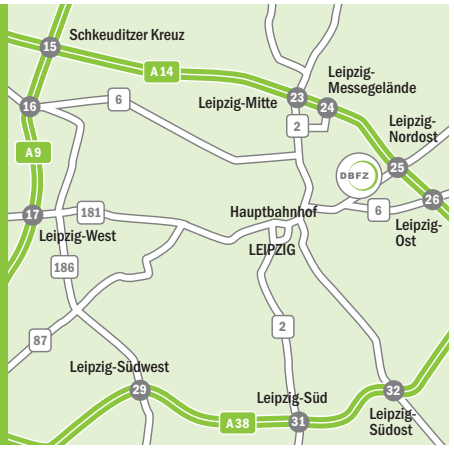
Deutsches Biomasseforschungszentrum
gemeinnützige GmbH

DBFZ

ANNUAL REPORT 2018



DIRECTIONS

By train: to Leipzig main station. Take tram line 3/3E (towards Taucha/Sommerfeld) as far as the Bautzner Strasse stop. Cross over the road, passing the car park on the right, and turn right through gate number 116, after approximately 100 metres turn left, the DBFZ entrance is 60 metres further along on the left-hand side.

By car: on the A14 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 3/3E towards Taucha/Sommerfeld; Bautzner Strasse stop (see "By train" for further directions).

Deutsches Biomasseforschungszentrum
gemeinnützige GmbH

DBFZ

ANNUAL REPORT 2018

TABLE OF CONTENTS

1 Preface by the management 4

2 The year 2018 in figures 6

3 Biofuels and climate protection in the context of the Renewable Energy Directive 8
3.1 Interview with Dr. Franziska Müller-Langer 10

4 Highlights of the research focus areas 18
4.1 Systemic contribution of biomass 20
4.2 Anaerobic processes 30
4.3 Processes for chemical bioenergy sources and fuels 42
4.4 SmartBiomassHeat 52
4.5 Catalytic Emission Control 61

5 Cooperations and networks 70

6 The DBFZ in public 76

7 Executive Support Team 84

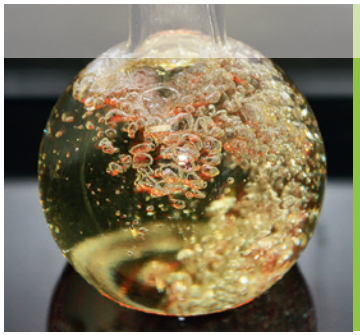
8 Doctoral programme 94

9 Contract research and science based services 104
9.1 Policy recommendations and advice 106
9.2 Market analyses and data provision 109
9.3 Technical, economic and ecological assessment 112
9.4 Concept and process development and optimisation 115
9.5 Scientfic support for R&D projects 118
9.6 Knowledge and technology transfer 121

10 Technical and scientific services 122
10.1 Research infrastructure 127

11 Organisation and structure 130
11.1 Scientfic mission 133
11.2 Research departments 134
11.3 Supervisory Board and Research Advisory Council 135
11.4 Finance and personnel 140
11.5 Scientific bodies, advisory boards and committees 143

12 Projects and publications 152




1
PREFACE BY THE MANAGEMENT

Dear Reader,

In 2018, we were able to use the momentum from the positive feedback we received from the German Council of Science and Humanities to further advance our research activities on the energetic and integrated material use of biomass on the basis of the R&D roadmap. A particular highlight in autumn 2018 was the DBFZ annual conference to mark the 10th anniversary of the DBFZ in Leipzig, which we combined with the 1st German Bioenergy Doctoral Colloquium. This new format is now to be established with the relevant research institutions as a national network event for young scientists in the area of bioenergy.

Our involvement in national and international expert committees has also been further expanded. Since 2015, the DBFZ has been a member of the German Renewable Energy Research Association (FVEE) and in 2018, for the first time, took on the role of spokesperson for the Board of Directors. On an international level, we were able to stage the DBFZ with important cooperations, joint research projects, committee work and the co-organisation of important conferences. The DBFZ's diverse involvement in the International Energy Agency (IEA) and the co-organisation of top-class conferences in Italy, China and India, for example, deserve special mention. The new construction activities also progressed well, with the move-in taking place as planned in summer 2019.

As every year, we would like to thank our numerous supporters (shareholders, supervisory board, research advisory board, ministries, project sponsors and all project partners). We are very grateful to you for the fruitful cooperation and your many suggestions, which help us to become even better every day!

Prof. Dr. mont. Michael Nelles
Scientific Managing Director

Daniel Mayer
Administrative Managing Director

2
THE YEAR 2018 IN FIGURES

3 BIOFUELS AND CLIMATE PROTECTION IN THE CONTEXT OF THE RENEWABLE ENERGY DIRECTIVE

The latest Special Report of the Intergovernmental Panel on Climate Change (IPCC) once again calls for decisive action for a paradigm shift, particularly in the energy sector, transport and agriculture, in order to achieve the agreed Paris climate targets (i.e. to reduce greenhouse gases by at least 80 to 95 % by 2050 compared to 2010). A key to this lies in drastically reducing energy consumption while massively increasing the share of sustainable renewable energy sources. This will require a technological revolution in many areas within the coming years. The transport sector faces particular challenges if mobility is to be sustainable and climate-friendly. With regard to climate protection, it is essential for the transport sector, in addition to the efforts to reduce final energy consumption and improve propulsion systems, to promote the further implementation of energy sources with high energy density and at the same time the lowest possible greenhouse gas emissions in the overall “well-to-wheel/wave/wing” (WTW) chain.

Fig. 1 **The volume of traffic and the pressure to reduce greenhouse gas emissions are increasing**

3.1 INTERVIEW WITH DR. FRANZISKA MÜLLER-LANGER

Dear Dr. Müller-Langer: Traffic volume, energy consumption and CO_2 emissions are increasing. At the same time, Germany has set itself the goal of reducing CO_2 emissions from transport by at least 40 % compared with 1990 levels as part of its climate protection plan. How can this conflict be resolved?

Franziska Müller-Langer: Achieving this ambitious goal requires a number of measures such as traffic avoidance, traffic shifting (e. g. from road to rail) or increased use of efficient powertrains such as electric drives. In the foreseeable future, the energy sources used and thus all available renewable fuels will remain a crucial lever for climate protection in transport.

How can biofuels contribute effectively to climate protection?

Franziska Müller-Langer: In 2015, Germany was the first member state in the European Union who introduced the so-called greenhouse gas (GHG) quota, according to which increasing proportions (currently 4 %, from 2020 6 %) of GHG reductions in fuels placed on the market have to be accounted. Failure to comply with the quota could result in penalties. Already today, around 7.7 million tonnes of CO_2 equivalents are avoided in the German transport sector through the use of sustainable biofuels. The average specific greenhouse gas reduction is more than 80 % compared to fossil fuels, which is significantly more than the 50 % required under the currently binding Renewable Energy Directive (RED).

Fig. 2 Dr. Franziska Müller-Langer at the conference "Fuels of the Future" (January 21, 2019)

In the area of heat and electricity, considerable market shares can already be gained through the use of renewable raw materials. What is the situation in the transport sector?

Franziska Müller-Langer: The share of renewable energies in the transport sector was about 5 % in 2017, with the use of biofuels alone accounting for 4 %. This corresponds to a total of approx. 113 PJ and is mainly achieved in Germany through the blending of biofuels (approx. 80 PJ biodiesel/FAME and approx. 1 PJ hydrotreated vegetable oils/HVO via diesel, approx. 31 PJ bioethanol via gasoline and just under 2 PJ biomethane via CNG/natural gas). Tax relief for biofuels or renewable fuels no longer exists; nevertheless, there are enormous challenges in the transport sector.

The Renewable Energy Directive (RED II) adopted at the end of 2018 increases the 2020 target of 10 % renewable energies in the transport sector to 14 % by 2030. It also sets minimum/maximum limits for various fuels and multiple credits. What is your assessment from a scientific point of view?

Fig. 3 DBFZ Report 11 (4th edition): Monitoring Biokraftstoffsektor

Franziska Müller-Langer: Against the background of better knowledge, RED II (Directive 2018/2001) sets unambitious framework conditions until 2030 and takes the real proportions for selected energy sources and transport sectors to absurdity through the possibility of multiple crediting. The RED II expressed in figures: among others 14 % renewable energies in transport, with a maximum of 7.0 % conventional biofuels from raw materials that can also be used in the food/food sector, with the proportions of advanced fuels gradually increasing to 3.5 % by 2030, as well as 65 % specific minimum GHG reduction with a simultaneous increase in the fossil reference value. Germany would have the possibility to go beyond the targets set in RED II, but apparently will not pursue this. Rather, it can be assumed that the GHG quota existing since 2015 will not even begin to meet the actual requirements for achieving the climate target in Germany (minus 40 % by 2030) after 2020.

What prospects do you see for a GHG quota after 2020?

Franziska Müller-Langer: The continuation and expansion of the GHG quota after 2020 is one of several necessary measures to drive forward the energy revolution in transport. To date, the GHG quota introduced in Germany in 2015 has had a positive impact on technology (further) developments, the associated specific GHG reductions and achievable market prices for renewable fuels. Quota shares for all renewable energy sources (biofuels, electricity-based fuels such as PTX and renewable electricity) that meet the targets, with corresponding subquotas for the targeted promotion of advanced fuels could create a positive environment. This could enable the successful implementation of available technical solutions (e. g. biomethane/PTG, lignocellulosic ethanol) and the further development of technologies to advanced fuels (e. g. paraffinic and synthetic fuels based on BTx and PTx) as well as propulsion and infrastructure side.

What other framework conditions are necessary to achieve the goals set?

Franziska Müller-Langer: It is important for technical progress and a market implementation or establishment of renewable fuels, especially in the timeframe up to 2030 and beyond, to create clear and reliable framework conditions already today, e. g. with regard to quota shares to be met. The same applies to the contractual penalties to be paid in the event of non-compliance with the respective specifications within the GHG quota or, for example, with regard to the EU-regulated CO_2 limit values for vehicle fleets. An important building block for this is the overarching evaluation of fuels and powertrains together, which has been carried out in a regulatively decoupled manner so far. In addition, the proposals for CO_2 taxation of energy sources currently under discussion in specialist circles offer the potential to provide important incentive for the expansion of renewable energy sources and alternative powertrains in transport.

What research do you conduct on biogenic fuels at the DBFZ?

Franziska Müller-Langer: Fuels are the subject of research on several levels at the DBFZ and our department and research focus area respectively. First and foremost, we focus on renewable (bio)-fuels as an essential product of biorefineries or SynBioPTx hybrid refineries. For many years we have been looking at various plant concepts at the level of technical, economic and ecological feasibility. Last but not least, our monitoring of the biofuel sector published regularly in DBFZ Report 11 (see Figure 3) provides a very good overview of the market developments of the various fuel options under the respective boundary and frame conditions. On a pilot scale, we are working on various processes for biorefineries along the supply chain. These are not only relevant for the production of biofuels, but also for the supply of other value-adding products, that are necessary for the competitivness of biorefineries. These include so-called hydrothermal processes (HTP), thermo-chemical gasification, gas conditioning and product synthesis as well as

Fig. 4 Biomethane as a renewable fuel has lower pollutant emissions than diesel and petrol

various separation processes. We are working intensively on mapping complete chains in technical interaction and on being able to analytically examine reactants and (intermediate) products accordingly. In addition, we can examine various fuels with regard to their properties and their behaviour in the overall engine exhaust aftertreatment system as well as related emissions.

Can you name a concrete research project you are currently working on?

Franziska Müller-Langer: We are currently working on a practical project of the Mobility and Fuels Strategy financed by the Federal Ministry of Transport and Digital Infrastructure (BMVI), which involves the production and supply of biomethane from so far unused biogenic residues and waste materials. Here we rely on an innovative technology approach involving hydrothermal processes, anaerobic digestion, product separation and synthesis from biogenic CO_2. Our goal is to realise a pilot plant at the DBFZ in the R&D project that will initially run until 2021. To implement this successfully and to identify in the accompanying feasibility study framework conditions which could enable a competitive mobilisation of this potential for several biomethane plants are undoubtedly challenges to be managed.

Keyword biomethane: the renewable, gaseous energy source has great, but still largely untapped potential. What significance does biomethane have for the fuel sector?

Franziska Müller-Langer: Biomethane is a fuel option that is already available on the market, that can be blended up to 100 % with natural gas/CNG fuel and that also has advantages over fossil gasoline/diesel in terms of pollutant emissions. In addition, by mobilising previously unused potential for biogenic residual and waste materials, further quantities could be developed and used advantageously on a large scale in transport. Due to the advantages with regard to the specific greenhouse gas emissions of biomethane from waste and residual materials, the fuel is used within the GHG quota; despite the available infrastructure and mode of transport, however, only to a comparatively very small extent to date (approx. 5 PJ CNG in 2017, thereof approx. 2 PJ biomethane).

Advanced fuels are strongly targeting biogenic residues and waste materials. What are the value-added opportunities for agriculture?

Franziska Müller-Langer: In the production of conventional biofuels such as biodiesel/FAME from oilseeds/vegetable oils and bioethanol from plants containing sugar and starch, for example, large quantities of animal feed are provided at the same time, depending on the plant concept. A further added value results from the use of stillage from bioethanol plants for the production of biomethane.
In addition, there is considerable potential for straw and other agricultural residues (e. g. manure) to be used as raw materials for biofuels. If the synergies in the interaction of biomass-based products (BTx) and electricity-based products (PTx) can be exploited in so-called SynBioPTx concepts (e. g. by using biogenic CO_2 from biogas/biomethane plants and bioethanol plants for PTx processes with the integration of renewable electrolytically produced hydrogen), existing value-added chains can be extended and thus added value generated.

A look into the future: how much longer will you be giving fossil fuels?

Franziska Müller-Langer: For decades we have been talking about fossil resources being finite. However, it is currently not possible to predict when oil reserves will really run out. The climate targets defined in Paris have priority, and biofuels – as already mentioned – are still the only option currently available to a significant extent in order to achieve significant reductions in greenhouse gases on the fuel side, taking into account a number of sustainability criteria.

Will the classic internal combustion engine as solitary powertrain ever be history?

Franziska Müller-Langer: That depends on the framework and boundary conditions, the region and the time horizon; in its current, still very dominant form, it does. Conventional powertrain concepts (especially the engine as a whole, exhaust aftertreatment and overall vehicle management) are also being continuously further developed, taking into account the respective modes of transport. In all probability, however, the future will lie in the mix of electromobility and hybrid drives with the best possible integration of the various renewable fuels. In individual areas of application, however, we will have to continue to rely on pure combustion engines in the future, such as in aviation and shipping.

Thank you very much for the interview.

Further information:
www.dbfz.de/en/research/research-focus-areas/processes-for-chemical-bioenergy-sources-and-fuels/

In profile:

Dr.-Ing. Franziska Müller-Langer specialised in energy technology during her mechanical engineering studies at the TU Bergakademie Freiberg and worked for Siemens AG, Power Generation in Erlangen and the Aristoteles University Thessaloniki (Greece), among others. She received her doctorate in biofuels from the TU Hamburg. From 2004 she was project manager and later working group leader at the Institute of Energy and Environment (IE Leipzig). Since 2008 she has been working as head of the Biorefineries Department at the DBFZ as well as head of the research focus area “Processes for chemical bioenergy sources and fuels”. She is also a member of various committees and working groups (e. g. National Team Leader of the IEA Bioenergy Task 39; European Technology and Innovation Platform, National Platform Future of Mobility; DECHEMA ProcessNet – Sustainable Production, Energy and Resources (SuPER), Division Energy Process Engineering as well as Working Group Alternative Fuels; Scientific Advisory Board Förderkreis Abgasnachbehandlungstechnologien für Verbrennungskraftmaschinen e. V.)

4
HIGHLIGHTS OF THE RESEARCH FOCUS AREAS

At the DBFZ, relevant research areas of energetic biomass use and integrated material use are dealt with in five main research focus areas. They ensure that important questions and aspects of bioenergy can be mapped in the depth required for excellent research. The priorities are oriented towards future developments as well as research policy challenges and framework conditions (e. g. the strategies of the Federal Government such as the national research strategy BioEconomy 2030, the national policy strategy BioEconomy, the mobility and fuel strategy of the Federal Government, the roadmap Biorefineries, etc.). Other important cornerstones for the scientific orientation of the research priorities are the funding policy framework, the unique selling points in the research landscape and the good infrastructure of the DBFZ.

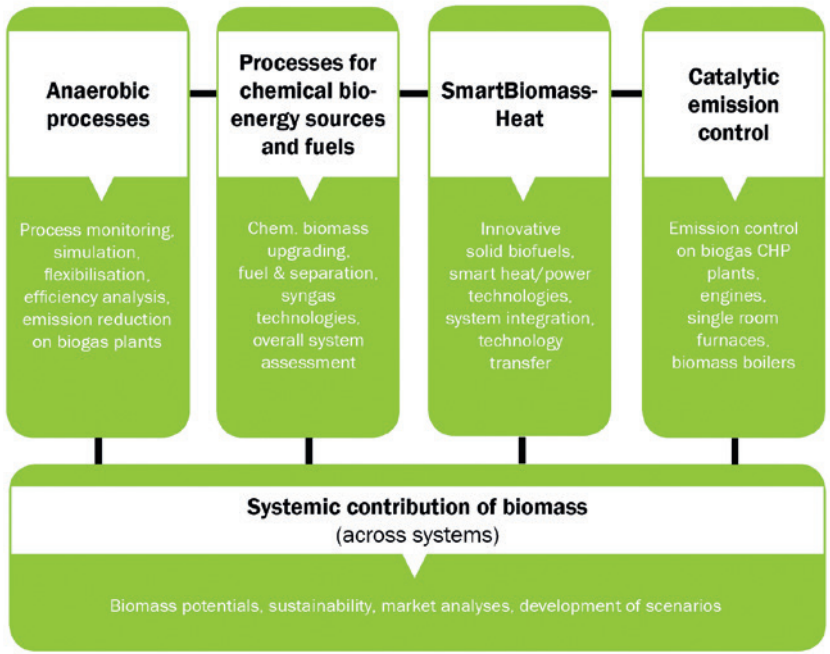


Fig. 5 The five research focus areas of the DBFZ

4.1
SYSTEMIC CONTRIBUTION OF BIOMASS

"STAR-ProBio makes an important contribution to the development of a sustainable bioeconomy. The project builds on the numerous existing sustainability certification systems for bio-based products and develops them further. As a result, STAR-ProBio will develop a consistent set of sustainability criteria and their decided methodological foundations as well as two comprehensive assessment tools for bio-based products and for policy strategies."

Stefan Majer, Project Manager

STAR-PROBIO – SUSTAINABILITY TRANSITION ASSESSMENT AND RESEARCH OF BIO-BASED PRODUCTS

Europe is facing major challenges in terms of increasing scarcity of natural resources, increasing global competitive pressure and continued global population growth. The development of a sustainable bioeconomy with dynamic, resource-efficient and competitive sectors is a possible response to these challenges. In particular, it supports the transition from a fossil-based to a bio-based society. Bio-based products are an opportunity to promote sustainable economic activity and environmental protection – a priority of the European growth strategy [1] – through responsible management with renewable resources in agriculture and industry. The sustainable use of these resources and the products produced from them is in turn accompanied by major new challenges. These make it necessary

STAR ProBio

to develop and use adequate assessment and monitoring instruments to accompany the process.
The development and use of sustainability assessment systems for bio-based products is expected to make a clear and evidence-based contribution to the economic, social and ecological impacts of bio-based solutions. Systems and instruments for assessing sustainability are therefore also crucial for promoting the market viability of bio-based products [2], [3]. The STAR-ProBio project (Sustainability Transition Assessment and Research of Bio-based Products) is a joint research and innovation project with 15 partners from 11 EU countries, which deals intensively with this topic. The project is funded by the European Commission over a period of three years within the Horizon 2020 programme.

The overall objectives of the project are as follows:

- Development of standards and guidelines for the sustainability assessment of all types of bio-based products,
- Analysis of measures to support the market introduction of sustainable bio-based products,
- Analysis of policy elements for the development of a coherent framework with a level playing field for bio-based and non-bio-based products at EU level,
- Development of a scheme for the sustainability certification of bio-based products.

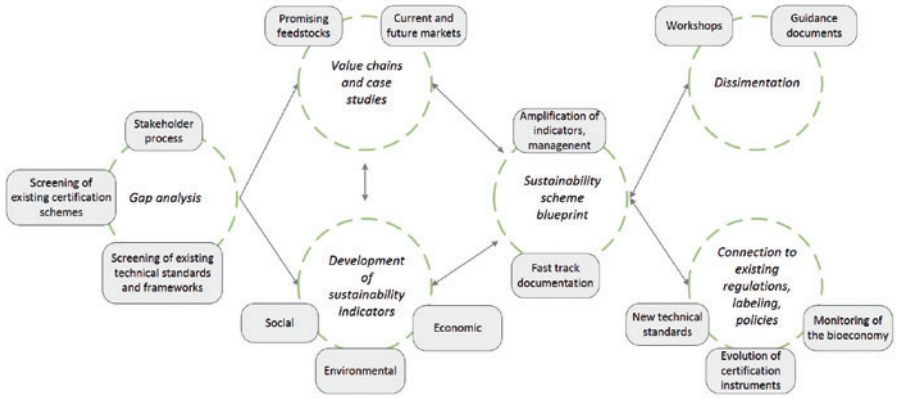
STAR-ProBio thus supports the development of an adapted sustainability concept that enables the comparability of bio-based and non-bio-based products. For this purpose, gaps in knowledge on sustainability criteria and indicators are identified. The existing sustainability assessment and certification systems for biomass and biofuels will be extended to include elements of holistic life cycle assessment

(cradle-to-cradle). To this end, a harmonised approach for ecological (life cycle assessment – LCA) and social life cycle assessment (S-LCA) as well as technical-economic life cycle costing (LCC) will be developed. In addition, the introduction of the adapted assessment instruments developed in the project is supported. Furthermore, the risks of Indirect Land Use Change (ILUC) will be identified and approaches for their reduction or avoidance will be demonstrated. At the societal level, the demand for sustainable bio-based products is to be strengthened. To this end, STAR-ProBio is conducting extensive analyses to assess preferences, consumer acceptance and awareness of the sustainable production of bio-based products among agricultural associations, industry, EU institutions, entrepreneurs and civil society organisations.

METHODS/MEASURES

The first step of the project was a comprehensive gap analysis[1], which helped to identify missing sustainability criteria and related indicators in existing certification systems as well as in technical standards (see Figure 6). This gap analysis was based on a comprehensive evaluation of the literature on existing certification systems and standards as well as interviews with numerous international experts. Based on these results (see e. g. [4]), suitable case studies on bio-based products and their associated value chains are identified. The selected case studies are based on real marketable examples of bio-based products, such as building materials, bio-based plastics and fine chemicals. They also focus on the consideration of different utilisation possibilities at the end of the product life [5]. The results of the gap analysis are used to develop suitable sustainability criteria and indicators. They are supplemented by a literature search on ecological, social and technical-economic indicators of bio-based products. Conversely, the case studies serve to validate the determined quantitative indicators, which are then combined to form a consistent set of criteria.

1 Majer, S, Wurster, S, Moosmann, D, Ladu, L, Sumfleth, B, Thrän, D (2018): Gaps and Research Demand for Sustainability Certification and Standardisation in a Sustainable Bio-Based Economy in the EU. Sustainability, 10(7):2455.



© STAR-ProBio

Fig. 6 Methodical approach of Star-ProBio

A core element of STAR-ProBio is the further development of life cycle analysis methods (LCA, S-LCA and LCC), e. g. the testing of other methods, such as stakeholder analysis to determine social indicators using participative methods, including workshops with stakeholders; resource efficiency analysis of technical-economic indicators; market assessment and field trials of sustainability preferences and expectations of producers and consumers; the Delphi survey of EU member states to obtain information on the market positioning of bio-based products, etc. (see Figure 7).
STAR-ProBio‘s main focus is on the development of indicators to reduce the ILUC risk of bio-based products, based on the further development of existing approaches in the field of biofuels. The aim is to develop a catalogue of measures (cultivation practices, production practices) to reduce the demand for land per unit produced. On the basis of the case studies and the sustainability indicators developed, a scheme for a comprehensive sustainability assessment system or a certification system will then be developed. The results achieved are presented to the public in workshops and guidelines.

MILESTONES/CHALLENGES

As an essential result of the STAR-ProBio project, in addition to a series of individual results on sustainability criteria and indicators as well as on the scientific methods for their operationalisation, a scheme for the integrated, comprehensive

sustainability assessment of bio-based products will be developed. The prerequisite for this is the analysis and combination of ecological, social and economic indicators, whereby suitable indicators for the respective life cycle analyses as well as indicators to reduce the ILUC risk are developed. In addition, the development of fast-track standards, chain-of-custody tools and criteria for the existing Ecolabel are expected as concrete results. The harmonisation of the results of the project with the concept of the Product Environmental Footprint (PEF) and the EU Ecolabel will increase the usability of the results.

The following further developments are expected in detail:

- The integration of a holistic life cycle assessment into the sustainability certification of bio-based products, in particular by considering cascade use effects at the end of the product life
- Increasing the quality and reliability of the sustainability assessment instruments applied in practice by taking greater account of social and economic aspects
- Development of universal and quantitative sustainability criteria with international life cycle data (ILCD [6]) and indicators, taking into account typical end-of-life scenarios and indirect changes in land use
- Accelerating the development of certification, revision of standards and extension of criteria for labelling bio-based products
- Further development of the existing sustainability assessment methodology of bio-based products to enable consumers to make an informed purchase decision and to illustrate the advantages of bio-based products over conventional products.

