojekt, 17.10.2023–20.11.2023
OSchein – Erstellung von Schulungsmaterial zum richtigen Heizen mit Holz (Ofenführerschein), Marktprojekt, 05.11.2021–30.06.2023
PanBio23 – Evaluating the anaerobic digestibility of liquid effluents, Marktprojekt, 06.11.2023–30.03.2024
PAPER – Ressourcenscreening & Entwicklung einer Mobilisierungs-/Einkaufsstrategie, Marktprojekt, 13.10.2020–30.06.2023
RiPaKa – Ringversuch Partikelzahlmessung an Kaminöfen, Marktprojekt, 05.07.2021–30.06.2023
SchauBio – Schaufenstertag Bioökonomie im Altenburger Land, Marktprojekt, 01.01.2023–30.06.2023
SideMeth – Biomassepotenziale verschiedener Nebenprodukte, Marktprojekt, 01.12.2022–31.08.2023
SOILLCA – Life Cycle Assessment of selected soil healths input, Gesellschaft für Internationale Zusammenarbeit, 22.11.2021–30.04.2023
STARCH2E – Support biogas project, Marktprojekt, 01.01.2023–30.09.2023
StrohGas – Wirtschaftlichkeitsanalyse zur Strohvergärung mit Vermarktungsoption Biomethan, Marktprojekt, 01.08.2023–31.12.2024
Strumus – Nachhaltigkeit Stroh-Bioraffinerie, Marktprojekt, 01.07.2021–30.04.2023
SUVALIG – Entwicklung eines Bioraffineriekonzeptes im Rahmen des Projektes SUVALIG, Marktprojekt, 01.11.2019–31.07.2023
UFP-MESS – Messung ultrafeiner Partikel aus Kleinfeuerungsanlagen, Marktprojekt, 27.07.2022–30.11.2025 (FKZ: 3721522050)
UmGärr – Aufbereitung vorbehandelter Gärreste mittels Umkehrosmose, Marktprojekt, 29.11.2022–28.02.2023
VFAslope – Gärsäuremuster bei der Vergärung zuckerhaltiger Reststoffe, Marktprojekt, 23.11.2022–30.06.2023
VITERRA – Versuche zur hydrothermalen Verflüssigung, Marktprojekt, 01.04.2022–30.04.2023
WASTEGUI – WasteGui – Leitfaden organische Reststoffe in Afrika am Beispiel Äthiopien, Gesellschaft für Internationale Zusammenarbeit, 01.12.2020–30.04.2023
WEPart – Untersuchung der Wirkung bestehender primärer und sekundärer Emissionsminderungstechniken an Feuerungsanlagen zur Partikelanzahlminderung abhängig von Brennstoff und Feuerungstechnik, Marktprojekt, 01.03.2022–31.07.2024



## Publications

**Monographs**

Brödner, R.; Cyffka, K.-F.; Fürst, K.; García Laverde, L.; Glowacki, R.; Graffenberger, M.; Hoffmann, J.; Richter, S.; Schmid, C.; Siebenhühner, E.; Szarka, N. (2023). *MoReBio – Modellregionen Bioökonomie im Mitteldeutschen Revier und im Lausitzer Revier.* (DBFZ-Report, 49). Leipzig:

DBFZ. VII, 204 S. ISBN: 978-3-946629-97-9. DOI: 10.48480/zgk7-vm49.
Dögnitz, N.; Etzold, H.; Naumann, K. (2023). *Marktanalyse und Treibhausgasquote für erneuerbares Methan im Verkehr: Fokusheft im Projekt Pilot-SBG*. Leipzig: DBFZ. 35 S. ISBN: 978-3-949807-00-8. DOI: 10.48480/fctg-2823.
Eckel, H.; Remmele, E.; Frerichs, L.; Hipp, J.; Müller-Langer, F.; Schröder, J. (2023). *Verwendung erneuerbarer Antriebsenergien in landwirtschaftlichen Maschinen*. (KTBL-Sonderveröffentlichung, 12643). Darmstadt: KTBL. 48 S.
Meisel, K.; Götz, I. K.; Helka, J.; Sumfleth, B. (2023). *Nachhaltigkeit für Einsteiger:innen mit einer Product Carbon Footprint Beispielrechnung: Handreichung*. Version 2.0. Leipzig: DBFZ. ISBN: 978-3-949807-03-9. DOI: 10.48480/6xfs-js98.
Nieß, S.; Dietrich, S.; Klemm, M.; Etzold, H.; Oehmichen, K. (2023). *Methanisierung: Bereitstellung von erneuerbarem Methan aus Biogas und Wasserstoff. Fokusheft im Projekt Pilot-SBG*. Leipzig: DBFZ. 41 S. ISBN: 978-3-946629-99-3. DOI: 10.48480/rm3g-ej31.
Nitzsche, R. (2023). *Adsorption and Membrane Filtration for the Separation and Valorization of Hemicellulose from Organosolv Beechwood Hydrolyzates: Doctoral thesis*. (DBFZ-Report, 48). Leipzig: DBFZ. 127 S. ISBN: 978-3-946629-96-2. DOI: 10.48480/z2mn-2r87.
Rensberg, N.; Denysenko, V.; Daniel-Gromke, J. (2023). *Biogaserzeugung und -nutzung in Deutschland: Report zum Anlagenbestand Biogas und Biomethan*. (DBFZ-Report, 50). Leipzig: DBFZ. VII, 9-122 S. ISBN: 978-3-949807-02-2. DOI: 10.48480/zptb-yy32.
Schindler, H.; Majer, S.; Thrän, D.; Lenz, V. (2023). *Nachhaltigkeit von Holzenergie: Diskussionspapier*. Leipzig: DBFZ. III, 4-35 S. DOI: 10.48480/EDBC-EC31.
Schröder, J.; Hauschild, S.; Naumann, K. (2023). *Infrastruktur für erneuerbares Methan im Verkehr: Fokusheft im Projekt Pilot-SBG*. Leipzig: DBFZ. 33 S. ISBN: 978-3-949807-01-5. DOI: 10.48480/78kk-xp41.

**Collections**

Händler, T. (Hrsg.) (2023). *Collection of Methods for Biogas: Methods to determine parameters for analysis purposes and parameters that describe processes in the biogas sector. ERRATUM Dec 2023*. (Series „Biomass energy use“, 7). Leipzig: DBFZ. 18 S. DOI: 10.48480/f9ne-2j04.
Thrän, D.; Händler, T. (Hrsg.) (2023). *Focus on Bioenergie im Strom- und Wärmemarkt: Projektergebnisse 2021–2022*. (Fokusheft Energetische Biomassenutzung). Leipzig: DBFZ. 163 S. ISBN: 978-3-946629-94-8. DOI: 10.48480/hvyq-3t55.

**Conference Proceedings/Conference Readers**

*14. Fachgespräch Partikelabscheider in häuslichen Feuerungen: 09. Februar 2023. Technologie- und Forschungszentrum, Straubing* (2023). (Tagungsreader, 27). Leipzig: DBFZ. 163 S. ISBN: 978-3-946629-95-5. [14. Fachgespräch Partikelabscheider in häuslichen Feuerungen, Straubing, 09.02.2023].
Bockreis, A.; Faulstich, M.; Flamme, S.; Kranert, M.; Mocker, M.; Nelles, M.; Quicker, P.; Rettenberger, G.; Rotter, V. S. (Hrsg.) (2023). *12. Wissenschaftskongress Abfall- und Ressourcenwirtschaft: am 9. und 10. März 2023 an der Technischen Universität Hamburg*. Innsbruck (Österreich): Innsbruck University Press. 413 S. ISBN: 978-3-99106-095-6. [12. Wissenschaftskongress Abfall- und Ressourcenwirtschaft, Hamburg, 09.–10.03.2023]. DOI: 10.15203/99106-095-6.
Nelles, M. (Hrsg.) (2023). *17. Rostocker Bioenergieforum: Tagungsband. am 15. und 16. Juni 2023*. (Schriftenreihe Umweltingenieurwesen, 114). Rostock: Univ., Professur Abfall- und Stoffstromwirtschaft. ISBN: 978-3-86009-547-8. [17. Rostocker Bioenergieforum, Rostock, 15.–16.06.2023]. DOI: 10.18453/rosdok_id00004269.
Thrän, D.; Händler, T. (Hrsg.) (2023). *Statuskonferenz Bioenergie: 20. bis 22.09.2023*. (Reader Energetische Biomassenutzung). Leipzig: DBFZ. 117 S. ISBN: 978-3-946629-98-6. [Statuskonferenz Bioenergie, Leipzig, 20.–22.09.2023]. DOI: 10.48480/x66n-ev26.

**Book Contributions**

Dotzauer, M. (2023). Flexsignal: Konzepte für eine bedarfsorientierte, kosteneffiziente und klimaschonende Stromerzeugung aus Bioenergie- anlagen. In: Thrän, D.; Händler, Tina (Hrsg.) *Focus on Bioenergie im Strom- und Wärmemarkt*: *Projektergebnisse 2021-2022*. Leipzig: DBFZ. (Fokusheft Energetische Biomassenutzung). ISBN: 978-3-946629-94-8. S. 124–129.
Esmaeili Aliabadi, D.; Wulff, N.; Jordan, M.; Cyffka, K.-F.; Millinger, M. (2023). Soft-Coupling Energy and Power System Models to Analyze Pathways Toward a De-fossilized German Transport Sector. In: Grothe, O.; Nickel, S.; Rebennack, S.; Stein, Oliver (Hrsg.) *Operations Research Proceedings 2022*: *Selected Papers of the Annual International Conference of the German Operations Research Society (GOR), Karlsruhe, Germany, September 6–9, 2022*. Basel (Schweiz): Springer. ISBN: 978-3-031-24906-8. S. 313–320. DOI: 10.1007/978-3-031-24907-5_38.



Goldstein, M. (2023). Determination of crude fat. In: Händler, T. (Hrsg.) *Collection of Methods for Biogas*: *Methods to determine parameters for analysis purposes and parameters that describe processes in the biogas sector. ERRATUM Dec 2023*. Leipzig: DBFZ. (Series „Biomass energy use“, 7). S. 7–9.
Goldstein, M. (2023). Determination of crude fibre. In: Händler, T. (Hrsg.) *Collection of Methods for Biogas*: *Methods to determine parameters for analysis purposes and parameters that describe processes in the biogas sector. ERRATUM Dec 2023*. Leipzig: DBFZ. (Series „Biomass energy use“, 7). S. 10–12.
Goldstein, M. (2023). Determination of Neutral Detergent Fibre (NDF). In: Händler, T. (Hrsg.) *Collection of Methods for Biogas*: *Methods to determine parameters for analysis purposes and parameters that describe processes in the biogas sector. ERRATUM Dec 2023*. Leipzig: DBFZ. (Series „Biomass energy use“, 7). S. 16–18.
Goldstein, M. (2023). Determination of total Kjeldahl nitrogen and crude protein. In: Händler, T. (Hrsg.) *Collection of Methods for Biogas*: *Methods to determine parameters for analysis purposes and parameters that describe processes in the biogas sector. ERRATUM Dec 2023*. Leipzig: DBFZ. (Series „Biomass energy use“, 7). S. 4–6.
Goldstein, M. (2023). Process specification for the determination of ADF and ADL. In: Händler, T. (Hrsg.) *Collection of Methods for Biogas*: *Methods to determine parameters for analysis purposes and parameters that describe processes in the biogas sector. ERRATUM Dec 2023*. Leipzig: DBFZ. (Series „Biomass energy use“, 7). S. 13–15.
Graffenberger, M.; Brödner, R. (2023). Die Modellregion. In: Ermann, U.; Höfner, M.; Hostniker, S.; Preininger, E. Michael; Simić, Danko (Hrsg.) *Die Region*: *eine Begriffserkundung*. Bielefeld: transcript. (Sozial- und Kulturgeographie, 52). ISBN: 978-3-8376-6010-4. S. 217–228. DOI: 10.14361/9783839460108-019.
Lange, N.; Moosmann, D.; Majer, S.; Meisel, K.; Oehmichen, K.; Rauh, S.; Thrän, D. (2023). Assessment of Greenhouse Gas Emission Reduction from Biogas Supply Chains in Germany in Context of a Newly Implemented Sustainability Certification. In: Hesser, F.; Kral, I.; Obersteiner, G.; Hörtenhuber, S.; Kühmaier, M.; Zeller, V.; Schebek, Liselotte (Hrsg.) *Progress in Life Cycle Assessment 2021*. Cham (Schweiz): Springer. (Sustainable Production, Life Cycle Engineering and Management). ISBN: 978-3-031-29293-4. S. 85–101. DOI: 10.1007/978-3-031-29294-1_6.
Nelles, M.; Sprafke, J.; Heickoff, I.; Morscheck, G. (2023). Waste Segregation at the Source in Germany: A Key Component of Sustainable Waste Management Systems. In: Ghosh, S. Kumar; Samanta, S.; Hirani, H.; Vieira da Silva, Carlos Roberto (Hrsg.) *Effective Waste Management and Circular Economy*: *Legislative Framework and Strategies*. Boca Raton, FL (USA): CRC Press. (The Circular Economy in Sustainable Solid and Liquid Waste Management). ISBN: 9781003231608. S. 43–51.
Schäfer, F.; Janke, L.; Pröter, J.; Himmelstoss, A.; Rocktäschel, B.; Niebling, F. (2023). NovoHTK: Neuartiges Verfahren zur Monovergärung von Hühnertrockenkot. In: Thrän, D.; Händler, Tina (Hrsg.) *Focus on Bioenergie im Strom- und Wärmemarkt*: *Projektergebnisse 2021–2022*. Leipzig: DBFZ. (Fokusheft Energetische Biomassenutzung). ISBN: 978-3-946629-94-8. S. 130–141.
Schwarz, B.; Kirsten, C. (2023). KoSaTZ: Behandlung und kombinierter Einsatz von Stroh- und Getreideausputzmischungen für eine Biogas-Technologiekette mit Zukunft. In: Thrän, D.; Händler, Tina (Hrsg.) *Focus on Bioenergie im Strom- und Wärmemarkt*: *Projektergebnisse 2021–2022*. Leipzig: DBFZ. (Fokusheft Energetische Biomassenutzung). ISBN: 978-3-946629-94-8. S. 28–41.
Zeug, W.; Bezama, A.; Thrän, D. (2023). Life Cycle Sustainability Assessment for Sustainable Bioeconomy, Societal-Ecological Transformation and Beyond. In: Hesser, F.; Kral, I.; Obersteiner, G.; Hörtenhuber, S.; Kühmaier, M.; Zeller, V.; Schebek, Liselotte (Hrsg.) *Progress in Life Cycle Assessment 2021*. Cham (Schweiz): Springer. (Sustainable Production, Life Cycle Engineering and Management). ISBN: 978-3-031-29293-4. S. 131–159. DOI: 10.1007/978-3-031-29294-1_8.

**Contributions to Conference Proceedings**

Barchmann, T.; Rensberg, N.; Dotzauer, M.; Daniel-Gromke, J.; Nelles, M. (2023). Stärkung der Güllevergärung in Deutschland zur Reduzierung der Emissionen in der Landwirtschaft. In: Nelles, M. (Hrsg.) *17. Rostocker Bioenergieforum*: *Tagungsband. am 15. und 16. Juni 2023*. Rostock: Univ., Professur Abfall- und Stoffstromwirtschaft. (Schriftenreihe Umweltingenieurwesen, 114). ISBN: 978-3-86009-547-8. S. 147–158.
Bezama, A. (2023). Challenges of the bioeconomy from a life cycle perspective. In: Nelles, M. (Hrsg.) *17. Rostocker Bioenergieforum*: *Tagungsband. am 15. und 16. Juni 2023*. Rostock: Univ., Professur Abfall- und Stoffstromwirtschaft. (Schriftenreihe Umweltingenieurwesen, 114). ISBN: 978-3-86009-547-8. S. 63–71.
Büttner, B.; Wurdinger, K.; Vehse, M.; Pflugradt, N.; Yasin, M.; Groß, B. (2023). Gebäudebestand der Zukunft: Smarte Energieeffizienz. In: *Forschung für die Wärmewende*: *klimaneutral, effizient und flexi-*

*bel. Beiträge zur FVEE-Jahrestagung 2022*. Berlin: FVEE. (FVEE-Themen). S. 108–116.

Cadenbach, A. M.; Weismann, S.; Gebhardt, H.; Oliva, A.; Schiebler, B.; Schüwer, D. (2023). Neubau und Transformation hocheffizienter Wärmenetze im Kontext der Dekarbonisierung und Flexibilisierung unserer Energiesysteme. In: *Forschung für die Wärmewende*: *klimaneutral, effizient und flexibel. Beiträge zur FVEE-Jahrestagung 2022*. Berlin: FVEE. (FVEE-Themen). S. 90–95.

Davidis, B.; Reumerman, P.; Vos, J.; Janssen, R.; Rutz, D.; Talluri, G.; Siegfried, K.; Cristou, M.; Panapoulos, K.; Kardaras, G.; Kraia, T.; Karampinis, M. (2023). Market uptake support for intermediate bioenergy carriers: music results. In: Bari, I. de; Scarlat, N.; Grassi, A. (Hrsg.) *Papers of the 31st European Biomass Conference*: *Setting the Course for a biobased economy. Extracted from the Proceedings of the International Conference held in Bologna, Italy. 5–8 June 2023*. Florenz (Italien): ETA-Florence Renewable Energies. ISBN: 978-88-89407-23-3. S. 484–489. DOI: 10.5071/31stEUBCE2023-3BO.15.1.

Dwi Putra, R.; Beidaghy Dizaji, H.; Kulshresth, D.; Zeng, T.; Overmann, S.; Vollpracht, A. (2023). Potential Use of Bottom Ashes from Non-woody Biomass Combustion as Sustainable Supplementary Cementitious Material: Effect of the Combustion Temperature. In: Bari, I. de; Scarlat, N.; Grassi, A. (Hrsg.) *Papers of the 31st European Biomass Conference*: *Setting the Course for a biobased economy. Extracted from the Proceedings of the International Conference held in Bologna, Italy. 5–8 June 2023*. Florenz (Italien): ETA-Florence Renewable Energies. ISBN: 978-88-89407-23-3. S. 635–640. DOI: 10.5071/31stEUBCE2023-4CO.3.4.

Ender, T.; Ekanthalu, V. S.; Sprafke, J.; Nelles, M. (2023). Anaerobversuche mit Prozesswasser aus der HTC von Klärschlamm. In: Bockreis, A.; Faulstich, M.; Flamme, S.; Kranert, M.; Mocker, M.; Nelles, M.; Quicker, P.; Rettenberger, G.; Rotter, Vera Susanne (Hrsg.) *12. Wissenschaftskongress Abfall- und Ressourcenwirtschaft*: *am 9. und 10. März 2023 an der Technischen Universität Hamburg*. Innsbruck (Österreich): Innsbruck University Press. ISBN: 978-3-99106-095-6. S. 205–210.