DBFZ CONTRIBUTION TO THE PROJECT

The DBFZ is significantly involved in the STAR-ProBio project at various points. At the beginning of the project, the DBFZ provided a gap analysis on existing certification systems in the bioeconomy, providing important foundations for the further course of the project. Based on comprehensive research and the results of expert

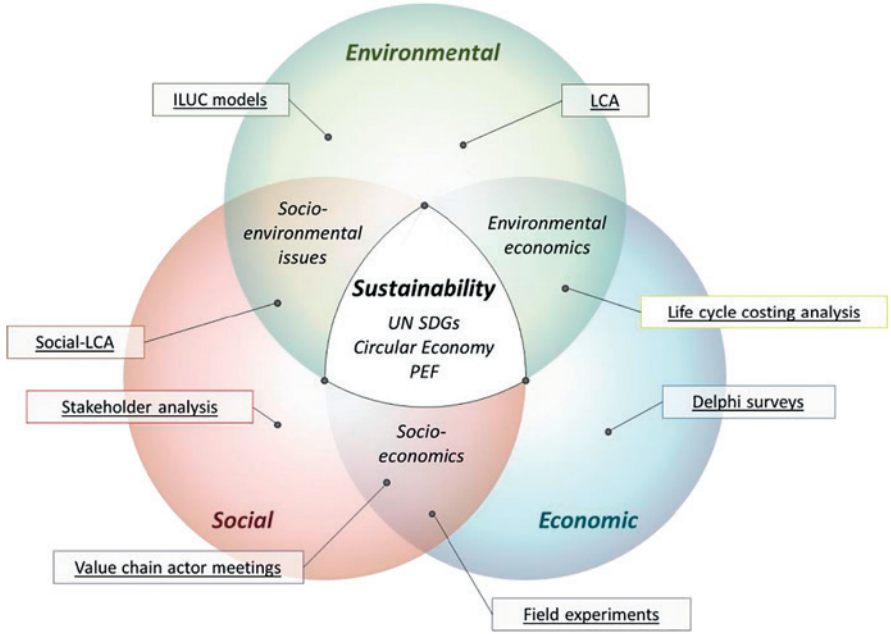


Fig. 7 The three sustainability dimensions with the most important tools and methods used in STAR-ProBio

interviews, a comprehensive inventory of available systems and their sustainability criteria and indicators was generated. On this basis, it was possible to identify criteria that have so far been inadequately covered by certification systems or have been poorly implemented in practice. The legal framework and the end-of-life processes as well as the necessary standardisation activities are sometimes described as incomplete. The existing need for research to improve sustainability certification and standardisation in a growing bio-based economy was clearly demonstrated in this gap analysis [4]. The identified gaps and conclusions will be taken up by the project in the following. The DBFZ is also involved in the further development of existing approaches for the development of “low iLUC risk” factors for bio-based products and their integration into sustainability certification systems. In addition, the analysis of the acceptance of developed indicators and

the formulation of policy recommendations for the control of future land use fall within the scope of this project. In addition, the DBFZ is intensively involved in the development of a scheme for a new sustainability assessment system, which is the main product of the project. The DBFZ takes a leading position in the development of consistent and coherent policy recommendations for the future design of the political framework of the bioeconomy, taking into account the products developed in STAR-ProBio. The results of the analysis of existing regulatory and voluntary frameworks of the sustainability assessment are included. In addition, the DBFZ participates in the comparison of the developed indicators with the UN Sustainable Development Goals (SDG)[2]. Further potential links to the monitoring of the bioeconomy and its support by the results of STAR-ProBio are being sought.

PERSPECTIVES

As a result, the project provides a kind of toolbox for the development of efficient and functional sustainability certification systems for bio-based products. This toolbox is complemented by the fast-track standards for selected bio-based products that are relevant for the European bioeconomy developed within the project. These can be applied directly after the end of the project. In addition, the results contribute to policy analysis by determining the correct classification and framework of sustainability certification systems. Furthermore, proposals for specific regulatory recommendations will be made possible to accompany the efficient and supportive regulatory framework of bio-based products. This facilitates the development of a level playing field between different sectors of the bio-based economy and fossil-based alternatives.

Further information:
www.star-probio.eu

2 https://sustainabledevelopment.un.org/?menu=1300

Sources:

[1] Europäische Kommission (2010): EUROPA 2020: Eine Strategie für intelligentes, nachhaltiges und integratives Wachstum, Brüssel.
[2] Delbrück, S, Griestop, L, Hamm, U (2018): Future Opportunities and Developments in the Bioeconomy. A Global Expert Survey, Berlin.
[3] Scarlat, N, Dallemand, J-F, Monforti-Ferrario, F, Nita, V (2015): The role of biomass and bioenergy in a future bioeconomy. Policies and facts. Environmental Development, 15:3-34
[4] Majer, S, Wurster, S, Moosmann, D, Ladu, L, Sumfleth, B, Thrän, D (2018): Gaps and Research Demand for Sustainability Certification and Standardisation in a Sustainable Bio-Based Economy in the EU. Sustainability, 10(7):2455.
[5] Lokesh, K, Ladu, L, Summerton, L (2018): Bridging the Gaps for a 'Circular' Bioeconomy. Selection Criteria, Bio-Based Value Chain and Stakeholder Mapping. Sustainability, 10(6):1695
[6] European Commission, Joint Research Centre, Institute for Environment and Sustainability (2010): International Reference Life Cycle Data System (ILCD) Handbook. General guide for Life Cycle Assessment – Provisions and Action Steps, Luxembourg.

THE RESEARCH FOCUS AREA "SYSTEMIC CONTRIBUTION OF BIOMASS"

The research focus area is intended to contribute to the development of sustainable bioenergy strategies at the national and international levels. This entails determining regionally and globally available biomass potentials and examinating and evaluating the various concepts for biomass utilisation. The overriding goal is to find methodological and system-engineering solutions to the problems of efficiency and sustainability of biomass use from an economic, ecological and technical perspective, taking into account the land resources and the processing and conversion technologies specific to energy sources. Combining these topics allows strategies and recommendations for action to be devised for decision-makers from politics and business.

Important reference projects and publications

Project: acatech – Energiesysteme der Zukunft (ESYS): Biomasse im Spannungsfeld zwischen Energie- und Klimapolitik: Strategien für eine nachhaltige Bioenergienutzung, Federal Ministry of Education and Research, 01.09.2017–31.08.2018

Project: OpenGeoEdu – Offene Daten für Lehre und Forschung in raumbezogenen Studiengängen; Teilvorhaben e-Learning: Räumliche Verteilung von biogenen Ressourcen, Federal Ministry of Transport and Digital Infrastructure/ VdI/VDE/IT + TÜV Rheinland, 01.05.2017–30.04.2020 (FKZ: 19S2007D)

Project: MethBos2 – Bioenergy Component – Advisory for biomass potential map development in Bosnia and Herzegovina, GIZ, 05.09.2017–30.08.2018

Project: MoBiFuels – Analyse und Beseitigung von technisch modifizierten Bioenergieträgern, Federal Ministry for Economic Affairs and Energy/Project Management Jülich, 01.11.2018–31.10.2021 (FKZ: 03KB136A)

Project: TATBIO – Technoökonomische Analyse und Transformationspfade des energetischen Biomassepotentials, Federal Ministry for Economic Affairs and Energy/Project Management Jülich, 10.10.2017–31.01.2019 (FKZ: 03MAP362)

Publication: Dotzauer, M.; Pfeiffer, D.; Lauer, M.; Pohl, M.; Mauky, E.; Bär, K.; Sonnleitner, M.; Zörner, W.; Hudde, J.; Schwarz, B.; Faßauer, B.; Dahmen, M.; Rieke, C.; Herbert, J.; Thrän, D. (2019). "How to measure flexibility: performance indicators for demand driven power generation from biogas plants". Renewable Energy (ISSN: 0960-1481), H. 134. p. 135–146. DOI: 10.1016/j.renene.2018.10.021.

Publication: Scheftelowitz, M.; Becker, R.; Thrän, D. (2018). "Improved power provision from biomass: A retrospective on the impacts of German energy policy". Biomass and Bioenergy (ISSN: 0961-9534), H. 111. p. 1–12. DOI: 10.1016/j.biombioe.2018.01.010

Publication: Lauer, M.; Hansen, J. K.; Lamers, P.; Thrän, D. (2018). "Making money from waste: The economic viability of producing biogas and biomethane in the Idaho dairy industry". Applied Energy (ISSN: 0306-2619), H. 222. p. 621–636. DOI: 10.1016/j.apenergy.2018.04.026.

Publication: Millinger, M.; Meisel, K.; Budzinski, M.; Thrän, D. (2018). "Relative Greenhouse Gas Abatement Cost Competitiveness of Biofuels in Germany". Energies (ISSN: 1996-1073), Vol. 11, H. 3. DOI: 10.3390/en11030615.

Publication: Reißmann, D.; Thrän, D.; Bezama, A. (2018). "Hydrothermal processes as treatment paths for biogenic residues in Germany: A review of the technology, sustainability and legal aspects". Journal of Cleaner Production (ISSN: 0959-6526), H. 172. p. 239–252. DOI: 10.1016/j.jclepro.2017.10.151.

Publication: Horschig, T.; Welfle, A.; Billig, E.; Thrän, D. (2019). "From Paris agreement to business cases for upgraded biogas: Analysis of potential market uptake for biomethane plants in Germany using biogenic carbon capture and utilization technologies". Biomass and Bioenergy (ISSN: 0961-9534), H. 120. p. 313–323. DOI: 10.1016/j.biombioe.2018.11.022.

Project summary

Duration:	01.05.2017–30.04.2020
Project partners:	Department of Law and Economics, Unitelma-Sapienza University of Rome (Itlay, Unitelma); Department of Chemistry, University of York (Great Britain, UoY); Chair of Innovation Economics, Technische Universität Berlin (Germany, TUB); Department of Natural Resources and Agricultural Engineering and Department of Food Science & Human Nutrition, Agricultural University of Athens (Greece, AUA); Bioenergy Systems, Deutsches Biomasseforschungszentrum (Germany, DBFZ); SQ Consult (Netherlands); CIRSA Centro Interdipartimentale di Ricerca per le Scienze Ambientali, University of Bologna – Alma Mater Studiorum (Italy, Unibo); Centre for Renewable Energy Research, Uniwersytet Warminsko Mazurski w Olsztynie (Poland, UWM); ChemProf Doradztwo Chemiczne sc (Poland); Quantis Sàrl (Suisse); NOVAMONT SPA (Italy); Swedish Environmental Protection Agency – Naturvardsverket (Sweden, SEPA); Chemical Engineering Department, Universidade de Santiago de Compostela (Spain, USC); European Environmental Citizens Organisation For Standardisation (Belgium, ECOS); agroVet GmbH (Austria)
Scientific contact:	Stefan Majer
Project number:	GA727740
Funding body:	European Union' Horizon 2020 Research & Innovation Programme

Head of the research focus area

Prof. Dr.-Ing. Daniela Thrän
Phone: +49 (0)341 2434-435
E-Mail: daniela.thraen@dbfz.de

4.2 ANAEROBIC PROCESSES

"Within the scope of the project ‚eMikroBGAA' it was analysed under which framework conditions small processing plants make sense and how large the potentials for these plants are. Against the background of the current framework conditions, very small treatment plants cannot be operated economically. For an economic operation, either cost reductions of the treatment and feed-in of biomethane or financial incentives for the implementation of the micro-processing plants have to be realised".

Jaqueline Daniel-Gromke, Project Manager

EMIKROBGAA – SUB-PROJECT 2: POTENTIAL ASSESSMENT AND BUSINESS EVALUATION FOR MIKROBGAA

In Germany, a total of around 8,900 biogas production plants are in operation, of which the majority are on-site biogas plants (and satellite CHP plants) and around 200 plants with processing technology for the supply of biomethane (as of 2018). In view of the existing biogas plants and the expiry of the EEG tariff, a technical conversion from current biogas on-site power plants (VOV) to biogas upgrading and biomethane injection into the gas grid could represent an option for further operation.

The aim of the joint project "Efficient Micro Biogas Processing Plants" (eMikroBGAA) was to answer the question of whether and under what conditions the processing and injection of comparatively small quantities of biogas is justified primarily from an economic point of view. In addition, the Germany-wide potential for the economically optimised MikroBGAA sites was estimated. The following work packages were processed in the project by the project consortium (IEE, DBFZ, DBI and dena) led by Fraunhofer IEE:

- Project management (WP 1)
- Economic comparison of potential concepts for decentralised biomethane feed-in (WP 2)
- Presentation of further relevant aspects of decentralised biomethane feed-in (WP 3)
- Method development and verification for the estimation of the MinFlow in gas distribution networks (WP 4)
- Potential estimation for eMikroBGAA in Germany (WP 5)
- Analysis and evaluation of capacity expansion measures (WP 6)
- Business evaluation of the economically optimised MikroBGAA (WP 7)
- Actor-based analysis of potential business models (WP 8)
- Assessment of barriers and development of solutions (WP 9)
- Reporting and publications (WP 10)

METHODS/MEASURES

In sub-project 2, the DBFZ worked on the determination of the specific treatment costs (WP 2), the compilation of the ecological aspects of decentralised biomethane feed-in (WP 3), the potential assessment at sites in Germany with regard to potential conversion of VOV plants and construction of new small treatment plants (WP 5) and the economic evaluation of the economically optimised MikroBGAA (WP 7). In addition, the following work packages were also carried out:

- WP 2: Economic evaluations and comparison of plant concepts with IEE
- WP 6: Analysis and evaluation of capacity expansion measures with IEE, DBI
- WP 9: Legal framework for biomethane (barriers, solutions)

Fig. 8 Biomethane feed-in

Economic comparison of potential concepts for decentralised biomethane feed-in (WP 2)

For the economic comparison of potential concepts for decentralised biomethane feed-in, (cost) analyses for combinations of biogas upgrading and biomethane feed-in plants of fully cost-optimised constellations were determined and evaluated. For the economic evaluation of the provision of biomethane, costs of manufacturers of various biogas upgrading technologies (DBFZ) on the market as well as costs of plant constructors and planners of biogas feed-in plants (IEE) were collected. In meetings with operators, planners and (component) manufacturers of biogas upgrading plants and feed-in plants, the data collected in the project were completed and verified together with these market players.

Presentation of further relevant aspects of the decentralised biomethane feed-in (WP 3)

In WP 3, the GHG emissions for the provision of electricity for on-site conversion (VOV) scenarios of the biogas were presented in comparison to average treatment plants with 700 $m^3_{i.N.}$/h raw gas in order to determine for which plant constellations a conversion of biogas plants (VOV) for the provision of biomethane is most sensible from the point of view of the GHG balance.

Potential assessment for eMikroBGAA in Germany (WP 5)

As part of the potential assessment, it was analysed how large the potential for micro-processing plants in Germany is, taking into account the economic costs of decentralised biogas feed-in. The estimation included the potential conversion of existing VOV plants and the available potentials for the construction of micro treatment plants in Germany. By overlapping the gas network feed-in potentials (DBI) with the feed-in information for the biogas plant sites in Germany (DBFZ) and the biomass potentials (DBFZ, DBI), a minimum and maximum potential for microprocessor plants (MikroBGAA) in Germany was estimated. On the basis of the biogas plants in Germany and the allocation of the CHP share after evaluation of the data from the Federal Network Agency (BNetzA), the extent of external heat utilisation was taken into account in order to filter out which plants are best suited for retrofitting.

Analysis and evaluation of capacity expansion measures (WP 6)

Based on the results of the “MinFlow+” concept, an expanded concept for increasing gas network capacities, further capacity-increasing measures were investigated. In addition, parameters relevant for the feed-in such as the pressure level of the networks (influence on the energy input for the feed-in) and the average length of the connecting line between the biogas plant and the gas network were worked out.

Business evaluation of the economically optimized MikroBGAA (WP 7)

The MikroBGAA constellations determined in WP 2 were evaluated in WP 7 from an economic point of view, whereby the costs of a standard treatment plant (700 $m^3_{i.N.}$/h raw gas) were compared with a capacity of 250 $m^3_{i.N.}$/h raw gas. For the evaluation of a merger of small biogas plants, the evaluation of a central treatment by coupling two biogas plants á 250 $m^3_{i.N.}$/h raw gas was exemplarily considered.

Evaluation of obstacles and development of solutions (WP 9)

Finally, the obstacle analysis and the derivation of options for action were carried out in order to be able to dismantle possible obstacles that negatively influence the operation of the MikroBGAA sites, which were identified as economically meaningful in the overall project.

MILESTONES/CHALLENGES

Depending on the processing capacity, there are significant economies of scale with regard to processing costs. The manufacturer survey for processing technologies considered processing capacities of 40 to 3,000 $m^3_{i.N.}$/h raw biogas and showed specific processing costs of 0.93 ct/kWh_{Hs} to 7.63 ct/kWh_{Hs} (see Figure 9). The highest treatment costs are incurred by smaller treatment plants with capacities of less than 200 $m^3_{i.N.}$/h raw biogas. In the range of treatment capacity between 100 and 125 $m^3_{i.N.}$/h the treatment costs are between 4.6 and 2.3 ct/kWh, while in the 200-550 $m^3_{i.N.}$/h range treatment costs between 2.4 and 1.6 ct/kWh are achieved.
The specific investments for all processes under consideration include, in addition to the investments for the treatment technology, the costs for low-gas aftertreatment, commissioning, approval and planning, ancillary construction costs and, if necessary, the costs for replacement investments (e.g. to replace the membranes) as well as maintenance and repair costs. All the model cases of small BGAA feed-in concepts considered show higher specific costs than the reference cases of larger plant capacities considered when considering the full costs (total costs of processing and network feed-in) even when feeding into lower pressure stages. On the basis of the defined boundary conditions, plants with a raw gas capacity of 250 $m^3_{i.N.}$/h have higher costs even when fed into natural gas networks with lower pressure stages (PN 1, PN 4) than plants with a raw gas capacity of 700 $m^3_{i.N.}$/h when fed into PN 16 networks. A cost parity of the lower capacity considered here to the conventional reference case considered would thus only be given if the specific capital-bound costs of the plants with lower capacity were significantly reduced.
Regardless of the plant size classes considered, the results show that the combination of biogas upgrading plant technology and natural gas network pressure stage has a relevant influence on the full costs of biogas upgrading and biomethane network feed-in. With regard to the costs for the feed-in, the compression of the biomethane plays a significant role. Taking into account the costs of processing and feed-in overall, the membrane processes and the pressure water wash (DWW) in the low pressure stages (1 and 4 bar) are the most cost-effective.

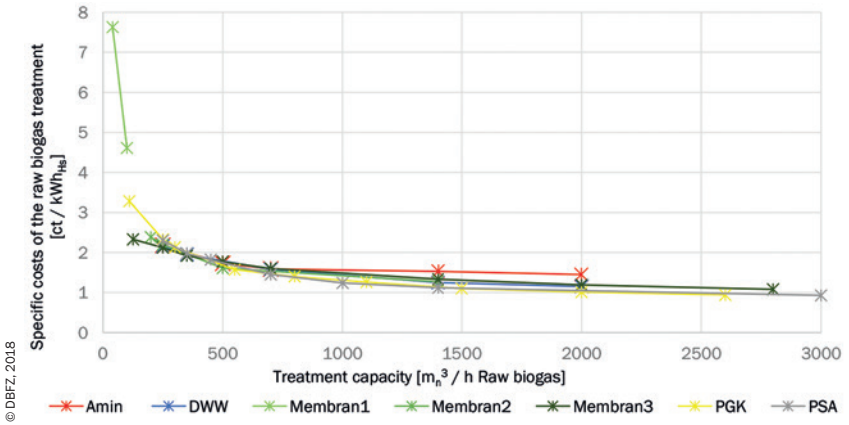


Fig. 9 Specific costs of raw gas treatment by treatment capacity and process in ct/kW_{Hs}^{-1}

By overlapping the determined feed-in potentials with the feed-in information on the biogas plant sites in Germany and the biomass potentials, an estimation of the possible potential at MikroBGAA sites in Germany was also carried out. The determined technical biogas potential (2015) is between 155–263 TWh_{Hs}/a (without or with energy crops). If additional straw potential is taken into account, the maximum total potential is approx. 284 TWh_{Hs}/a taking the current biogas production into account, more than 1/3 of the biogas potential is currently used for biogas production.

If the focus – due to the high specific costs for very small treatment plants – is placed on VOV plants with a rated output of 400 kW_{el} or more and a CHP share of less than 25 or 50 %, conversion to biomethane can be considered for approx. 1,300 or 2,000 biogas plants with an installed plant output of 900 or 1,320 MW_{el} respectively. This corresponds to a share of 16–24 % of the plant stock or 30–44 % of the total gas production. Further limitations of this potential must be taken into account on the basis of the determined gas grid feed-in potentials at distribution grid level. The gas grid feed-in potential at the distribution grid level was determined by DBI at 30–80 TWh_{Hs}/a and at the transport grid level at 300–320 TWh_{Hs}/a (cf. WP 4). This feed-in potential was reported by DBI as "MinFlow" or "MinFlow+" and represents the year-round available capacity in the gas distribution network for the absorption of biomethane, which is limited by the small quantities purchased in summer.

Considering the determined network feed-in potentials at distribution network level, approx. 300–600 biogas plants (VOV) with a total installed capacity of approx. 200–400 MW_{el} can be considered, which, due to their output size (> 400 kW_{el} rated output) and currently low CHP utilisation (< 25 or 50 %), can be upgraded to biomethane (see Figure 10). The predicted decline in gas demand for DBI also automatically leads to a reduction in biomethane feed-in capacities. According to DBI analyses, the gas distribution networks will see a reduction in Germany-wide capacity by approx. 47 % by 2030 compared with 2015, and by approx. 19 % for regional transport networks.

The results show that significant differences must be taken into account at district level. Regions in which there is more biomass potential than can be fed into the gas network occur – but differ from region to region due to the different customer structures. This means that there are regions in which the biomethane potential

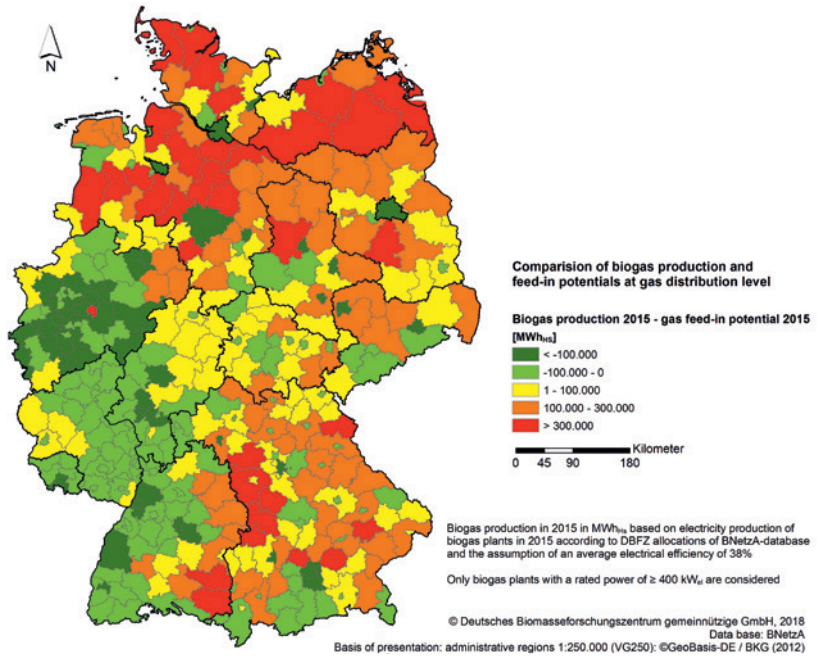


Fig. 10 Comparison of the gas production of biogas plants > 400 kW_{el} (rated power) and CHP share < 25 % less the determined gas grid feed-in potentials at distribution grid level 2020 (database: biogas production and CHP share according to BNetzA) 2015, gas grid feed-in potential according to DBI)

exceeds the feed-in potential. These regions could alternatively be fed into another grid level (transport grid), but this would involve higher energy consumption (e. g. compression to a higher pressure stage). Against the background of falling gas grid potentials for 2020 and 2030, the results of the overlap will show even stronger regions without available feed-in potentials. The background to this is the regional differences in biogas potential on the one hand and the comparatively low gas network potential in rural areas (with low gas consumption) on the other. Profitability could therefore probably only be achieved for large plants or by merging several plants.

PERSPECTIVES

Against the background of the current framework conditions, micro-processing plants cannot be operated economically. Low remuneration rates in the EEG 2014 and upper bid limits in the EEG 2017 have led to the fact that the generation of electricity from biomethane in biomethane CHP plants with high heat utilisation is only rarely competitive. In addition to the use of biomethane in CHP plants, it is also possible to sell biomethane to gas traders or use it as a fuel. The proceeds from the sale of biomethane (e. g. to biomethane traders) are to be negotiated and depend on the current framework conditions (e. g. plant size, biomethane sales, traders, marketing skills of the plant operator). If biomethane is marketed as a fuel, additional revenues can be generated from the inclusion of the biofuel quota in addition to the prices for natural gas (filling station). While biomethane based on renewable raw materials was mainly used for sales in the CHP sector, biomethane as a fuel is mainly produced from waste and residual materials. The EEG 2017 offers hardly any prospects for the use of biomethane from cultivated biomass; sales opportunities are currently only seen for biomethane from residues and waste materials.
For an increased incentive, either cost reductions in the processing and feeding of biomethane or financial incentives for the implementation of micro-processing plants should be implemented. Cost reductions with regard to the upgrading of biogas to biomethane will only be feasible to a limited extent in the future, while cost savings will be achieved by feeding biogas into the natural gas grid due to the lack of cost efficiency incentives.
In the research report the factors and conditions under which an economic operation of micro-biogas treatment plants can be promising were pointed out:

- in the case of low specific investments for small treatment and feed-in plants,
- in the case of selecting the appropriate biogas treatment plant technology for the pressure stage of the gas network at the site,
- in the case of adapting/improving the regulatory framework,
- in the case of transferring responsibilities – in particular for the compression of biomethane to feed-in pressure – to the connectee.