Ender, T.; Harchegani, S. K.; Jalalipour, H.; Ekanthalu, V. S.; Nelles, M. (2023). Hydrothermal Carbonization of the Organic Fine Fraction from Mechanical Biological Treatment from Municipal Solid Waste. In: Nelles, M. (Hrsg.) *17. Rostocker Bioenergieforum*: *Tagungsband. am 15. und 16. Juni 2023*. Rostock: Univ., Professur Abfall- und Stoffstromwirtschaft. (Schriftenreihe Umweltingenieurwesen, 114). ISBN: 978-3-86009-547-8. S. 193–201.

Ender, T.; Mohammadi, M.; Jalalipour, H.; Flemming, A.; Schneider, W.; Nelles, M. (2023). Hydrothermale Karbonisierung von Klärschlämmen zur Energie-Erzeugung und Nährstoffrückgewinnung. In: Gulden, J. (Hrsg.) *Nutzung regenerativer Energiequellen und Wasserstofftechnik 2023*. Stralsund: Hochschule Stralsund. S. 31–39.

Engler, N.; Schumacher, B.; Knoll, L. (2023). Emissionen aus der Gülle- oder Gärpoduktlagerung unter Praxisbedingungen messen. In: *Biogas 2023*: *16. Innovationskongress. Tagungsband 2023*. Hildesheim: ProFair Consult+Project GmbH. ISBN: 978-3-947777-08-2. S. 93–100.

Esmaeili Aliabadi, D.; Jordan, M.; Thrän, D.; Aliabadi, D. E. (2023). The complementary role of utility-scale battery energy storage systems and bioenergy in future German transportation. In: *19th International Conference on the European Energy Market (EEM)*. [online]. [s.l.]: [s.n.]. ISBN: 979-8-3503-1258-4. S. 1–6. DOI: 10.1109/EEM58374.2023.10161801.

Gievers, F.; Loewen, A.; Nelles, M. (2023). Ökobilanzielle Bewertung der HTC und Pyrolyse von Klärschlamm. In: Bockreis, A.; Faulstich, M.; Flamme, S.; Kranert, M.; Mocker, M.; Nelles, M.; Quicker, P.; Rettenberger, G.; Rotter, Vera Susanne (Hrsg.) *12. Wissenschaftskongress Abfall- und Ressourcenwirtschaft*: *am 9. und 10. März 2023 an der Technischen Universität Hamburg*. Innsbruck (Österreich): Innsbruck University Press. ISBN: 978-3-99106-095-6. S. 229–234.

Güsewell, J.; Barchmann, T.; Eltrop, L. (2023). Zukünftiger Weiterbetrieb von Biogasanlagen: Flexibilisierung, Biomethan oder gänzlich andere Wege? In: *Biogas in der Landwirtschaft*: *Stand und Perspektiven. FNR/KTBL-Kongress vom 11. bis 12. September 2023 in Bonn*. Darmstadt: KTBL. ISBN: 978-3-945088-99-9. S. 247–259.

Hartmann, I.; Formann, S.; König, M.; Bindig, R.; Stolze, B.; Sittaro, F.-C.; Schliermann, T. (2023). Study on the feasibility of in-situ extraction of biogenic silica from rice husks in the Mekong Delta. In: Nelles, M. (Hrsg.) *17. Rostocker Bioenergieforum*: *Tagungsband. am 15. und 16. Juni 2023*. Rostock: Univ., Professur Abfall- und Stoffstromwirtschaft. (Schriftenreihe Umweltingenieurwesen, 114). ISBN: 978-3-86009-547-8. S. 133–143.

Hellmann, S.; Hempel, A.-J.; Streif, S.; Weinrich, S. (2023). Observability and Identifiability Analyses of Process Models for Agricultural Anaerobic Digestion Plants. In: Paulen, R.; Fikar, M. (Hrsg.) *Proceedings of the 2023 24th International Conference on Process Control (PC)*: *Proceedings of the 2023 24th International Conference on Process Control (PC) Štrbské Pleso, Slovakia, June 6–9, 2023*. [s.l.]: IEEE. ISBN: 979-8-3503-4763-0. S. 84–89. DOI: 10.1109/PC58330.2023.10217587.

Hlawenka, S.; Hartmann, I. (2023). Neuartige Katalysatoren für nachhaltige, wärmeintensive Industrieprozesse. In: *Forschung für die Wärmewende*: *klimaneutral, effizient und flexibel. Beiträge zur FVEE-Jahrestagung 2022*. Berlin: FVEE. (FVEE-Themen). S. 82–85.

Hüsing, F.; Giovannetti, F.; Klinker, F.; Lenz, V.; Bongs, C. (2023). Wärmepumpen machen Umweltwärme in Gebäuden nutzbar: der Schlüssel zu einer nachhaltigen Wärmeversorgung. In: *Forschung für die Wärmewende*: *klimaneutral, effizient und flexibel. Beiträge zur FVEE-Jahrestagung 2022*. Berlin: FVEE. (FVEE-Themen). S. 47–53.

Jordan, M.; Thrän, D.; Groß, M.; Hüesker, F.; Siegfried, K.; Rösch, C.; Schill, E.; Best, B.; Wolf, P. (2023). Gesellschaftliche Akzeptanz der Wärmewende: Aktuelle Forschung, Fallbeispiele und sozialverträgliche Lösungsansätze. In: *Forschung für die Wärmewende*: *klimaneutral, effizient und flexibel. Beiträge zur FVEE-Jahrestagung 2022*. Berlin: FVEE. (FVEE-Themen). S. 16–22.

Knoll, L.; Daniel-Gromke, J. (2023). Methanemissionen von Biogasaufbereitungs- und Nachbehandlungsanlagen. In: *Biogas in der Landwirtschaft*: *Stand und Perspektiven. FNR/KTBL-Kongress vom 11. bis 12. September 2023 in Bonn*. Darmstadt: KTBL. ISBN: 978-3-945088-99-9. S. 155–163.

Kornatz, P.; Müller, J. (2023). Biogas als multifunktionaler Baustein für die Energieversorgung, den ländlichen Raum und die Umwelt. In: *Biogas in der Landwirtschaft*: *Stand und Perspektiven. FNR/KTBL-Kongress vom 11. bis 12. September 2023 in Bonn*. Darmstadt: KTBL. ISBN: 978-3-945088-99-9. S. 12–23.

Kornatz, P.; Rensberg, N.; Daniel-Gromke, J.; Nelles, M. (2023). Stand und Perspektiven der Biogaserzeugung in Deutschland. In: *Biogas 2023*: *16. Innovationskongress. Tagungsband 2023*. Hildesheim: ProFair Consult+Project GmbH. ISBN: 978-3-947777-08-2. S. 13–22.

Korte, H.; Juma Al Abd Al-Saadi, Abdullah; Nelles, M.; Sprafke, J. (2023). Holzkohleherstellung in einem 90-Liter-Reaktor: Ein Erfahrungsbericht. In: Nelles, M. (Hrsg.) *17. Rostocker Bioenergieforum*: *Tagungsband. am 15. und 16. Juni 2023*. Rostock: Univ., Professur Abfall- und Stoffstromwirtschaft. (Schriftenreihe Umweltingenieurwesen, 114). ISBN: 978-3-86009-547-8. S. 173–178.

Kretzschmar, J.; Winkler, M.; Mauky, E.; Naegeli de Torres, F.; Weinrich, S. (2023). Eignung landwirtschaftlicher Reststoffe zur Flexibilisierung des Biogasprozesses (RestFlex). In: *Biogas in der Landwirtschaft*: *Stand und Perspektiven. FNR/KTBL-Kongress vom 11. bis 12. September 2023 in Bonn*. Darmstadt: KTBL. ISBN: 978-3-945088-99-9. S. 237–246.

Kullmann, F.; Röder, L. S.; Kutne, P.; Holtz, G.; Schneider, C.; Krönauer, A. (2023). Industrielle Prozesswärme im Kontext eines treibhausgasneutralen Energiesystems. In: *Forschung für die Wärmewende*: *klimaneutral, effizient und flexibel. Beiträge zur FVEE-Jahrestagung 2022*. Berlin: FVEE. (FVEE-Themen). S. 74–77.

Lenz, V.; Hartmann, I.; Eggert, D.; Bongs, C.; Mattmüller, J.; Thomas, S. (2023). Lösungsansätze für die schnelle Umstellung von 20 Mio. Einzelgebäudeheizungen von fossil auf erneuerbar. In: *Forschung für die Wärmewende*: *klimaneutral, effizient und flexibel. Beiträge zur FVEE-Jahrestagung 2022*. Berlin: FVEE. (FVEE-Themen). S. 23–29.

Lenz, V.; Schindler, H.; Nelles, M. (2023). Nachhaltige Bioenergie in der Wärmewende, aber wie? In: Nelles, M. (Hrsg.) *17. Rostocker Bioenergieforum*: *Tagungsband. am 15. und 16. Juni 2023*. Rostock: Univ., Professur Abfall- und Stoffstromwirtschaft. (Schriftenreihe Umweltingenieurwesen, 114). ISBN: 978-3-86009-547-8. S. 53–62.

Majer, S.; van Dam, J.; Fritsche, U. R.; Heukels, B.; Harris, Z. M.; Egnell, G.; Thrän, D. (2023). Lessons learned from compliance and verification processes in certification of forestry biomass. In: Bari, I. de; Scarlat, N.; Grassi, A. (Hrsg.) *Papers of the 31st European Biomass Conference*: *Setting the Course for a biobased economy. Extracted from the Proceedings of the International Conference held in Bologna, Italy. 5–8 June 2023*. Florenz (Italien): ETA-Florence Renewable Energies. ISBN: 978-88-89407-23-3. S. 308–310. DOI: 10.5071/31stEUBCE2023-2CO.2.3.

Mäki, E.; Hennig, C.; Thrän, D.; Lange, N.; Schildhauer, T.; Schipfer, F. (2023). Defining the value of bioenergy system services for accelerating the integration of bioenergy into a low-carbon economy. In: Bari, I. de; Scarlat, N.; Grassi, A. (Hrsg.) *Papers of the 31st European Biomass Conference*: *Setting the Course for a biobased economy. Extracted from the Proceedings of the International Conference held in Bologna, Italy. 5–8 June 2023*. Florenz (Italien): ETA-Florence Renewable Energies. ISBN: 978-88-89407-23-3. S. 363–367. DOI: 10.5071/31stEUBCE2023-2DO.2.4.

Müller-Langer, F.; Kretzschmar, J.; Nelles, M. (2023). Wasserstoff aus bzw. mit Biomasse: sinnvolle Optionen und fragwürdige Ansätze. In: Nelles, M. (Hrsg.) *17. Rostocker Bioenergieforum*: *Tagungsband. am 15. und 16. Juni 2023*. Rostock: Univ., Professur Abfall- und Stoffstromwirtschaft. (Schriftenreihe Umweltingenieurwesen, 114). ISBN: 978-3-86009-547-8. S. 37–46.

Nelles, M.; Angelova, E.; Deprie, K.; Kornatz, P.; Rensberg, N.; Schaller, S.; Selig, M. (2023). Stand und Perspektiven der energetischen Verwertung von Biomasse in Deutschland. In: Nelles, M. (Hrsg.) *17. Rostocker Bioenergieforum*: *Tagungsband. am 15. und 16. Juni 2023*. Rostock: Univ., Professur Abfall- und Stoffstromwirtschaft. (Schriftenreihe Umweltingenieurwesen, 114). ISBN: 978-3-86009-547-8. S. 13–36.

Nieß, S.; Dietrich, S.; Klemm, M. (2023). Von Abfallbiomasse zum Biokraftstoff: geeignete Katalysatoren für eine direkte Biogasmethanisierung. In: Bockreis, A.; Faulstich, M.; Flamme, S.; Kranert, M.; Mocker, M.; Nelles, M.; Quicker, P.; Rettenberger, G.; Rotter, Vera Susanne (Hrsg.) *12. Wissenschaftskongress Abfall- und Ressourcenwirtschaft*: *am 9. und 10. März 2023 an der Technischen Universität Hamburg*. Innsbruck (Österreich): Innsbruck University Press. ISBN: 978-3-99106-095-6. S. 133–137.

Pohl, M.; Winkler, M.; Haupt, M. (2023). Prozessinformationssysteme zur kontinuierlichen Überwachung der Energieeffizienz von Biogasanlagen. In: *Biogas in der Landwirtschaft*: *Stand und Perspektiven. FNR/KTBL-Kongress vom 11. bis 12. September 2023 in Bonn*. Darmstadt: KTBL. ISBN: 978-3-945088-99-9. S. 104–115.

Richter, L.; Lenz, V.; Dotzauer, M.; Seifert, J. (2023). A 2-stage optimisation approach to ensure security of supply in rural cellular energy structures with solid biomass-based (hybrid) systems. In: *ETG Kongress 2023*: *Die Energiewende beschleunigen, 25.–26.05.2023 in Kassel*. Berlin: VDE. (ETG-Fachberichte, 170). ISBN: 978-3-8007-6108-1. S. 399–405.

Schossig, P.; Kost, C.; Herkel, S.; Szarka, N.; Pregger, T.; Gils, C.; Niepelt, V.; Krüger, C.; Binder, J. (2023). Klimaneutrale Wärmeversorgung: Bedeutung für die Energiewende und Herausforderungen bei Technik, Wirtschaftlichkeit und Regulierungen. In: *Forschung für die Wärmewende*: *klimaneutral, effizient und flexibel. Beiträge zur FVEE-Jahrestagung 2022*. Berlin: FVEE. (FVEE-Themen). S. 11–15.

Schröder, J.; Müller-Langer, F. (2023). Erreichung der $CO_2$-Ziele aus der Kraftstoffperspektive: Status und Trends für erneuerbare Kraftstoffe. In: *12. Tagung Einspritzung und Kraftstoffe*: *10./11. Mai 2023, Dessau-Roßlau, Sachsen-Anhalt*. *Tagungsband*. Rostock: Forschungszentrum für Verbrennungsmotoren und Thermodynamik Rostock GmbH. ISBN: 978-3-941554-26-9. S. 14–19.

Schröder, J.; Naumann, K.; Meisel, K. (2023). Zwischen Gegenwart und Zukunft: Wohin mit den erneuerbaren Kraftstoffen im Verkehr? In: Nelles, M. (Hrsg.) *17. Rostocker Bioenergieforum*: *Tagungsband. am 15. und 16. Juni 2023*. Rostock: Univ., Professur Abfall- und Stoffstromwirtschaft. (Schriftenreihe Umweltingenieurwesen, 114). ISBN: 978-3-86009-547-8. S. 79–86.

Siegfried, K.; Blümel, L.; Riedel, F.; Moosmann, D.; Cyffka, K.-F.; Richters, M.; Reumerman, P.; Vos, J.; Matisons, M.; Thrän, D. (2023). Plating the hot potato: how to make intermediate bioenergy carriers an accelerator to a climate neutral Europe. In: Bari, I. de; Scarlat, N.; Grassi, A. (Hrsg.) *Papers of the 31st European Biomass Conference*: *Setting the Course for a biobased economy. Extracted from the Proceedings of the International Conference held in Bologna, Italy. 5–8 June 2023*. Florenz (Italien): ETA-Florence Renewable Energies. ISBN: 978-88-89407-23-3. S. 814–815. DOI: 10.5071/31stEUBCE2023-5BO.4.4.

Stinner, W.; Hermus, S.; Häner, J.; Goldstein, M.; Brathe, C.; Knutzen, K. O.; Wiechen, J.; Hanrath, C.; Brügging, E. (2023). Projekt Nährwert: optimierte Gärproduktnutzung durch Komination von Technik und Anbaumanagement. In: *Biogas in der Landwirtschaft*: *Stand und Perspektiven. FNR/KTBL-Kongress vom 11. bis 12. September 2023 in Bonn*. Darmstadt: KTBL. ISBN: 978-3-945088-99-9. S. 188–197.

Szarka, N.; Lenz, V.; Hartmann, I.; Kutne, P.; Mercker, O.; Wern, B.; Jordan, M. (2023). Systemdienliche Wärmeversorgung aus Biomasse. In: *Forschung für die Wärmewende*: *klimaneutral, effizient und flexibel. Beiträge zur FVEE-Jahrestagung 2022*. Berlin: FVEE. (FVEE-Themen). S. 65–73.

Thrän, D. (2023). Editorial. In: Thrän, D.; Händler, Tina (Hrsg.) *Statuskonferenz Bioenergie*: *20. bis 22.09.2023*. Leipzig: DBFZ. (Reader Energetische Biomassenutzung). ISBN: 978-3-946629-98-6. S. 4.

Uhrlandt, D.; Stukenbrock, J.; Hink, Rüdiger, Klebingat, Stefan; Gräbner, M.; Kirsten, C. (2023). Effektive Verwertung biogener Reststoffe durch Kopplung von Energie- und Stoffströmen: ein Konzept. In: Nelles, M. (Hrsg.) *17. Rostocker Bioenergieforum*: *Tagungsband. am 15. und 16. Juni 2023*. Rostock: Univ., Professur Abfall- und Stoffstromwirtschaft. (Schriftenreihe Umweltingenieurwesen, 114). ISBN: 978-3-86009-547-8. S. 181–186.

Wurdinger, K.; Büchner, D.; Mercker, O.; Lenz, V. (2023). Biomasse-Hybridheizung: ein Beitrag zur Versorgungssicherheit. In: Wesselak, V. (Hrsg.) *6. Regenerative Energietechnik Konferenz in Nordhausen*: *09.–10. Februar 2023*. *Tagungsband*. Nordhausen: Hochschule Nordhausen, Institut für Regenerative Energietechnik. ISBN: 978-3-940820-21-1. S. 204–208.

Zeng, T.; Nix, J.; Müller, D.; Karl, J. (2023). Bewertung des Emissions- und Ascheverhaltens einer kleinskaligen Wirbelschichtfeuerung zur Nutzung nicht-holzartiger Festbrennstoffe. In: Nelles, M. (Hrsg.) *17. Rostocker Bioenergieforum*: *Tagungsband. am 15. und 16. Juni 2023*. Rostock: Univ., Professur Abfall- und Stoffstromwirtschaft. (Schriftenreihe Umweltingenieurwesen, 114). ISBN: 978-3-86009-547-8. S. 121–132.



**Abstracts in Conference Readers/ Conference Proceedings**

Adam, R. (2023). Numerical investigation of pressure and holding time on raw density and mechanical durability during biomass densification with an industrial stamp briquetting machine. In: *7. Mitteleuropäische Biomassekonferenz*: *Tagungsband. 18. bis 20. Jänner 2023, Graz, Österreich*. Wien (Österreich): Österreichischer Biomasse-Verband. ISBN: 978-3-9504380-6-2. S. 184.

Adam, R.; Röver, L.; Schneider, P.; Zeng, T.; Werner, H.; Lenz, V. (2023). Einsatz von Parklaub als „sonstiger nachwachsender Rohstoff“ gemäß § 3 (1) Nr. 13 der 1. BImSchV. In: Thrän, D.; Händler, Tina (Hrsg.) *Statuskonferenz Bioenergie*: *20. bis 22.09.2023*. Leipzig: DBFZ. (Reader Energetische Biomassenutzung). ISBN: 978-3-946629-98-6. S. 18–19.

Beidaghy Dizaji, H.; Kulshresth, D.; Zeng, T.; Overmann, S.; Vollpracht, A. (2023). Potential of bottom ashes from non-woody biomass combustion as sustainable supplementary cementitious materials. In: *7. Mitteleuropäische Biomassekonferenz*: *Tagungsband. 18. bis 20. Jänner 2023, Graz, Österreich*. Wien (Österreich): Österreichischer Biomasse-Verband. ISBN: 978-3-9504380-6-2. S. 158.

Cramer, O.; Hartmann, I. (2023). Einfluss vom Naturzugbetrieb auf das Emissionsverhalten von Stückholzfeuerstätten. In: Thrän, D.; Händler, Tina (Hrsg.) *Statuskonferenz Bioenergie*: *20. bis 22.09.2023*. Leipzig: DBFZ. (Reader Energetische Biomassenutzung). ISBN: 978-3-946629-98-6. S. 50–51.

Dögnitz, N.; Dietrich, S.; Hauschild, S.; Kretzschmar, J. (2023). Wasserstoff aus Biomasse: Stand der Technik und Entwicklungsperspektiven. In: Thrän, D.; Händler, Tina (Hrsg.) *Statuskonferenz Bioenergie*: *20. bis 22.09.2023*. Leipzig: DBFZ. (Reader Energetische Biomassenutzung). ISBN: 978-3-946629-98-6. S. 38–39.

Hartmann, I.; Kummrow, M. (2023). Emissionsminderung an Holzfeuerungen durch Kombination von schulischen und technischen Maßnahmen. In: Thrän, D.; Händler, Tina (Hrsg.) *Statuskonferenz Bioenergie*: *20. bis 22.09.2023*. Leipzig: DBFZ. (Reader Energetische Biomassenutzung). ISBN: 978-3-946629-98-6. S. 28–29.

Heinrich, M.; Plessing, T.; Herrmann, A.; Klemm, M.; Kuffer, G. (2023). Brennstoffspezifische Simulation thermochemischer Biomassevergasung. In: Thrän, D.; Händler, Tina (Hrsg.) *Statuskonferenz Bioenergie*: *20. bis 22.09.2023*. Leipzig: DBFZ. (Reader Energetische Biomassenutzung). ISBN: 978-3-946629-98-6. S. 64–65.

Hubert, C.; Steiniger, B.; Schaum, C.; Kretzschmar, J.; Einsiedel, S.; Athanasiadis, K.; Henker, J.; Heinrich, M. (2023). Flexible und vollenergetische Nutzung biogener Rest- und Abfallstoffe: Faulungen und Biogasanlagen als Energieverbraucher, -speicher und -erzeuger: Christian Hubert, Bettina Steiniger, Christian Schaum, Jörg Kretzschmar, Stefan Einsiedel, Konstantinos Athanasiadis, Jens Henker, Markus Heinri. In: Thrän, D.; Händler, Tina (Hrsg.) *Statuskonferenz Bioenergie*: *20. bis 22.09.2023*. Leipzig: DBFZ. (Reader Energetische Biomassenutzung). ISBN: 978-3-946629-98-6. S. 34–35.

Janssen, R.; Rutz, D.; Vos, J.; Reumerman, P.; Siegfried, K.; König, L. (2023). Market Uptake Support for Intermediate Bioenergy Carriers: MUSIC project results. In: *7. Mitteleuropäische Biomassekonferenz*: *Tagungsband. 18. bis 20. Jänner 2023, Graz, Österreich*. Wien (Österreich): Österreichischer Biomasse-Verband. ISBN: 978-3-9504380-6-2. S. 101.

Kretzschmar, J.; Geyer, F.; Krebs, C. (2023). Monovergärung von Weizenpülpe im Labor- und Pilot-Maßstab. In: Thrän, D.; Händler, Tina (Hrsg.) *Statuskonferenz Bioenergie*: *20. bis 22.09.2023*. Leipzig: DBFZ. (Reader Energetische Biomassenutzung). ISBN: 978-3-946629-98-6. S. 68–69.

Lange, N.; Hennig, C.; Thrän, D. (2023). Aktivitäten der IEA Bioenergy Task 44: Flexible Bioenergie und Systemintegration. In: Thrän, D.; Händler, Tina (Hrsg.) *Statuskonferenz Bioenergie*: *20. bis 22.09.2023*. Leipzig: DBFZ. (Reader Energetische Biomassenutzung). ISBN: 978-3-946629-98-6. S. 100–101.

Lenz, V. (2023). Neues zur DIN 33999 und VDI 3670. In: *14. Fachgespräch Partikelabscheider in häuslichen Feuerungen*: *09. Februar 2023. Technologie- und Forschungszentrum, Straubing*. Leipzig: DBFZ. (Tagungsreader, 27). ISBN: 978-3-946629-95-5. S. 32–36.

Lenz, V.; Szarka, N.; García Laverde, L.; Wurdinger, K.; Pomsel, D. (2023). Challenges and possible solutions for the replacement of all oil and gas boilers in the consumer market by 2045. In: *7. Mitteleuropäische Biomassekonferenz*: *Tagungsband. 18. bis 20. Jänner 2023, Graz, Österreich*. Wien (Österreich): Österreichischer Biomasse-Verband. ISBN: 978-3-9504380-6-2. S. 217.

Prempeh, C. O.; Formann, S.; Hartmann, I.; Nelles, M.

(2023). An improved method for the production of biogenic silica from cornhusk using sol-gel polymeric route. In: *7. Mitteleuropäische Biomassekonferenz*: *Tagungsband. 18. bis 20. Jänner 2023, Graz, Österreich*. Wien (Österreich): Österreichischer Biomasse-Verband. ISBN: 978-3-9504380-6-2. S. 187.

Richter, L. (2023). Optimizing the value of solid biomass-based (hybrid) systems in the context of the cellular approach. In: *7. Mitteleuropäische Biomassekonferenz*: *Tagungsband. 18. bis 20. Jänner 2023, Graz, Österreich*. Wien (Österreich): Österreichischer Biomasse-Verband. ISBN: 978-3-9504380-6-2. S. 122.

Schön, C.; Müller, M.; Hartmann, H.; Ulbricht, T.; Eßbach, R.; Hartmann, I.; Hermann, L.; Wagner, M. (2023). Log wood stove licence: Emission reduction through training of log wood stove users. In: *7. Mitteleuropäische Biomassekonferenz*: *Tagungsband. 18. bis 20. Jänner 2023, Graz, Österreich*. Wien (Österreich): Österreichischer Biomasse-Verband. ISBN: 978-3-9504380-6-2. S. 94.

Stolze, B.; Hartmann, I.; Bindig, R. (2023). Umweltfreundliche Katalysatorherstellung auf Basis von biogenem Silica. In: Thrän, D.; Händler, Tina (Hrsg.) *Statuskonferenz Bioenergie*: *20. bis 22.09.2023*. Leipzig: DBFZ. (Reader Energetische Biomassenutzung). ISBN: 978-3-946629-98-6. S. 58–59.

Sumfleth, B.; Majer, S.; Thrän, D. (2023). Integrated Assessment Framework for Low iLUC Risk Certification. In: *7. Mitteleuropäische Biomassekonferenz*: *Tagungsband. 18. bis 20. Jänner 2023, Graz, Österreich*. Wien (Österreich): Österreichischer Biomasse-Verband. ISBN: 978-3-9504380-6-2. S. 56.

Thrän, D.; Mäki, E.; Lange, N.; Hennig, C.; Schmieder, U.; Schildhauer, T.; Kiel, J.; Kroon, P.; Schipfer, F.; Philbrook, A.; Andersson, K.; Higa, C.; Gölles, M. (2023). Overview on flexible bioenergy options and implementation. In: *7. Mitteleuropäische Biomassekonferenz*: *Tagungsband. 18. bis 20. Jänner 2023, Graz, Österreich*. Wien (Österreich): Österreichischer Biomasse-Verband. ISBN: 978-3-9504380-6-2. S. 36.

Wiechen, J.; Stinner, W.; Goldstein, M.; Häner, J.; Knutzen, K. O.; Brügging, E.; Brathe, C.; Hermus, S. (2023). Innovationen für ein regionales Nährstoffmanagement (Technisch, pflanzen- baulich und managementseitig in Kombination). In: Thrän, D.; Händler, Tina (Hrsg.) *Statuskonferenz Bioenergie*: *20. bis 22.09.2023*. Leipzig: DBFZ. (Reader Energetische Biomassenutzung). ISBN: 978-3-946629-98-6. S. 80–81.

Wöhrl, T.; König, M.; Ritter, T.; Sauter, A.; Hessam, E.; Hagen, G.; Moos, R. (2023). Konzepte zur Optimierung der Selektiven Katalytischen Reduktion (SCR) von Stickoxiden bei der Verbrennung biogener Rest- und Abfallstoffe. In: Thrän, D.; Händler, Tina (Hrsg.) *Statuskonferenz Bioenergie*: *20. bis 22.09.2023*. Leipzig: DBFZ. (Reader Energetische Biomassenutzung). ISBN: 978-3-946629-98-6. S. 24–25.

**(Abstract of) Poster in conference proceedings**

Chang, Y.; Stinner, W.; Thrän, D. (2023). Value creation of biogas in China. In: Bari, I. de; Scarlat, N.; Grassi, A. (Hrsg.) *Papers of the 31st European Biomass Conference*: *Setting the Course for a biobased economy. Extracted from the Proceedings of the International Conference held in Bologna, Italy. 5–8 June 2023*. Florenz (Italien): ETA-Florence Renewable Energies. ISBN: 978-88-89407-23-3. S. 767–769. DOI: 10.5071/31stEUBCE2023-4CV.10.12.

Formann, S.; Schliermann, T.; Hartmann, I.; Bindig, R.; Hoferecht, F. (2023). Anwendung von porösem biogenem Siliziumdioxid ($SiO_2$) in Feinstaubfilter-Prozessen. In: Thrän, D.; Händler, Tina (Hrsg.) *Statuskonferenz Bioenergie*: *20. bis 22.09.2023*. Leipzig: DBFZ. (Reader Energetische Biomassenutzung). ISBN: 978-3-946629-98-6. S. 92–93.

García Laverde, L.; Bezama, A.; Zinke, C. (2023). Regionale Modelle für die Bioökonomie-entwicklung: Ansichten aus 5 EU-Regionen. In: Thrän, D.; Händler, Tina (Hrsg.) *Statuskonferenz Bioenergie*: *20. bis 22.09.2023*. Leipzig: DBFZ. (Reader Energetische Biomassenutzung). ISBN: 978-3-946629-98-6. S. 96–97.

Manolikakes, N.; Dzofou Ngoumelah, D.; Zeng, T.; Nefigmann, S.; Peters, G.; Jansen, N.; Kretzschmar, J. (2023). Entwicklung und Validierung eines innovativen Eisen-Kohlenstoff Präparates zur Gasreinigung und Effizienzsteigerung des Biogasprozesses. In: Thrän, D.; Händler, Tina (Hrsg.) *Statuskonferenz Bioenergie*: *20. bis 22.09.2023*. Leipzig: DBFZ. (Reader Energetische Biomassenutzung). ISBN: 978-3-946629-98-6. S. 110–111.

Meola, A.; Weinrich, S. (2023). Hybrid modelling of dynamic anaerobic digestion process in full-scale with LSTM NN and BMP measurements. In: *ESANN 2023*: *Proceesdings. 31st European Symposium on Artificial Neural Networks, Computational Intelligence and Machine Learning*. [online]. [s.l.]: i6doc.com publ. ISBN: 978-2-87587-088-9. S. 543–548. DOI: 10.14428/esann/2023.ES2023-133.

Oehmichen, K.; Majer, S.; Naumann, K. (2023). Renewable methane from biogas and hydrogen: enviromental assessment from different perspektives. In: Bari, I. de; Scarlat, N.; Grassi, A. (Hrsg.) *Papers of the 31st European Biomass Conference*: *Setting the Course for a biobased economy. Extracted from the Proceedings of the International Conference held in Bologna, Italy. 5–8 June 2023*. Florenz (Italien): ETA-Florence Renewable Energies. ISBN: 978-88-89407-23-3. S. 424–425. DOI: 10.5071/31stEUBCE2023-2AV.5.6.

Sadr, M.; Esmaeili Aliabadi, D.; Avsar, B.; Thrän, D. (2023). Assessing the seasonality impact on bioenergy production from energy crops in Germany. In: Bari, I. de; Scarlat, N.; Grassi, A. (Hrsg.) *Papers of the 31st European Biomass Conference*: *Setting the Course for a biobased economy. Extracted from the Proceedings of the International Conference held in Bologna, Italy. 5–8 June 2023*. Florenz (Italien): ETA-Florence Renewable Energies. ISBN: 978-88-89407-23-3. S. 284–289. DOI: 10.5071/31stEUBCE2023-1DV.4.16.

Sumfleth, B.; Majer, S.; Thrän, D. (2023). Knowledge based decision-making tool for the assessment of trade-offs in low ILUC risk certification. In: Bari, I. de; Scarlat, N.; Grassi, A. (Hrsg.) *Papers of the 31st European Biomass Conference*: *Setting the Course for a biobased economy. Extracted from the Proceedings of the International Conference held in Bologna, Italy. 5–8 June 2023*. Florenz (Italien): ETA-Florence Renewable Energies. ISBN: 978-88-89407-23-3. S. 384–386. DOI: 10.5071/31stEUBCE2023-2AV.1.16.

**Contributions in reports**

Chi, Y.; Dahmen, N.; Dittmeyer, R.; Heß, D.; Borchers, M.; Gawel, E.; Korte, K.; Markus, T.; Schaller, R.; Thrän, D.; Mayer, M.; Rau, B.; Brinkmann, T.; Hamedimastanabad, H.; Monnerie, N.; Prats Salvado, E. (2023). Cluster I: Net-Zero-2050. Project 2 Circular Carbon Approaches. In: Jacob, D.; Teutsch, G.; Koch, Roland (Hrsg.) *Helmholtz Climate Initiative*: *Final Report 2022*. Version 1.1. Berlin: Helmholtz-Klima-Initiative. S. 47–61.

El Zohbi, J.; Görl, K.; Groth, M.; Jacob, D.; Köhnke, F.; Preuschmann, S.; Steuri, B.; Mengis, N.; Oschlies, A.; Schill, E.; Steiner, U.; Beck, S.; Borchers, M.; Förster, J.; Gawel, E.; Korte, K.; Luz Schaller, R.; Markus, T.; Thoni, T.; Thrän, D. (2023). Cluster I: Net-Zero-2050. Project 1.1 National Roadmap Net Zero. In: Jacob, D.; Teutsch, G.; Koch, Roland (Hrsg.) *Helmholtz Climate Initiative*: *Final Report 2022*. Version 1.1. Berlin: Helmholtz-Klima-Initiative. S. 7–27.

Lehneis, R.; Manske, D.; Schinkel, B.; Thrän, D. (2023). Power Generation from Variable Renewable Energies (VRE). In: Jacob, D.; Teutsch, G.; Koch, Roland (Hrsg.) *Helmholtz Climate Initiative*: *Final Report 2022*. Version 1.1. Berlin: Helmholtz-Klima-Initiative. S. 213–215.

Müller-Langer, F.; Schröder, J.; Dahmen, N. (2023). Germany. In: *Implementation Agendas*: *Compare-and-Contrast Transport Biofuels Policies. (2021-2023 Update)*. S. 65–76.

**Journal articles (peer reviewed)**

Dzofou Ngoumelah, D.; Kuchenbuch, A.; Harnisch, F.; Kretzschmar, J. (2023). „Combining Geobacter spp. Dominated Biofilms and Anaerobic Digestion Effluents: The Effect of Effluent Composition and Electrode Potential on Biofilm Activity and Stability“. *Environmental Science & Technology* (ISSN: 1520-5851), Vol. 57, Nr. 6. S. 2584–2594. DOI: 10.1021/acs.est.2c07574.

Ender, T.; Ekanthalu, V. S.; Nelles, M. (2023). „Hydrothermal carbonization of sewage sludge: an effective approach to treat and manage sewage sludge in rural areas of Germany?“. *Detritus* (ISSN: 2611-4135), Nr. 24. S. 70–77. DOI: 10.31025/2611-4135/2023.18308.

Gallegos Ibáñez, D.; Jurado-Molina, J.; Wedwitschka, H.; Delgado, E.; Nelles, M.; Stinner, W. (2023). „Ensiling of Invasive Elodea sp., a Novel Aquatic Biomass Feedstock for the Sustainable Biogas Production: Effects of Wheat Straw and Silage Additives on Silage Quality and Methane Production“. *ACS Agricultural Science & Technology*, Vol. 3, Nr. 6. S. 477–486. DOI: 10.1021/acsagscitech.3c00043.

Logroño, W.; Kleinsteuber, S.; Kretzschmar, J.; Harnisch, F.; Vrieze, J. de; Nikolausz, M. (2023). „The microbiology of Power-to-X applications“. *FEMS Microbiology Reviews* (ISSN: 0168-6445), Vol. 47, Nr. 2. DOI: 10.1093/femsre/fuad013.

Meola, A.; Winkler, M.; Weinrich, S. (2023). „Metaheuristic optimization of data preparation and machine learning hyperparameters for prediction of dynamic methane production“. *Bioresource Technology* (ISSN: 0960-8524), Nr. 372. DOI: 10.1016/j.biortech.2023.128604.

Solís, A.; Rocha, S.; König, M.; Adam, R.; Garcés, H. O.; Candia, O.; Muñoz, R.; Azócar, L. (2023). „Preliminary assessment of hazelnut shell biomass as a raw material for pellet production“. *Fuel* (ISSN: 0016-2361), Nr. 333, Part 2. DOI: 10.1016/j.fuel.2022.126517.

Yang, J.; Cong, W.; Zhu, Z.; Miao, Z.; Wang, Y.-T.; Nelles, M.; Fang, Z. (2023). „Microwave-assisted one-step production of biodiesel from waste cooking oil by magnetic bifunctional SrO–ZnO/MOF catalyst“. *Journal of Cleaner Production* (ISSN: 0959-6526), Nr. 395. DOI: 10.1016/j.jclepro.2023.136182.

**Open Access journal articles (peer reviewed)**

Adam, R.; Pollex, A.; Zeng, T.; Kirsten, C.; Röver, L.; Berger, F.; Lenz, V.; Werner, H. (2023). „Systematic homogenization of heterogenous biomass batches: Industrial-scale production of solid biofuels in

two case studies“. *Biomass and Bioenergy* (ISSN: 0961-9534), Nr. 173. DOI: 10.1016/j.biombioe.2023.106808.

Ahiekpor, J. C.; Mensah, I.; Bensah, E. C.; Narra, S.; Amponsem, B.; Antwi, E. (2023). „Modeling the behavior of Celtis mildbraedii sawdust and polyethylene terephthalate co-pyrolysis for syngas production“. *Scientific African* (ISSN: 2468-2276), Nr. 19. DOI: 10.1016/j.sciaf.2022.e01450.

Amponsem, B.; Bensah, E. C.; Antwi, E.; Ahiekpor, J. C.; Boahen, B.; Mensah, I.; Narra, S. (2023). „Electricity generation from biogas as resource recovery potential from solid waste composition in a mixed-income municipality“. *Cleaner Waste Systems* (ISSN: 2772-9125), Nr. 4. DOI: 10.1016/j.clwas.2022.100067.