Download of the research report (german language):
http://download.fnr-server.de/download.php?file=979190219_eMikroBGAA_Schlussbericht.pdf

Project summary

Duration:	01.11.2015–31.01.2018
Project partners:	Deutsches Biomasseforschungszentrum (DBFZ), Fraunhofer-Institut für Energiewirtschaft und Energiesystemtechnik (IEE), DBI Gas- und Umwelttechnik GmbH, Deutsche Energieagentur (dena) as a subcontract
Scientific contact:	Jaqueline Daniel-Gromke
Project number:	22401615 (DBFZ)
Funding body:	Federal Ministry of Food and Agriculture/Agency for Renewable Resources e. V. (FNR)

With support from
Federal Ministry of Food and Agriculture
by decision of the German Bundestag
FNR Fachagentur Nachwachsende Rohstoffe e.V.

THE 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 that provide energy sources and materials for material use. In the research focus area “Anaerobic Processes”, flexible and efficient processes are developed primarily for biogas production in order to meet the requirements of the future energy system. A higher added value is achieved by linking them to processes for material recycling. The research area focuses on the development of tools for process monitoring and control, concepts for flexible, low-emission plants and operating regimes, methods for evaluating and optimising efficiency, and methods for maximising material turnover, especially for difficult substrates.

Important reference projects and publications

Project: SubEval – Verbundvorhaben: Bewertung von Substraten hinsichtlich des Gasertrags – vom Labor zur großtechnischen Anlage; Teilvorhaben 1: Durchführung der Labor- und Praxisversuche, Federal Ministry of Food and Agriculture/Agency for Renewable Resources e.V., 01.10.2015–30.09.2018 (FKZ: 22034614)

Project: OptiFlex – Optimierung des Betriebs und Design von Biogasanlagen für eine bedarfsgerechte, flexibilisierte und effiziente Biogasproduktion unter Berücksichtigung der Prozessstabilität als Post-EEG Strategie, Federal Ministry of Food and Agriculture/Agency for Renewable Resources e.V., 01.10.2017–30.09.2020 (FKZ: 22401717)

Project: CIP – Entwicklung einer kostengünstigen Wertschöpfungskette für biobasierte Olefine und Komplexnährmedien auf Basis von Insektenbiomasse für die industrielle Anwendung, Federal Ministry for Economic Affairs and Energy/Project Management Jülich, 01.10.2017–31.12.2019 (FKZ: 031B0338A)

Project: SchlauFe2 – IBÖM04 Entwicklung eines geotextilen, mehrjährig verwendbaren Schlauchfermentationsverfahrens für TS-arme Biomassen, Federal Ministry of Education and Research/Project Management Jülich, 01.05.2018–30.04.2020 (FKZ: 031B0578A)

Publication: Kretzschmar, J.; Böhme, P.; Liebetrau, J.; Mertig, M.; Harnisch, F. (2018). “Microbial Electrochemical Sensors for Anaerobic Digestion Process Control: Performance of Electroactive Biofilms under Real Conditions”. Chemical Engineering & Technology (ISSN: 0930-7516), Vol. 41, H. 4. p. 687–695. DOI: 10.1002/ceat.201700539.

Publication: Janke, L.; Weinrich, S.; Leite, A. F.; Sträuber, H.; Radetski, C. M.; Nikolausz, M.; Nelles, M.; Stinner, W. (2018). “Year-round biogas production in sugarcane biorefineries: Process stability, optimization and performance of a two-stage reactor system”. Energy Conversion and Management (ISSN: 0196-8904), Vol. 168, H. 168. p. 188–199. DOI: 10.1016/j.enconman.2018.04.101.

Publication: Zehnsdorf, A.; Moeller, L.; Stabenau, N.; Bauer, A.; Wedwitschka, H.; Gallegos, D.; Stinner, W.; Herbes, C. (2018). “Biomass potential analysis of aquatic biomass and challenges for its use as a non-conventional substrate in anaerobic digestion plants”. Engineering in Life Sciences (ISSN: 1618-2863), Vol. 18, H. 7. p. 492–497. DOI: 10.1002/elsc.201800032.

Publication: Bonk, F.; Popp, D.; Weinrich, S.; Sträuber, H.; Kleinsteuber, S.; Harms, H.; Centler, F. (2018). “Ammonia Inhibition of Anaerobic Volatile Fatty Acid Degrading Microbial Communities”. Frontiers in Microbiology (ISSN: 1664302X), H. 9. DOI: 10.3389/fmicb.2018.02921.

Publication: Murphy, J. (Ed.) (2018). Weinrich, S.; Schäfer, F.; Bochmann, G.; Liebetrau, J. Value of batch tests for biogas potential analysis: Method comparison and challenges of substrate and efficiency evaluation of biogas plants: IEA Bioenergy. 44 S. ISBN: 78-1-910154-48-9.

Head of the research focus area

Dr.-Ing. Jan Liebetrau
Phone: +49 (0)341 2434-716
E-Mail: jan.liebetrau@dbfz.de

4.3
PROCESSES FOR CHEMICAL BIOENERGY SOURCES AND FUELS

"For the development of new, bio-based products, the conversion steps and separation processes must be jointly developed. The KomBiChem[PRO] project successfully demonstrated and evaluated complete processes for different wood-based products."

Arne Gröngröft, Project Manager

DEMONSTRATION PROJECT KOMBICHEM[PRO] – FINE AND PLATFORM CHEMICALS MADE OF WOOD THROUGH COMBINED CHEMICAL-BIOLOGICAL PROCESSES – SUB-PROJECT B

The material use of organic residues and waste materials, in particular lignocellulose-containing materials, has been promoted in recent years by various research initiatives of the German Federal Government in the direction of a bio-based economy. A major focus is on the development of efficient and integrated process chains, so-called biorefineries. They offer an integrated recycling approach for various processes in order to make all components of lignocellulose usable and to compete with the petrochemical industry. The demonstration project KomBiChem[PRO] was dedicated to the material use of residual wood and combined new approaches from research in integrated biorefinery concepts.
While previous questions were mostly aimed at the conversion of C6 sugars into derived products or lignin into bio-based aromatics, the hemicellulose fraction has now also been considered. Besides cellulose and lignin, hemicellulose is one

KomBiChem Pro

of the most frequently occurring biopolymers of lignocellulosic biomass, which is predominantly composed of linked C5 sugar units (pentoses) and partly of C6 sugars (hexoses). For hemicellulose, which occurs in lignocellulose with 20–40 %, no process paths have yet been developed which would allow a high-quality material use and commercial exploitation of this component. This is reason enough to deal with environmentally friendly conversion processes and purification methods that can be used to produce organic acids and furans from hemicellulose derived C5 sugars. When cellulose from the organosolv process is recycled, the focus of research is now shifting from the previous focus on extracting glucose as a raw material for fermentation to the extraction of fibres and cellulose. In addition, the hydrothermal treatment of the lignin fraction from the digestion for the production of phenols is being investigated. The starting point for the material use of lignocellulose residues and waste materials is the fractionation of the starting materials into their three main components cellulose, hemicellulose and lignin using a digestion process. One process that has already been implemented and investigated on a pilot scale at the Fraunhofer Center for Chemical Biotechnological Processes (CBP) is the organosolv process. The lignocellulose is broken down and fractionated using an ethanol/water mixture. While the processing of cellulose into sugars and fibres is already well developed, there is still a considerable need for research into the hemicellulose and lignin fractions. The following tasks were carried out at the DBFZ as part of the KomBiChem[PRO] project:

- Hydrothermal conversion of hemicellulose to C5 sugars and furfural
- Preparation of recyclables from organosolv hydrolysates
- Balancing and holistic evaluation of the developed process chains

For the first two points, comprehensive tests were carried out with a continuously operated high-pressure flow tube reactor for hydrothermal conversion as well as

experiments on the adsorption of impurities and filtration of recyclables. The experimental results then flowed into a final balancing and evaluation.

Xylose and furfural from hemicellulose

In KomBiChem^{PRO}, a hydrothermal process was developed at the DBFZ to convert hemicellulose solution from the organosolv process into high-quality products such as xylose and furfural [1]. Hydrothermal processes are ideally suited for the conversion of such aqueous fractions, as water is required as a reaction medium for such processes. The hydrothermal processes developed at the DBFZ are able to convert the contained hemicellulose into xylose monomers and then further convert them into furfural, depending on the process control. While xylose, for example, can act as a starting material for innovative biotechnological processes such as the production of xylon and malic acid, furfural is regarded as a basic chemical on the basis of which a large number of high-quality bio-based products such as synthetic resins, fuels or synthetic fibres such as elastane (polytetrahydrofuran) can be produced.
At the DBFZ, optimal reaction conditions with regard to high product yields, high selectivities, low waste accumulation and low auxiliary material consumption were identified in a high-pressure flow tube reactor. With regard to the hemicellulose contained in the solution, xylose yields of over 95 % and furfural yields of approx. 60 % and 85 % respectively could be achieved with the aid of ethanol as an additional solvent. The results obtained under laboratory conditions could be transferred to pilot scale within the framework of the project at Fraunhofer CBP.

Preparation of recyclable materials from organosolv hydrolysates

The recyclables from the hemicellulose solution of the organosolv digestion and from its hydrothermally converted product solutions were also purified and concentrated within the scope of the project. For the separation of products such as oligo- and mono sugars, furans, organic acids and phenol derivatives the separation processes liquid phase adsorption, membrane filtration and preparative

chromatography were investigated. Membrane filtration can be used to separate different groups of substances such as sugars, organic acids, furans and phenols due to their different particle sizes. Compared to classical thermal separation processes, this offers a high potential for energy savings. However, high throughputs must be achieved and fouling on the membrane must be prevented. For the investigations, a test rig for membrane screening was used at the DBFZ, which allows different membrane filtration from microfiltration to reverse osmosis. For this purpose, a purification cascade for xylose was developed. In the first step, the lignin and furans could be removed from the hemicellulose solution by adsorption. The sugars were then concentrated in the solution by membrane filtration. By selecting a suitable polymeric resin, over 93 % of the lignin and 99 % of the furans could be removed from the hemicellulose solution [2]. It was also shown that the

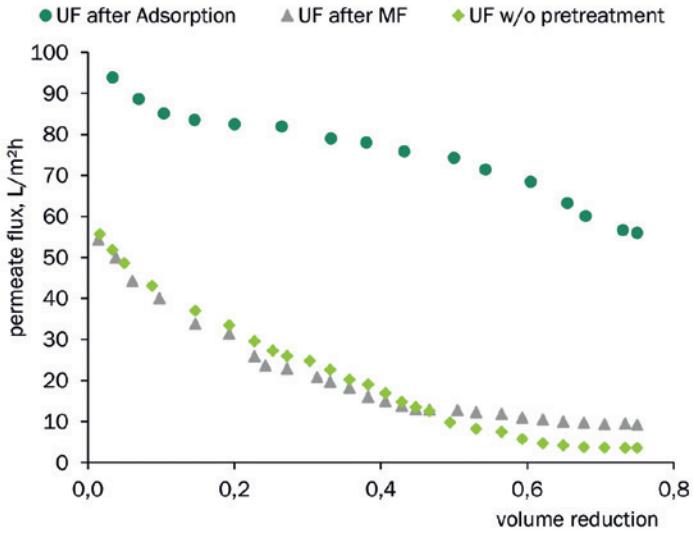


Fig. 11 **The adsorption of lignin components and furans prior to ultrafiltration led to a considerable increase in permeate flux. Alternatively, microfiltration could not confirm this effect.**

adsorption step can significantly reduce membrane fouling (see Figure 11) [3]. In the subsequent nanofiltration, an average of 96 % of the xylose could be retained with simultaneous high permeate fluxes of up to 120 l/(m²h). Thus, the xylose solution could be concentrated up to 120 g/l. At the Fraunhofer CBP, the first fermentation tests for the production of malic and xylonic acid could be carried out with the purified xylose.

Process simulation, cost accounting and sustainability of plant concepts

Within the scope of the project, complete plant concepts were developed from the experimentally investigated process steps. These include all processing steps necessary to manufacture the desired products. Decisions made during the design phase have a considerable influence on the costs and sustainability of the subsequent operation of a plant. In order to support the targeted development of the individual process steps, economic and ecological analyses were carried out parallel to the project work. The DBFZ established the balancing and dimensioning of material and energy flows by means of process simulation as an important tool for the investigation of suitable process chains. Technical analyses can be carried out and upscaling effects determined at a very early stage of process development. The results of the balancing served as a basis for cost accounting and sustainability assessments. Thus, the following technical-economic-ecological parameters could be calculated for all important products in the project:

- Mass and energy flows
- Assessment of total investments (equipment costs, indirect costs, etc.)
- Raw material, auxiliary and energy costs
- Specific production costs incl. allocation of cost categories and sensitivity analysis with regard to important partial costs
- Specific GHG emissions from production
- Most important drivers of GHG emissions
- Comparison of emissions with reference products

PERSPECTIVES

Within the framework of the project, technologies for the complete recycling of wood components were developed. It is unlikely, however, that these technologies will be used in the combination as they were developed in the project. Rather, towards the end of the project it was examined which process steps could be further developed and then, if necessary, applied in other contexts. It played an important role that raw materials and/or products of the respective process steps could also be tradable and available as platform intermediates. Therefore, the following so-called recycling chains were identified in the project, which will be further developed by the project partners:

- Organosolv digestion of wood for the production of lignin and pulp, with the by-product hemicellulose solution
- Production of chemical pulp from organosolv pulp. Alternatively, an enzymatic hydrolysis of the fibre could be carried out in order to obtain glucose.
- Extraction of bioaromatics from lignin. The results could also be transferred to lignin from other sources.
- Preparation of the hemicellulose solution into xylose or furfural. The results could also be transferred to hemicellulose solutions from the steam pretreatment of straw or bagasse for ethanol production.
- Malic acid production from xylose and xylonic acid production from xylose. The origin of xylose plays no role in the fermentation process as long as the quality requirements and purities are met.

The research activities will be continued in these exploitation chains with the aim of involving interested industrial partners more strongly in the future.

Sources:

[1] Köchermann, J.; Mühlenberg, J.; Klemm, M. (2018). "Kinetics of Hydrothermal Furfural Production from Organosolv Hemicellulose and d -Xylose". Industrial & Engineering Chemistry Research (ISSN: 0888-5885), Vol. 57, H. 43. p. 14417–14427. DOI: 10.1021/acs. iecr.8b03402.

[2] Nitzsche, R.; Gröngröft, A.; Kraume, M. (2019). "Separation of lignin from beech wood hydrolysate using polymeric resins and zeolites: Determination and application of adsorption isotherms". Separation and Purification Technology (ISSN: 1383-5866), Vol. 209. p. 491–502. DOI: 10.1016/j.seppur.2018.07.077.

[3] Nitzsche, R.; Gröngröft, A.; Kraume, M. (2018). Leistungsbewertung enger Ultrafiltrationsmembranen zur Isolierung von Hemicellulose und Lignin aus Buchenholzhydrolysaten mittels Response Surface Methodology. In: *Jahrestreffen der ProcessNet-Fachgruppen Fluidverfahrentechnik, Membrantechnik und Mischvorgänge:* 27–28 February 2018. p. 60–61.

Further information:
https://kombichempro.de/

Project summary

Duration:	15.11.2015–31.12.2018
Project partner:	Fraunhofer Center for Chemical-Biotechnological Processes CBP
Scientific contact:	Arne Gröngröft
Project number:	031B0083B
Funding body:	Federal Ministry of Education and Research (BMBF)/ Project Management Jülich (PTJ)

Federal Ministry of Education and Research

Projektträger Jülich Forschungszentrum Jülich

THE RESEARCH FOCUS AREA "PROCESSES FOR CHEMICAL BIOENERGY SOURCES AND FUELS"

The research focus area is an integral part of the overall process chains, from the raw biomass material to biofuels and chemical bioenergy sources as products of biorefineries. In addition to process and concept development, it also implements processes on a laboratory and pilot plant scale and assesses technical systems. The overriding goal is to contribute to flexible, highly efficient and sustainable biorefinery concepts through innovative technology approaches and thus also to meet requirements in the context of the bioeconomy. Chemical refinement processes that focus on hydrothermal processes (HTP) are being further developed for this purpose. The development of fractionation processes for solid-liquid and liquid-liquid separation plays a key role linking the individual research focus areas (especially in connection with anaerobic processes and HTP intermediates). Another element of research is the development of synthesis gas processes to create high-grade products with a focus on biomethane in the form of bio-synthetic natural gas (Bio-SNG). In the short term, a sample HTP-based biorefinery concept is being developed. To this end, work within the research focus area will concentrate on (i) the analysis of relevant individual processes and required system components, (ii) preliminary tests for selected individual processes (e. g. HTP, gasification, methanation to SNG) and (iii) the preparation of an accompanying technology assessment (focus: material and energy balancing, costs and cost-effectiveness, environmental effects).

Important reference projects and publications

Project: CapAcidy – Bio-based Carboxylid acid for chemical industry made of anaerobic fermentation, Federal Ministry of Education and Research/Project Management Jülich, 01.07.2017–30.09.2019 (FKZ: 031B0389A)

Project: DEMO-SPK – Research and Demonstration Project on the Use of Renewable Kerosene at Airport Leipzig/Halle, Federal Ministry of Transport and Digital Infrastructure (Inhouse), 04.11.2016–30.04.2019

Project: HTC-liq – Entwicklung eines hocheffizienten Kaskadenprozesses zur Aufbereitung von Prozesswässern aus hydrothermalen Prozessen, insbes. der hydrothermalen Carbonisierung mit Gewinnung von org. Säuren, anschließender energetischer Nutzung und Prozesswasserreinigung, Sächsische Aufbaubank, 01.04.2017–31.03.2020 (FKZ: 100283030)

Project: Fermenthen – Production of light alkenes from biogas and excess electricity, Sächsische

Aufbaubank, 01.10.2016–30.09.2019 (FKZ: 100244827)

Project: BBCHEM – Aufwertung von kohlehydrathaltigen Stoffströmen zu bio-basierten Chemikalien. Teilvorhaben 2: Hydrothermale Umsetzung, Federal Ministry of Education and Research/Project Management Jülich, 01.03.2016–28.02.2018 (FKZ: 033RK031B)

Publication: Köchermann, J.; Görsch, K.; Wirth, B.; Mühlenberg, J.; Klemm, M. (2018). "Hydrothermal carbonization: Temperature influence on hydrochar and aqueous phase composition during process water recirculation". Journal of Environmental Chemical Engineering (ISSN: 2213-3437), Vol. 6, H. 4. p. 5481–5487. DOI: 10.1016/j.jece.2018.07.053.

Publication: Kröger, M.; Klemm, M.; Nelles, M. (2018). "Hydrothermal Disintegration and Extraction of Different Microalgae Species". Energies (ISSN: 1996-1073), Vol. 11, H. 2. DOI: 10.3390/en11020450.

Publication: Matthischke, S.; Roensch, S.; Güttel, R. (2018). "Start-up Time and Load Range for the Methanation of Carbon Dioxide in a Fixed Bed Recycle Reactor". Industrial & Engineering Chemistry Research (ISSN: 0888-5885), Vol. 57, H. 18. p. 6391-6400. DOI: 10.1021/acs.iecr.8b00755.

Publication: Schneider, J.; Struve, M.; Trommler, U.; Schlüter, M.; Seidel, L.; Dietrich, S.; Rönsch, S. (2018). "Performance of supported and unsupported Fe and Co catalysts for the direct synthesis of light alkenes from synthesis gas". Fuel Processing Technology (ISSN: 0378-3820), H. 170. p. 64–78. DOI: 10.1016/y.fuproc.2017.10.018.

Publication: Zech, K.; Dietrich, S.; Reichmuth, M.; Weindorf, W.; Müller-Langer, F. (2018). "Techno-economic assessment of a renewable bio-jet-fuel production using power-to-gas". Applied Energy (ISSN: 0306-2619), H. 231. p. 997–1006. DOI: 10.1016/j.apenergy.2018.09.169.

Head of the research focus area

Dr.-Ing. Franziska Müller-Langer
Phone: +49 (0)341 2434-423
E-Mail: franziska.mueller-langer@dbfz.de

4.4 SMARTBIOMASSHEAT

"In the 'DRALOD' project, an industrial-scale plant is to be built that uses an intelligent combination of renewable energies (solar and bioenergy) to dry waste from a large number of food processing industries in a sustainable, climate-friendly and economical way. Through the development of an intelligent system controller, the complex system is to be optimally operated in compliance with ecological, operational and economic requirements."

Daniel Büchner, Project Manager

RENEWABLES-BASED DRYING TECHNOLOGY FOR COST-EFFECTIVE VALORISATION OF WASTE FROM THE FOOD PROCESSING INDUSTRY – DRALOD

One-third of the food produced in Europe is not consumed and waste occurs at all stages of the supply chain, with 39 % generated in manufacturing processes. The EU27 annually generates 90 million tonnes of food waste, implying a major environmental problem, not only in terms of resource efficiency, also because each tonne of food waste corresponds to two tonnes of CO_2 emission, in average. [1] Consequently, lowering the environmental impact of food production is an integral part of the EU Action Plan for the Circular Economy.

DRALOD

[2] Experts have highlighted the need for generation of food waste valorisation and re-use strategies to produce higher value and commercial products rather than conventional food waste processing (incineration and composting), thus alternative processes leading to a higher adoption of circular economy strategies by the food processing sector. Therefore, this project identifies an excellent opportunity in promoting the valorisation for reuse of certain wastes from the food and drink processing industry, characterised by:

- The use of raw materials with a high content of water (> 80 %), which has traditionally been a drawback for reuse, since this type of waste (i) has a very rapid fermentation and degradation and (ii) is enormously inefficient for transport and storage.
- Raw materials containing highly valuable nutritional ingredients are maintained in their natural strucutre by using low temperature drying.

Waste from a large variety of food processing industries meet these criteria, including the brewery (high protein content in Brewers' spent grain [3]), the fruit juice (phenolic and antioxidant compounds in skin and seeds [4,5]) or the olive oil (phenolic and antioxidant compounds in olive pulp and pits [6]), among other sectors. However, the enormous potential of this market remains untapped due to the following main limitations:

- Lack of cost-effective technology: In particular, the high operational costs when using materials with a high content of water and a low market price are presenting an obstacle to an economic plant operation.
- Lack of environmentally sustainable solutions: Drying processes are highly energy consuming. If based on fossil fuels, they negatively affect the climate and the environment.

- Lack of scalability: The application of renewable energies for the drying process has been demonstrated with solar and hybrid plants with respect to sewage (municipal waste) since the enormous market size has made technology progress feasible. Such scalability has not yet been achieved in the segment of food waste valorisation.

Thus, the overall objective of this project is to build a drying plant (herein labelled DRALOD plant) using a smart combination of solar and biomass renewable energies to dry waste materials from a variety of food processing industries in a sustainable, ecological and economical way. The dried products can be commercialised for the extraction of functional components by the pharmaceutical industries, as well as for animal feeding.

METHODS/MEASURES

To meet the project objectives, the project is structured within several subtasks:

- To design, implement and validate an energy recovery system, optimised to DRALOD plant's requirements.
- To implement a biomass heating system with high flexibility concerning both fuel quality and mode of operation to enable low operational costs as an auxiliary heat source.
- To design, implement and validate a proprietary smart controller unit, enabling an optimal and continuous drying operation with the solar biomass system as heat supplier.
- To commission a DRALOD pilot plant with a drying capacity of 35,000 tons a year and to run the demonstrator for a period of at least six months.

For this, DBFZ analyses of the thermodynamical interaction of the subsystems (solar, biomass and energy recovery units), as a function of temperature and pressure levels, solar radiation including daily, weekly and seasonal fluctuations, and drying capacity will be performed. A flow sheet calculation will be performed using the software Aspen. In addition to considering stationary operating conditions,

Fig. 12 Scheme of the planned Dralod drying plant

specific dynamic process conditions will also be simulated. This includes in particular the fluctuation in solar radiation and other changes of conditions during plant operation such as drying capacity. Therefore, possible challenges in the design, troubleshooting and optimisation of the plant as well as the conduction of case studies to assess the impacts of process modifications can be evaluated, to provide the basis for the design of the DRALOD plant.

Based on this, a suitable control strategy enabling the optimal and continuous plant operation with various and fluctuating renewable energy sources. The resulting control algorithm can then be implemented in the drying plant. Therefore, Matlab/Simulink will be used in combination with Aspen for modelling, simulating and analysing the multi-domain dynamic system. The optimisation is aimed to minimise the additional use of biomass and to ensure a sufficient heat generation, making use of weather forecast for the determination of the appropriate operating periods for the biomass boiler. The hardware implementation of the smart

system control unit will be conductet in close cooperation with the project partner Pernia. Afterwards, the models will be validated based on operational data of the installed and operated plant, enabling a validated simulation tool for optimisation of the smart control system.