Bao, K.; Schröter, B.; Thrän, D. (2023). „Land Resource Allocation between Biomass and Ground-Mounted PV under consideration of the Food-Water-Energy Nexus Framework at Regional Scale“. *Renewable Energy* (ISSN: 0960-1481), Nr. 203. S. 323–333. DOI: 10.1016/j.renene.2022.12.027.

Bassey, U.; Sarquah, K.; Hartmann, M.; Tom, A.; Beck, G.; Antwi, E.; Narra, S.; Nelles, M. (2023). „Thermal treatment options for single-use, multilayered and composite waste plastics in Africa“. *Energy* (ISSN: 0360-5442), Nr. 270. DOI: 10.1016/j.energy.2023.126872.

Beguedou, E.; Narra, S.; Afrakoma Armoo, E.; Agboka, K.; Damgou, M. K. (2023). „Alternative Fuels Substitution in Cement Industries for Improved Energy Efficiency and Sustainability“. *Energies* (ISSN: 1996-1073), Vol. 16, Nr. 8. DOI: 10.3390/en16083533.

Beguedou, E.; Narra, S.; Afrakoma Armoo, E.; Agboka, K.; Kongnine, D. M. (2023). „E-Technology Enabled Sourcing of Alternative Fuels to Create a Fair-Trade Circular Economy for Sustainable Energy in Togo“. *Energies* (ISSN: 1996-1073), Vol. 16, Nr. 9. DOI: 10.3390/en16093679.

Beguedou, E.; Narra, S.; Agboka, K.; Kongnine, D. M.; Afrakoma Armoo, E. (2023). „Alternative Fuel Substitution Improvements in Low NOx In-Line Calciners“. *Clean Technologies* (ISSN: 2571-8797), Vol. 5, Nr. 2. S. 713–743. DOI: 10.3390/cleantechnol5020036.

Beguedou, E.; Narra, S.; Agboka, K.; Kongnine, D. M.; Afrakoma Armoo, E. (2023). „Review of Togolese Policies and Institutional Framework for Industrial and Sustainable Waste Management“. *Waste* (ISSN: 2813-0391), Vol. 1, Nr. 3. S. 654–671. DOI: 10.3390/waste1030039.

Blümel, L.; Siegfried, K.; Riedel, F.; Thrän, D. (2023). „Are strategy developers well equipped when designing sustainable supply chains for a circular bio-economy?: Supporting innovations' market uptake in a PESTEL + I environment“. *Energy, Sustainability and Society* (ISSN: 2192-0567), Vol. 13. DOI: 10.1186/s13705-023-00415-2.

Boldt, C.; Thrän, D. (2023). „How to implement the urban bioeconomy: insights from Leipzig's current policy mix for transitioning towards a bio-principled city“. *Urban Transformations* (ISSN: 2524-8162), Vol. 5. DOI: 10.1186/s42854-023-00052-0.

Cantarella, H.; Leal Silva, J. F.; Nogueira, L. A. H.; Maciel Filho, R.; Rossetto, R.; Ekbom, T.; Souza, G. M.; Müller-Langer, F. (2023). „Biofuel technologies: Lessons learned and pathways to decarbonization“. *GCB Bioenergy* (ISSN: 1757-1693), Vol. 15, Nr. 10. S. 1190–1203. DOI: 10.1111/gcbb.13091.

Chaher, N. E. H.; Engler, N.; Nassour, A.; Nelles, M. (2023). „Effects of co-substrates' mixing ratios and loading rate variations on food and agricultural wastes' anaerobic co-digestion performance“. *Biomass Conversion and Biorefinery* (ISSN: 2190-6815), Vol. 13, Nr. 8. S. 7051–7066. DOI: 10.1007/s13399-021-01655-y.

Darmey, J.; Ahiekpor, J. C.; Narra, S.; Achaw, O.-W.; Ansah, H. F. (2023). „Municipal Solid Waste Generation Trend and Bioenergy Recovery Potential: A Review“. *Energies* (ISSN: 1996-1073), Vol. 16, Nr. 23. DOI: 10.3390/en16237753.

Dzofou Ngoumelah, D.; Harnisch, F.; Sulheim, S.; Heggeset, T. M. B.; Aune, I. H.; Wentzel, A.; Kretzschmar, J. (2023). „A unified and simple medium for growing model methanogens“. *Frontiers in Microbiology* (ISSN: 1664-302X), Vol. 13. DOI: 10.3389/fmicb.2022.1046260.

Ekanthalu, V. S.; Ender, T.; Narra, S.; Antwi, E.; Bej, S.; Nelles, M. (2023). „Acid leaching of hydrothermally carbonized sewage sludge: phosphorus recovery and hydrochar characteristics“. *Frontiers in Environmental Engineering* (ISSN: 2813-5067), Nr. 2. DOI: 10.3389/fenve.2023.1223247.

Esmaeili Aliabadi, D.; Chan, K.; Wulff, N.; Meisel, K.; Jordan, M.; Österle, I.; Pregger, T.; Thrän, D. (2023). „Future renewable energy targets in the EU: Impacts on the German transport“. *Transportation Research Part D: Transport and Environment* (ISSN: 1361-9209), Nr. 124. DOI: 10.1016/j.trd.2023.103963.

Esmaeili Aliabadi, D.; Manske, D.; Seeger, L.; Lehneis, R.; Thrän, D. (2023). „Integrating Knowledge Acquisition, Visualization, and Dissemination in Energy System Models: BENOPTex Study“. *Energies* (ISSN: 1996-1073), Vol. 16, Nr. 13. DOI: 10.3390/en16135113.

Etzold, H.; Röder, L. S.; Oehmichen, K.; Nitzsche, R. (2023). „Technical design, economic and environmental assessment of a biorefinery concept for the integration of biomethane and hydrogen into the transport sector“. *Bioresource Technology Reports* (ISSN: 2589-014X), Nr. 22. DOI: 10.1016/j.biteb.2023.101476.

Hagen, G.; Herrmann, J.; Zhang, X.; Kohler, H.; Hartmann, I.; Moos, R. (2023). „Application of a Robust Thermoelectric Gas Sensor in Firewood Combustion Exhausts“. *Sensors* (ISSN: 1424-8220), Vol. 23, Nr. 6. DOI: 10.3390/s23062930.

Heinrich, M.; Herrmann, A.; Gradel, A.; Klemm, M.; Plessing, T. (2023). „Extensive Experimental Characterization with Kinetic Data for the Gasification Simulation of Solid Biofuels“. *Energies* (ISSN: 1996-1073), Vol. 16, Nr. 6. DOI: 10.3390/en16062888.

Hirschler, O.; Thrän, D. (2023). „Peat Substitution in Horticulture: Interviews with German Growing Media Producers on the Transformation of the Resource Base“. *Horticulturae* (ISSN: 2311-7524), Vol. 9, Nr. 8. DOI: 10.3390/horticulturae9080919.

Jordan, M.; Meisel, K.; Dotzauer, M.; Schröder, J.; Cyffka, K.-F.; Dögnitz, N.; Schmid, C.; Lenz, V.; Naumann, K.; Daniel-Gromke, J.; Paiva, G. C. de; Schindler, H.; Aliabadi, D. E.; Szarka, N.; Thrän, D. (2023). „The controversial role of energy crops in the future German energy system: The trade offs of a phase-out and allocation priorities of the remaining biomass residues“. *Energy Reports* (ISSN: 2352-4847), Nr. 10. S. 3848–3858. DOI: 10.1016/j.egyr.2023.10.055.

Kacanski, M.; Knoll, L.; Nussbaumer, M.; Neureiter, M.; Drosg, B. (2023). „Anaerobic acidification of pressed sugar beet pulp for mcl-polyhydroxyalkanoates fermentation“. *Process Biochemistry*, Nr. 131. S. 235–243. DOI: 10.1016/j.procbio.2023.06.019.

Klein, J.; Schüch, A.; Sandmann, P.; Nelles, M.; Palm, H. W.; Bischoff, A. (2023). „Utilization of Sludge from African Catfish (Clarias gariepinus) Recirculating Aquaculture Systems for Vermifiltration“. *Sustainability* (ISSN: 2071-1050), Vol. 15, Nr. 9. DOI: 10.3390/su15097429.

Klüpfel, C.; Herklotz, B.; Biller, P. (2023). „Influence of processing conditions and biochemical composition on the hydrothermal liquefaction of digested urban and agricultural wastes“. *Fuel* (ISSN: 0016-2361), Nr. 352. DOI: 10.1016/j.fuel.2023.129016.

Köchermann, J.; Klemm, M. (2023). „Hydrothermal Reactive Distillation of Biomass and Biomass Hydrolysates for the Recovery and Separation of Furfural and Its Byproducts“. *Industrial & Engineering Chemistry Research* (ISSN: 0888-5885), Vol. 62, Nr. 18. S. 6886–6896. DOI: 10.1021/acs.iecr.3c00259.

Köhnke, F.; Steuri, B.; El Zohbi, J.; Görl, K.; Borchers, M.; Förster, J.; Thrän, D.; Mengis, N.; Oschlies, A.; Jacob, D. (2023). „On the path to net-zero: Establishing a multi-level system to support the complex endeavor of reaching national carbon neutrality“. *Frontiers in Climate* (ISSN: 2624-9553), Vol. 5. DOI: 10.3389/fclim.2023.1056023.

Krüger, D.; Mutlu, Ö. Ç. (2023). „The Apeli: An Affordable, Low-Emission and Fuel-Flexible Tier 4 Advanced Biomass Cookstove“. *Energies* (ISSN: 1996-1073), Vol. 16, Nr. 7. DOI: 10.3390/en16073278.

Lauer, M.; Dotzauer, M.; Millinger, M.; Oehmichen, K.; Jordan, M.; Kalcher, J.; Majer, S.; Thrän, D. (2023). „The crucial role of bioenergy in a climate neutral energy system in Germany“. *Chemical Engineering & Technology* (ISSN: 0930-7516), Vol. 46, Nr. 3. S. 501–510. DOI: 10.1002/ceat.202100263.

Lehneis, R.; Thrän, D. (2023). „Temporally and Spatially Resolved Simulation of the Wind Power Generation in Germany“. *Energies* (ISSN: 1996-1073), Vol. 16, Nr. 7. DOI: 10.3390/en16073239.

Lenhart, M.; Pohl, M.; Sprafke, J. (2023). „Challenges and Potential of Anaerobic Digestion from Municipal and Agricultural Organic Waste in Ethiopia“. *Ethiopian Journal of Applied Science and Technology* (ISSN: 2220-5802), Nr. Special Issue 2. S. 33–41.

Mutlu, Ö. Ç.; Jordan, M.; Zeng, T.; Lenz, V. (2023). „Competitive Options for Bio-Syngas in High-Temperature Heat Demand Sectors: Projections until 2050“. *Chemical Engineering & Technology* (ISSN: 0930-7516), Vol. 46, Nr. 3. S. 559–566. DOI: 10.1002/ceat.202200217.

Osei, J. A.; Adamou, R.; Kabo-Bah, A. T.; Narra, S. (2023). „Climate variability and change impacts on vehicular fuel consumption and emissions: A systematic overview in Africa“. *STED Journal* (ISSN: 2637-2150), Vol. 5, Nr. 1. S. 50–77. DOI: 10.7251/STED23050500.

Pollex, A.; Zeng, T.; Bandemer, S.; Ulbricht, A.; Herrmann, K.; Bräkow, D. (2023). „Characteristics of gasification chars: Results from a screening campaign“. *Biomass and Bioenergy* (ISSN: 0961-9534), Nr. 179. DOI: 10.1016/j.biombioe.2023.106962.

Prempeh, C. O.; Hartmann, I.; Formann, S.; Eiden, M.; Neubauer, K.; Atia, H.; Wotzka, A.; Wohlrab, S.; Nelles, M. (2023). „Comparative Study of Commercial Silica and Sol-Gel-Derived Porous Silica from Cornhusk for Low-Temperature Catalytic Methane Combustion“. *Nanomaterials* (ISSN: 2079-4991), Vol. 13, Nr. 9. DOI: 10.3390/nano13091450.

Röder, L. S.; Gröngröft, A.; Grünewald, M.; Riese, J. (2023). „Assessing the demand side management potential in biofuel production: A theoretical study for biodiesel, bioethanol, and biomethane in Germany“. *Biofuels, Bioproducts and Biorefining* (ISSN: 1932-1031), Vol. 17, Nr. 1. S. 56–70. DOI: 10.1002/bbb.2452.

Sambiani, K.; Lare, Y.; Zanguina, A.; Narra, S. (2023). „Location-allocation combining fuzzy analytical hierarchy process for waste to energy facilities siting in developing urban areas: The case study of Lomé, Togo“. *Heliyon* (ISSN: 2405-8440), Vol. 9, Nr. 9. DOI: 10.1016/j.heliyon.2023.e19767.

Sarquah, K.; Narra, S.; Beck, G.; Bassey, U.; Antwi, E.; Hartmann, M.; Derkyi, N. S. A.; Awafo, E. A.; Nelles, M. (2023). „Characterization of Municipal Solid Waste and Assessment of Its Potential for Refuse-Derived Fuel (RDF) Valorization“. *Energies* (ISSN: 1996-1073), Vol. 16, Nr. 1. DOI: 10.3390/en16010200.

Siegfried, K.; Blümel, L.; Riedel, F.; Moosmann, D.; Cyffka, K.-F.; Richters, M.; Reumerman, P.; Vos, J.; Matisons, M.; Thrän, D. (2023). „Plating the hot potato: how to make intermediate bioenergy carriers an accelerator to a climate-neutral Europe“. *Energy, Sustainability and Society* (ISSN: 2192-0567), Vol. 13. DOI: 10.1186/s13705-023-00416-1.

Siegfried, K.; Günther, S.; Mengato, S.; Riedel, F.; Thrän, D. (2023). „Boosting Biowaste Valorisation: Do We Need an Accelerated Regional Implementation of the European Law for End-of-Waste?“. *Sustainability* (ISSN: 2071-1050), Vol. 15, Nr. 17. DOI: 10.3390/su151713147.

Siol, C.; Thrän, D.; Majer, S. (2023). „Utilizing residual biomasses from agriculture and forestry: Different approaches to set system boundaries in environmental and economic life-cycle assessments“. *Biomass and Bioenergy* (ISSN: 0961-9534), Nr. 174. DOI: 10.1016/j.biombioe.2023.106839.

Sittaro, F.-C.; Hutengs, C.; Vohland, M. (2023). „Which factors determine the invasion of plant species?: Machine learning based habitat modelling integrating environmental factors and climate scenarios“. *International Journal of Applied Earth Observation and Geoinformation* (ISSN: 1569-8432), Nr. 116. DOI: 10.1016/j.jag.2022.103158.

Sumfleth, B.; Majer, S.; Thrän, D. (2023). „A Review of Trade-Offs in Low ILUC-Risk Certification for Biofuels: Towards an Integrated Assessment Framework“. *Sustainability* (ISSN: 2071-1050), Vol. 15, Nr. 23. DOI: 10.3390/su152316303.

Szarka, N.; García Laverde, L.; Thrän, D.; Kiyko, O.; Ilkiv, M.; Moravckíková, D.; Cudlínová, E.; Lapka, M.; Hatvani, N.; Koós, Á.; Luks, A.; Martín Jimenez, I. (2023). „Stakeholder Engagement in the Co-Design of Regional Bioeconomy Strategies“. *Sustainability* (ISSN: 2071-1050), Vol. 15, Nr. 8. DOI: 10.3390/su15086967.

Szarka, N.; Schmid, C.; Pfeiffer, D.; Thrän, D. (2023). „The System Role of Smart Bioenergy: A Multicriteria Assessment“. *Chemical Engineering & Technology* (ISSN: 0930-7516), Vol. 46, Nr. 3. S. 550–558. DOI: 10.1002/ceat.202100069.

Thabit, Q.; Nassour, A.; Nelles, M. (2023). „Facts and Figures on Aspects of Waste Management in Middle East and North Africa Region“. *Waste* (ISSN: 2813-0391), Vol. 1, Nr. 1. S. 52–80. DOI: 10.3390/waste1010005.

Thrän, D.; Deprie, K.; Dotzauer, M.; Kornatz, P.; Nelles, M.; Radtke, K. S.; Schindler, H. (2023). „The potential contribution of biogas to the security of gas supply in Germany“. *Energy, Sustainability and Society* (ISSN: 2192-0567), Vol. 13. DOI: 10.1186/s13705-023-00389-1.

Undiandeye, J. A.; Kiman, S.; Kefas, H. M.; Nelles, M.; Stinner, W. (2023). „Ensiling water hyacinth for enhanced biomethane production: Effect of co-ensiling with maize straw and eggshell powder as additive“. *Journal of Chemical Technology & Biotechnology* (ISSN: 1097-4660), Vol. 98, Nr. 2. S. 490–497. DOI: 10.1002/jctb.7263.

Wechselberger, V.; Reinelt, T.; Yngvesson, J.; Scharfy, D.; Scheutz, C.; Huber-Humer, M.; Hrad, M. (2023). „Methane losses from different biogas plant technologies“. *Waste Management* (ISSN: 0956-053X), Nr. 157. S. 110–120. DOI: 10.1016/j.wasman.2022.12.012.

Wedwitschka, H.; Gallegos Ibáñez, D.; Reyes-Jáquez, D. (2023). „Biogas Production from Residues of Industrial Insect Protein Production from Black Soldier Fly Larvae Hermetia ilucens (L.): An Evaluation of Different Insect Frass Samples“. *Processes* (ISSN: 2227-9717), Vol. 11, Nr. 2. DOI: 10.3390/pr11020362.

Williams, P. A.; Narra, S.; Antwi, E.; Quaye, W.; Hagan, E.; Asare, R.; Owusu-Arthur, J.; Ekanthalu, V. S. (2023). „Review of Barriers to Effective Implementation of Waste and Energy Management Policies in Ghana: Implications for the Promotion of Waste-to-Energy Technologies“. *Waste* (ISSN: 2813-0391), Vol. 1, Nr. 2. S. 313–332. DOI: 10.3390/waste1020021.

Yuan, B.; Braune, M.; Gröngröft, A. (2023). „Liquid-Liquid Extraction of Caproic and Caprylic Acid: Solvent Properties and pH“. *Chemie Ingenieur Technik* (ISSN: 1522-2640), Vol. 95, Nr. 10. S. 1573–1579. DOI: 10.1002/cite.202200189.

Yunusa, S. U.; Mensah, E.; Preko, K.; Narra, S.; Saleh, A.; Sanfo, S.; Isiaka, M.; Dalha, I. B.; Abdulsalam, M. (2023). „Biomass cookstoves: A review of technical aspects and recent advances“. *Energy Nexus* (ISSN: 2772-4271), Nr. 11. DOI: 10.1016/j.nexus.2023.100225.

Zeug, W.; Yupanqui, K. R. G.; Bezama, A.; Thrän, D. (2023). „Holistic and integrated life cycle sustainability assessment of prospective biomass to liquid



production in Germany“. *Journal of Cleaner Production* (ISSN: 0959-6526), Nr. 418. DOI: 10.1016/j.jclepro.2023.138046.