MILESTONES/CHALLENGES

DRALOD plant offers a sustainable, effective and low-cost way for the valorisation and the reuse of the wastes from food processing industry by using the smart combination of solar and biomass energies. However, the development of such a system, which includes different subsystems and many parameters, brings some challenges along. One of the important aspects of the DRALOD drying plant will be its ability to achieve drying waste materials with high moisture content of up to 80 % using a dryer operated at low temperatures. Thus, the overall process is slower when undertaken at low temperatures. In addition, maximum air outlet temperature and the water evaporation rate are some of the process limitations. Therefore, achieving the desired moisture content of the product considering the low temperature process limitations stands as one of the challenges.
On the other hand, DRALOD drying plant aims to use the solar energy as the primary source (> 50 %) in the drying process with a back-up including a biomass heating system (with a nominal heat capacity of approx. 1 MW). Therefore, the design, implementation and validation of the smart controller unit for the combined solar-biomass drying process constitutes as one of the other difficulty. The aim of designing the smart controller unit is the optimisation of solar-biomass combination in the energy mix while preserving the critical parameters such as uniformity, elimination of the pathogens, preservation of the nutrients etc. for quality of the dried product. Therefore, such a smart controller unit needs to optimize the complex multi-criteria model to take into account environmental, operational and financial aspects that can be summarised as follows:

- Up-front investment (solar air heater, biomass heating system, energy recovery system, dryer, auxiliary systems)
- Operational costs (electricity consumption, biomass fuel, labor work, maintenance)

- Drying capacity (average air temperature, temperature fluctuations, average drying air flow rate, average drying time)
- Emissions and ashes produced from biomass heating system, electricity consumption by air ducting system.

In addition, as the back-up system of the DRALOD plant, especially for the cases in which the energy from the solar walls are not fulfilling 100 % of the heat requirements, the biomass heating system becomes the other important component of the process. Considering the main target of the DRALOD drying plant is to bring sustainable and cost-effective technologies together, the selection of the biomass feedstock for the heating system becomes an important aspect. A biomass heating system, which enables high flexibility in the selected fuel types, fuel quality, and mode of operation (full and part load, dynamic operation behaviour) is planned to be adapted with low operational costs.

PERSPECTIVES

DRALOD pilot plant, as a technology demonstrator and showroom, will also be used after launch for a sustained improvement of the process and expansion to new food processing segments, e. g. to test new plant configurations and new equipment integration, as well as to assess different drying parameters for several types of waste. The pilot plant offers flexibility to be reconfigured, versatility to use the dryer for different types of products and full availability to be shown to potential customers, investors and funding bodies. As a European flagship technology, the plant is open to visitors.
By enabling a game-changer solution that brings cost-effectiveness to the revalorisation of food-processing waste, using environmental friendly technology, this project will create a new market. The increasing exploitation of food wastes/by-products for the recovery of added-value compounds is the new market and drives the demand for DRALOD plants by reinforcing the basis of DRALOD's business case: (i) it continuously widens the market for DRALOD plants; (ii) it supports, or even increases, the price of DRALOD outputs; (iii) ultimately, it increases DRALOD's profitability for our target customers.

Further information:
www.dralod.com

Sources:

[1] Mirabella, N., Castellani, V., & Sala, S. (2014). Current options for the valorization of food manufacturing waste: a review. Journal of Cleaner Production, 65, 28-41.
[2] http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52015DC0614&from=EN
[3] Lynch, K. M., Steffen, E. J., & Arendt, E. K. (2016). Brewers' spent grain: a review with an emphasis on food and health. Journal of the Institute of Brewing.
[4] Henríquez, C., Speisky, H., Chiffelle, I., Valenzuela, T., Araya, M., Simpson, R., Almonacid, S., 2010. Development of an ingredient containing apple peel, as a source of polyphenols and dietary fiber. J Food Sci 75, H172–81
[5] Viuda-Martos, M., Fernandez-Lopez, J., Sayas-Barbera, E., Sendra, Esther, Perez-Alvarez, J. a., 2011. Physicochemical Characterization of the Orange Juice Waste Water of a Citrus By-Product. JFood Process Pres 35, 264–271.
[6] Uribe, E., Lemus, R., Vega, A., López, L. a., Pereira, K., López, J., Ah-Hen, K., Scala, K., 2012. Quality Characterization of Waste Olive Cake During Hot Air Drying: Nutritional Aspects and Antioxidant Activity. Food Bioprocess Tech 6, 1207–1217.

Project summary

Duration:	01.08.2018–31.07.2020
Project partners:	Deutsches Biomasseforschungszentrum (DBFZ), Ökotherm (D), L.Pernia (ES), RISE (SWE) und Matical (ES)
Scientific contact:	Thomas Zeng, Daniel Büchner
Project number:	GA 820554
Funding body:	Horizon 2020/Fast Track to Innovation (H2020-EIC-FTI-2018-2020)

THE RESEARCH FOCUS AREA "SMARTBIOMASSHEAT"

The focus is on small-scale, renewable heat supply to individual buildings and small groups of buildings up to village communities using other renewable energy sources and cross-linking intelligent heating technologies based on biomass originating primarily from residual materials, by-products and waste. The aim is to make optimal use of all renewable heat sources, both technologically and economically, through the flexible and demand-based use of biomass-based heating technologies. For this purpose, the entire chain must be mapped, examined, simulated and optimised individually and collectively, from the refining of biomass fuels, to new conversion plants and integration into the heat and electricity network of the biomass heating systems that will also be designed as heat, power and cooling plants in the future. It will require the development of technical components and related control research and development in order to achieve efficient, environmentally friendly, economical, safe, demand-based, flexible and sustainable (smart) operation via flexible operation (including micro- and small-scale CHP).

Further information:
www.smartbiomassheat.com

Important reference projects and publications

Project: REFAWOOD – ERA-NET Bioenergy: Ressourceneffiziente Brennstoffadditive zur Verringerung der verbrennungstechnischen Probleme bei der Rest- und Gebrauchtholzverbrennung, ERANET/Agency for Renewable Resources e. V., 01.04.2016–31.03.2019 (FKZ: 22404215)
Project: STEP – Verwertung strohbasierter Energiepellets und Geflügelmist in Biogasanlagen mit wärmeautarker Gärrestveredlung; Teilvorhaben: Verbesserung der Verbrennungseigenschaften projektspezifischer Gärreste, Federal Ministry for Economic Affairs and Energy/Project Management Jülich, 01.08.2016–31.01.2019 (FKZ: 03KB116B)
Project: Dampf-KWK – Entwicklung eines Klein-KWK-Dampfmotors zur Nachrüstung von Feuerungsanlagen im mittleren Leistungsbereich, Federal Ministry for Economic Affairs and Energy/Project Management Jülich, 01.07.2016–30.06.2019 (FKZ: 03KB118A)
Project: UFOKFA – Evaluierung der 1. BImSchV von 2010 – Evaluierung der 1. Novelle der 1. BImSchV von 2010, Marktprojekt, 01.12.2017–31.10.2018
Publication: Açikkalp, E.; Zeng, T.; Ortwein, A.; Burkhardt, H.; Klenk, W. (2018). "Exergy, Exergoeconomic and Enviroeconomic Evaluation of a Biomass Boiler-Steam Engine Micro-CHP System". Chemical Engineering & Technology (ISSN: 0930-7516), Band 41, H. 11. p. 2141–2149. DOI: 10.1002/ceat.201800041.
Publication: Pollex, A.; Zeng, T.; Khalsa, J. H. A.;

Erler, U.; Schmersahl, R.; Schön, C.; Kuptz, D.; Lenz, V.; Nelles, M. (2018). "Content of potassium and other aerosol forming elements in commercially available wood pellet batches". Fuel (ISSN: 0016-2361), H. 232. p. 384–394. DOI: 10.1016/j.fuel.2018.06.001.

Publication: Zeng, T.; Pollex, A.; Weller, N.; Lenz, V.; Nelles, M. (2018). "Blended biomass pellets as fuel for small scale combustion appliances: Effect of blending on slag formation in the bottom ash and pre-evaluation options". Fuel (ISSN: 0016-2361), H. 212. p. 108–116. DOI: 10.1016/j.fuel.2017.10.036.

Publication: Sedlmayer, I.; Arshadi, M.; Haslinger, W.; Hofbauer, H.; Larsson, I.; Lönnermark, A.; Nilsson, C.; Pollex, A.; Schmidl, C.; Stelte, W.; Wopienka, E.; Bauer-Emhofer, W. (2018). "Determination of off-gassing and self-heating potential of wood pellets: Method comparison and correlation analysis". Fuel (ISSN: 0016-2361), Vol. 234. p. 894–903. DOI: 10.1016/j.fuel.2018.07.117.

Publication: Kohler, H.; Ojha, B.; Illyaskutty, N.; Hartmann, I.; Thiel, C.; Eisinger, K.; Dambacher, M. (2018). "In situ high-temperature gas sensors: Continuous monitoring of the combustion quality of different wood combustion systems and optimization of combustion process". Journal of Sensors and Sensor Systems (ISSN: 2194-8771), Band 7, H. 1. p. 161–167. DOI: 10.5194/jsss-7-161-2018.

Publication: Purkus, A.; Gawel, E.; Szarka, N.; Lauer, M.; Lenz, V.; Ortwein, A.; Tafarte, P.; Eichhorn, M.; Thrän, D. (2018). "Contributions of flexible power generation from biomass to a secure and cost-effective electricity supply: a review of potentials, incentives and obstacles in Germany". *Energy, Sustainability and Society* (ISSN: 2192-0567), Band 8, H. 1. p. 18. DOI: 10.1186/s13705-018-0157-0.

Head of the research focus area

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

4.5
CATALYTIC EMISSION CONTROL

"The ‚GASASH' project aims to develop a fuel-flexible overall process for the recycling of ash-rich agricultural residues. For an overall process development from gasifier and CHP, both product gas quality and CHP emissions must be optimised and recycling possibilities for the ashes must be investigated."

Thomas Schliermann, Project Manager

GASASH – THERMO-CHEMICAL CONVERSION OF RESIDUES IN A GASIFIER CHP PLANT WITH COUPLED ASH UTILISATION – SUB-PROJECT DBFZ: INVESTIGATIONS ON PRODUCTGAS QUALITY, CHP EMISSIONS, EMISSION REDUCTION MEASURES AND ASH UTILISATION

Innovative and sustainable process concepts for the management and use of large quantities of waste and residual materials represent a major global challenge and a high usable potential. There is a particular need for innovative recycling strategies in the area of ash-rich residual materials with a complex spectrum of contents.

For this reason, the project aims to use large quantities of fermentation residues and rice husks for combined energetic-material use. The aim of the project is to develop a new variant based on the gasifier CHP developed to market maturity by the project partner LiPRO for wood chips with regard to a temperature flexible operation and a wide range of usable biomasses and to be able to operate the

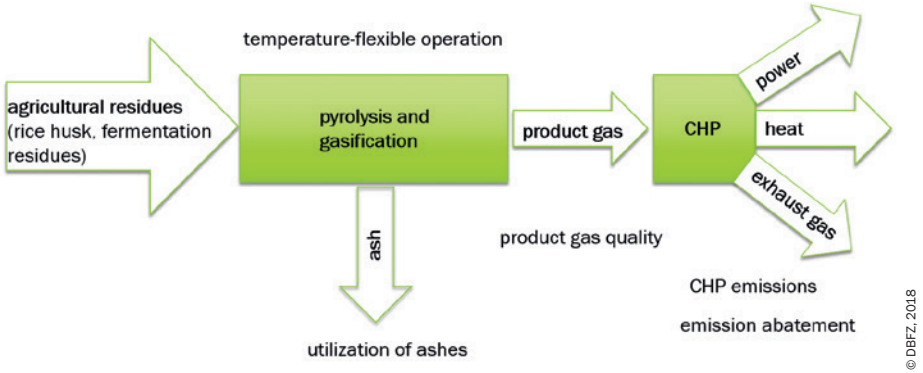


Fig. 13 Overall process scheme for the energetic and material use of ash-rich agricultural residues

gasification flexibly, especially with regard to temperature. The aim is to achieve an amorphous formation of more than 95 % SiO_2 husk ash with regard to the residual material rice husks and to prevent undesired crystallisation. Such amorphous husk ashes (so-called biogenic silica) represent a valuable material which is used in a variety of chemical products in different industries. The further development of the LiPRO plant includes ash recycling possibilities. A carbon- and slag-free full ashing should be achieved and the ashes obtained should be investigated by a comprehensive analysis of the recyclable materials. In the process, the highest possible ash utilisation in the chemical industry, e. g. as adsorbent, catalyst or catalyst carrier, will be tested.

Gasification at temperatures < 800 °C and the use of alternative and ash-rich biomasses have an influence on the thermo-chemical conversion processes, the composition and quality of the product gas as well as on CHP emissions. The process management should be further developed in such a way that tars in the product gas are prevented and a deteriorating emission spectrum and/or level of the CHP exhaust gas (e. g. benzene is to be mentioned here) can be counteracted by operational changes and oxidation catalysts. Figure 13 shows the overall process diagram.

In detail, the project partners pursue the following subgoals:

University of Applied Sciences of South Westphalia

- Evaluation of the LiPRO gasification plant with regard to the process parameters that are essential for a tar-free gas in temperature flexible operation. Parameter variation to determine the effects of the use of alternative biomass (rice husks, fermentation residues) on pyrolysis, tar degradation and turnover. Exemplary description of process and heat transport.
- Adaptation of the plant and the process control for tar degradation in gasification in temperature flexible operation with fermentation residues or rice husks. Evaluation of the admixture of wood chips with regard to the necessity of partial oxidation and catalytic tar decomposition.
- Evaluation of the operation of the demonstration plant in temperature flexible operation with alternative biomass and biomass/wood mixtures.

DBFZ gGmbH

- Evaluation of material recycling possibilities by comprehensive structural and physico-chemical characterisation of the ashes produced: e. g. crystallinity/amorphicity, specific surfaces and pore volumes, surface chemistry, ingredients, loss on ignition, proportion of elemental and organically bound carbon.
- Determination of the catalytic properties of the ashes with regard to their application as adsorbent, catalyst or catalyst carrier.
- Investigation and evaluation of ash preparation and shaping processes.
- Determination of the composition of the gasifier product gas and determination of the tar and dust load at the LiPRO gasification plant at different times of the optimisation phase or depending on the properties of the different residual materials.
- Evaluation of the emissions in the CHP flue gas at different times of the optimisation phase or depending on the waste materials used.
- Investigations on reduction measures (e. g. with regard to benzene) by using oxidation catalysts in laboratory measurements (on the model exhaust gas) or on the operational plant.

LiPRO GmbH

- Development of a gasifier CHP plant (plant size: nominal capacity of 33 kW_{el} and 70 kW_{th} gross) for alternative fuels: rice husks and fermentation residues
- Test operation in temperature flexible operation
- Developments to prepare the market launch (one to two years after project completion) of a temperature flexible gasifier CHP plant, suitable for a wide range of biomass by construction, testing and validation of a prototype.

METHODS/MEASURES

The DBFZ takes over the coordination of the project. In addition, the project focuses on ash utilisation, determination of product gas quality and CHP emissions, emission reduction measures, market research and economic feasibility studies. The University of Applied Sciences of South Westphalia focuses on the development of two-stage gasification towards a suitable operation for ash-rich fuels – both experimentally and by means of model descriptions of the processes. LiPRO GmbH is responsible for the development of the individual components as well as the complete gasifier CHP demonstration plant for high ash fuels and carries out market analyses and economic feasibility studies with regard to the planned market launch.

The development of the gasifier CHP plant for ash-rich residual materials initially requires a comprehensive analysis of the status quo of the existing plant in operation with wood chips (see Figure 14). By means of an extended comprehensive measurement data acquisition all necessary data for the preparation of the mass, material and energy balance for this reference condition are determined. By determination of the product gas composition, the tar load (local and temporal), the dust content in the product gas and the particulate and gaseous emissions in the CHP flue gas as well as the resulting rust and filter ashes, a complete description of the existing plant in reference operation results. Finally, the design of the demonstration plant can take place in the interplay of laboratory tests under changed process conditions as well as tar degradation, the model process description and the validation of selected plant modifications. Of particular importance are questions on the effectiveness of tar degradation at lower process temperatures and new structural developments to be carried out, e. g. due to the changed pieceiness of the ash-rich fuels or due to the desired temperature-flexible operation and the necessity of ash utilisation.

Fig. 14 Project employees in front of the operational plant “LiPRO HKW30” of the company LiPRO Energy GmbH

In cooperation with the Institut für Nichtklassische Chemie at the University of Leipzig, the ashes are investigated with regard to their structural, chemical, physical and catalytic properties. This is especially necessary for the SiO_2-rich rice husk ashes, as their utilisation possibilities strongly depend on structure sizes such as purity, amorphousness, specific surface and porosity. Forming processes are also being tested on these silica-rich ashes, and potentially further property modifications by chemical ash preparation processes are planned. The design of the catalyst in the CHP exhaust gas requires activity measurements with model gases approximating the CHP exhaust gas. The laboratory reactors for powder catalysts (KDA) and monolithic catalysts (VGA) available at the DBFZ are used to determine and realize the necessary oxidation rates at the highest possible

space velocities. The development of the monolithic catalyst for the operational plant takes place under consideration of the mass and heat transport under approximate practical conditions with regard to temperature and flow characteristics. There, catalytic activity and phenomena of catalyst ageing are investigated under practical conditions. After LiPRO has implemented the plant design required for temperature flexible operation with ash-rich residual materials in the demonstration plant and integrated it into the corresponding periphery, the final test is carried out using the ash-rich fuels in continuous test operation. In order to be able to respond early to changing markets and requirements as well as to regulations during the course of the project, market research is carried out in parallel and the overall process to be developed is examined from the point of view of economic efficiency.

MILESTONES/CHALLENGES

A central challenge is the transfer of pyrolysis/gasification from wood chips to fermentation residues or rice husks. Due to their different piece size and chemical composition, issues such as slagging, tar formation, crystallisation processes, changes in product gas composition or entrained particles receive a different weighting and must be taken into account, e. g. through process adaptations or new developments in equipment. A transfer to the more complex fuels (structure, constituents) must also take place here in the model description of the processes taking place (e. g. heat transfer, pyrolysis/gasification). Parameter variations in laboratory experiments should support this. Central further questions are additional effects of the necessary scale increase or of another form factor of the reactor to be considered (laboratory vs. operational plant). Through the development of the process, an ash should also be obtained which can be used as a valuable material in different industries, depending on the properties. Questions such as heavy metal contamination, high impurities, crystalline or insufficient pore volumes or specific surfaces are decisive here. A higher value ash utilisation may be possible after an adaptation of the process conditions or by a tailor-made ash treatment. It must be ensured that emission limit values are adhered to, which vary depending on the target market, but in all cases

are likely to be further tightened in the future. This requires the use of reduction measures in order to obtain an environmentally friendly process. Overall, a process must be developed that meets technical and environmental as well as economic requirements.

PERSPECTIVES

After the successful completion of the research project, a plant for the thermal utilisation of residual and waste materials for coupled electricity and heat generation is to be developed, tested and validated under consideration of economic viability considerations in order to enable the supply of neighbourhoods and commercial enterprises. On the basis of a detailed emission-related evaluation of the process, an environmentally friendly energetic utilisation of the residual materials will be possible. By using the process, low-emission generation of electricity and heat (CHP) from biogenic residues and waste materials is to be made possible while complying with existing and future limit values. The developed process should also be flexible with regard to the fuel used and – if rice husks are used as fuel – enable the generation of ash with a high silicon dioxide content, which can be used as a chemical raw material in adsorption and catalysis due to its structural properties (high mesopore volume, amorphous SiO_2).
The refinement of the model descriptions of the central processes made possible by the design and validation of the demonstration operation allows a further scaling of the plant size in perspective, so that further markets can be opened up. The knowledge gained on the basis of different residual materials as fuel during the development of the catalyst leads to a much deeper understanding of the necessary requirements for the catalyst and it's ageing behaviour in the real CHP flue gas. Finally, the use of decentralised CHP plants can also contribute to demand-oriented power generation for balancing fluctuating wind and solar energy, since the plants can be operated flexibly in the small and medium output range while at the same time being highly environmentally friendly. Thus, there is a potential for a broad application of the plant development with corresponding positive economic effects through the coupled climate-neutral energy generation and utilisation of the resulting ashes.

Project summary

Duration:	01.09.2018–30.08.2020
Project partners:	Deutsches Biomasseforschungszentrum (DBFZ) (Subcontractor: INC, Leipzig), University of Applied Sciences of South Westphalia, LiPRO Energy GmbH
Scientific contact:	Thomas Schliermann
Project number:	03KB139A
Funding body:	Federal Ministry for Economic Affairs and Energy/ Project Management Jülich (Funding program “Biomass Energy Use”)

Supported by:

Federal Ministry for Economic Affairs and Energy

on the basis of a decision by the German Bundestag

Projektträger Jülich Forschungszentrum Jülich

Biomass energy use

THE RESEARCH FOCUS AREA “CATALYTIC EMISSION CONTROL”

The objective of this research focus area is to investigate catalytic emission reduction in combustion plants for gaseous, liquid and solid bioenergy carriers on solid state catalysts. The focus is on the catalytic reduction of combustion emissions of methane (CH_4), volatile organic compounds (NMVOC), semi- and low-volatile hydrocarbons, such as polycyclic aromatics (PAK), polychlorinated dioxins and furans (PCDD/PCDF), soot particles (black carbon) and nitrogen oxides (NO_x). These pollutants are significantly reduced by using integrated catalytic processes on the exhaust gas end. The aim is to develop catalysts and processes that enable the combustion of bioenergy sources that is practically emission free and thus environmentally friendly.

Important reference projects and publications

Project: Vollkat – Labortechnische Untersuchungen zur Entwicklung eines keramischen Vollkatalysators für Biomassefeuerungen – 1. Phase,, Deutsche Bundesstiftung Umwelt, 01.01.2018–31.12.2018 (FKZ: 32996/01-24/0)

Project: Bio-Mini – Verbundvorhaben: Entwicklung einer marktnahen emissionsarmen Biomasse-Kleinstfeuerung für Niedrigenergie- und Passivhäuser; Teilvorhaben 1: Feuerungstechnische Entwicklung (Gesamtkonzept) und Charakterisierung einer Biomasse-Kleinstfeuerung für Niedrigenergie- und Passivhäuser,, Federal Ministry of Food and Agriculture/Agency for Renewable Resources e. V. 01.10.2017–30.09.2019 (FKZ: 22025816)

Project: SCRCOAT – Optimierung u. Validierung von Verfahren zur kombinierten Reduktion von Feinstaub u. sauren Schadgasen an Biomassefeuerungen; Teilvorhaben: Experimentelle Untersuchungen zur Kombination von SCR- u. Precoatverfahren an einem Gewebefilter,, Federal Ministry for Economic Affairs and Energy/ Project Management Jülich, 01.09.2017–31.08.2020 (FKZ: 03KB135A)

Project: Kleinmotoren – Entwicklung eines effizienten Abgasbehandlungssystems für Dieselmotoren der Leistungsklasse < 19 kW bei Einsatz kohlenstoffreduzierter Kraftstoffe, Sächsische Aufbaubank, 01.08.2016–01.07.2019

Publication: Grimm, A.; Enke, D.; Roppertz, A.; Hartmann, I.; Frieß, M. (2018). *Synthesis of rice husk silica supported base metal catalysts for exhaust gas treatment*. Poster presented: DBFZ Annual Conference, Leipzig, 19.–20.09.2018.

Publication: Hartmann, I.; Günther, S. (2018), “Emission measurement data of a wood log stove with an integrated two-stage catalytic converter module”, Mendeley Data, v1. http://dx.doi.org/10.17632/2xcp6rytgw.1

Publication: Kohler, H.; Ojha, B.; Illyaskutty, N.; Hartmann, I.; Thiel, C.; Eisinger, K.; Dambacher, M. (2018). “In situ high-temperature gas sensors: Continuous monitoring of the combustion quality of different wood combustion systems and optimization of combustion process”. *Journal of Sensors and Sensor Systems* (ISSN: 2194-8771), Vol. 7, H. 1. p. 161–167. DOI: 10.5194/jsss-7-161-2018.

Publication: König, M., Eisinger, K., Hartmann, I., Müller, M.: Combined removal of particulate matter and nitrogen oxides from the exhaust gas of small-scale biomass combustion, Biomass Conv. Bioref. (2018). https://doi.org/10.1007/s13399-018-0303-0

Publication: Müller, M.; Schenk, J. (2018). Smart Bioenergy: *new developments for energetic and integrated material use of biomas*. Lecture given: 4th National Scientific Conference “Renewable Energy Sources: Theory and Practice”, Opole (Poland), 10.10.2018.

Head of the research focus area

Dr. rer. nat. Ingo Hartmann
Phone: +49 (0)341 2434-541
E-Mail: ingo.hartmann@dbfz.de

5 COOPERATIONS AND NETWORKS

R&D-COOPERATIONS WITH THE LOCAL ECONOMY

The research and development work (R&D) of the DBFZ is carried out in close cooperation with partners from industry and other research institutions. This ensures the necessary practical relevance, access to important market information and a focus on innovative and feasible solutions. In cooperation projects with industry, the DBFZ guarantees a neutral and holistic view and approach in order to be able to fully contribute its scientific expertise to market-oriented R&D projects. Especially in third-party funded projects a strong participation of the company is the rule. For this purpose, the five research focus areas of the DBFZ have national and international networks with R&D-driving companies as well as industry-relevant networks from the bioenergy sector at their disposal.

Fig. 15 The expansion of cooperations and networks is an essential part of the work at the DBFZ

NETWORKS AND RESEARCH ALLIANCES

The DBFZ is a member of numerous scientific networks and research alliances related to bioenergy and bioeconomy. The strong networking within the research landscape is of essential importance in order to meet the complex challenges of the energy and raw materials revolution to be able to provide comprehensive and sustainable solutions.
In addition to the existing national networks, international activities with IEA Bioenergy were expanded in 2018. Here, scientists of the DBFZ have been active as "National Team Leaders" in a total of five working groups (Tasks) since the beginning of 2019. The IEA Bioenergy was founded in 1978 by the International Energy Agency (IEA). It pursues the objective, cooperation and exchange of information between countries which have national programmes for research, development and use of bioenergy. The International Energy Agency acts as energy policy advisor to 28 Member States and the European Commission in order to ensure reliable, affordable and clean energy for their citizens.