Zhang, X.; Ojha, B.; Bichlmaier, H.; Hartmann, I.; Kohler, H. (2023). „Extensive Gaseous Emissions Reduction of Firewood-Fueled Low Power Fireplaces by a Gas Sensor Based Advanced Combustion Airflow Control System and Catalytic Post-Oxidation“. *Sensors* (ISSN: 1424-8220), Vol. 23, Nr. 10. DOI: 10.3390/s23104679.

**Journal articles (not peer reviewed)**

Daniel-Gromke, J.; Oehmichen, K.; Knoll, L.; Reinelt, T.; Matlach, J.; Vater, F.; Stinner, W.; Cuhls, C.; Reinhold, J. (2023). „Klimaschutzorientierte Bioabfallverwertung: Projektergebnisse aus dem Verbundvorhaben ‚KlimaBioHum‘“. *Müll und Abfall* (ISSN: 0027-2957), Nr. 7. S. 398–405. DOI: 10.37307/j.1863-9763.2023.07.07.

Ekanthalu, V. S.; Asiedu, Z.; Narra, M.-M.; Narra, S.; Nelles, M. (2023). „Perspektiven für die energetische Verwertung von Abfällen in Ghana“. *Müll und Abfall* (ISSN: 0027-2957), Vol. 55, Nr. 6. S. 316–324. DOI: 10.37307/j.1863-9763.2023.06.04.

Formann, S.; Schliermann, T. (2023). „Value element recovery from biomass resources“. *Eebio News*, Nr. 19. S. 12–13.

Görsch, K.; Naumann, K. (2023). „Pilotanlage für grünes Methan am DBFZ“. *GWF. Gas + Energie* (ISSN: 0016-4909), Nr. 1. S. 18–19.

Nelles, M. (2023). „Editorial: Klima- und Ressourcenschutz durch Kreislaufwirtschaft: Engegement aus Deutschland international stark nachgefragt!“. *Müll und Abfall* (ISSN: 0027-2957), Vol. 55, Nr. 6. S. 305.

Nelles, M.; Deprie, K.; Jalalipour, H. (2023). „Editorial: The role of biogenic wastes and residues in a climate-neutral society: Carbon source, bioenergy and negative emissions“. *Waste Management & Research* (ISSN: 0734-242X), Vol. 41, Nr. 4. S. 741–743. DOI: 10.1177/0734242X231161506.

Nelles, M.; Deprie, K.; Kornatz, P. (2023). „Biogene Abfälle und Reststoffe: Kohlenstoffquelle, Bioenergie und negative Emissionen“. *Müll und Abfall* (ISSN: 0027-2957), Vol. 55, Nr. 2. S. 96–102. DOI: 10.37307/j.1863-9763.2023.02.07.

Nelles, M.; Deprie, K.; Kornatz, P. (2023). „Multitalent vor großer Karriere“. *Entsorga-Magazin* (ISSN: 0933-3754), Vol. 42, Nr. 3. S. 42–45. DOI: 10.51202/0933-3754-2023-3-042.

Nelles, M.; Deprie, K.; Kornatz, P.; Morscheck, G.; Narra, S.; Nassour, A. (2023). „Material and Energetic Use of Biogenic Residues and Waste“. *Waste Management World* (ISSN: 2707-580X), Nr. 3. S. 24–31.

Schindler, H.; Thrän, D.; Dotzauer, M.; Kornatz, P.; Nelles, M. (2023). „Die Rolle von Biogas für eine sichere Gasversorgung in Deutschland“. *Müll und Abfall* (ISSN: 0027-2957), Nr. 4. S. 199–203. DOI: 10.37307/j.1863-9763.2023.04.05.

Schumacher, B.; Grundmann, J.; Schlüter, E. (2023). „Poplar Wood Fibers as an all-rounder for the production of biomethane and peat substitute?“. *Biogas Journal (English Issue)*, Nr. Spring 2023. S. 38–44.

Schumacher, B.; Stinner, W.; Strach, K.; Amon, T. (2023). „Entwicklung und Test einer Methodik zur Langzeitmessung von Methanimissionen aus Gülle“. *Biogas Journal* (ISSN: 1619-8913), Nr. 2. S. 76–85.

Stryi-Hipp, G.; Lenz, V. (2023). „Umdenken für die Energiewende“. *HLH* (ISSN: 1436-5103), Vol. 74, Nr. 5. S. 3.

Thrän, D.; Dotzauer, M.; Meisel, K.; Szarka, N.; Jordan, M. (2023). „Auch 2050 dominiert Holzeinsatz im Wärmebereich: Stand und Perspektiven der energetischen Holznutzung in Deutschalnd vor dem Hintergrund angestrebter Klimaneutralität“. *Holz-Zentralblatt* (ISSN: 0018-3792), Nr. 38. S. 619–621.

Wiechert, J.; Chaher, N. E. H.; Nassour, A.; Nelles, M. (2023). „Erweiterte Verantwortung für eine nachhaltige Kreislaufwirtschaft im Tourismussektor“. *Müll und Abfall* (ISSN: 0027-2957), Vol. 55, Nr. 6. S. 308–315. DOI: 10.37307/j.1863-9763.2023.06.03.

Yunusa, S. U.; Mensah, E.; Preko, K.; Narra, S.; Saleh, A.; Sanfo, S. (2023). „Evaluation of selected physical and thermochemcial properties of rice husk of one- and two-stage milling for briquette production“. *Proceedings of the Nigerian Institution of Agricultural Engineers*, Nr. 43. S. 430–442.

**Reports, background papers, statements, etc.**

Abetz, V.; Baetcke, L.; Ball, C.; Bauer, F.; Beck, S.; Berkel, M.; Blome, T.; Borchers, M.; Brinkmann, T.; Bruhn, D.; Chi, Y.; Dahmen, N.; Dittmeyer, R.; Dolch, T.; Dold, C.; Dornheim, M.; El Zohbi, J.; Fogel, S.; Förster, J.; Fuchs, S.; Gardian, H.; Gawel, E.; Görl, K.; Groth, M.; Hamedimastanabad, H.; Hampel, U.; Harpprecht, C.; Herbst, M.; Heß, D.; Jacob, D.; Kalhori, A.; Kiendler-Scharr, A.; Klassen, T.; Köhnke, F.; Koop-Jakobsen, K.; Korte, K.; Kuckshinrichs, W.; Li, Z.; Markus, T.; Mayer, M.; Mengis, N.; Monnerie, N.; O Corcora, T.; Oschlies, A.; Pardo Perez, L. C.; Prats Salvado, E.; Pregger, T.; Preuschmann, S.; Rau, B.; Rechid, D.; Reusch, T. B. H.; Rhoden, I.; Riehm, J.; Roeb, M.; Rolletter, M.; Sachs, T.; Sattler, C.; Sauer, J.; Schaller, R.; Schätzler, K.; Schill, E.; Schmidt-Hattenberger, C.; Schultz, M.; Simon, S.;

Steiner, U.; Steuri, B.; Stevenson, A.; Sun, J.; Thoni, T.; Thrän, D.; Unger, S.; Vögele, S.; Waczowicz, S.; Weihermüller, L.; Xiao, M.; Yeates, C.; Zwickel, P. (2023). *Netto-Null-2050 Wegweiser: Strategische Handlungsempfehlungen und mögliche Wege für ein $CO_2$-neutrales Deutschland bis 2050. Projekt: Netto-Null-2050 (Mitigation)*. Version 1.0. [s.l.]: UFZ. 208 S.

Adam, R.; Beneker, C.; Schröder, C.; Calmet, A.; Jung, E.; Kirsten, C.; Krause, A. (2023). *EU-Recht nutzen, um Märkte zu erweitern und Ressourcen zu schonen: ein Positionspapier zur Sanitär- und Nährstoffwende*. Berlin et al. 7 S.

Adam, R.; Krause, A.; Calmet, A.; Jung, E.; Schröder, C.; Beneker, C.; Kirsten, C. (2023). *Recyclingdünger: warum wir eine Anpassung rechtlicher Rahmenbedingungen brauchen, um Wasser zu sparen, Schadstoffe zu reduzieren und Ressourcen zu schonen. Ein Positionspapier zur Sanitär- und Nährstoffwende*. [s.l.]: [s.n.]. 8 S.

Artz, J.; Ruff, P. (Hrsg.) (2023). Artz, J.; Braun-Unkhoff, M.; Eiden, S.; Feldhoff, S.; Fischer, J.; Görsch, K.; Lucka, K.; Richter, S.; Ruff, P.; Schröder, J.; Weiß, U. *Fact Sheets: Normkonformität und Materialverträglichkeit alternativer Kraftstoffe*. 1. Auflage. Frankfurt am Main: DECHEMA e. V. 82 S. ISBN: 978-3-89746-244-1.

Ekbom, T. (Hrsg.) (2023). Burli, P.; Hennig, C.; Hoefnagels, R.; Wild, M.; Majer, S.; Nguyen, Q. *Assessment of successes and lessons learned for biofuels deployment: Report Work package 4. Sustainable biomass supply chains for international markets*. [s.l.]: IEA Bioenergy. 34 S. ISBN: 979-12-80907-30-1.

Müller-Langer, F. (Hrsg.) (2023). Cantarella, H.; Mendes Souza, G.; Horta Nogueira, L.; Maciel Filho, R.; Costa de Paiva, G.; Islongo Canabarro, N.; Silva Ortiz, P.; Ekbom, T.; Leal Silva, J. F. *Assessment of successes and lessons learned for biofuels deployment: Report Work package 2. Meta-analysis of existing studies*. [s.l.]: IEA Bioenergy. III, 62 S. ISBN: 979-12-80907-29-5.

Thrän, D. (Hrsg.) (2023). Dotzauer, M.; Hartmann, I. *Workshop „Heizen ohne Erdgas?“ vom 30.11.2022: Resümeepapier. BMWK-Forschungsnetzwerk Bioenergie*. Leipzig: DBFZ. 14 S. DOI: 10.48480/tj2x-c881.

Ekbom, T.; Edgren, H. (Hrsg.) (2023). Ekbom, T.; Costa de Paiva, G.; Müller-Langer, F. *Assessment of successes and lessons learned for biofuels deployment: Report Work package 3. Case studies technologies*. [s.l.]: IEA Bioenergy. [78] S.

Jacob, D.; Teutsch, G.; Koch, R. (Hrsg.) (2023). Förster, J.; Hermoza Cacsire de Schaller, R. L.; Thrän, D.; Teutsch, G.; Marx, A.; Samaniego, L.; Boeing, F.; Rakovec, O.; Thober, S.; Müller, S.; Kelbling, M.; Hertel, D.; Schlink, U.; Volke, V.; Knapp, S.; Yang, S.; Büttner, O. *Helmholtz Climate Initiative: Final Report 2022*. Version 1.1. Berlin: Helmholtz-Klima-Initiative. 235 S. DOI: 10.57699/MDTD-NR07.

Fürst, K. (2023). *Energieversorgung und Entsorgungswirtschaft im Kontext der Bioökonomie im Mitteldeutschen Revier und im Lausitzer Revier: Sektorstudie*. Leipzig: DBFZ. 36 S.

Händler, T.; Thrän, D. (2023). *Konsulationspapier zum 8. Energieforschungsprogramm aus dem Forschungsnetzwerk Bioenergie*. Stand: Oktober 2023. Leipzig: DBFZ. 14 S. DOI: 10.48480/s9hy-e911.

Hennig, C.; Olsson, O.; Thrän, D.; Mäki, E. (2023). *BECCUS and flexible bioenergy – finding the balance: Contribution of IEA Bioenergy Task 44 & Task 40 to the Inter-task project Deployment of BECCUS value chains*. [s.l.]: IEA Bioenergy. 15 S. ISBN: 979-12-80907-31-8.

Hoefnagels, R.; Fritsche, U. R.; Graffenberger, M.; Hartley, D.; Hennig, C.; Kupfer, R.; Li, C.; Pfeiffer, A.; Schmid, C.; Schipfer, F. (2023). *Regional transitions in existing bioenergy markets: Synthesis report of IEA Bioenergy Task 40 Regional Transitions project 1.0*. [s.l.]: IEA Bioenergy. 24 S. ISBN: 979-12-80907-32-5.

Majer, S.; van Dam, J.; Fritsche, U. R.; Heukels, B.; Harris, Z. M.; Egnell, G. (2023). *Approaches to sustainability compliance and verification for forest biomass: Project report. IEA Bioenergy: Task 45*. [s.l.]: IEA Bioenergy. 60 S. ISBN: 979-12-80907-25-7.

Matschegg, D.; Bacovsky, D.; Schramm, J.; Stolz, B.; Da Costa Barbosa, P. I.; Martins Henriques, R.; Oliveira Da Costa, A.; Rangel do Nascimento, J.; Winther, K.; Huck, L.; Wu, Y.; Li, J.; Müller-Langer, F.; Hauschild, S.; Lee, U.; Liu, X.; Chen, P.; Wang, M.; Stork, K. (2023). *Sustainable Aviation Fuels: Status quo and national assessments. A Report from the Advanced Motor Fuels Technology Collaboration Programme*. [s.l.]: [s.n.]. III, 3–95 S.

Müller-Langer, F.; Ekbom, T.; Cantarella, H.; Pralhad, B. H. (2023). *Lessons learned biofuels: Assessment of successes and lessons learned for biofuels deployment*. [s.l.]: IEA Bioenergy. 4 S.

Müller-Langer, F.; Ekbom, T. (Hrsg.) (2023). Müller-Langer, F.; Ekbom, T.; Costa de Paiva, G.; Cantarella, H.; Pralhad, B. H. *Assessment of successes and lessons learned for biofuels deployment: Report Work package 5. Synopsis/synthesis of key issues*. [s.l.]: IEA Bioenergy. 20 S.

Rutz, D.; Janssen, R.; Boutikos, P.; Atsonios, K.; Grammelis, P.; Brunner, C.; Calderoni, M.; Friedmann, M.; Müller-Langer, F.; Mata, T.; Martins, A.; Haslinger, W. (2023). *Renewable Hydrogen: Opportunities, limitations and threats of hydrogen for the energy transition in Europe. Position Paper of ETIP RHC and ETIP Bioenergy*. [s.l.]: ETIP RHC, ETIP Bioenergy. 31 S.

Seeger, L.; Mittelstädt, N.; Manske, D.; Thrän, D. (2023). *Kritische Flächenfragen: Flächenveränderungen und Flächendruck in Deutschland im Untersuchungszeitraum 2016–2020*. Leipzig: UFZ. [38] S.



**Online Documents**

Bestenlehner, J. M.; Enßlin, T.; Bergemann, M.; Crowther, P. A.; Greiner, M.; Selig, M. (2023). *Spectroscopic analysis of hot, massive stars in large spectroscopic surveys with de-idealised models* [online]. Verfügbar unter: dx.doi.org/10.48550/arXiv.2309.06474. [Stand: 16.10.2023].

Hellmann, S.; Hempel, A.-J.; Streif, S.; Weinrich, S. (2023). *Observability and Identifiability Analyses of Models for Agricultural Anaerobic Digestion Plants* [online]. Verfügbar unter: dx.doi.org/10.48550/arXiv.2301.05068.

Hellmann, S.; Wilms, T.; Streif, S.; Weinrich, S. (2023). *Comparison of Unscented Kalman Filter Design for Agricultural Anaerobic Digestion Model* [online]. Verfügbar unter: dx.doi.org/10.48550/arXiv.2310.15958.

Nelles, M.; Deprie, K.; Kornatz, P.; Morscheck, G.; Narra, S.; Nassour, A. (2023). *Biogas: An important contribution to climate and resource protection* [online]. Verfügbar unter: https://waste-management-world-com/waste-to-energy/biogas-contribution-to-climate-protection/.

Thrän, D.; Manske, D.; Schinkel, B.; Schmiedt, J.; Mittelstädt, N. (2023). *EE-Monitor: Monitoring for a nature-friendly energy transition in Germany* [online]. Verfügbar unter: dx.doi.org/10.5281/zenodo.7664005. [Stand: 16.10.2023].

**Presentations**

Acosta, A.; Biller, P.; Brix, H.; Arias, C. A. (2023). *Resource Recovery Engineering: Hydrothermal Synthesis and Thermochemical Conversion as nexus for Wetland-based chars, Platform Chemicals and Activated Carbons*. Vortrag gehalten: Seminar HTP, Aarhus (Dänemark), 08.12.2023.

Acosta, A.; Herklotz, B.; Klüpfel, C. (2023). *Hydrothermal Carbonisation of Sewage Sludge: Unlocking P-Recovery Potential & Addressing Limitations*. Vortrag gehalten: From WASTE to WEALTH, [online], 15.06.2023.

Adam, R. (2023). *Abfallende und AbfallendeV für Holzrezyklate*. Vortrag gehalten: Workshop „Wärme, Strom und Rohstoffe aus naturbelassenen holzigen Abfällen“, [online], 28.02.2023.

Adam, R.; Röver, L.; Zeng, T. (2023). *Einsatz von Parklaub als sonstiger nachwachsender Rohstoff gemäß § 3 (1) Nr. 13 der 1. BImSchV*. Vortrag gehalten: 11. Statuskonferenz Bioenergie, Leipzig, 20.–22.09.2023.

Barchmann, T.; Rensberg, N.; Dotzauer, M. (2023). *Stärkung der Güllevergärung in Deutschland zur Reduzierung der Emissionen in der Landwirtschaft*. Vortrag gehalten: 17. Rostocker Bioenergieforum, Rostock, 15.–16.06.2023.

Braune, M. (2023). *Two-month researcher exchange in the Netherlands: from DBFZ to WUR*. Vortrag gehalten: EERA Bioenergy Steering Committee meeting, Bologna (Italien), 08.06.2023.

Brödner, R. (2023). *Bioökonomie: (Neue) Perspektiven für Mitteldeutschland*. Vortrag gehalten: Fachveranstaltung „Grüne Berufe“, Zittau, 13.01.2023.

Brödner, R. (2023). *Bioökonomie im Altenburger Land: Der Status Quo*. Vortrag gehalten: Schaufenster-Tag „Bioökonomie im Altenburger Land“, Altenburg, 22.02.2023.

Brödner, R. (2023). *Schwerpunkte einer Bioökonomie: Strategie für das Land Brandenburg (BÖ-StrBB)*. Vortrag gehalten: WFBB Bioökonomie Stammtisch – Bioökonomiestrategie, [online], 23.03.2023.

Brödner, R. (2023). *Biomassepotential für eine nachhaltige Verpackungsindustrie*. Vortrag gehalten: simul+-Werkstatt, Dresden, 25.04.2023.

Brödner, R. (2023). *Was ist eigentlich Bioökonomie: Rolle und Potentiale im Strukturwandel*. Vortrag gehalten: Strukturwandel-Stammtisch, [online], 25.09.2023.

Brödner, R. (2023). *Schafwolle: Das biobasierte und biologich abbaubare Biotextil*. Vortrag gehalten: Schafwollkonvent, Leipzig, 24.–25.10.2023.

Brödner, R. (2023). *Biomasse: Ein wichtiger Teil der zukünftigen Wärmeversorgung?* Vortrag gehalten: 2. Fachnetzwerk „Energiemodellregion im Mitteldeutschen Revier“, Böhlen, 20.11.2023.

Brödner, R. (2023). *Flächenpotenziale für den Anbau von Faserpflanzen*. Vortrag gehalten: Innovations-Workshop Faserpflanzen, Cottbus, 29.11.2023.