IEA Bioenergy

Network activities of the DBFZ can be found in the following research alliances:

- Renewable Energy Research Association – FVEE
- BioEconomy Cluster
- BMWi Research Network Bioenergy/Funding Programme "Biomass Energy Use"
- Research Network "Energy Saxony"
- Leipzig Network Energy and Environment – NEU e. V.
- TREC Danube Network (EU level)

FVEE ForschungsVerbund Erneuerbare Energien
Renewable Energy Research Association

BioEconomy Cluster

Biomass energy use

SCIENTIFIC COOPERATIONS WITH UNIVERSITIES AND OTHER RESEARCH INSTITUTES

Scientific cooperation with universities and other research institutions in the field of the energetic and integrated material use of biomass is a further essential component of the network activities of the DBFZ. The focus of the activities is on the implementation of the defined research objectives within the framework of applied research and development (R&D).
The DBFZ has been cooperating with the Helmholtz Centre for Environmental Research – UFZ for many years on questions of system evaluation of bioenergy and the microbiological basis of biochemical processes. The DBFZ "Bioenergy Systems Department" cooperates closely with the UFZ Department of Bioenergy. On the other hand, the "Biochemical Conversion Department" cooperates closely with the UFZ Department of Microbiology. In the field of energy recovery from organic waste and residual materials, the DBFZ's research departments cooperate intensively and strategically with the Rostock Professorship for Waste and Material Flow Management (ASW), represented by the scientific managing director of the DBFZ, Prof. Dr. Michael Nelles. In addition, the University of Rostock is organizing in cooperation with the DBFZ, such as the annual Rostock Bioenergy Forum.

UNIVERSITÄT LEIPZIG

Universität Rostock Traditio et Innovatio

HELMHOLTZ CENTRE FOR ENVIRONMENTAL RESEARCH – UFZ

© Universität Rostock

Fig. 16 Prof. Dr. Daniela Thrän at the Rostock Bioenergy Forum

The deputy scientific managing director of the DBFZ, Prof. Dr. Daniela Thrän, has been closely associated with the University of Leipzig since the end of 2011 via the Chair of Bioenergy Systems at the Faculty of Economic Sciences (IIRM – Institute for Infrastructure and Resource Management). As of February 2019, eight scientists of the DBFZ are also working on their doctoral thesis in cooperation with the University of Leipzig. In addition to the University of Leipzig, other national universities such as the Merseburg University of Applied Sciences, the Ernst Abbe University of Jena and the Erfurt University of Applied Sciences are linked to the DBFZ through the lecturing activities of DBFZ staff.

In addition to the national networks and research cooperations described above, the scientific cooperation with non-European countries, especially China, has expanded considerably in recent years. Scientists of the DBFZ are visiting professors at the University of Hefei and other renowned universities in China.

6
THE DBFZ IN PUBLIC

In the tenth year of its existence, the DBFZ has again been able to set important, public-effective highlights with new scientific publications, press and media relations, a large number of guided tours for visitors as well as various events and to further increase its level of recognition in the scientific community. Of the large number of events in 2018, the most important in particular is the 3rd DBFZ Annual Conference. With well over 200 participants, a personal greeting from the Saxon Minister of State for Environment and Agriculture, Thomas Schmidt, as well as renowned bioenergy experts the DBFZ Annual Conference 2018 was one of the most important events of the past year. The annual conference took place from 19 to 21 September 2018 in the Leipziger Foren and stood under the slogan:

Fig. 17 The 3rd DBFZ Annual Conference in the Leipzig Foren (19–21 September 2018)

"Energy & materials from biomass: competitors or partners". The extensive conference reader for the event is available as a free download at **www.dbfz.de**.
Parallel to the annual conference, the expert forum "Hydrothermal Processes" took place again in 2018. For the fourth time, representatives from the fields of disposal and supply, biomass use, chemistry, energy supply, carbon materials, plant construction, agriculture as well as planning and consulting services were able to discuss the extensive results of their work, as well as questions and solutions in the field of hydrothermal processes. The results can also be downloaded in the form of slides and abstracts in digital and free of charge available conference readers.

FORUM SCIENCE MANAGEMENT

As early as spring 2018, a new cooperation event, the "Forum Science Management" (FoWi), was launched under the coordination of the DBFZ. In the opening event on 23/24 April 2018, the administrative symposium was dedicated to the goal of taking up current topics and debates concerning the management of innovative and successful scientific institutions. Developments from administration, research and society were presented and discussed from different perspectives and action and optimisation concepts were presented. Particular focus was placed on the areas of human resources, research infrastructure, purchasing and finance. The Forum Science Management is jointly organised by the DBFZ, the Helmholtz Centre for Environmental Research – UFZ, the Leibniz Institute for Tropospheric Research and the Leibniz Institute for Surface Modification.
Numerous other events such as the 9th Expert Discussion "Particle Separators in Domestic Firing Systems", the Leipzig Expert Talks on the topics of Biogas, Biofuels and Solid Biomass, the participation in the Long Night of the Sciences, the Hanover Fair and various other scientific events have successfully rounded off the very intensive event year 2018.

Further information:
www.dbfz.de/en/events/
www.flickr.com/photos/dbfz/albums
www.dbfz.de/en/events/event-newsletter/

Fig. 18 Panel discussion at the Forum Science Management (23/24 April 2018)

Fig. 19 Conference readers for DBFZ events are available online and are free of charge

Fig. 20 Anniversary brochure “Ten years of biomass research at the DBFZ”

NEW PUBLICATIONS

The publication of scientific and popular scientific publications in 2018 was once again one of the many activities of the Press- and Public Relations Department. In addition to the “DBFZ Report” No. 31 on the topic “Low-temperature synthesis of methane in thermal oil-temperated plate reactors” (more on this on page 97), the DBFZ series of publications has been extended by four new issues, in particular the series of conference readers. In addition, the programme support of the BMWi’s “Biomass Energy Use” working at the DBFZ has published the English-language manual “Methods for Measuring Emissions of Particulate Matter from Solid Biomass Combustion” as part of its publication series.
On the occasion of the tenth anniversary of the DBFZ in 2018, the Press and Public Relations Department also published the german language brochure “Ten Years of Biomass Research at the DBFZ” as a PDF and print version. The 60-page publication offers interviews, photos, statements, a greeting from the Federal Minister of Food and Agriculture, Julia Klöckner, and important reference projects as an overview of the ten-year research work on the DBFZ. All publications are available at the website of the DBFZ as a free PDF download and can also be ordered free of charge as a print version.

For further information and downloads see:
www.dbfz.de/en/press-media-library/publication-series/
www.energetische-biomassenutzung.de/en/publications/

VISITORS MANAGEMENT

In 2018, numerous visitors from all regions of Germany and the world visited the DBFZ again. In addition to project partners, study groups and other groups interested in the topic of bioenergy, politicians from various factions were also welcomed. A highlight was the visit of the Federal Government Commissioner for Eastern Europe, Christian Hirte, on 20 June 2018. Hirte emphasized in particular the successful development work at the DBFZ and at the same time urged that the spirit of entrepreneurship in Eastern Germany be further stimulated: “I am

very pleased that the ‘Development East’ is bearing visible fruit in the field of bioenergy research as well as in the field of scientific spin-offs. In particular, the extensive new construction of the DBFZ symbolises this in an impressive way. For further growth and the corresponding economic impulses in the region, it is important to strengthen the scientific and political framework conditions, to create market incentives through appropriate funding programmes and to further stimulate the spirit of entrepreneurship in the field of bioenergy research,” said Christian Hirte.

Further information:
www.dbfz.de/en/events/visits-to-the-dbfz/

Contact

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

Katja Lucke
Phone: +49 (0)341 2434-119
E-Mail: katja.lucke@dbfz.de

Joana Klein
Phone: +49 (0)341 2434-752
E-Mail: joana.klein@dbfz.de

Fig. 21 The Federal Government Commissioner for Eastern Germany, Christian Hirte (centre), visiting the DBFZ

7 EXECUTIVE SUPPORT TEAM

"The Executive Support Team makes an important contribution to the successful scientific operation at the DBFZ. In addition to controlling and Press and Public Relations Departments, the scientific staff units in particular ensure successful synergies within the research work at the DBFZ as well as the continuous further development of our R&D networks domestically and abroad".

Prof. Dr. Michael Nelles, Scientific Managing Director of the DBFZ

The DBFZ's staff units (executive support team) are directly assigned to the scientific management of Prof. Dr. Michael Nelles. In addition to the Press and Public Relations Department and Controlling, the coordinators for research, innovation and international knowledge and technology transfer work closely together with the four research departments of the DBFZ and the heads of the five research focus areas. The aim of the scientific staff units is to create synergies in the strategic research and project orientation, in the formation of consortia, and in the development of new research areas and internationalisation for the entire research centre.

Fig. 22 The DBFZ executive support team in March 2019

INNOVATION COORDINATION UNIT

Bioenergy is an essential component of the renewable energy system as well as of the bioeconomy. Technologies that provide energy sources or process energy as well as valuable bio-based products in coupled production open up a wide range of new fields of innovation. The Innovation Coordination Department, headed by Romann Glowacki, seeks and develops this innovation potential. To this end, it links the DBFZ's application-oriented research with partners and R&D&I structures from other sectors of the bioeconomy. The DBFZ's research partners from small and medium-sized enterprises (SMEs) are also included in these structures. An example of this is the co-creation of the BMBF's BioEconomy Cluster based in Halle/Saale. Other tasks of the innovation coordinator include the transfer of knowledge and technology, the management of intellectual property rights and the establishment of own innovation structures in the field of spin-off promotion.

CONTACT FOR COMPANIES

To provide companies with an overview of the scientific services or to facilitate access to the research infrastructure of the DBFZ, the Innovation Coordinator is the first point of contact. In this way, even companies with little R&D experience can quickly get in touch with the DBFZ experts or save time in finding the right contact person. Even ideas for possible joint R&D projects can be developed jointly. In 2018, more than 40 company enquiries were successfully in-house mediated and answered.

PROMOTION OF SPIN-OFFS

The DBFZ promotes employees who want to found and build their own companies. An example of a successful spin-off of the DBFZ is ETE EmTechEngineering GmbH. In 2018, the consortium with other partners won two first prizes at the "Wood Stove Design Challenge" held in Washington/USA for the world's most innovative emission minimisation and combustion optimisation concepts with a sophisticated combination of combustion chamber, catalysts and thermoelectric elements. The team received awards in the categories "Fine Dust, CO, Efficiency and Safety" and "Furnaces with Thermoelectric Generators".

© Kittner/BNL

Fig. 23 The winning team "Wittus" at the "Woodstove Design Challenge" 2018 in Washington/USA

Further information:
www.dbfz.de/en/services/research-with-companies/
www.ete-ing.de/en

Contact

Romann Glowacki
Phone: +49 (0)341 2434-464
E-Mail: romann.glowacki@dbfz.de

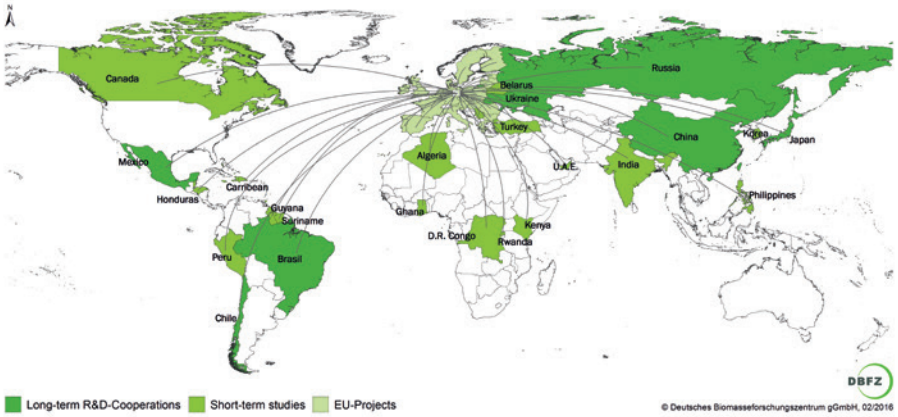


Fig. 24 International cooperation of the DBFZ

INTERNATIONAL KNOWLEDGE AND TECHNOLOGY TRANSFER UNIT

The scientific staff unit “International Knowledge and Technology Transfer”, headed by Dr. Sven Schaller, aims to make the scientific expertise of the DBFZ available to international partners. Instruments for this purpose are joint research projects, the exchange of doctoral students and the implementation of reciprocal research stays. A further goal of the department is the establishment of cooperations with international top universities and non-university research institutes. In addition, international networks are to be consolidated and selectively expanded. This also includes the initiation and mediation of reciprocal visits and the organisation of workshops and conferences.

START OF A LONG-TERM COOPERATION WITH THE UNIVERSITY HEFEI

The long-standing research contacts with the Chinese University of Hefei led to a five-year project in 2018 to establish research laboratories and personnel capacities. Two DBFZ employees will provide the colleagues on site with half of each position, to establish a suitable research infrastructure and laboratory equipment for biochemical analyses and for the exploitation of the results to build a new world of rice husks. In addition, Chinese guest scientists at the DBFZ shall become further qualified for these activities. In the course of this project, DBFZ scientist Dr. Walter Stinner was appointed as visiting professor at the University of Hefei.

Fig. 25 DBFZ cooperation in Africa

DBFZ STRENGTHENS ENGAGEMENT IN AFRICA

In April, the DBFZ established a contact with the West African Science Service Center on Climate Change and Adapted Land Use (WASCAL) during a trip by the Federal Ministry of Education and Research (BMBF) to Togo and Ghana. Throughout the region, traditional biomass use plays a major role in the use of energy. In particular, charcoal obtained from deforestation is used for cookin in almost every household. Despite the enormous potential of unused agricultural residues, this remains largely unused, while the deforestation rate is over four percent. On the one hand, the DBFZ shall contribute to establishing a stable database for the availability of agricultural residues through various projects. On the other hand, the DBFZ expertise is needed in the construction of pilot plants and the establishment of own bioenergy research centres in the region. Ghana and Togo are expected to become the DBFZ anchor centres in Africa in the foreseeable future.

Fig. 26 The DBFZ has a long partnership with the Instituto de Energia e Ambiente at the University of São Paulo

INTENSIFICATION OF COOPERATION WITH BRAZIL

During a visit to the University of São Paulo (USP) in May 2018, the existing cooperation was further strengthened. In addition to the topic of flexible biogas production, the cooperation will in future focus on automatic process control. Prof. Dr. José Moreira, a long-standing member of the research advisory council of the DBFZ, and the current director of the Instituto de Energia e Ambiente (IEE), Prof. Dr. Ildo Sauer, emphasised that Brazil and specifically the USP could benefit greatly from the research results of the DBFZ. In the near future, the DBFZ will also be expanding its cooperation with the Universidade Estadual de Campinas (UNICAMP).

Further information:
www.dbfz.de/en/research/international-activities/

Contact

Dr. rer. pol. Sven Schaller
Phone: +49 (0)341 2434-551
E-Mail: sven.schaller@dbfz.de

RESEARCH COORDINATION UNIT

The Research Coordination Unit under the direction of Dr. Elena H. Angelova pursues various tasks in the field of science management. The focus is on medium- and long-term research planning, on the one hand, and quality assurance of research on the other. In addition, the department supports and coordinates the networking of scientists between the five research focus areas of the DBFZ and other research institutions and partner organisations. The aim is to make better use of existing synergies and expertise, to initiate promising research cooperations and to find suitable funding for the implementation of research ideas. Dr. Elena H. Angelova is also responsible for the implementation of the doctoral program and the support of the doctoral students of the DBFZ.

DOCTORAL COLLOQUIUM BIOENERGY

In the coming decades, the topics of climate protection and energy system transformation will continue to influence the discourse of society as a whole in Germany. Bioenergie is both a versatile source of energy and a decisive contribution to reducing greenhouse gas emissions. The research is outstanding and diverse. In order to bring together the knowledge and decision-makers of tomorrow at an early stage and to achieve better networking of scientific institutions in the field of bioenergy, the 1st German Bioenergy Doctoral Colloquium was launched as a new series of events at the end of 2018 on the initiative of Prof. Dr. Daniela Thrän (UFZ/DBFZ/University of Leipzig). With more than 150 active participants in the opening session, the new event series got off to a successful start. Under the patronage of Daniela Thrän and the DBFZ, the new series of events will take place annually from now on and will be organised alternately by the participating scientific institutions. The follow-up event will take place on 30 September and 1 October 2019 in Nuremberg. The organiser is the Chair of Energy Process Engineering at the Friedrich-Alexander-University (FAU) in Erlangen-Nuremberg in cooperation with the BayWISS Verbundkolleg Energie. For further information see: **www.doc-bioenergy.de**

BIOENERGIE DOC2018 | 1. DEUTSCHES DOKTORANDENKOLLOQUIUM BIOENERGIE

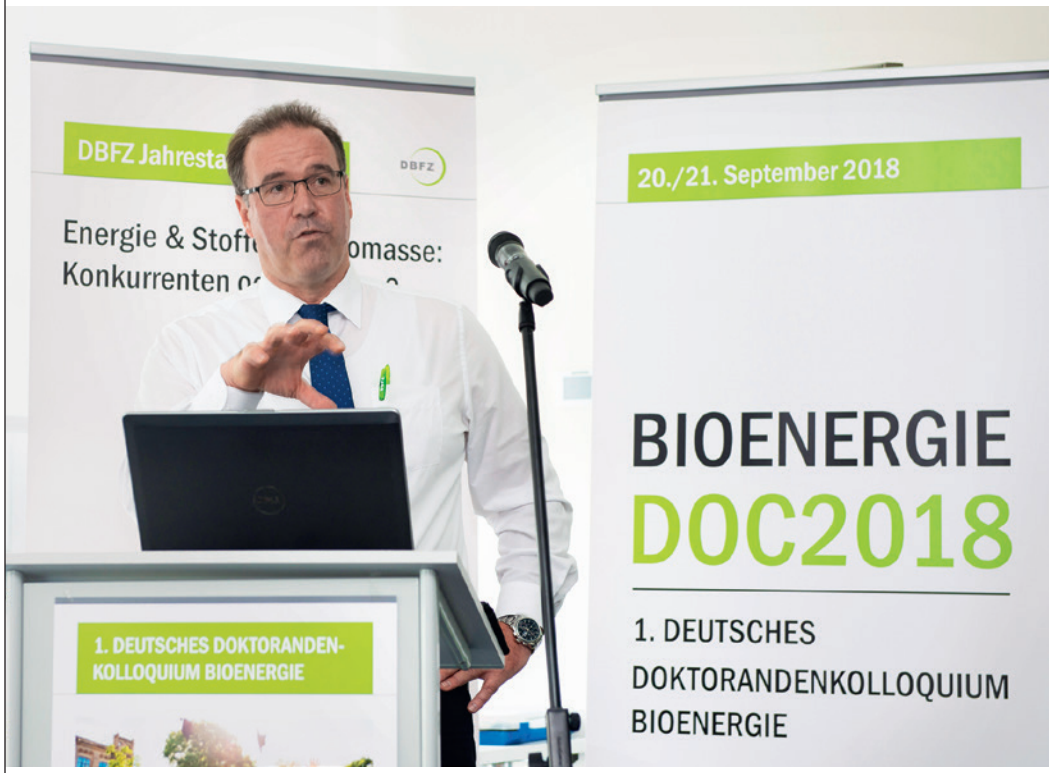


Fig. 27 Prof. Dr. Michael Nelles opens the 1st German Doctoral Colloquium Bioenergy (20 September 2018)

Contact

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

8 DOCTORAL PROGRAMME

Doctoral students represent an indispensable cogwheel in the scientific system. They not only accompany top-level research through their in-depth focus, creativity and commitment, but also significantly accelerate and guide it. Against this background, the DBFZ doctoral programme was launched in 2013. The aim of the programme is, on the one hand, to have the research-relevant and industry-related future topics in the field of bioenergy developed by doctoral projects and, on the other hand, to offer outstanding scientists the opportunity to doctorate under the best possible conditions. The DBFZ PhD program gives PhD students access to state-of-the-art laboratories and technologies in the field of bioenergy. In addition, doctoral candidates are given the opportunity to be involved in ongoing national and international projects and to actively contribute to the content of specialist events.

Fig. 28 DBFZ scientist Dr. Jörg Kretzschmar (right) receives the certificate for successful participation in the DBFZ doctoral programme at the Doctoral Colloquium Bioenergy

A total of about 70 doctoral projects are carried out annually at and in cooperation with the DBFZ. For this purpose, the DBFZ cooperates with eight universities and one university of applied sciences from Germany as well as two foreign universities. Of a total of 71 doctoral projects in 2018, 16 were carried out in cooperation with the Helmholtz Centre for Environmental Research (UFZ) in Leipzig and 15 in cooperation with the Chair of Waste and Material Flow Management at the University of Rostock. Of these, three doctoral projects[3] were successfully completed in cooperation with the University of Rostock and two in cooperation with the University of Leipzig.

3 Two of them as part of the DBFZ doctoral programme

PROMOTIONAL EXAMPLE FROM DR. MICHAEL SCHLÜTER

Optimisation of the methane yield in the heterogeneously catalysed methanation at reduced temperatures and pressures by targeted equilibrium shift

Dr. Michael Schlüter

With almost 25 %, the use of biomass (status quo 2016) accounts the second largest share regarding the generation of electricity from renewable energies in Germany, right after wind power and before solar and hydropower. In addition to the direct generation of heat, biomass is used as a raw material for the synthesis of solid, liquid and gaseous secondary energy carriers. These are able to replace their fossil equivalents and to reduce the emission of greenhouse gases (GHG) [Kaltschmitt 2009]. Especially, the synthesis of of a biogenic substitute for natural gas from fossil sources, so-called Bio-SNGs (SNG – synthetic natural gas/synthetic natural gas), is a promising way to achieve this. Investigations have shown that by substituting fossil natural gas with its biogenic equivalent, taking into account the different production processes, a reduction in GHG emissions of more than 80 % can be achieved [EU 2009] [Pucker 2012] [Müller-Langer 2015]. A further advantage of the area-wide methane synthesis from biomass for the production of Bio-SNG is the increasing independence from natural gas imports due to the use of regional resources [Rönsch 2011]. Against the background of the energy system transformation, this synthesis pathway is again attracting more and more attention nowadays.

For the thermochemical generation of artificial natural gas, the use of lignocellulosic biomass species, in particular wood and straw, is necessary. Due to their complex cell structure, they cannot be directly converted into biogas by biochemical fermentation [Kaltschmitt 2009] [Müller-Langer 2015]. Initially, the biomass

Fig. 29 DBFZ Report No. 31 – dissertation paper

passes through one or more several pretreatment steps (e. g. crushing, drying), depending on the raw material used. Subsequently, it is thermochemically converted into synthesis gas by means of sub-stoichiometric addition of an oxygen-containing gasification agent. [Kaltschmitt 2009]. The subsequent methanation is the central chemical transformation of the process. The Purified synthesis gas is transferred into a methane-rich gas by means of a catalyst, usually consisting of nickel (Ni) on a support of aluminium oxide (Al_2O_3), at increased temperatures and under pressure. In order to achieve natural gas quality and thus be able to feed it into the existing natural gas network [DVGW 2013], the raw product from methanation still has to be processed. This is done, for example, by drying and separating by-products or the admixture of other gases (e. g. propane) to increase the calorific value [Müller-Langer 2015].

For the thermochemical process, the total energy efficiency is as follows of up to 65 % [Kopyscinski 2010]. However, the step from application-oriented research to the comprehensive production of Bio-SNG has so far failed due to the high costs and the current, comparatively low price for fossil natural gas (as of 2017). More recent studies have shown that border-crossing prices for fossil natural gas reach from 6.25 to 17.00 €ct kWh^{-1} depending on the raw material used and the size of the SNG production plant [Rönsch 2009] [Rönsch 2012] [Aranda 2014] [Rönsch 2014], whereas the prices in Germany were significantly lower with 1.81 €ct kWh^{-1} at the beginning of 2017 [BAFA 2017]. Currently, there is no plant producing Bio-SNG on a commercial scale. All in all, the commercial production of Bio-SNG is confronted with numerous problems. In order to be able to carry out this synthesis economically, it is necessary to increase the economic competitiveness of Bio-SNG. To achieve this, its production costs must be significantly reduced.

The investigations focussed on methanation as a central partial reaction of the SNG production process for the conversion of the gaseous raw materials from the upstream gasification to the methane-rich raw product. Conventional systems for the production of SNG or Bio-SNG operate in the field of methanation at temperatures that are in some cases significantly above 300 °C, and pressures above 20 bar [Kopyscinski 2010] [Rönsch 2016] [Sculptor 2016]. It is to be assumed that the investment and operating costs for methanation decline due to reduced process parameters (temperature and pressure). Since methanation itself accounts for about 10–15 % of the investment costs of a Bio-SNG plant [Heyne 2014] [Rönsch 2014], a reduction in methanation costs would also mean a reduction in the costs of the entire process. The aim of the research work was to ensure that, even under these reduced conditions (temperature ≤ 300 °C, pressure ≤ 5 bar), the reaction with a commercial nickel catalyst delivers maximum methane yields.

To download the report incl. source references see:
www.dbfz.de/en/press-media-library/publication-series/dbfz-reports/

Contact

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

Tab. 1 List of doctoral theses at the DBFZ, excluding cooperation partners UFZ/University of Rostock (as per: February 2019)

Name	Dissertation subject	Institution	Type of doctorate
Beidaghy, Hossein	Ash-related aspects during the thermo-chemical conversion of leached silicon rich biomass assortments for the production of heat and power and the combined transformation into valuable inorganic multipurpose chemical compounds	University of Leipzig/ Iran University	Doctorate (BLE/BMEL PhD project Iran)
Bindig, René	Cleaning of waste gases from small-scale biomass furnaces on innovative monolithic catalysts	University of Leipzig	Doctorate (part-time)
Boße, Jasmin	Upgrading of Residual Biomass by Pre-treatment for Utilization in Small-Scale CHP Applications	(still open)	PhD position in externally funded research project
Brosowski, André	National Resource Monitoring for Biogenic Residues, Wastes and By-products – Development of a Systematic Data Collection, Management and Assessment for Germany	University of Leipzig	Doctorate (part-time)
Butt, Saad	High-temperature oxidation of pollutants on solid state catalysts	University of Leipzig	Doctorate (part-time)
Büchner, Daniel	Optimised control strategies for combination pellet/solar plants to improve system efficiency while minimising environmental impact	Technical University Dresden	Doctorate (part-time)
Dernbecher, Andrea	Method for modelling thermochemical biomass conversion in a CFD-based simulation	Technical University Berlin	Doctorate (work programme)
Dietrich, Sebastian	Biogas upgrading to H-gas by direct synthesis of short-chain hydrocarbons	Technical University Berlin	PhD position in externally funded research project
Dotzauer, Martin	Numeric input/output model of plants for electricity generation from biomass in Germany and derivation of medium-term trend scenarios	University of Leipzig	Doctorate (part-time)
Gallegos, Daniela	Potential of water plants for water cleaning and sustainable energy production for Mexico	University of Rostock	Doctorate (grant)
Gebhardt, Heike	Heating networks 4.0	(still open)	Doctorate (part-time)
Gökgöz, Fatih	Development and optimisation of self-sufficient biogas treatment plants with integrated filling station technology for a local biomethane fuel supply	University of Rostock	Doctorate (grant)
Gröngröft, Arne	Optimising the conversion efficiency of bioethanol refineries	Technical University Hamburg	Doctorate (part-time)
Hahn, Alena	The role of smart bioenergy in combination with CO_2 removal in decarbonisation scenarios	University of Leipzig	Doctorate (work programme)
Herrmann, André	Combined high-temperature combustion gas cleaning via moving bed reactor (topic currently being adapted)	Technical University Hamburg	Doctorate (part-time)
Horschig, Thomas	Using system dynamics to model the German and European biomethane markets	University of Leipzig	Doctorate (work programme)
Kar, Indrani	Maintaining regional soil quality for a Biobased biobased economy	University of Leipzig	Doctorate (work programme)
Kirsten, Claudia	Contribution to optimising the pelleting behaviour of fermentation residues and landscape conservation hay and mixtures	Technical University Berlin	Doctorate (part-time)
Kirstein, Niels	Future use of biogenic solid fuels against the background of the two-degree objective	University of Leipzig	Doctorate (work programme)
Köchermann, Jakob	Hydrothermal conversion of wood pulp solutions for the production of furan derivatives	Technical University Berlin	PhD position in externally funded research project
König, Mario	Catalytically aided reduction of gaseous and particulate emissions from wood burning in Chilean households	Martin-Luther-University Halle-Wittenberg	Doctorate (part-time)
Krüger, Dennis	Development and system integration of a micro-scale combined heat and power plant for solid biomass	Technical University Chemnitz	Doctorate (part-time)
Kurth, Matthis	Development of a water-separating membrane to increase the turnover of the methanation process	Technical University Berlin	Doctorate (work programme)
Lauer, Markus	Macro-economic assessment of biogas plants as an option to enhance flexibility in the electricity system of the future	University of Leipzig	Doctorate (work programme)
Müller, Mirjam	Emissions reduction in small-scale biomass furnaces based on integrated catalysis	Leipzig University of Applied Sciences (HTWK)	Doctorate (work programme)
Ngoumelah, Daniel Dzofou	Development of microbial electrochemical technologies for material and energetic use of humans' and animals' raw liquid manure	University of Leipzig	Doctorate (grant)

Name	Dissertation subject	Institution	Type of doctorate
Nitzsche, Roy	Adsorption and membrane filtration for the treatment of aqueous product solutions in lignocellulose biorefineries	Technical University Berlin	PhD position in externally funded research project
Pujan, Robert	Modelling of Biorefinery Processes	NTNU Trondheim, Norway	Doctorate (work programme and NTNU Trondheim)
Reinelt, Torsten	Monitoring of locally unknown and time-varying methane emissions from biogas plants	Technical University Dresden	Doctorate (part-time)
Rönsch, Cornelia	Development of a method for the utilisation of chimney-sweeping data in energy reporting	University of Leipzig	Doctorate (work programme)
Sumfleth, Beike	Measurement of low ILUC risk indicators with a LCA for the implementation in sustainability certification schemes of bio-based products	University of Leipzig	Doctorate (work programme)
Theurich, Steffi	Unsteady-State Operation of a Fixed-Bed Recycle Reactor for the Methanation of Carbon Dioxide	University of Ulm	Doctorate (grant)
Undiandeye, Jerome Anguel	Fermentation of Agricultural Residues for Energetic and Material Utilization	University of Rostock	Doctorate (grant)
Winkler, Manuel	Model-based process optimization of biogas plants	(still open)	Doctorate (part-time)
Zeng, Thomas	Targeted treatment of wood-type biomass residues for use as fuel in small-scale furnaces for heat supply	University of Rostock	Doctorate (part-time)

9 CONTRACT RESEARCH AND 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 services. These services go beyond the research focus areas and are directed equally at politicians, industry, associations, experts and committees. The work on the content is carried out in an interdisciplinary and cross-departmental way, so that the entire expertise of the DBFZ can be used comprehensively and efficiently for the following consulting and technical services.

Fig. 30 Working at the biogas lab of the DBFZ

9.1 POLICY RECOMMENDATIONS AND ADVICE

The DBFZ offers a wide range of advisory services for political decision-makers. These include the long-term monitoring of the development of bioenergy markets within the framework of various monitoring projects (in the area of electricity generation from biomass and biofuel use) and support for the design of policy instruments based on the above with reference to energetic and material biomass use (e. g. EEG, EEWärmeG, Biokraft-NachV, etc.). In addition, the DBFZ supports political decision-makers by commenting on current legislative procedures and by answering questions from political institutions. Expertise is also provided in the form of status papers, for example on the current state of energetic utilisation potentials of biogenic waste and residual materials, to the stock of bioenergy and waste wood plants as well as to the Consequences of a further development of the biofuel quota.

Since January 2017, part of the policy advice has taken the form of direct secondment of DBFZ staff to the Federal Ministry of Food and Agriculture (BMEL). The aim is to support the BMEL divisions 524 “Bioenergie und Energieangelegenheiten” (bioenergy and energy matters) and 525 “Bioökonomie, stoffliche Biomassenutzung” (bioeconomy, material biomass use) in the negotiations on the revision of the Renewable Energy Directive (RED II). The directive sets the targets for the further expansion of renewable energies for the period 2020 to 2030 for the EU. In the course of the departmental negotiations for RED II, many ad hoc enquiries were made directly to the DBFZ, which were answered competently and quickly. Furthermore, the BMEL is supported in connection with the elaboration of the Federal Government’s new bioeconomy strategy which sets targets and measures for an economy based on renewable biogenic energy sources.

Fig. 31 The State Secretary of the BMEL, Michael Stübgen (centre), at the parliamentary lunch of the DBFZ in Berlin (4 June 2018)

Since 2017, a strategy for the future of heat generation from biomass has also been developed for the BMEL. In the scope of the project “Untersuchungen zur Ausgestaltung der Biokraftstoffgesetzgebung” (Investigations for the conception of biofuel legislation, acronym BKSQuote), a basis for discussion and decision-making on the further and overarching strategy development for the use of renewable energy in transport with a focus on biofuels is also being developed. In addition to collecting, analysing and presenting data and information on market development, available biomass potentials or the typical parameters of bioenergy technologies, the DBFZ has also developed suitable tools for the development of medium- and long-term bioenergy scenarios for the development of strategies in recent years and supports the scientific monitoring of strategic projects.

Tab. 2 Important projects relating to "Policy recommendations and advice" in 2018 (selection)

Project	Funding bodies
TATBIO – Technoeconomic analysis and transformation paths of the energetic biomass potential	Federal Ministry of Education and Research (BMWi)
BKSQuote – Investigations into the design of biofuel legislation	Federal Ministry of Food and Agriculture (BMEL)
STAR-ProBio – Sustainability Transition Assessment and Research of Bio-based Products	EU Commission
DEMO-SPK – Research and demonstration projects: Use of renewable kerosene at Leipzig/Halle Airport	Federal Ministry of Transport and Digital Infrastructure (BMVI)

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

AN OVERVIEW OF SERVICES

- Scientific monitoring of strategic policy development and derivation of recommendations for action
- Comments on legislative procedures and the provision of expertise in parliamentary questions and support in the further development of laws and other standards
- Development and implementation of suitable monitoring systems at changing (research) political framework conditions

9.2 MARKET ANALYSES AND DATA PROVISION

Bioenergy plays a decisive role in the substitution of fossil fuels. Accordingly, the trend of recent years is continuing and regional and international usage paths are being further expanded. With the parallel development of the bioeconomy sector, the number of market players is increasing and with it the potential competition for the limited available biomass. Against the background of the continuously increasing demands on efficient utilisation technologies for sustainable bioenergy supply and biomass use, a comprehensive and up-to-date database is the strategic basis for individual planning and the further development of the political framework conditions. This includes the presentation of the development of markets, trade and raw material flows as well as prices.
In addition, the DBFZ aims to collect technological, economic and ecological data and integrate them into the analysis and evaluation of biomass supply concepts and technology options. Furthermore, established and potential market players as well as other interested parties can be provided with transparent information on the continuously increasing quality and sustainability requirements. Since February 2016, data management and provision at the DBFZ has been supported by the establishment of a structured research data management system.

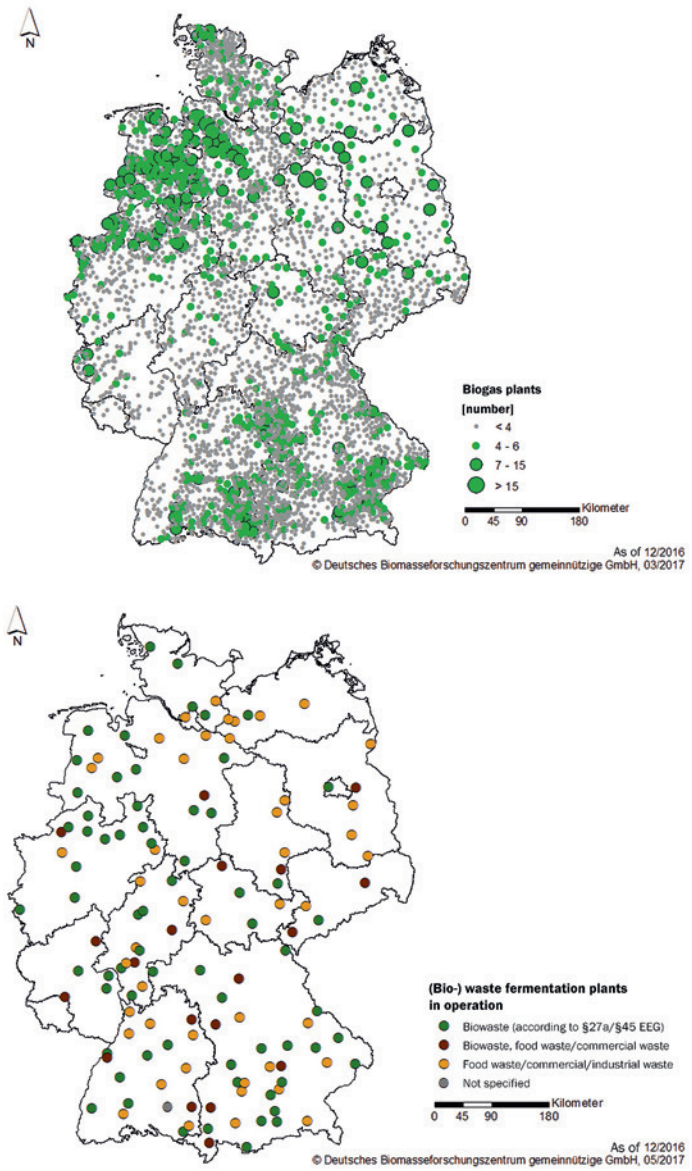


Fig. 32 A large number of bioenergy data are collected at the DBFZ

AN OVERVIEW OF SERVICES

- Determination of biomass potentials and development of utilisation scenarios and utilisation strategies for various actors in biomass markets (material and energetic utilisation)
- Monitoring of the market and technology development including the systematic recording in databases as well as the preparation of market and technology overviews (incl. economic data)
- Forecast of future development trends in the field of bioenergy and bioeconomy
- Provision of data for the trade of biomass/bioenergy (costs, prices and quantities) as well as cost analysis of biomass provision (so-called cost supply curves)
- Provision of structural data on the electricity, heat and fuel markets as well as analysis of the marketing strategies of plant and grid operators (e. g. for demand-oriented energy supply)

Depending on the issue at hand, efficiency and sustainability analyses can be carried out based on economic, ecological and technical assessments and supported by sensitivity analyses and scenario analyses. This also applies to the evaluation of concepts for market and system integration for flexible bioenergy provision.

Further information:
www.dbfz.de/en/research/research-data/

9.3 TECHNICAL, ECONOMIC AND ECOLOGICAL ASSESSMENT

The increasing competition for limited biomass resources as well as continuously increasing and changing demands on the economic and ecological performance lead to an increasing innovation and optimisation pressure for bioenergy plant operators. The DBFZ offers market players various services for the analysis and optimisation of existing and future bioenergy technologies and concepts. In addition to the assessment of the technical, economic and ecological parameters of bioenergy plants, the offered analyses represent a suitable basis for process and concept optimisation.

AN OVERVIEW OF SERVICES

Technical evaluation

- Material and energy balancing
- Technical feasibility
- Technology screening and learning curves
- Parameter-based evaluation (e. g. specific efficiencies, availability, quality, classification according to technical state of development)

Economic evaluation

- Feasibility studies and evaluation of use/operation concepts including costs of new plants, plant extensions or conversion projects
- Analyses of costs and profitability for biogenic supply concepts (electricity, heat, fuels, chemical bioenergy sources)

- Analysis of value chains on the basis of life cycle cost analyses (LCC, Social Life Cycle Assessment) and evaluations of the regional added value of the contribution of biomass use concepts

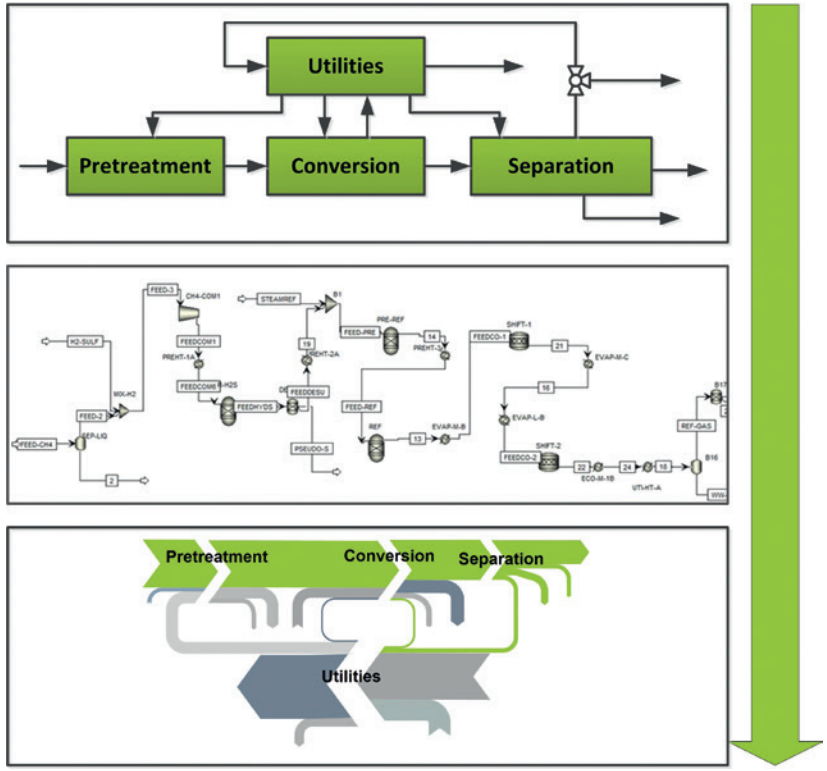


Fig. 33 From plant design to process simulation to technical evaluation

Ecological evaluation

- Life Cycle Assessment (LCA) related to greenhouse gas emissions and other environmental impacts (including biological water balance, humus, eutrophication, acidification) as well as primary energy consumption
- Competition for land use

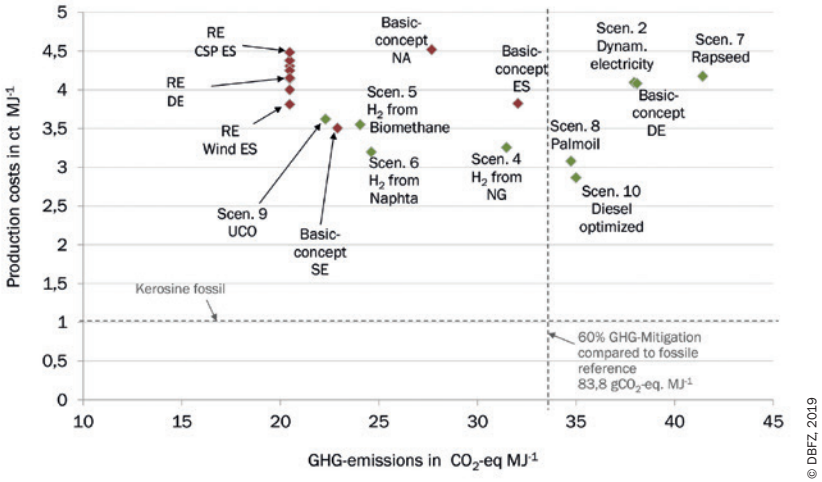


Fig. 34 Comparison of the costs and GHG emissions of the various concepts for the provision of HEFA kerosene

Further information (german language):
www.bmvi.de/SharedDocs/DE/Artikel/G/MKS/machbarkeitsanalyse-ptg-hefa-hybridraffinerie.html

9.4 CONCEPT AND PROCESS DEVELOPMENT AND OPTIMISATION

In order to meet the challenges of changing political and social conditions, concept and process development play a particularly important role in the field of bioenergy research. In doing so, constantly updated knowledge of the state of the art is used to further develop processes. In addition to our own test facilities, computer models developed in-house are important tools for calculating material and energy flows. These relate to entire biorefineries or individual components such as combustion, gasification and synthesis plants. In this way, the experiments are supported and completed by numerical investigations. Depending on the object under investigation, flowchart simulations are used, e.g. in Matlab and Aspen Plus, or CFD models in Open FOAM and Ansys CFD, to precisely understand processes and procedures and improve the predictive accuracy of the models.

The interaction of the different process steps can be investigated with flow diagram simulations. In particular, the investigation of mass and energy balances of complete biorefineries or parts thereof offers opportunities to increase efficiency at an early stage. In addition, the results provide an essential basis for economic and ecological analyses. The effects of adaptations in existing plants can also be well mapped using flowchart simulations. With CFD simulations, plants of any size can be represented three-dimensionally and the physico-chemical processes therein can be investigated. Special attention is paid to the investigation of the flow processes under consideration of the chemical reactions taking place. By varying different parameters, the running processes can be controlled and optimisations can be found, for example to reduce emissions from combustion plants or to increase the efficiency of synthesis plants.

AN OVERVIEW OF SERVICES

- Development of new process concepts
- Calculation of material and energy flows (process balancing)
- Upscaling of processes
- Test and development of new technologies and process steps
- Optimisation of existing technologies, process steps and material flow management concepts
- Creation of CFD and flow diagram simulations (stationary and dynamic)
- Performance of kinetics measurements for catalysts
- Development of control concepts

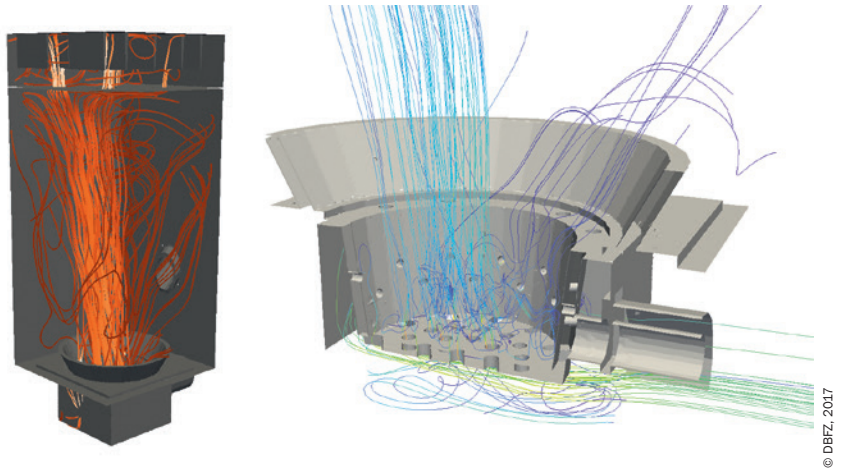


Fig. 35 Streamlines in a pellet boiler (left) and a pellet burner (right) from a CFD simulation

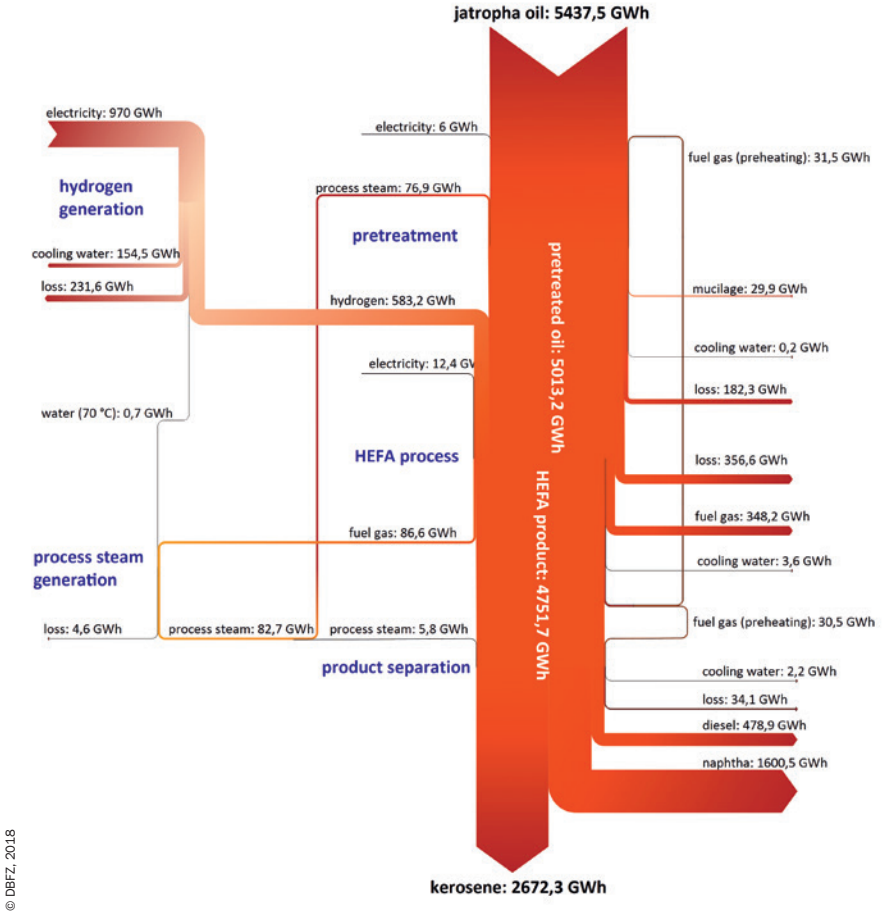


Fig. 36 Energy balance for the PTG-HEFA concept for the provision of kerosene from vegetable oils and electricity

9.5 SCIENTFIC SUPPORT FOR R&D PROJECTS

As an example of comprehensive scientific support for R&D projects, the programme support of the BMWi funding programme “Biomass Energy Use” has been working for nine years at the DBFZ. In the context of events as well as symposia and workshops, 150 projects and 375 project partners from small and medium-sized enterprises and research institutions have been successfully networked through the funding programme to date. A further focus is the consolidation of the scientific output of the programme participants and the transfer of the results to different groups of actors (politics, research, practice). To this end, a series of publications has been developed in which more than 20 volumes and six focus issues on various key topics (biogas, solid fuels, hydrothermal processes, bioenergy technologies, etc.) have been published to date. Furthermore, the programme support organises the cross-project working groups of the funding programme in the process of harmonising methods and political discourse. So far, in the context of an intensive discussion process with the programme participants, the measurement method collections on the topic of biogas, particulate matter and gasification as well as a method handbook (in German and English) have been further developed and joint statements have been drafted. The funding programme has been a member of the BMWi research networks since 2016. Here, the programme support coordinated the development of future R&D recommendations within the framework of the consultation process on the 7th Energy Research Programme. The network currently consists of over 600 members.