Brödner, R.; Lenz, V. (2023). *Bioökonomie: Wie verändert sich die Branche und wie geht es weiter mit der energetischen Biomassenutzung?* Vortrag gehalten: BBE-Vorstandsklausur, [online], 14.09.2023.

Cyffka, K.-F. (2023). *Zukunft Holzenergie: Smart Wirbelschicht*. Vortrag gehalten: Abschlussworkshop SmartWirbelschicht, Nürnberg, 27.04.2023.

Cyffka, K.-F. (2023). *Biomasse als Kohlenstoffquelle: Säule 2*. Vortrag gehalten: 31. Deutscher Ingeniertag, Berlin, 25.05.2023.

Cyffka, K.-F. (2023). *Biogenic residues for the production of advanced biofuels: Germany and Portugal potential's comparison and insights about RED II transposition in Germany and in Portugal in light of the German biomass strategy (NABIS). Experience report – EERA exchange LNEG/DBFZ*. Vortrag gehalten: 31st European Biomass Conference and Exhibition, Bologna (Italien), 05.–08.06.2023.

Cyffka, K.-F.; Wilske, B.; Meisel, K.; Gröngröft, A.; Röder, L. S. (2023). *Biomasseverfügbarkeits-Szenarien für die Chemieindustrie*. Vortrag gehalten: Greenfeed, Wuppertal, 17.04.2023.

Daniel-Gromke, J.; Knoll, L.; Matlach, J.; Oehmichen, K.; Stinner, W. (2023). *Kurzverstellung Vorhaben KlimaBioHum: Untersuchung von Emissionen an Bioabfallbehandlungsanlagen*. Vortrag gehalten: AK Biologische Abfallbehandlung, Leipzig, 10.11.2023.

Deprie, K. (2023). *Das DBFZ: Biomasse für eine nachhaltige Zukunft*. Vortrag gehalten: 18. Treffen des Sächsischen Transfer-Netzwerk, Leipzig, 01.03.2023.

Deprie, K. (2023). *Biomethan in der europäischen Energiewende*. Vortrag gehalten: Energiewende – Best Practices aus Europa, [online], 02.03.2023.

Deprie, K. (2023). *DBFZ: Innovationen für eine nachhaltige Bioökonomie*. Vortrag gehalten: Circular Saxony Arbeitskreises „Biomasse", Leipzig, 08.03.2023.

Deprie, K. (2023). *Applied R&D on the material and energetic use of biomass, guided by the SDGs: How can biomass best contribute to a bio-economy & to an entirely renewable energy system?* Vortrag gehalten: Estonia and Saxony. On the way forward to Clean Energy. Research, Innovation, Realization, Tallin (Estland), 02.05.2023.

Dögnitz, N.; Etzold, H. (2023). *German GHG Quota in the Transport Sector: Certificate trading as a promising business model?* Vortrag gehalten: 31st European Biomass Conference and Exhibition, Bologna (Italien), 05.–08.06.2023.

Dotzauer, M. (2023). *Welche Rolle kann Bioenergie im klimaneutralen Stromsystem spielen und gibt es dafür eine nachhaltig verfügbare Rohstoffbasis?* Vortrag gehalten: Themenlunch der Gesellschaft für Nachhaltigkeit, [online], 16.01.2023.

Dotzauer, M. (2023). *Potentiale und Gechäftsfelder für Biomasse im deutschen Strom- und Wärmemarkt*. Vortrag gehalten: Grüne KWK – Dekarbonisierung hocheffizienter KWK-Anlagen, Magdeburg, 14.03.2023.

Engler, N.; Schumacher, B.; Knoll, L. (2023). *Emissionen aus der Gülle- oder Gärproduktlagerung unter Praxisbedingungen messen*. Vortrag gehalten: 16. Biogas-Innovationskomgress, Osnabrück, 24.–25.05.2023.

Etzold, H. (2023). *Economic parameters of hydrothermal carbonization*. Vortrag gehalten: 3rd International Symposium on Hydrothermal Carbonization, Seoul (Südkorea), 10.–13.05.2023.

Etzold, H.; Meisel, K.; Röver, L. (2023). *Hydrothermally treated lignin-based functional fillers: Environmental impacts from the substitution of the conventional finite resource-based fillers silica and carbon black*. Vortrag gehalten: 3rd International Symposium on Hydrothermal Carbonization, Seoul (Südkorea), 10.–13.05.2023.

Formann, S.; Hartmann, I.; Stinner, W. (2023). *Utilisation and management strategies for biomass from phytoremediation or phytomining*. Vortrag gehalten: 21st Jena Remediation Symposium, Jena, 05.–06.10.2023.

Fürst, K. (2023). *Bioökonomie in Sachsen*. Vortrag gehalten: 10. Mitteldeutsches Forum: 3D-Druck in der Anwendung. Biotechnologie, Polymere & Metalle, Leipzig, 14.06.2023.

Geyer, F. (2023). *Monovergärung von Weizenpülpe im Labor – und Pilot-Maßstab*. Vortrag gehalten: 11. Statuskonferenz Bioenergie, Leipzig, 20.–22.09.2023.

Gleeson, S. A.; Kusebauch, C.; Baumann, M.; Formann, S.; Hartmann, I.; Naegler, T.; Weil, M.; Zapp, P. (2023). *Energy transition and (critical) raw materials: Is the supply of Critical Raw Materials a barrier for the Energy Transition?* Vortrag gehalten: FVEE-Jahrestagung, Berlin, 10.–11.10.2023.

Görsch, K.; Müller-Langer, F.; Gröngröft, A.; Naumann, K. (2023). *Einsatz von biogenen Abfällen und Reststoffen in Bioraffinerien der Zukunft*. Vortrag gehalten: 18. Kreislaufwirtschaftstage Münster, Münster, 28.02.–01.03.2023.

Görsch, K.; Naumann, K.; Schröder, J.; Müller-Langer, F. (2023). *Fortschrittliche Biokraftstoffe CNG-LNG*. Vortrag gehalten: VIP-Days Iveco, 24.–25.04.2023.

Gröngröft, A. (2023). *Forschung für die energetische und stoffliche Biomassenutzung*. Vortrag gehalten: Jahreskonferenz „Wertschöpfung durch Innovation: Wissenschaft und Forschung als Treiber des Strukturwandels", Leipzig, 25.05.2023.

Gröngröft, A.; Röder, L. S.; Cyffka, K.-F.; Schneider, C. (2023). *Development and assessment of biorefinery processes for the conversion of biomass into polymers*. Vortrag gehalten: Biopolymer. Processing & Moulding, Halle, 13.06.2023.

Gröngröft, A.; Röder, L. S.; Meisel, K. (2023). *Selecting relevant biopolymers for modeling of the future polymer production*. Vortrag gehalten: 11th European Symposium on Biopolymers, Brno (Tschechien), 13.–15.09.2023.

Günther, S. (2023). *Mapping of biogenic resource potentials across Europe: A test case for CAFIPLA transferability*. Vortrag gehalten: CAFIPLA Conference „Urban Circular Bioeconomy Valorising Biowaste – Creating Prosperty", Vitoria-Gasteiz (Spanien), 10.5.2023.

Günther, S.; Karras, T.; Semella, S. (2023). *Temporal and spatial mapping of the theoretical biomass potential of 13 residues across Europe*. Vortrag gehalten: 31st European Biomass Conference and Exhibition, Bologna (Italien), 05.–08.06.2023.

Hagen, G.; Wöhrl, T.; Müller, A.; Herrmann, J.; Moos, R.; Hartmann, I. (2023). *Flue gas analysis of wood combustion*. Vortrag gehalten: Sensor and Measurement Science International Conference, Nürnberg, 08.–11.05.2023.

Hartmann, I. (2023). *Was ist Feinstaub und wie kann man ihn verhindern?: Technische Möglichkeiten und die Rolle des Menschen vor dem Ofen*. Vortrag gehalten: Pressetermin „Richtig Heizen mit Holz", Leverkusen, 24.03.2023.

Hartmann, I. (2023). *Wo liegt das wahre Problem: Nutzerinnen/Nutzer oder Technik?* Vortrag gehalten: World of Fireplaces, Leipzig, 17.–19.04.2023.

Hartmann, I. (2023). *Heizen mit Holz: Technik, Rohstoff- und Umweltbilanz*. Vortrag gehalten: Volkshochschule der Bundesstadt Bonn, [online], 08.05.2023.

Hartmann, I. (2023). *Emissionsdaten bezüglich Gesamtstaub, CO, OGC und PN-Verteilung von am Markt verfügbaren Kaminöfen in Abhängigkeit von der genutzten Prüfstandsprozedur (EN 13240, beReal und Blauer Engel)*. Vortrag gehalten: 26. Fachgespräch Arbeitskreis Holzfeuerungen, Straubing, 24.05.2023.

Hartmann, I. (2023). *Emissionen und Effizienz von Holzfeuerungen im Bereich der 1. BImSchV*. Vortrag gehalten: 26. Fachtagung für Nachwachsende Rohstoffe, Zittau, 07.07.2023.

Hartmann, I. (2023). *Staubabscheider für Einzelraumfeuerungen: Impulsreferat: Emissionsminderung an Einzelraumfeuerungen*. Vortrag gehalten: Zukunftsworkshop der Clean Exhaust Association (CEA) in Kooperation mit dem Deutschen Biomasseforschungszentrum (DBFZ), Leipzig, 28.09.2023.

Hartmann, I. (2023). *Aktuelle Erkenntnisse zur Partikelanzahlmessung an Holzfeuerungen*. Vortrag gehalten: Fachgruppentagung EFA e.V., [online], 18.10.2023.

Hartmann, I.; Formann, S.; König, M.; Bindig, R.; Stolze, B.; Sittaro, F.-C.; Schliermann, T. (2023). *Machbarkeitsstudie der in-situ-Extraktion von biogenem Siliziumdioxid aus Reisspelzen des Mekong-Delta, Vietnam*. Vortrag gehalten: 17. Rostocker Bioenergieforum, Rostock, 15.–16.06.2023.

Hartmann, I.; Kummrow, M. (2023). *Emissionsminderung an Holzfeuerungen durch Kombination von schulischen und technischen Maßnahmen*. Vortrag gehalten: 11. Statuskonferenz Bioenergie, Leipzig, 20.–22.09.2023.

Hartmann, I.; Ulbricht, T.; König, M. (2023). *Forschungsarbeiten zur Emissionsminderung bei Einzelraumfeuerstätten am DBFZ*. Vortrag gehalten: World of Fireplaces, Leipzig, 17.–19.04.2023.

Hellmann, S. (2023). *Extended and Unscented Kalman Filter Design for mass-based ADM1 Simplification*. Vortrag gehalten: VI. CMP International Conference on Monitoring and Control of Anaerobic Digestion Processes, Leipzig, 22.–23.03.2023.

Hellmann, S. (2023). *Observability and Identifiability Analyses of Models for Agricultural Anaerobic Digestion Plants*. Vortrag gehalten: 24th International Conference on Process Control, Štrbské Pleso (Slowakei), 06.–09.06.2023.

Hennig, C. (2023). *IEA Bioenergy inter-task project (ITP) ‚Synergies of green hydrogen and bio-based value chains deployment'*. Vortrag gehalten: Expert Workshop „Deployment perspective of green hydrogen from biomass and use in bio-based processes", Berlin, 29.03.2023.

Hennig, C.; Bang, C. (2023). *Management of Biogenic $CO_2$: BECCUS Inter-task Phase 2. IEA Bioenergy Inter-task project 2022-2024*. Vortrag gehalten: ExCo91, [online], 15.05.2023.

Herklotz, B. (2023). *Anaerobic treatment of liquid by-products from hydrothermal carbonization: A review*. Vortrag gehalten: 3rd International Symposium on Hydrothermal Carbonization, Seoul (Südkorea), 10.–13.05.2023.

Kirsten, C. (2023). *Aufbereitung von Vergaserkoks für eine weitere (energetische) Nutzung*. Vortrag gehalten: 14. Kolloquium Regenerative Energien, Leipzig, 09.05.2023.

Kirsten, C.; Klebingat, S. (2023). *biogeniV: Verwertung von biogenen Reststoffen, $CO_2$ und erneuerbaren Energien zu grünen Kraft- und Wertstoffen*. Vortrag gehalten: 4. Bioraffinerietag, Leipzig, 12.09.2023.

Klüpfel, C. (2023). *Energetic and material valorization of digestate via hydrothermal liquefaction: Influence of input material and process parameters*. Vortrag gehalten: Pyroliq II: Pyrolysis and Liquefaction of Biomass and Wastes, Hernstein (Österreich), 07.–12.05.2023.

Knoll, L. (2023). *GHG-emissions from anaerobic digestion and compsting plants for organic waste treatment*. Vortrag gehalten: 31st European Biomass Conference and Exhibition, Bologna (Italien), 05.–08.06.2023.

Knoll, L. (2023). *Methanemissionen von Biogasaufbereitungs- und Nachbehandlungsanlagen*. Vortrag gehalten: Biogas in der Landwirtschaft, Bonn, 11.–12.09.2023.

Knoll, L. (2023). *Emissions from biogas upgrading plants: results of the measurment campaign in Germany*. Vortrag gehalten: Workshop IEA Bioenergy Task 37 – Energy from Biogas, Oberkirch-Ringelbach, 25.10.2023.

Knoll, L. (2023). *Vorstellung und aktuelle Ergebnisse aus dem Verbundvorhaben „EmMinA: Emissionsminderung bei der Biogasaufbereitung, -verdichtung und -einspeisung“*. Vortrag gehalten: Leipziger Biogas-Fachgespräch, Leipzig, 29.11.2023.

Knoll, L.; Kretzschmar, J. (2023). *WP3: Emission measurements at demonstration units*. Vortrag gehalten: Project meeting „Biomethaverse“, Uppsala (Schweden), 14.06.2023.

Knötig, P.; Herklotz, B.; Etzold, H.; Zerback, T. (2023). *Development of a hydrothermal multi-purpose reactor: within a pilot-scale biorefinery concept for fuel production from biogenic residues. Project Pilot-SBG*. Vortrag gehalten: 3rd International Symposium on Hydrothermal Carbonization, Seoul (Südkorea), 10.–13.05.2023.

König, M. (2023). *Emisiones de dióxido de azufre ($SO_2$): Origen, características y disminución*. Vortrag gehalten: Webinar „Emisiones de dióxido de azufre ($SO_2$): Normativa, medición y control“ KIPUS, [online], 25.07.2023.

Kornatz, P. (2023). *Biogas in Hungersnot?!: Wenn Substrat nicht mehr bezahlbar ist*. Vortrag gehalten: E2M Wintertagung, Schweinfurt, 25.01.2023.

Kornatz, P. (2023). *Economics of manure digestion in Germany*. Vortrag gehalten: IEA Tast 37 Meeting, Bangalore (Indien), 10.05.2023.

Kornatz, P.; Barchmann, T.; Daniel-Gromke, J.; Dotzauer, M.; Rensberg, N.; Denysenko, V.; Stinner, W. (2023). *Stand und Perspektiven der Güllevergärung in Deutschland*. Vortrag gehalten: Online-Infoveranstaltung „Vergärung von Wirtschaftsdüngern“, [online], 23.03.2023.

Kornatz, P.; Barchmann, T.; Daniel-Gromke, J.; Dotzauer, M.; Rensberg, N.; Denysenko, V.; Stinner, W. (2023). *Stand und Perspektiven der Biogaserzeugung in Deutschland*. Vortrag gehalten: 16. Biogas-Innovationskomgress, Osnabrück, 24.–25.05.2023.

Kornatz, P.; Müller, J. (2023). *Biogas als multifunktionaler Baustein für die Energieversorgung, den ländlichen Raum und die Umwelt*. Vortrag gehalten: Biogas in der Landwirtschaft, Bonn, 11.–12.09.2023.

Kornatz, P.; Naumann, K.; Stinner, W.; Pertagnol, J.; Stapf, D.; Stark, S. (2023). *Shorten up!: Mit regionalen Kreisläufen zum resilienten Wirtschaftssystem*. Vortrag gehalten: FVEE-Jahrestagung, Berlin, 10.–11.10.2023.

Kornatz, P.; Stinner, W.; Müller, J.; Daniel-Gromke, J.; Dotzauer, M. (2023). *Vision Biogas: Wege zur klimapositiven zukunftsfähigen multifunktionalen Landwirtschaft*. Vortrag gehalten: IBBK Konferenz „Fortschritt Gülle und Gärprodukt“, Schwäbisch Hall, 07.–09.11.2023.

Kümmel, A.; Barchmann, T.; Naumann, K.; Henke, M.; Vandersickel, A.; Zunft, S.; Achtizger-Zupancic, P.; Fitz, O.; Fluri, T.; Schill, E. (2023). *Resilienz durch Energiespeicher*. Vortrag gehalten: FVEE-Jahrestagung, Berlin, 10.–11.10.2023.

Lenhart, M. (2023). *Einführung Bioökonomie/ Bioenergiesysteme*. Vortrag gehalten: Bauingenierswesen 5. Semester Bachelorstudium, Erfurt, 02.02.2023.

Lenhart, M. (2023). *Guideline to Organic Waste Management – Rwanda Expert Exchanges GiZ*. Vortrag gehalten: RWANDA Sustainable Waste and Circular Economy support project, Berlin, 06.03.2023.

Lenhart, M.; Pohl, M.; Sprafke, J. (2023). *Challenges and potential of anaerobic digestion from municipal and agricultural organic waste in Ethiopia*. Vortrag gehalten: International Conference on Green Fuels for Bio-Based Circular Economy, Jimma (Äthiopien), 11.–12.05.2023.

Lenz, V. (2023). *Current Status and Issues of Biomass Industrial Heat in Germany*. Vortrag gehalten: International Symposium on Biomass Industrial Heat, Tokio (Japan), 13.01.2023.

Lenz, V. (2023). *Neues zur DIN 33999 und VDI 3670*. Vortrag gehalten: 14. Fachgespräch Partikelabscheider in häuslichen Feuerungen, Straubing, 09.02.2023.

Lenz, V. (2023). *Impulsvortrag „Energetische Holzverwendung“*. Vortrag gehalten: Dritter Waldtreff im Waldforum 3 „Holzversorgung und Holzverwendung“, [online], 28.02.2023.

Lenz, V. (2023). *Studie Feinstaubaufkommen Holzenergie*. Vortrag gehalten: DEPV-Mitgliederversammlung, Berlin, 24.03.2023.

Lenz, V. (2023). *Bioenergie: Alternative zu Erdgas?* Vortrag gehalten: Fachsymposium 2023 „Gas weg, was nun?“, Dresden, 11.05.2023.

Lenz, V. (2023). *Energetische „Holz“nutzung und Eckpunkte der nationalen Biomassestrategie*. Vortrag gehalten: Besuch WBG Kontakt, Leipzig, 22.05.2023.

Lenz, V. (2023). *Technisches Potenzial der Biomasse als „Lückenfüller“*. Vortrag gehalten: VDI DIT, [online], 25.05.2023.

Lenz, V. (2023). *Technisches Potenzial der Biomasse als „Lückenfüller“*. Vortrag gehalten: DIT-Breakout-Session „Wege zur klimaneutralen Wärmeversorgung“, Leipzig, 25.05.2023.