Fig. 37 Workshop “Vom Frosch zum Prinzen” (How does the frog become the prince) within the framework of the DBFZ Annual Conference 2018

AN OVERVIEW OF SERVICES

- Accompanying scientific research on complex R&D collaborations
- Scientific advice and support for bioenergy initiatives in the field of municipalities/regions
- Scientific accompaniment of research programmes through:
  - Networking between the projects
  - Bringing together the scientific output and knowledge transfer (public relations and press work)
  - Increasing the visibility and external presentation of the programmes
  - Coordination of cross-project working groups
  - Coordination and moderation of (socio)political discourses
- Coordination of (technical) events and production of publications
- Support of current expert dialogues
- Coordination of harmonisation processes

Further information:
www.energetische-biomassenutzung.de/en/

Fig. 38 9th Expert talk "Partikelabscheider in häuslichen Feuerungen" (Particle separators in domestic furnaces) (21 March 2018)

Fig. 39 Conference readers of the expert talk about particle separators in domestic furnaces are available free of charge on the DBFZ website

9.6 KNOWLEDGE AND TECHNOLOGY TRANSFER

In the field of knowledge and technology transfer, the DBFZ offers the organisation of specialist conferences on specific focal topics (e.g. hydrothermal processes, monitoring & process control of anaerobic digestion plants, particle separators in domestic furnaces). In addition, current topics and research results on the topics of biogas, biofuels and solid biomass are regularly presented and discussed within the framework of the series of events "Leipziger Fachgespräche" (Leipzig Expert Talks). Through numerous publications (final reports, dissertations, guidelines, handbooks and conference proceedings, reports), an extensive portfolio of scientific reports is additionally made available, which can be downloaded free of charge on the internet. The Innovation Centre for Bioenergy offers interested research partners the opportunity to control and coordinate innovation processes in a targeted manner and to establish national and international networks. and expand it. Through a wide variety of cooperation projects domestically and abroad, there is a continuous transfer of knowledge and technology in the form of workshops, guidelines and staff training.

AN OVERVIEW OF SERVICES

- Organisation and implementation of specialist events (technical discussions, specialist conferences, workshops)
- Coordination of innovation processes
- Preparation of guidelines and manuals
- Development and creation of web-based information platforms and open-source portals
- Further education (Summer-School)

10 TECHNICAL AND SCIENTIFIC SERVICES

In addition to the services mentioned above, the DBFZ offers a special R&D infrastructure in the three technical research departments of biochemical conversion, thermo-chemical conversion and biorefineries as well as the Analytical Lab. The technical and scientific services are aimed at plant and mechanical engineering companies, process developing companies, plant operators as well as other R&D-driving companies and institutions.

Fig. 40 Work in the biorefineries technical centre

SERVICES OF THE DEPARTMENTS

Biochemical Conversion Department:

- Market analysis (based on the annual operator survey, among other things), forecast and strategy consulting
- Scientific monitoring of the development of plant components
- Accounting and evaluation of processes with regard to efficiency, technical feasibility and economy
- Experiment execution (batch and continuous experiments)
- Concept development for specific site conditions

Thermo-chemical Conversion Department:

- Development, characterisation, pretreatment and additives of fuels
- Combustion tests and comparative classification of combustion properties
- Separator measurement
- Dust and CO measurements
- CFD simulation of thermodynamic processes
- Investigation of catalyst technology for furnace integration
- Catalyst tests on the test bench and in practice in terms of efficiency and emissions
- Catalytic converter screening in model and real gas
- Catalyst characterisation by physical and chemisorption measurement
- Catalyst synthesis

Biorefineries Department:

- technical centre trials to:
    - hydrothermal carbonisation and liquefaction,
    - fixed bed and dust gasification,
    - synthesis gas process,
    - gas purification,
    - solid-liquid/liquid-liquid separation processes for biogenic materials from aqueous media
- Investigation of the behaviour of fuels and their emissions in engine test beds

Fig. 41 Working in the Analytical Lab of the DBFZ

ANALYTICAL LAB

In order to assess the application possibilities of different biomasses, the chemical composition and fuel properties of liquid fuels, solid biofuels, biogas substrates, by-products and residues as well as their conversion products such as ashes, filter dusts and process waters are analysed in the Analytical Laboratory of the DBFZ. Analytics is carried out both according to current standards and according to problem-oriented method development or adaptation. With the existing equipment, the following parameters can be determined: pellet density, bulk density, particle size distribution, fines, abrasion resistance, calorific value, water content, volatile content, fixed, elemental and organic carbon, CHNS composition, ash content, elemental composition with respect to the main and trace elements, total sulphur and chlorine contents and concentrations of elutable components, density, viscosity, refractive index, flash point, degree of copper corrosion, acid and saponification number for glycerine and pH value. Polycyclic aromatic hydrocarbons (PAHs), fatty acid methyl esters (FAMEs) and phenols can be identified and quantified by GC analysis and the concentrations of sugars and furan derivatives determined by HPLC. A method for the determination of volatile organic hydrocarbons (BTEX) using GC is to be established in the future.

The central contact person for services is the DBFZ innovation coordinator, Romann Glowacki.

Contact

Romann Glowacki
Phone: +49 (0)341 2434-464
E-Mail: romann.glowacki@dbfz.de

Fig. 42 The DBFZ research biogas plant

10.1 RESEARCH INFRASTRUCTURE

The DBFZ conducts predominantly applied biomass research. For this purpose, the research centre has a large number of technical facilities and test beds.

For detailed information on the technical infrastructure of the DBFZ see:
www.dbfz.de/en/research/research-infrastructure

Fig. 43 New technical centre of the DBFZ (thermo-chemical conversion part) in April 2019

Tabular overview:

Department	Description	Contact
Biochemical Conversion	Research biogas plant	Ulf Müller E-Mail: ulf.mueller@dbfz.de Christian Krebs E-Mail: christian.krebs@dbfz.de
	Biogas lab	Dr. Jürgen Pröter E-Mail: juergen.proeter@dbfz.de Katrin Strach E-Mail: katrin.strach@dbfz.de
	Emission measurement	Dr. Tina Clauß E-Mail: tina.clauss@dbfz.de Torsten Reinelt E-Mail: torsten.reinelt@dbfz.de
Thermo-chemical Conversion	Combustion lab	Michael Junold E-Mail: michael.junold@dbfz.de
	Fuel conditioning lab	Claudia Kirsten E-Mail: claudia.kirsten@dbfz.de
Biorefineries	Biorefineries technical centre	André Hermann E-Mail: andre.herrmann@dbfz.de
	Engine test bed	Jörg Schröder E-Mail: joerg.schroeder@dbfz.de Thomas Hirsch E-Mail: thomas.hirsch@dbfz.de
Bioenergy Systems	Databases/Research data	Martin Bauschmann E-Mail: martin.bauschmann@dbfz.de
	Assesment methods	Stefan Majer E-Mail: stefan.majer@dbfz.de
	Potential analyses	André Brosowski E-Mail: andre.brosowski@dbfz.de
All departments	Analytical Lab	Dr. Jana Mühlenberg E-Mail: jana.muehlenberg@dbfz.de Igor Adolf E-Mail: Igor.Adolf@dbfz.de

11 ORGANISATION AND STRUCTURE

Fig. 44 The new DBFZ building in March 2019: House 1 incl. new event hall

The DBFZ was founded in Berlin on 28 February 2008 as a non-profit limited liability company against the background of the complex issues relating to the provision and use of bioenergy. The research institute belongs to the Federal Republic of Germany and is represented by the Federal Ministry of Food and Agriculture.

11.1
SCIENTFIC MISSION

"The objective of the institute is to conduct application-oriented research and development in the field of energetic and integrated use of renewable raw materials in the bioeconomy, with special consideration of innovative technologies, economic impact and environmental concerns."
(Scientific mission of the DBFZ)

The DBFZ was founded in 2008 by the former Federal Ministry of Food, Agriculture and Consumer Protection (BMELV). The aim was to establish a central research institution for all relevant fields of bioenergy research and to link the results of the very complex German research landscape in this sector. The scientific mission of the DBFZ covers technical, ecological, economic, social and energy aspects along the entire process chain, i. e. from production to provision and use of bioenergy.
The development of new processes, procedures and concepts is accompanied and supported by the DBFZ in close cooperation with partners from science and industry. At the same time, it networks closely with German public research in the agricultural, forestry and environmental sectors as well as with European and international institutions. Using this broad research background, the DBFZ also develops scientifically sound decision-making tools for policymakers.

11.2 RESEARCH DEPARTMENTS

The DBFZ has four research departments that work closely together in practice as an organisational framework for handling the numerous scientific research tasks. While the departments of biochemical conversion, thermo-chemical conversion and biorefineries mainly carry out applied research tasks, in the area of bioenergy systems potential analyses, acceptance studies and various scenarios for biomass use are developed in addition to policy advice.

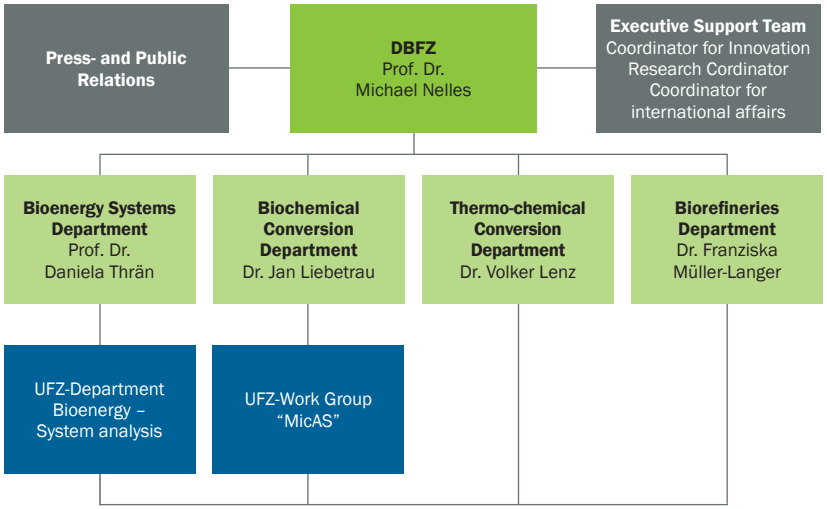


Fig. 45 The research departments of the DBFZ including the cooperation departments with the Helmholtz-Centre for environmental Research – UFZ

11.3 SUPERVISORY BOARD AND RESEARCH ADVISORY COUNCIL

The DBFZ is advised by an international research advisory council on the content of its scientific work. It consists of ten national and eight internationally renowned scientists from the field of bioenergy research. The members of the Research Advisory Council are appointed by the Supervisory Board, which is composed of representatives of the five most important federal ministries for the work of the DBFZ.

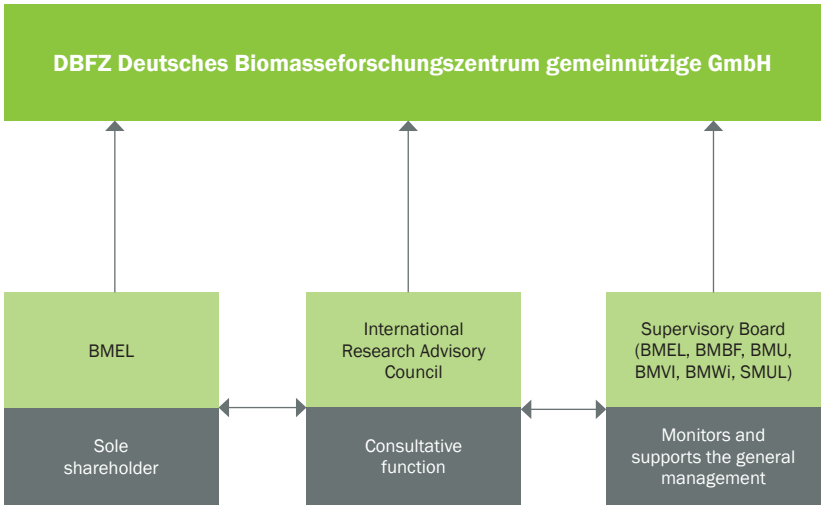


Fig. 46 The regulatory bodies of the DBFZ

THE SUPERVISORY BOARD OF THE DBFZ

The Supervisory Board, chaired by the Federal Ministry of Food and Agriculture (BMEL), takes the groundbreaking, content- and organisation-related decisions regarding the development of the DBFZ. Other members are the Federal Ministry of Education and Research (BMBF), the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU), the Federal Ministry of Transport and Digital Infrastructure (BMVI), the Federal Ministry for Economic Affais and Energy (BMWi) and the Saxon State Ministry of the Environment and Agriculture (SMUL). The Supervisory Board meets twice a year at the DBFZ.

Representatives of the Supervisory Board are the persons listed below:

(Status: 1 May 2019)

Bernt Farcke (Chairman)
Head of Department 52 “Sustainability, regrowable resources”,
Federal Ministry of Food and Agriculture (BMEL)

Deputy Director Berthold Goeke (Deputy Chairman)
Head of Department “KI I Climate Protection Policy”, Federal Ministry
for the Environment, Nature Conservation and Nuclear Safety (BMU)

Daniel Gellner
Head of Department “Agriculture and Forestry”,
Saxon State Ministry of the Environment and Agriculture (SMUL)

Dr. Karin Freier
Head of Department III B, Renewable Energies in the Electricity Sector,
Federal Ministry for Economic Affairs and Energy (BMWi)

Andrea Heyn
Head of Division, Department 7 (Provision for the Future), Division 723 “Energy”,
Federal Ministry of Education and Research (BMBF)

Birgit Breitfuß-Renner
Head of Subdepartment G2, Environment and Noise Control,
Federal Ministry of Transport and Digital Infrastructure (BMVI)

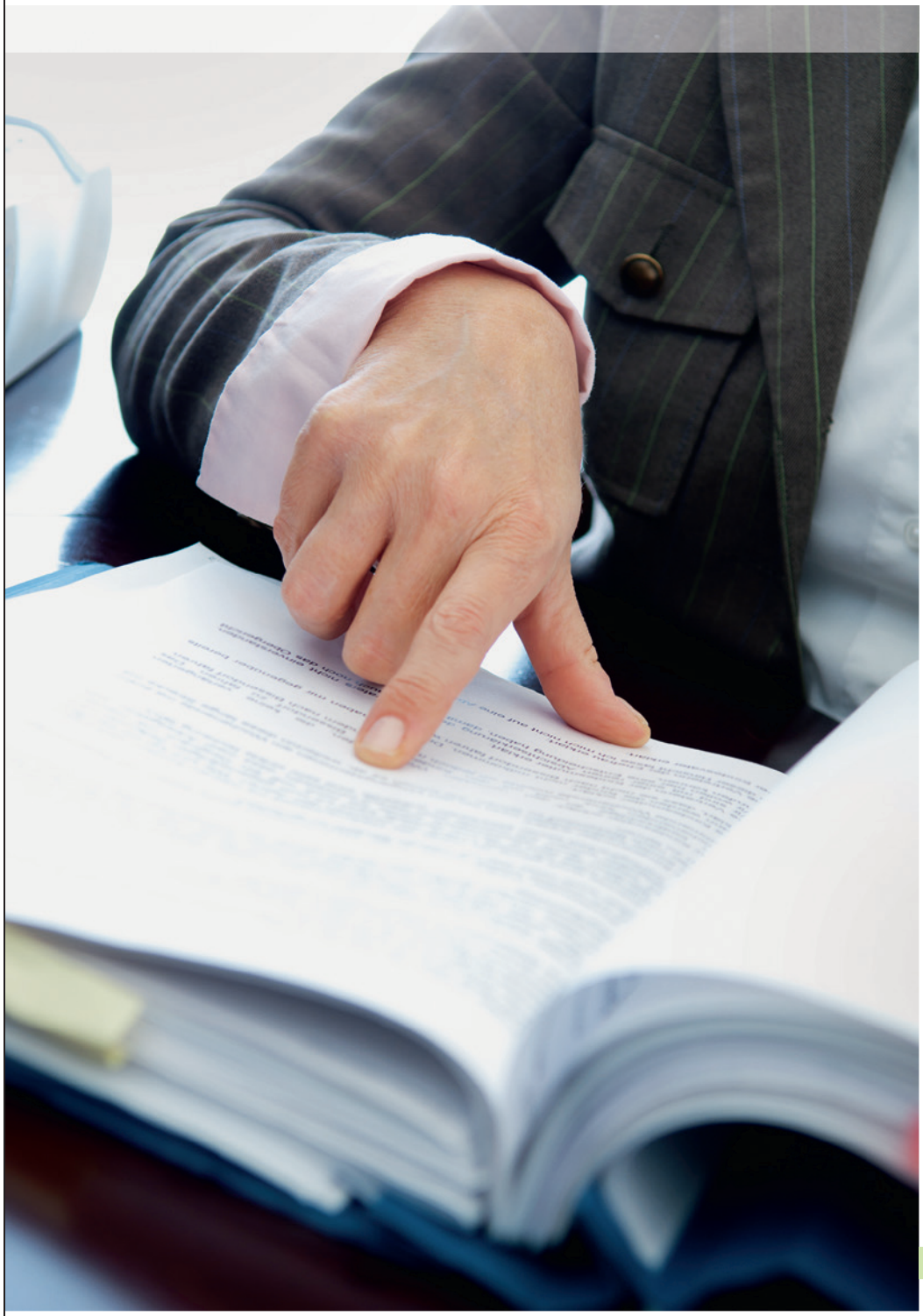


Fig. 47 The Research Advisory Council of the DBFZ (18 September 2018)

THE RESEARCH ADVISORY COUNCIL

The Research Advisory Council, made up of nationally and internationally renowned bioenergy experts, advises the DBFZ on the orientation of its scientific activities. This 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 Research Advisory Council meets once a year at the DBFZ.

Tab. 3 Representatives of the Research Advisory Council are the following persons (as of 1 February 2019)

Member	Organisation	City and Country
Barbosa, PhD Maria	Microalgal Biotechnology AlgaePARC, Wageningen University	Wageningen (Netherlands)
Bauen, Dr. Ausilio	Imperial College London	London (England)
Bill, Prof. Dr. Ralf	University of Rostock – Faculty of Agricultural and Environmental Sciences	Rostock (Germany)
Chiaramonti, Prof. Dr. David (Chairman)	Renewable Energy Consortium R&D, University of Florence	Florenz (Italy)
Christen, Prof. Dr. Olaf	Martin-Luther-University, Halle-Wittenberg	Halle/Saale (Germany)
Dach, Prof. Dr. Jacek	Poznań University of Life Sciences	Poznań (Poland)
Dong, Prof. Dr. Renjie	China Agricultural University (CAU)	Beijing (China)
Dornack, Prof. Dr. Christina	Technical University Dresden – Institute of Waste Management and Circular Economy	Dresden (Germany)
Hartmann, Dr. Hans	Technology- and Promotion Centre at the Regrowable Ressource Competence Centre (TFZ)	Straubing (Germany)
Hirth, Prof. Dr. Thomas	Karlsruhe Institute of Technology (KIT); University of Stuttgart – Faculty of Energy-, Process- and Bio-Engineering	Stuttgart (Germany)
Kemfert, Prof. Dr. Claudia	German Institute for Economic Research (DIW Berlin)	Berlin (Germany)
Kruse, Prof. Dr. Andrea	University of Hohenheim	Stuttgart (Germany)
Meyer, Prof. Dr. Bernd	Institute of Energy Process Engineering and Chemical Engineering, TU Bergakademie Freiberg	Freiberg (Germany)
Moreira, Dr. José Roberto	Universidade de São Paulo, Instituto de Eletrotécnica e Energia	São Paulo (Brazil)
Serrano, Prof. Dr. David	IMDEA Energy Institute	Madrid (Spain)
Teutsch, Prof. Dr. Georg	Helmholtz-Centre for Environmental Research – UFZ	Leipzig (Germany)
Thiffault, PhD Evelyne	University Laval Canada Québec	Québec (Canada)
Walther, Prof. Dr. Grit	RWTH Aachen – Faculty of Economic Sciences	Aachen (Germany)

11.4
FINANCE AND PERSONNEL

The DBFZ was founded in the legal form of a non-profit limited liability company (gGmbH) in order to make flexible and transparent use of public research funding and to be able to conduct research and provide advice on behalf of third parties. The DBFZ is financed by institutional funding from the Federal Ministry of Food and Agriculture as well as by project grants and research contracts acquired through competition.
In 2018, the DBFZ was financed with 21.1 million euros by the BMEL. In addition, approximately 7.3 million euros of third-party funds were raised (see Figure 48). On the expenditure side, the investments due to the new building project were clearly in the foreground with 72,5 %. Further expenses were distributed among personnel expenses at 19.4 % and material expenses at 8.1 %.

PERSONNEL

In 2018, an average of 183 employees under collective agreements were on the payroll at the end of the year at the DBFZ. Including the executive support team as well as press and public relations, 142 of these employees worked in the scientific/technical area and 41 in administration (including property management and IT).
In 2018 a large number of work on the DBFZ could be supervised. A total of 25 internships and student research projects as well as 53 bachelor, master and diploma theses were supervised. In addition, a total of 40 guest scientists, foreign interns and scholarship holders worked at the DBFZ last year.

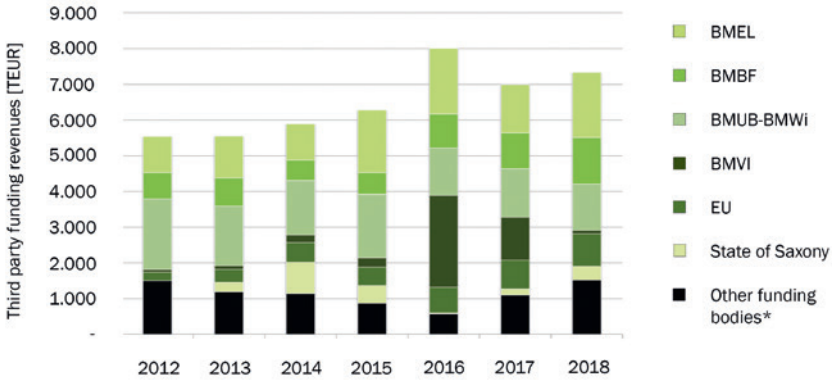


Fig. 48 Overview of external funding income for 2012–2018 (preliminary figures) (* Contract research and services for private and public clients)

Fig. 49 Workforce development at the DBFZ (2008–2018)

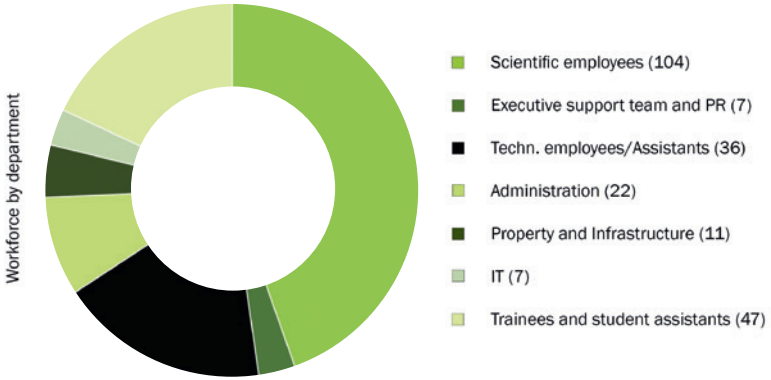


Fig. 50 Breakdown of the DBFZ workforce by departments (as per 31 December 2018)

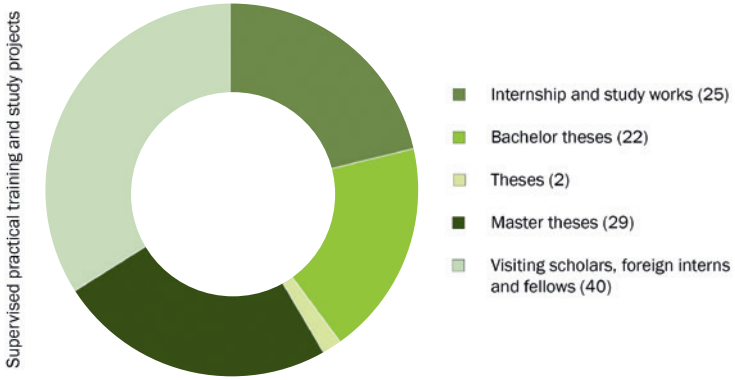


Fig. 51 Overview of study projects supervised at the DBFZ (as per 31 December 2018)

TRAINEES AT THE DBFZ

The DBFZ has been a training company since it was founded in 2008. During this time, a total of 23 trainees and retrainees have successfully completed their training. In 2018, ten trainees/retrainees were undergoing training in the areas of “Event Management Assistant”, “Office Management Assistant”, “Electronics Technician for Industrial Engineering”, “Personnel Services Management Assistant” and “Chemical Laboratory Assistant” (new since 2018) as well as four BA students in the areas of “Computer Science”, “Controlling” and “Biotechnology”.

11.5 SCIENTIFIC BODIES, ADVISORY BOARDS AND COMMITTEES

Right from the start, the DBFZ strives for an intensive transfer of knowledge with other institutions and the scientific community. This is part of the objective of applied research and the exploitation of research results. The scientists of the DBFZ are represented in the most diverse scientific committees, advisory boards, working groups, networks and committees as well as (guest) professors at home and abroad.