Lenz, V.; Beidaghy Dizaji, H.; Kulshresth, D.; Zeng, T.; Overmann, S.; Vollpracht, A. (2023). *Potential of bottom ashes from non-woody biomass combustion as sustainable supplementary cementitious materials*. Vortrag gehalten: 7. Mitteleuropäische Biomassekonferenz, Graz (Österreich), 18.–20.01.2023.

Lenz, V.; Böttner, J. (2023). *Bivalenzpunkt von Luft-Wasser-Wärmepumpen-Biomasse-Hybridheizungen*. Vortrag gehalten: 26. Fachgespräch Arbeitskreis Holzfeuerungen, Straubing, 24.05.2023.

Lenz, V.; Thrän, D. (2023). *Kurzpräsentation zur Diskussion um Biomassenutzung*. Vortrag gehalten: 67. FARE-Sitzung, [online], 15.02.2023.

Liebetrau, J.; Klüpfel, C. (2023). *EmMinA: Emissionsminderung bei der Biogasaufbereitung, verdichtung und -einspeisung. (2220NR151A-B)*. Vortrag gehalten: FNR Statusseminar „Optimierung der Biomethanerzeugung – aktuelle Forschungsergebnisse“, [online], 13.06.2023.

Mäki, E.; Hennig, C. (2023). *Inter-Task project Synergies of green hydrogen and bio-based value chains deployment: Progress report/ITP Focus*. Vortrag gehalten: ExCo91, [online], 15.05.2023.

Mäki, E.; Hennig, C.; Thrän, D.; Lange, N.; Schildhauer, T.; Schipfer, F. (2023). *Defining the value of bioenergy system services for accelerating the integration of bioenergy into a low-carbon economy*. Vortrag gehalten: 31st European Biomass Conference and Exhibition, Bologna (Italien), 05.–08.06.2023.

Matlach, J.; Knoll, L. (2023). *Emissionsreduzierung bei der Bioabfallbehandlung, insbesondere bei der Gärproduktbehandlung/-kompostierung: Klimaschutzorientierte Bioabfallverwertung für die Landwirtschaft (KlimaBioHum)*. Vortrag gehalten: Statuskonferenz Bioenergie, Leipzig, 20.–22.09.2023.

Meisel, K. (2023). *E-fuels/RFNBO und die Delegierten Rechtsakte*. Vortrag gehalten: Workshop „Anrechenbarkeit und Bilanzierung strombasierter Kraftstoffe“, Leipzig, 05.12.2023.

Meisel, K.; Götz, I. K.; Helka, J.; Sumfleth, B.; Seidel, L. (2023). *Nachhaltigkeit für Einsteiger*. Vortrag gehalten: Workshop „Nachhaltigkeit für Einsteiger“, Leipzig, 18.10.2023.

Meisel, K.; Jordan, M.; Dotzauer, M.; Schröder, J.; Cyffka, K.-F.; Dögnitz, N.; Schmid, C.; Lenz, V.; Naumann, K.; Daniel-Gromke, J.; Costa de Paiva, G.; Schindler, H.; Esmaeili Aliabadi, D.; Szarka, N.; Thrän, D. (2023). *SoBio: Szenarien einer optimalen Biomassenutzung im deutschen Energiesystem. Eine Langfristperspektive*. Vortrag gehalten: SoBio – Szenarien einer optimalen Biomassenutzung in der Energiewende, [online], 20.04.2023.

Meisel, K.; Jordan, M.; Dotzauer, M.; Schröder, J.; Cyffka, K.-F.; Dögnitz, N.; Schmid, C.; Lenz, V.; Naumann, K.; Daniel-Gromke, J.; Costa de Paiva, G.; Schindler, H.; Esmaeili Aliabadi, D.; Szarka, N.; Thrän, D. (2023). *SoBio: Szenarien einer optimalen Biomassenutzung im deutschen Energiesystem. Eine Mittelfristperspektive*. Vortrag gehalten: SoBio – Szenarien einer optimalen Biomassenutzung in der Energiewende, [online], 20.04.2023.

Meisel, K.; Jordan, M.; Dotzauer, M.; Schröder, J.; Cyffka, K.-F.; Dögnitz, N.; Schmid, C.; Lenz, V.; Naumann, K.; Daniel-Gromke, J.; Costa de Paiva, G.; Schindler, H.; Esmaeili Aliabadi, D.; Szarka, N.; Thrän, D. (2023). *Szenarien einer optimalen Biomassenutzung im deutschen Energiesystem bis 2050*. Vortrag gehalten: 11. Statuskonferenz Bioenergie, Leipzig, 20.–22.09.2023.

Meisel, K.; Müller-Langer, F. (2023). *Nachhaltigkeit verschiedener Biomasseoptionen als Ressourcen für SAF*. Vortrag gehalten: aireg AK3 Sitzung (Nachhaltigkeit), [online], 16.03.2023.

Meola, A.; Weinrich, S. (2023). *Predictive modelling of dynamic anaerobic digestion at laboratory-scale with machine learning*. Vortrag gehalten: VI. CMP International Conference on Monitoring and Control of Anaerobic Digestion Processes, Leipzig, 22.–23.03.2023.

Meola, A.; Weinrich, S. (2023). *AI upscaling: Modeling a full-scale biogas reactor using lab-scale data with machine learning algorithms*. Vortrag gehalten: 6th Doctoral Colloquium Bioenergy, Göttingen, 18.–19.09.2023.

Meola, A.; Weinrich, S. (2023). *Prediction of biomethane production from anaerobic digestion plants in intra-day resolution: lessons learned and challanges*. Vortrag gehalten: KIDA-Fachtagung, Quedlinburg, 27.–28.09.2023.

Mühlenberg, J. (2023). *Qualität von Kompost aus Inhalten von Trockentoiletten*. Vortrag gehalten: Kreislauftage, Eberswalde, 05.–06.10.2023.

Müller-Langer, F. (2023). *Wasserstoff aus Biomasse*. Vortrag gehalten: Energieforschung vernetzt – 1. Symposium der Forschungsnetzwerke, Berlin, 13.–14.06.2023.

Müller-Langer, F.; Costa de Paiva, G.; Ekbom, T.; Cantarella, H.; Burli, P. H. (2023). *Successes and lessons learned for biofuels deployment*. Vortrag gehalten: 3rd Biofuels Forum, Berlin, 20.–21.06.2023.

Müller-Langer, F.; Kretzschmar, J.; Nelles, M. (2023). *Wasserstoff aus bzw. mit Biomasse: sinnvolle Optionen und fragwürdige Ansätze*. Vortrag gehalten: 17. Rostocker Bioenergieforum, Rostock, 15.–16.06.2023.

Müller-Langer, F.; Naumann, K.; Meisel, K.; Cyffka, K.-F.; Jordan, M. (2023). *AtJ-SAF im Wettbewerb mit anderen biobasierten Produkten und Energieträgern*. Vortrag gehalten: Alcohol-to-Jet für Sustainable Aviation Fuels (SAF) – Regionale Abfall- und

Reststoffe als Option für SAF made in Germany, Berlin, 12.01.2023.

Müller-Langer, F.; Naumann, K.; Schröder, J. (2023). *Klimaschutz nur über integrierte Verkehrs- und Energiewende: Rolle von Biokraftstoffen in der Treibhausgasminderungsquote*. Vortrag gehalten: Sitzung Begleitgruppe Klimaschutz und Transformation zum Themenkomplex „Biokraftstoffe“, Berlin, 01.03.2023.

Müller-Langer, F.; Naumann, K.; Schröder, J. (2023). *Klimaschutz nur über integrierte Verkehrs- und Energiewende: Rolle von erneuerbaren Kraftstoffen in der Treibhausgasminderungsquote*. Vortrag gehalten: 2. Sitzung des Beirats – Plattform Nachhaltiger Schwerlastverkehr, Berlin, 07.03.2023.

Müller-Langer, F.; Schröder, J. (2023). *Erreichung der $CO_2$-Ziele aus der Kraftstoffperspektive: Status und Trends für erneuerbare Kraftstoffe*. Vortrag gehalten: 12. Tagung Einspritzung und Kraftstoffe, Dessau-Roßlau, 10.–11.05.2023.

Müller-Langer, F.; Schröder, J.; Naumann, K. (2023). *Overview of quota developments in selected EU Member States*. Vortrag gehalten: 20th International Conference on Renewable Mobility „Fuels of the Future“, Berlin, 23.–24.01.2023.

Müller-Langer, F.; Schröder, J.; Naumann, K. (2023). *Rahmenbedingungen für den Einsatz von erneuerbaren Kraftstoffen*. Vortrag gehalten: BMDV-Fachkonferenz Erneuerbare Kraftstoffe, Berlin, 14.03.2023.

Müller-Langer, F.; Schröder, J.; Naumann, K. (2023). *Rolle erneuerbarer Kraftstoffe als Erfüllungsoptionen für die Treibhausquote in Deutschland*. Vortrag gehalten: FAD-Workshop „Herausforderungen für die postfossile Mobilität“, Radebeul, 11.–12.05.2023.

Müller-Langer, F.; Schröder, J.; Naumann, K.; Meisel, K. (2023). *Erneuerbare gasförmige Kraftstoffe für Klimaschutz im Verkehr*. Vortrag gehalten: 23. Fachtagung „Energie Umwelt Zukunft“, Leipzig, 29.06.2023.

Naumann, K.; Etzold, H. (2023). *Pilot system synthesized biogas*. Vortrag gehalten: 9th REGATEC, Berlin, 15.–16.05.2023.

Naumann, K.; Naegeli de Torres, F.; Sittaro, F.-C. (2023). *Pilotanlage für erneuerbares Methan: Optimierung von Methanausbeute und Ressourceneffizienz*. Vortrag gehalten: Straubinger Gärproduktttagung, Straubing, 17.10.2023.

Naumann, K.; Röder, L. S.; Etzold, H.; Oehmichen, K.; Nitzsche, R.; Schröder, J.; Knötig, P.; Görsch, K. (2023). *Pilot-SBG: Renewable methane as a building block for a sustainable transport sector*. Vortrag gehalten: 20th International Conference on Renewable Mobility „Fuels of the Future“, Berlin, 23.–24.01.2023.

Nelles, M.; Daniel-Gromke, J.; Denysenko, V.; Kornatz, P.; Rensberg, N.; Stinner, W. (2023). *Status and outlook of biogas in Germany*. Vortrag gehalten: Sardinia Academy of Waste Management – Training Webinar „Anaerobic biomass and waste treatment in the Circular Economy“, [online], 30.06.2023.

Nieß, S. (2023). *Von Abfallbiomasse zum Biokraftstoff: Geeignete Katalysatoren für eine direkte Biogasmethanisierung*. Vortrag gehalten: 12. Wissenschaftskongress Abfall- und Ressourcenwirtschaft, Hamburg, 09.–10.03.2023.

Nieß, S. (2023). *Catalytic methanation of biogas: on the way to pilot scale*. Vortrag gehalten: 6th Nuremberg Workshop on „Methanation and 2nd Generation Fuels“, Nürnberg, 01.–02.06.2023.

Nieß, S. (2023). *Investigation of materials for an integrated methanation process in a biorefinery*. Vortrag gehalten: 6th Doctoral Colloquium Bioenergy, Göttingen, 18.–19.09.2023.

Owusu Prempeh, C. (2023). *Practical synthesis route for developing environmentally friendly catalysts on biogenic silica for low-temperature catalytic methane combustion*. Vortrag gehalten: ASW-Meeting, Rostock, 13.–14.07.2023.

Owusu Prempeh, C. (2023). *Generation of biogenic silica from biomass residues for sustainable industrial material applications: Practical synthesis route for developing environmentally friendly catalysts on biogenic silica for low-temperature catalytic methane combustion*. Vortrag gehalten: ICERAfrica, Kumasi (Ghana), 19.–21.09.2023.

Pohl, M.; Winkler, M.; Haupt, M. (2023). *Prozessinformationssysteme zur kontinuierlichen Überwachung der Energieeffizienz von Biogasanlagen*. Vortrag gehalten: Biogas in der Landwirtschaft, Bonn, 11.–12.09.2023.

Pohl, M.; Zerback, T. R.; Görsch, K. (2023). *Pilot-SBG: Bioresources and hydrogen to methane as fuel*. Vortrag gehalten: International Conference on Green Fuels for Bio-Based Circular Economy, Jimma [Äthiopien], 11.–12.05.2023.

Pouresmaeil, S.; Harnisch, F.; Kretzschmar, J. (2023). *Characterization of biochar as a susteinable electrode material for bioelectromethanation*. Vortrag gehalten: 8th Workshop „Microbial bioelectrotechnology: A platform initiative for Germany“, Bremen, 03.–04.05.2023.

Pouresmaeil, S.; Harnisch, F.; Kretzschmar, J. (2023). *Using charcoal for artisan cheese like Gouda Black Lemon or for methane producing cathodes in bioelectrochemical systems?!* Vortrag gehalten: 6th EU-ISMET, Wageningen (Niederlande), 06.–08.09.2023.

Pouresmaeil, S.; Harnisch, F.; Kretzschmar, J. (2023). *Biochar-based cathode catalyzing $H_2$ evolution in methane-producing bio-electrochemical systems (CH4-BES)*. Vortrag gehalten: 6th Doctoral Colloquium Bioenergy, Göttingen, 18.–19.09.2023.

Richter, L. (2023). *Optimizing the value of solid biomass-based (hybrid) systems in the context of the cellular approach*. Vortrag gehalten: 7. Central European Biomass Conference, Graz (Österreich), 18.–20.01.2023.

Richter, L. (2023). *Numerische Optimierung der Versorgungssicherheit in einem zellular strukturierten Quartier unter Nutzung festbiomassebasierter Hybridsysteme*. Vortrag gehalten: 4. TGA Kongress, Berlin, 23.–24.05.2023.

Richter, L.; Lenz, V.; Dotzauer, M.; Seifert, J. (2023). *Numerical optimisation of supply security in a cellularstructured district using solid biomass-based hybrid systems*. Vortrag gehalten: ENERDAY, Dresden, 05.05.2023.

Richter, L.; Lenz, V.; Dotzauer, M.; Seifert, J. (2023). *A 2-stage optimisation approach to ensure security of supply in rural cellular energy structures with solid biomass-based (hybrid) systems*. Vortrag gehalten: ETG-Kongress, Kassel, 25.–26.05.2023.

Röder, L. S. (2023). *Demand Side Management Implementation: A Decision Support Tool Demonstation on Biorefineries*. Vortrag gehalten: 6th Doctoral Colloquium Bioenergy, Göttingen, 18.–19.09.2023.

Röder, L. S.; Gröngröft, A.; Riese, J.; Grünewald, M. (2023). *Demand Side Management Implementation: in Downstream Digestate Treatment of a Biomethane Biorefinery*. Vortrag gehalten: E2DT, Palermo (Italien), 22.–25.10.2023.

Röder, L. S.; Gröngröft, A.; Riese, J.; Grünewald, M. (2023). *Integration von Demand Side Management in Prozesskaskaden: Reduzierung von Spreicheranforderungen und Kosteneinsparungen*. Vortrag gehalten: PAAT Jahrestagung, Frankfurt am Main, 20.–21.11.2023.

Röver, L.; Adam, R. (2023). *MoBiFuels: Wie zertifiziere ich einen neuen Brennstoff?* Vortrag gehalten: Bioenergie Talk, [online], 22.06.2023.

Röver, L.; Herklotz, B. (2023). *Konstruktion und Inbetriebnahme eines hydrothermalen Membranversuchsstandes*. Vortrag gehalten: abonoCARE Konferenz, Leipzig, 20.06.2023.

Schäfer, F. (2023). *Kombiverfahren zur Gülleaufbereitung-GülleKOM*. Vortrag gehalten: Statusseminar „Vergärung von Wirtschaftsdüngern“, [online], 02.02.2023.

Schröder, J.; Müller-Langer, F.; Naumann, K.; Meisel, K. (2023). *Erneuerbares Methan für Güter und Schiffsverkehr: Einblicke in das Vorhaben Pilot-SBG*. Vortrag gehalten: 20. FAD-Konferenz, Dresden, 09.11.2023.

Schröder, J.; Naumann, K.; Meisel, K. (2023). *Zwischen Gegenwart und Zukunft: Wohin mit den erneuerbaren Kraftstoffen im Verkehr?* Vortrag gehalten: 17. Rostocker Bioenergieforum, Rostock, 15.–16.06.2023.

Schumacher, B.; Wedwitschka, H.; Fischer, P.; Schlüter, E.; Grundmann, J. (2023). *Holzfaservergärung zur Biogas- und Torfsubstitutgewinnung*. Vortrag gehalten: C.A.R.M.E.N.-Webkonferenz „Torfersatzsubstrate – auf dem Weg zu neuen Erden!“, [online], 08.02.2023.

Schumacher, B.; Wedwitschka, H.; Fischer, P.; Schlüter, E.; Grundmann, J. (2023). *Biomethan & Torfersatzstoff aus Pappelholz*. Vortrag gehalten: Online-Seminar „Zukunft Torfersatz – Alternative Substratausgangsstoffe“, [online], 28.09.2023.

Siol, C.; Meisel, K.; Majer, S. (2023). *Wie klimaneutral ist energetische Holznutzung?* Vortrag gehalten: World of Fireplaces, Leipzig, 17.–19.04.2023.

Stinner, W. (2023). *Bioökonomie im Altenurger Land: Multitalent Biogas*. Vortrag gehalten: Schaufenster-Tag „Bioökonomie im Altenburger Land“, Altenburg, 22.02.2023.

Stinner, W. (2023). *Biomethan & Brennstoffzelle*. Vortrag gehalten: Besprechung Bosch, Biopract, DBFZ, Stuttgart, 24.03.2023.

Stinner, W. (2023). *Welt der Krisen: Biogas – Lösungsbeiträge*. Vortrag gehalten: 58. Biogas-Fachtagung Thüringen, Apfelstädt, 07.06.2023.

Stinner, W. (2023). *Sewage and faecal sludge: technology and/or management to enable nutrient cycling while minimising risk*. Vortrag gehalten: Workshop on sewage and faecal sludge risk management, [online], 15.06.2023.

Stinner, W. (2023). *Knappe Ressource Biogas: Gaseinspeisung oder Vor-Ort-Verstromung?* Vortrag gehalten: Flexperten – Sommerworkshop, Kassel, 03.07.2023.

Stinner, W. (2023). *Knappe Ressource Biogas: Perspektiven, Chancen, Risiken?* Vortrag gehalten: Fachgespräch Bioenergie (Arbeitskreise Umwelt, Energie und Naturschutz sowie Infrastruktur, Landwirtschaft und Forsten der CDU im Thüringer Landtag), Erfurt, 12.07.2023.

Stinner, W. (2023). *Zukunft Biogas: Gasverwertung, Substrate und Gärrestmanagement als Schlüsselelemente*. Vortrag gehalten: 8. Heidener Biogasfachtagung, [online], 09.–10.08.2023.

Stinner, W. (2023). *Safran im Zukunftsklima*. Vortrag gehalten: 1. Deutsches Safran-Symposium, Altenburg, 05.09.2023.