SCIENTIFIC COMMITEES/EXECUTIVE BOARDS/DIRECTORATES (SELECTION)

Committee/Event	Role	Country	Since
6th International Conference on Solid Waste Management	Member of the Scientific Committee	India	2014
Bioeconomy Council – Independent Advisory Committee for the German Government	Member	Germany	2012
Biomass to Power and Heat	Member of the Programme Committee	Germany	2014
BMBF BioEconomy Cluster	Member of the Executive Board	Germany	2012
Bundesverband Bioenergie e. V. (BBE)	Member of the Advisory Board	Germany	2012
Chinese-German Centre for Environmental Technology and Knowledge Transfer (CETK) of Anhui Provence	Director	China	2005
Competence Centre for Biomass Use Schleswig-Holstein	Member of the Scientific Advisory Board	Germany	2013

Committee	Role	Country	Since
DGAW – Deutsche Gesellschaft für Abfallwirtschaft e. V.	Member of the Executive Board	Germany	2014
Economic and Scientific Strategy Council Mecklenburg Western-Pomerania	Speaker for the Future Field of Energy	Germany	2014
Energie und Umweltstiftung Leipzig	Member of the Board of Trustees	Germany	2013
Energy Council Saxony, state-level	Member of the Committee of Experts	Germany	2012
Energy, Sustainability and Society	Editor in Chief	International	2017
European Biogas Association (EBA)	Member of the Scientific Advisory Board	Belgium	2017
Export Initiative RETech “Recycling & Waste Management in Germany” of the German Federal Government (BMU, BMWi, BMZ)	Member of the Executive Board and Head of the China Working Group	Germany	2014
German-Chinese Centre in Anhui Province	Member of the Executive Board	China	2013
German Doctoral Colloquium Bioenergy	Member of the Programme Advisory Board	Germany	2018
Helmholtz Centre for Enviornmental Research – UFZ	Member of the Scientific Advisory Board	Germany	2013
IEA Bioenergy, Task 37 “Energy from Biogas”	Member	International	2016
IEA Bioenergy, Task 39 “Commercializing Conventional & Advanced Liquid Biofuels from Biomass”	German Representative	International	2014
IEA Bioenergy, Task 40 “Sustainable International Bionenergy Trade – Securing Supply and Demand”	German Representative	International	2010
IEA Bioenergy Task 44 “Flexible bioenergy and system integration”	German Representative	International	2019
IEA Bioenergy Task 45 “Climate and sustainability effects of bioenergy within the broader bioeconomy”	German Representative	International	2019
Institute for Non-Classic Chemistry at the University of Leipzig (INC)	Member of the Advisory Board	Germany	2013
Ministry of Agriculture, Environment and Consumer Protection, Mecklenburg Western-Pomerania	Member of the Scientific Advisory Board	Germany	2017
Research Steering Group for the Federal Ministry of Food and Agriculture (BMEL)	Member	Germany	2012

Committee	Role	Country	Since
Scientific Journal “Müll & Abfall”	Member of the Advisory Board	Germany	2007
Scientific Journal “Waste Management”	Co-publisher	International	2008
State Energy Council Mecklenburg Western-Pomerania	Member and Head of the F&L Working Group	Germany	2012
Steering Committee for the 2nd Phase of the 1st Federal Immission Control Act	Member and Head of the Technology Working Group	Germany	2014
The Association of German Engineers (VDI), District Association for Mecklenburg Western-Pomerania	Member of the Directives Committee	Germany	2013
The Research Association for Diesel Emission Control Technologies (FAD) e. V.	Member of the Advisory Board	Germany	2013
ZIM-Network – Application and Research Network “Radiowave Technology” (RWTec)	Member of the Advisory Board	Germany	2014

PROFESSORSHIPS

Committee	Role	Country	Since
College of Energy and Environment, Shenyang Aerospace University	Professorship	China	2011
Environmental Economics at the Department of Industrial Engineering and Management, Ernst Abbe University of Applied Sciences (EAH), Jena	Professorship	Germany	2016
Faculty of Agricultural and Environmental Sciences, University of Rostock	Professorship	Germany	2006
Faculty of Environmental and Biotechnology Hefei University of Technology	Professorship	China	2002
Faculty of Environmental and Biotechnology Hefei University of Technology	Professorship	China	2018
Institute for Infrastructure and Resource Management, Chair of Bioenergy Systems, University of Leipzig	Professorship	Germany	2011
Institute of Renewable Energies, China Petroleum University Beijing	Professorship	China	2014

WORKING GROUPS

Committee	Role	Country	Since
Ad Hoc Working Group of the 1st Federal Immission Control Act, Federal Environmental Agency (UBA)	Member	Germany	2012
European Technology and Innovation Platform (EBTP) Bioenergy	Member, WG1 Biomass availability & WG4 Policy and Sustainability	EU	2008
German RETech Partnership ""Recycling & Waste Management in Germany"	Member of the International (Emerging and Developing Countries) Working Group	Germany	2017
Horizontal Working Group: 100 % RE, Individually Heated & Cooled Buildings	Member	EU	2019
Method harmonization, BMWi Funding programme "Biomass Energy Use"	Member	Germany	2018
Platform for Renewable Heating and Cooling (ETP-RHC)	RHC-ETIP Steering Committee Member	Belgium	2015
ProcessNet – Sustainable Production, Energy and Resources (SuPER), "Energieverfahrenstechnik"	Member	Germany	2014
ProcessNet – Sustainable Production, Energy and Resources (SuPER), "Hochtemperaturtechnik"	Member of the Advisory Board	Germany	2015
ProcessNet - Sustainable Production, Energy and Resources (SuPER), "Integrierte stoffliche und energetische Nutzung von Biomasse"	Member	Germany	2013
ProcessNet- Sustainable Production, Energy and Resources (SuPER), "Alternative Brenn- und Kraftstoffe"	Member	Germany	2015
Research Association Think Tank, Helmholtz-Association UFZ	Member	Germany	2014
Working Group 2 – Alternative Propulsion Systems and Fuels for Sustainable Mobility (Focus Group 3 "Alternative Fuels for Combustion Engines"), National Platform Future of Mobility (NPM)	Member	Germany	2019

Committee	Role	Country	Since
Working Group "Bioökonomie der strukturbezogenen Kommission Technikbewertung und -gestaltung" of the Saxon Academy of Sciences at state level	Member	Germany	2014
Working Group "Blauer Engel", Environmental Action Germany (DUH)	Advisory Role	Germany	2014
Working Group "Bibliothekskonzepte" of the BMEL Departmental Research Institutes	Member	Germany	2016
Working Group "OpenAgrar" of the BMEL Departmental Research Institutes	Member	Germany	2016
Working Group "Ringversuch", Association for Technology and Structures in Agriculture (KTBL)	Member	Germany	2018
Working Committee "Stoffspezifische Abfallbehandlung", ASA e. V.	Member of the Advisory Board	Germany	2009
Working Group "Wärme" of the Funding Programme "Biomass Energy Use"	Member	Germany	2017

NETWORKS/ASSOCIATIONS/PLATFORMS (A SELECTION)

Committee	Role	Country	Since
BioEconomy e. V.	Member	Germany	2012
Combustion Institute (German section)	Member	Germany	2019
DECHEMA Gesellschaft für Chemische Technik und Biotechnologie e. V.	Member of the Advisory Board	Germany	2015
Dena Biogaspartner (German Energy Agency)	Member	Germany	2009
Energy Committe of Leipzig Chamber of Industry and Commerce (IHK)	Member	Germany	2016
Energy Raw Materials Network (ERN)	Founding Member	Germany	2012
Energy Saxony – the Energy Cluster for Saxony (joint initiative)	Member	Germany	2010
European Bioeconomy Stakeholders' Panel	Member	Belgium	2016
Forschungsnetzwerk Biokraftstoffe (ForNeBIK)	Member	Germany	2011
KUP-Network	Member	Germany	2012
Netzwerk Energie und Umwelt e. V. (NEU e. V.) – Bioenergy Cluster	Member of the Advisory Board	Germany	2014
RAL – Bundesgütegemeinschaft Brennholz	Member	Germany	2016
Renewable Energy Research Association FVEE (Forschungsverbund Erneuerbare Energien)	Member of the FVEE Directorate, Speaker (2018)	Germany	2015
Sustainable Development Solutions Network (SDSN)	Member of the Extended Steering Committee	Germany	2016
The Association of German Engineers (VDI)	Member of the Executive Board	Germany	2008
VGB PowerTech e. V.	Member	Germany	2014

DIN/ISO – STANDARDS COMMITTEES (A SELECTION)

Committee	Role	Country	Since
CEN/TC 454 Algae and algae products	Chairman WG3 "Productivity"	Belgium	2016
Dechema, Division "Measurement and Control in Biotechnology"	Member	Germany	2018
DIN: NA 062-05-82 AA Working Committee "Solid Biofuels"	Expert	Germany	2016
DIN: 33999 Working Committee "Dust separator test"	Member	Germany	2013
Institut für Normung e. V./ German Institute for Standardization e. V.	Member	Germany	2016
ISO TC 238 WG7 + WG4 + WG1 + WG2 + WG4 + WG5	Representative WG	Switzerland	2014
ISO TC 255 "Biogas"	Member	Germany	2015
NA 062-05-82 AA, Working Committee "Solid Biofuels"	Member	Germany	2019
VDI 3461 "Emission reduction of thermochemical gasification of biomass in combined heat and power generation"	Member	Germany	2012
VDI 3670 "Exhaust gas cleaning – Downstream dust reduction devices for small and medium-sized solid fuel combustion plants"	Member	Germany	2014
VDI 4630 "Fermentation of organic substances, substrate characterisation, sampling, substance data collection, fermentation experiments"	Member of Directives Committee	Germany	2013
VDI/DIN: AG "Production of biocarbonisates", Air Pollution Control Commission	Member	Germany	2013

GENERAL MANAGEMENT

Scientific Managing Director

Prof. Dr. mont. Michael Nelles
Phone: +49 (0)341 2434-112
E-Mail: michael.nelles@dbfz.de

Administrative Managing Director

Dipl.-Kfm. (FH), LL. M. Daniel Mayer
Phone: +49 (0)341 2434-112
E-Mail: daniel.mayer@dbfz.de

EXECUTIVE SUPPORT TEAM

Coordinator for Innovation

Romann Glowacki
Phone: +49 (0)341 2434-464
E-Mail: romann.glowacki@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

Research Coordinator

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

HEADS OF THE RESEARCH FOCUS AREAS

Systemic Contribution of Biomass

Prof. Dr.-Ing. Daniela Thrän
Phone: +49 (0)341 2434-435
E-Mail: daniela.thraen@dbfz.de

Anaerobic Processes

Dr.-Ing. Jan Liebetrau
Phone: +49 (0)341 2434-716
E-Mail: jan.liebetrau@dbfz.de

Processes for Chemical Bioenergy Sources 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

Dr. rer. nat. Ingo Hartmann
Phone: +49 (0)341 2434-541
E-Mail: ingo.hartmann@dbfz.de

12 PROJECTS AND PUBLICATIONS

The most important projects and publications from 2018 are listed to show the current working areas of the DBFZ. The language of the title reflects the language of the project/publication.

PROJECTS (SELECTION)

Federal Ministry of Food and Agriculture (BMEL)

AG Biomassereststoffmonitoring, Bundesministerium für Ernährung und Landwirtschaft/Fachagentur Nachwachsende Rohstoffe e. V., 01.07.2016–31.03.2019 (FKZ: 22019215)

BE20PLUS – BIO E Bioenergie – Potentiale, Langfristperspektiven und Strategien für Anlagen zur Stromerzeugung nach 2020, Bundesministerium für Ernährung und Landwirtschaft/Fachagentur Nachwachsende Rohstoffe e. V., 01.11.2017–31.10.2019 (FKZ: 22404016)

BetEmBGA – Betriebsbedingte Emissionen an Biogasanlagen, Bundesministerium für Ernährung und Landwirtschaft/Fachagentur Nachwachsende Rohstoffe e. V., 01.02.2015–31.10.2018 (FKZ: 22020313)

BiogasFingerprint – Verbundvorhaben: Flexible Steuerung der Biogasproduktion mittels bioinformatischer Populationsanalyse, Teilvorhaben 2: Flexible Steuerung eines Pfropfenstromfermenters mit nachgeschaltetem Rührkesselfermenter, Bundesministerium für Ernährung und Landwirtschaft/Fachagentur Nachwachsende Rohstoffe e. V., 01.02.2015–30.04.2018 (FKZ: 22009114)

BioHum – Klimaschutzorientierte Bioabfallverwertung für die Landwirtschaft, Bundesministerium für Ernährung und Landwirtschaft/Projektträger Bundesanstalt für Landwirtschaft und Ernährung, 01.10.2018–30.11.2021 (FKZ: 281B303316)

Bio-Mini – Verbundvorhaben: Entwicklung einer marktnahen emissionsarmen Biomasse-Kleinstfeuerung für Niedrigenergie- und Passivhäuser; Teilvorhaben 1: Feuerungstechnische Entwicklung (Gesamtkonzept) und Charakterisierung einer Biomasse-Kleinstfeuerung für Niedrigenergie- und Passivhäuser, Bundesministerium für Ernährung und Landwirtschaft/Fachagentur Nachwachsende Rohstoffe e. V., 01.10.2017–30.09.2019 (FKZ: 22025816)

BioRexWiVe – Verbundvorhaben: Entwicklung und Demonstration eines bio-kraftstoffbetriebenen Range-Extender-Systems zur Reichweitenverlängerung elektrisch betriebener Nutzfahrzeuge im Wirtschaftsverkehr; Teilvorhaben 1: Biokraftstoffe, Bundesministerium für Ernährung und Landwirtschaft/Fachagentur Nachwachsende Rohstoffe e. V., 01.12.2016–31.08.2018 (FKZ: 22401315)

BKSQuote – Untersuchungen zur Ausgestaltung der Biokraftstoffgesetzgebung, Bundesministerium für Ernährung und Landwirtschaft/Fachagentur Nachwachsende Rohstoffe e. V., 01.06.2016–31.03.2019 (FKZ: 22401416)

BMPIII – Biogas-Messprogramm III: Faktoren für einen effizienten Betrieb von Biogasanlagen – Teilvorhaben 1: Energiebilanzierung, Flexibilisierung, Ökonomie, Bundesministerium für Ernährung und Landwirtschaft/Fachagentur Nachwachsende Rohstoffe e. V., 01.12.2015–30.11.2019 (FKZ: 22403515)

ChinaRes – Energetische Nutzung landwirtschaftlicher Reststoffe in Deutschland und China; Teilvorhaben 1: Erarbeitung von Konzepten für zukünftige Biogasanlagenbetreiber, Bundesministerium für Ernährung und Landwirtschaft/Fachagentur Nachwachsende Rohstoffe e. V., 15.08.2017–31.10.2020 (FKZ: 22025816)

EvEmBi – Bewertung und Minderung von Methanemissionen aus verschiedenen europäischen Biogasanlagen; Teilvorhaben 1: Quantifizierung und Minderung von Methanemissionen aus landwirtschaftlichen Biogasanlagen und Wissenstransfer in die Praxis, Bundesministerium für Ernährung und Landwirtschaft/Fachagentur Nachwachsende Rohstoffe e. V. (FNR), 01.04.2018–31.03.2021 (FKZ: 22407917)

HYTORF – Prüfung und Bewertung der hydrothermalen Carbonisierung von Landschaftspflegematerial zur Herstellung von qualitativ hochwertigem Torfersatz, Bundesministerium für Ernährung und Landwirtschaft, Fachagentur Nachwachsende Rohstoffe e. V., 01.11.2017–31.10.2018 (FKZ: 22009916)

IraSIL – Untersuchung des Ascheverhaltens während der Thermo-chemischen Konversion vorbehandelter, siliziumreicher Biomassesortimente zur Strom- und Wärmeerzeugung und Nutzung der dabei anfallenden Aschen zur Gewinnung anorganischer Gerüstverbindungen mit vielfältigen Anwendungsmöglichkeiten, Bundesministerium für Ernährung und Landwirtschaft/Bundesanstalt für Landwirtschaft und Ernährung, 01.01.2018–31.12.2020 (FKZ: 2816DOKI03)

LF Flex – Leitfaden Flexibilisierung der Strombereitstellung von Biogasanlagen, Bundesmi-

nisterium für Ernährung und Landwirtschaft/ Fachagentur Nachwachsende Rohstoffe e. V., 01.11.2017–30.04.2019 (FKZ: 22402615)

MakroBiogas – Analyse der gesamtökonomischen Effekte von Biogasanlagen – Wirkungsabschätzung des EEG, Bundesministerium für Ernährung und Landwirtschaft/Fachagentur Nachwachsende Rohstoffe e. V., 01.10.2017–31.12.2018 (FKZ: 22406717)

MetHarmo – ERA-NET Bioenergy: Europäische Harmonisierung der Methoden zur Quantifizierung von Methanemissionen aus Biogasanlagen, ERANET/Fachagentur Nachwachsende Rohstoffe e. V., 01.03.2016–28.02.2018 (FKZ: 22403215)

OptiFlex – Optimierung des Betriebs und Design von Biogasanlagen für eine bedarfsgerechte, flexibilisierte und effiziente Biogasproduktion unter Berücksichtigung der Prozessstabilität als Post-EEG Strategie, Bundesministerium für Ernährung und Landwirtschaft/Fachagentur Nachwachsende Rohstoffe e. V., 01.10.2017–30.09.2020 (FKZ: 22401717)

PEGGÜ – Studie zu den Perspektiven für die energetische Güllenutzung, Bundesministerium für Ernährung und Landwirtschaft/Fachagentur Nachwachsende Rohstoffe e. V. (Inhouse), 08.08.2018–31.03.2019

REFAWOOD – ERA-NET Bioenergy: Ressourceneffiziente Brennstoffadditive zur Verringerung der verbrennungstechnischen Probleme bei der Rest- und Gebrauchtholzverbrennung, ERANET/Fachagentur Nachwachsende Rohstoffe e. V., 01.04.2016–31.03.2019 (FKZ: 22404215)

STM-DE – Auktionsmodell für eine nachhaltige Nutzung von Stroh in Deutschland, Bundesministerium für Ernährung und Landwirtschaft/ Fachagentur Nachwachsende Rohstoffe e. V., 01.10.2017–30.04.2019 (FKZ: 22027216)

SubEval – Verbundvorhaben: Bewertung von Substraten hinsichtlich des Gasertrags – vom Labor zur großtechnischen Anlage; Teilvorhaben 1: Durchführung der Labor- und Praxisversuche, Bundesministerium für Ernährung und Landwirtschaft/Fachagentur Nachwachsende Rohstoffe e. V., 01.10.2015–31.01.2019 (FKZ: 22034614)

Vabiflex – ERA-Net-Verbundvorhaben: Wertoptimierte Nutzung von Biomasse in einer flexiblen Energieinfrastruktur; Teilvorhaben 1: Theoretische und experimentelle Untersuchungen, Bundesministerium für Ernährung und Landwirtschaft/Fachagentur Nachwachsende Rohstoffe e. V., 01.09.2018–31.08.2020 (FKZ: 22408317)

Federal Ministry of Education and Research (BMBF)

BBCHEM – Aufwertung von kohlehydrathaltigen Stoffströmen zu bio-basierten Chemikalien. Teilvorhaben 2: Hydrothermale Umsetzung, Bundesministerium für Bildung und Forschung/ Projektträger Jülich, 01.03.2016–28.02.2018 (FKZ: 033RK031B)

BEPASO – Bioökonomie 2050: Potenziale, Zielkonflikte, Lösungsstrategien, Bundesministerium für Bildung und Forschung/Projektträger Jülich, 01.12.2016–30.11.2019 (FKZ: 031B0232B)

BioFAVOR 2 – Entwicklung und Evaluierung einer mobilen Demonstrationsanlage für die dezentrale Verwertung menschlicher Fäkalien, Bundesministerium für Bildung und Forschung/ Projektträger Jülich, 01.04.2018–31.03.2020 (FKZ: 031B0483E)

BIOKOFF – Bio-basierte Kohlenstoffe als funktionale Füllstoffe in Polymermischungen (kmu-innovativ), Bundesministerium für Bildung und Forschung/Projektträger Jülich, 01.09.2018–31.08.2020 (FKZ: 03XP0160D)

BIONET – Int. Ausschreibung zur Ausarbeitung und Einreichung von 3 EU-Anträgen zum thema BioE und BioÖk, Bundesministerium für Bildung und Forschung/Deutsches Zentrum für Luft- und Raumfahrt, 01.07.2016–30.06.2018 (FKZ: 01DS16030)

BIOSOL – ERA-NET MED: Entwicklung und Demonstration eines hybriden CSP-Biomassevergaser Systems, ERA-NET MED/Bundesministerium für Bildung und Forschung/Deutsches Zentrum für Luft- und Raumfahrt, 01.10.2016–30.09.2019 (FKZ: 01DH16006A)

CapAcidy – Bio-based Carboxylid acid for chemical industry made of anaerobic fermentation, Bundesministerium für Bildung und Forschung/ Projektträger Jülich, 01.07.2017–30.09.2019 (FKZ: 031B0389A)

CarBioPhos – Entwicklung eines integrierten Verfahrens zur Carbonisierung von Klärschlamm, Erzeugung von Biogas und Rückgewinnung von Phosphor, Teilprojekt 2, Bundesministerium für Bildung und Forschung/Karlsruhe Institut für Technologie, 01.07.2018–30.06.2020 (FKZ: 031B0483E)

CAROFIL – Entwicklung magnetisierbarer Filterkohlen zur hochselektiven Abscheidung von Partikeln, Bundesministerium für Bildung und Forschung/VDI-VDE-IT, 15.07.2017–14.07.2019 (FKZ: 03VNE1031C)

HTKkChem – Umwandlung von wasser- und kohlenhydratreichen Reststoffen der Biomasseverarbeitung in Chemikalien und Kraftstoffkomponenten durch Hydrothermale Prozesse, Bundesministerium für Bildung und Forschung/ Projektträger Jülich, 01.11.2018–30.04.2021 (FKZ: 031B0674A)

HYBE – ERA-NET MED: Entwicklung einer innovativen Hybridanlage für erneuerbare Energien basierend auf einer Kombination von Biomasse und Solarenergie und Entwicklung von fundierten Kenntnissen als Voraussetzung zur Anwendung in Ägypten und Marokko, ERA-NET MED/ Bundesministerium für Bildung und Forschung/ Deutsches Zentrum für Luft- und Raumfahrt, 01.10.2016–30.09.2018 (FKZ: 01DH16005C)

KomBiChem^{PRO} – Demonstrationsvorhaben: Fein- und Plattformchemikalien aus Holz durch kombinierte chemisch-biologische Prozesse – Teilvorhaben B, Bundesministerium für Bildung und Forschung/Projektträger Jülich, 15.11.2015–14.05.2018 (FKZ: 031B0083B)

MaiD(II) – Entwicklung eines auf Maisspindeln basierenden Einblasdämmstoffes, Bundesministerium für Bildung und Forschung/Projektträger Jülich, 15.12.2017–14.12.2019 (FKZ: 031B480A)

MKM2 – Entwicklung eines Mehrkammerbiomeilers zur effizienten Wärme- und Komposterzeugung, Bundesministerium für Bildung und Forschung/Projektträger Jülich, 01.04.2018–31.03.2020 (FKZ: 031B0492A)

NEUWERT – stadtPARTHEland, Bundesministerium für Bildung und Forschung/Projektträger Jülich, 01.09.2014–31.08.2019 (FKZ: 033L119E)

PhotoBioSense – Dual getriebener photonischer Sensor zur Überwachung von Biogasanlagen – Teilvorhaben: Validierung des Demonstrators, Bundesministerium für Bildung und Forschung/ VDI Technologiezentrum GmbH, 01.01.2016–31.12.2018 (FKZ: 13N13827)

RenewVal – ERA-NET-Verbundprojekt: Lokale nachhaltige Versorgung mit erneuerbarer Energie für gefährdete Gemeinden in ariden und semi-ariden Mittelmeerzonen; Teilvorhaben: DBFZ, Bundesministerium für Bildung und Forschung/Deutsches Zentrum für Luft- und Raumfahrt, 01.05.2018–31.08.2020 (FKZ: 01DH17063B)

SchlauF2 – Entwicklung eines geotextilen, kontinuierlichen, mehrjährig verwendbaren Schlauchfermentierungsverfahrens für TS-arme Biomassen zum automatisierbaren Einsatz für Biogasanlagen, Bioraffinerien und im Tierfutterbereich zur Emissionsminderung, Ressourcenschonung und Kostensenkung, Bundesministerium für Bildung und Forschung/ Projektträger Jülich, 01.09.2018–31.08.2020 (FKZ: 031B0578A)

SYMOBIO – Systemisches Monitoring und Modellierung der Bioökonomie, Bundesministerium für Bildung und Forschung/Projektträger Jülich, 01.03.2017–29.02.2020 (FKZ: 031B0281C)

ZEBS – Verbundprojekt: Abgasreinigungsanlage für emissionsfreie Biomasseöfen; Teilvorhaben: DBFZ, Bundesministerium für Bildung und Forschung/Deutsches Zentrum für Luft- und Raumfahrt, 01.09.2017–31.05.2019

Federal Ministry of Transport and Digital Infrastructure (BMVI)

DEMO-SPK – Research and Demonstration Project on the Use of Renewable Kerosene at Airport Leipzig/Halle, Bundesministerium für Verkehr und digitale Infrastruktur (Inhouse), 04.11.2016–30.04.2019

OpenGeoEdu – Offene Daten für Lehre und Forschung in raumbezogenen Studiengängen; Teilvorhaben e-Learning: Räumliche Verteilung von biogenen Ressourcen, Bundesministerium für Verkehr und digitale Infrastruktur/VdI/VDE/ IT + TÜV Rheinland, 01.05.2017–30.04.2020 (FKZ: 19S2007D)

waste2wave – Forschungs- und Demonstrationsvorhaben Bioressourcen und Wasserstoff zu Methan als Kraftstoff – Konzeptionierung und Realisierung einer Anlage im Pilotmaßstab, Bundesministerium für Verkehr und digitale Infrastruktur (Inhouse), 01.09.2018–31.12.2021

Federal Ministry for Economic Affairs and Energy (BMWi)/Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMUB/BMU)

AGRARSIL – Herstellung hochwertiger poröser Silikate und Wassergläser durch kombinierte stoffliche und energetische Verwertung verschiedener SiO2-angereicherter Agrarreststoffe, Bundesministerium für Wirtschaft und Energie/Arbeitsgemeinschaft industrieller Forschungsvereinigungen "Otto von Guericke" e.V., 01.04.2015–30.06.2018 (FKZ: KF2028019