Stinner, W.; Wiechen, J.; Goldstein, M.; Hermus, S.; Haener, J.; Knudsen, O. (2023). *Projektvorstellung Nährwert: Technisch unterstütztes Nährstoffmanagement im Verbund von Biogasanlagen und Anbauregionen*. Vortrag gehalten: Biogas in der Landwirtschaft, Bonn, 11.–12.09.2023.

Sumfleth, B. (2023). *Decision-Making Tool for the Assessment of Trade-offs in Low iLUC Risk Certification*. Vortrag gehalten: 6th Doctoral Colloquium Bioenergy, Göttingen, 18.–19.09.2023.
Thalheim, T.; Kloß, S. (2023). *Nach der Veröffentlichung ist vor der Re-Analyse: Mit dem R-Framework oposSOM neue Hypothesen aus offenen Daten generieren*. Vortrag gehalten: KIDA Fachtagung, Quedlinburg, 27.–28.09.2023.
Thrän, D. (2023). *Nachwachsende Rohstoffe und der Klimawandel*. Vortrag gehalten: Rotary Club, Leipzig, 10.05.2023.
Thrän, D. (2023). *Nachhaltige Bioökonomie*. Vortrag gehalten: GIZ Facharbeitskreistreffen zu ländlicher Entwicklung, Leipzig, 20.06.2023.
Thrän, D. (2023). *National bioeconomy roadmap and the role of the Bioeconomy Council in Germany*. Vortrag gehalten: Bioökonomierat, Hannover, 26.–27.06.2023.
Thrän, D. (2023). *Wärme und Kälte aus Biomasse: Rahmenbedingungen, Trends und Forschungsfragen*. Vortrag gehalten: 31. C.A.R.M.E.N.-Symposium, Würzburg, 03.–04.07.2023.
Thrän, D. (2023). *Forschung für Wärme und Kälte aus Biomasse*. Vortrag gehalten: 11. Statuskonferenz Bioenergie, Leipzig, 20.–22.09.2023.
Thrän, D. (2023). *Wärme und Kälte aus Biomasse*. Vortrag gehalten: BMWK meets FNE, [online], 21.09.2023.
Thrän, D. (2023). *Terrestrial Carbon Dioxide Removal (CDR)*. Vortrag gehalten: Kick-off Workshop SynCom Project „Scaling up Carbon Dioxide Removal (CDR)“, Berlin, 28.–29.9.2023.
Thrän, D. (2023). *[All about that b…iomass: Wie Biomasse und Negativemissionen zusammenspielen]*. Vortrag gehalten: CDR Dialog Bildungskonferenz zur Kohlenstoffdioxid-Entnahme, München, 10.–11.10.2023.
Thrän, D. (2023). *National bioeconomy roadmap and the role of the Bioeconomy Council in Germany*. Vortrag gehalten: Bioökonomierat, Berlin, 04.–05.12.2023.
Thrän, D.; Händler, T.; Dotzauer, M. (2023). *Bioenergie in weitgehend klimaneutralen Energiesystemen*. Vortrag gehalten: 1. Symposium der Forschungsnetzwerke Energie, Berlin, 13.–14.6.2023.
Thrän, D.; Jordan, M.; Majer, S.; García Laverde, L.; Cyffka, K.-F.; Siebenhühner, E. (2023). *Nachhaltige Potenziale an energetisch nutzbarer Biomasse*. Vortrag gehalten: Berliner Energietage – Heizen mit Biomasse und Biogas, Berlin, 04.05.2023.
Thrän, D.; Majer, S.; Cyffka, K.-F.; Szarka, N.; Schindler, H. (2023). *Zur nachhaltigen Waldnutzung und verfügbaren Biomassepotenzialen: Nationale Biomassestrategie. Wie soll Biomasse künftig energetisch genutzt werden?* Vortrag gehalten: Forum Nachhaltige Holzenergie, [online], 17.01.2023.
Thrän, D.; Mäki, E.; Lange, N.; Hennig, C.; Schmieder, U.; Schildhauer, T.; Kiel, J. H. A.; Kroon, P.; Schipfer, F.; Philbrook, A.; Andersson, K.; Higa, C.; Gölles, M. (2023). *Overview on flexible bioenergy options and implementation*. Vortrag gehalten: 7. Mitteleuropäische Biomassekonferenz, Graz (Österreich), 18.–20.01.2023.
Thrän, D.; Siol, C.; Siebenhühner, E. (2023). *Carbon neutral, yes or not: The $CO_2$ balance of biomass as carbon source for Green Fuel*. Vortrag gehalten: 6th Nuremberg Workshop on „Methanation and 2nd Generation Fuels“, Nürnberg, 01.–02.06.2023.
Wedwitschka, H.; Piofczyk, T. (2023). *Insect fat of Hermetia Illucens as base material for the production of biolubricants*. Vortrag gehalten: Insecta Conference, Magdeburg, 13.–14.09.2023.
Weinrich, S.; Winkler, M.; Mauky, E.; Kretzschmar, J. (2023). *Eignung landwirtschaftlicher Reststoffe zur Flexibilisierung des Biogasprozesses: RestFlex*. Vortrag gehalten: Biogas in der Landwirtschaft, Bonn, 11.–12.09.2023.
Wiechen, J. (2023). *Projektvorstellung Nährwert: Technisch unterstütztes Nährstoffmanagement im Verbund von Biogasanlagen und Anbauregionen*. Vortrag gehalten: 8. Heidener Biogasfachtagung, [online], 09.–10.08.2023.
Wiechen, J.; Stinner, W.; Goldstein, M.; Häner, J.; Knutzen, K. O.; Brathe, C.; Hermus, S. (2023). *Projektvorstellung Nährwert: Technisch unterstütztes Nährstoffmanagement im Verbund von Biogasanlagen und Anbauregionen*. Vortrag gehalten: 11. Statuskonferenz Bioenergie, Leipzig, 20.–22.09.2023.
Winkler, M.; Weinrich, S. (2023). *Comparative Model-based Estimation of BMP and Degradation Kinetics in Batch and Continuous Operation at Two Scales*. Vortrag gehalten: VI. CMP International Conference on Monitoring and Control of Anaerobic Digestion Processes, Leipzig, 22.–23.03.2023.
Winkler, M.; Weinrich, S. (2023). *Modellbasierte Ermittlung des BMP und der Abbaukinetik in Batch- und kontinuierlich betriebenen Biogasreaktioren in unterschiedlichen Maßstäben*. Vortrag gehalten: 29. SIMBA-Treffen, Blankenburg, 09.–10.05.2023.
Wolf, K.; Meola, A.; Weinrich, S. (2023). *Optimization pipeline tuning for ML-based anaerobic digestion predictive models*. Vortrag gehalten: VI. CMP International Conference on Monitoring and Control of Anaerobic Digestion Processes, Leipzig, 22.–23.03.2023.
Wollnik, R. (2023). *All about that b…iomass: Wie Biomasse und Negativemissionen zusammenspielen*. Vortrag gehalten: CDR Dialog Bildungskonferenz zur Kohlenstoffdioxid-Entnahme, München, 10.–11.10.2023.
Wollnik, R.; Borchers, M.; Abel, S.; Elsasser, P.; Herrmann, P.; Hildebrandt, J.; Mühlich, M.; Seibert, R.; Szarka, N.; Thrän, D. (2023). *Resource expectation for bio-based carbon dioxide removal (CDR) in Germany*. Vortrag gehalten: 31st European Biomass Conference and Exhibition, Bologna (Italien), 05.–08.06.2023.
Wurdinger, K.; Büchner, D.; Mercker, O.; Lenz, V. (2023). *Biomasse-Hybridheizung: ein Beitrag zur Versorgungssicherheit*. Vortrag gehalten: 6. Regenerative Energietechnik-Konferenz, Nordhausen, 09.–10.02.2023.
Yuan, B. (2023). *Aufbereitung von anaerob vergorenen, biogenen Reststoffen zur Nährstoff- und Wasserrückgewinnung: Teilaktivität im Projekt Pilot-SBG*. Vortrag gehalten: Konferenz „Fortschritt Gülle & Gärprodukt“, Schwäbisch Hall, 07.–09.11.2023.

**Poster**

Brödner, R.; Deprie, K. (2023). *Rohstoffe: Innovationen für eine nachhaltige Bioökonomie*. Poster präsentiert: Vernetzungsworkshop der Dialogplattform „Industrielle Bioökonomie“, Berlin, 15.03.2023.
Chang, Y.; Stinner, W.; Thrän, D. (2023). *Value Creation of Biogas in China*. Poster präsentiert: 31st European Biomass Conference and Exhibition, Bologna (Italien), 05.–08.06.2023.
D'Espiney, A.; Marques, I. P.; Pinheiro, H. M.; Verworner, B.; Engler, N. (2023). *Poultry and wood industry wastes co-management: Creation of value-added with fungal pre-treatment of wood*. Poster präsentiert: 6th Internation Conference Wastes, Coimbra (Portugal), 06.–08.09.2023.
Formann, S.; Schliermann, T.; Hartmann, I.; Bindig, R.; Hoferecht, F. (2023). *Anwendung von porösem biogenem $SiO_2$ in Feinstaubfilter-Prozessen*. Poster präsentiert: 11. Statuskonferenz Bioenergie, Leipzig, 20.–22.09.2023.
Frontzek, J.; Hellmann, S.; Wilms, T.; Knorn, S.; Streif, S.; Weinrich, S. (2023). *Model Predictive Control of Agricultural Biogas Plants with Uncertain Substrate Characterization*. Poster präsentiert: 6th Doctoral Colloquium Bioenergy, Göttingen, 18.–19.09.2023.
Hellmann, S.; Wilms, T.; Streif, S.; Weinrich, S. (2023). *Extended and Unscented Kalman Filter Design for Mass-Based ADM1 Simplification*. Poster präsentiert: 6th Doctoral Colloquium Bioenergy, Göttingen, 18.–19.09.2023.
Hurtig, O.; Buffi, M.; Agostini, A.; Carbone, C.; Scarlat, N.; Hrad, M.; Confalonieri, A.; Piccioli, B.; Chiabrando, A.; Knoll, L.; Klackenberg, L. (2023). *Biomethane leakages in biogas plants: cost effectiveness of a detection and repair program*. Poster präsentiert: 31st European Biomass Conference and Exhibition, Bologna (Italien), 05.–08.06.2023.
Klüpfel, C.; Biller, P.; Herklotz, B. (2023). *Energetic and material valorization of digestate*. Poster präsentiert: 31st European Biomass Conference and Exhibition, Bologna (Italien), 05.–08.06.2023.
Kurth, M.; Repke, J.–U.; Bhatia, S. K. (2023). *Maxwell-Stefan Surface Diffusion Modeling on Nano-Porous Carbon Membranes*. Poster präsentiert: 6th Doctoral Colloquium Bioenergy, Göttingen, 18.–19.09.2023.
Lange, N.; Hennig, C.; Thrän, D. (2023). *Aktivitäten der IEA Bioenergy Task 44: Flexible Bioenergie und Systemintegration*. Poster präsentiert: 11. Statuskonferenz Bioenergie, Leipzig, 20.–22.09.2023.
Lenz, V.; Szarka, N.; García Laverde, L.; Wurdinger, K.; Pomsel, D. (2023). *Challenges and possible solutions for the replacement of all oil and gas boilers in the consumer market by 2045*. Poster präsentiert: 7. Central European Biomass Conference, Graz (Österreich), 18.–20.01.2023.
Manolikakes, N.; Dzofou Ngoumelah, D.; Kretzschmar, J.; Nefigmann, S.; Jansen, N. (2023). *CarboFerro: Entwicklung und Validierung eines innovativen Eisen-Kohlenstoff Präparates zur Gasreinigung und Effizienzsteigerung des Biogasprozesses*. Poster präsentiert: 11. Statuskonferenz Bioenergie, Leipzig, 20.–22.09.2023.
Meola, A.; Weinrich, S. (2023). *Hybrid modelling of dynamic anaerobic digestion process in full-scale with LSTM and BMP measurements prediction*. Poster präsentiert: 31th European Symposium on Artificial Neural Networks, Brügge (Belgien), 04.–06.10.2023.
Prempeh, C. O.; Formann, S.; Hartmann, I.; Nelles, M. (2023). *An improved method for the production of biogenic silica from cornhusk using sol–gel polymeric route*. Poster präsentiert: 7. Central European Biomass Conference, Graz (Österreich), 18.–20.01.2023.
Prempeh, C. O.; Formann, S.; Hartmann, I.; Nelles, M. (2023). *Generation of Silicon Dioxide from Biomass for Industrial Applications*. Poster präsentiert: 31st European Biomass Conference and Exhibition, Bologna (Italien), 05.–08.06.2023.
Prempeh, C. O.; Hartmann, I.; Formann, S.; Neubauer, K.; Atia, H.; Wohlrab, S.; Nelles, M. (2023). *Low-temperature catalytic methane combustion using $Pd/CeO_2$ dispersed on Sol-gel-derived cornhusk support*. Poster präsentiert: 12. Wissenschaftskongress Abfall- und Ressourcenwirtschaft, Hamburg, 09.–10.03.2023.
Richter, L.; Lenz, V.; Dotzauer, M.; Seifert, J. (2023). *Numerische Optimierung der Versorgungssicher-*

*heit in einem zellular strukturierten Quartier unter Nutzung festbiomassebasierter Hybridsysteme*. Poster präsentiert: 31. Student Chapter, Dresden, 04.05.2023.

Schäfer, F.; Pröter, J.; Reinhold, P. (2023). *Kombination anaerober und aerober Verfahren zur Güllebehandlung: GülleKom*. Poster präsentiert: Fortschritt Gülle & Gärprodukt, Schwäbisch Hall, 07.–09.11.2023.

Schumacher, B. (2023). *Stoffliche Nutzung von Holz aus Agroforstsystemen zur Herstellung von Biomethan und Torfersatzstoff*. Poster präsentiert: Workshop „Resilienz durch regionale Kooperation? Wertschöpfung aus Agroforstsystemen mit schnellwachsenden Baumarten“, Peickwitz, 06.12.2023.

Sumfleth, B.; Majer, S.; Thrän, D. (2023). *Knowledge Based Decision Making Tool for the Assessment of Trade-offs in Low iLUC Risk Certification*. Poster präsentiert: 31st European Biomass Conference and Exhibition, Bologna (Italien), 05.–08.06.2023.

Wolf, K.; Meola, A.; Weinrich, S. (2023). *Optimization pipeline tuning for ML-based anaerobic digestion predictive models*. Poster präsentiert: VI International Conference on Monitoring and Control of Anaerobic Digestion Process, Leipzig, 22.–23.03.2023.

Wollnik, R. (2023). *How do $CO_2$ removal options compare?: Dynamics of bio-based carbon dioxide removal (CDR). An interdisciplinary and multidimensional perspective*. Poster präsentiert: Statuskonferenz Bioenergie, Leipzig, 20.–22.09.2023.

**Research data**

Günther, S.; Karras, T.; Semella, S. (2023). *Theoretical biomass potentials for EU 27* (Version 1.0 (April 2023)) [Data set]. Open Agrar Repositorium. https://doi.org/10.48480/g53t-ks72

Hartmann, I.; Kummrow, M. (2023). *Modellling GHG reduction through emission reduction at log wood stoves* (Version 1) [Data set]. Mendeley Data. https://doi.org/10.17632/ygt84rzkbj.

Hartmann, I.; Ulbricht, T.; Lenz, V.; Thiel, C. (2023). *Emission data from stoves available on the market at a test facility* (Version 1) [Data set]. Mendeley Data. https://doi.org/10.17632/7drrb87j7r.1

Hartmann, I.; Ulbricht, T.; Lenz, V.; Thiel, C. (2023). *Emission data from stoves available on the market at a test facility* (Version 2) [Data set]. Mendeley Data. https://doi.org/10.17632/7drrb87j7r.2

Hoffmann, J.; Grüter, M.; Lüttger, A. (2023). *Pflanzensteckbriefe 2.0: Pflanzen zur klimawandelangepassten Biomasseproduktion* (Version 2.0 (Mai 2023)) [Data set]. Open Agrar Repositorium. https://doi.org/10.48480/wgxe-2733

Winkler, M.; Radtke, K. S.; Weinrich, S.; Mauky, E.; Kretzschmar, J. (2023). *Parameter comparison of biomethane formation kinetics of selected agricultural residues* [Data set]. Open Agrar Repositorium. https://doi.org/10.48480/ybe2-3806

Winkler, M.; Radtke, K. S.; Weinrich, S.; Mauky, E.; Kretzschmar, J. (2023). *Parametervergleich der Biomethanbildungs-Kinetiken ausgewählter landwirtschaftlicher Reststoffe* [Data set]. Open Agrar Repositorium. https://doi.org/10.48480/2c10-kp95

Wollnik, R.; Borchers, M.; Seibert, R.; Abel, S.; Herrmann, P.; Elsasser, P.; Hildebrandt, J.; Mühlich, M.; Eisenschmidt, P.; Meisel, K.; Henning, P.; Radtke, K. S.; Selig, M.; Kazmin, S.; Thrän, D.; Szarka, N. (2023). *Factsheets for bio-based carbon dioxide removal options in Germany* [Data set]. Open Agrar Repositorium. https://doi.org/10.48480/x293-8050

Wollnik, R.; Borchers, M.; Seibert, R.; Abel, S.; Herrmann, P.; Elsasser, P.; Hildebrandt, J.; Mühlich, M.; Eisenschmidt, P.; Meisel, K.; Henning, P.; Radtke, K. S.; Selig, M.; Kazmin, S.; Thrän, D.; Szarka, N. (2023). *Steckbriefe für biobasierte Kohlenstoffdioxid-Entnahmeoptionen in Deutschland* [Data set]. Open Agrar Repositorium. https://doi.org/10.48480/tga8-t109

## Imprint

**Pubished by:**
DBFZ Deutsches Biomasseforschungszentrum
gemeinnützige GmbH, Leipzig,
an enterprise of the German governement with funding from the Federal Ministry of Food and Agriculture pursuant to a resolution by the german Bundestag.

**Contact:**
DBFZ Deutsches Biomasseforschungszentrum
gemeinnützige GmbH
Torgauer Straße 116
D – 04347 Leipzig
Phone: +49 (0)341 2434-112
E-mail: info@dbfz.de



**Editing/V.i.S.d.P.:** Paul Trainer
Responsibility for the content of this broschure lies with the publishers.

**Design/Desktop Publishing:** Stefanie Bader

**ISBN:** 978-3-949807-05-3
**DOI:** 10.48480/wt47-j353

**Pictures:** If not indicated on the picture:
DBFZ, Jan Gutzeit, Jürgen Lösel, Kai & Kristin Fotografie, Johannes Amm, Matthias Eimer, Adobe Stock



With support from
Federal Ministry of Food and Agriculture
by decision of the German Bundestag

**DBFZ Annual Conference 2024**

**“Multi-talented biomass:**
**basic resource, carbon source and energy option”**
11–12 September 2024 at the DBFZ
Info at **www.bioenergiekonferenz.de**

**DBFZ Deutsches Biomasseforschungszentrum**
**gemeinnützige GmbH**
Torgauer Straße 116
04347 Leipzig
Phone: +49 (0)341 2434-112
E-mail: info@dbfz.de

**www.dbfz.de/en**

Visit us on our social media channels: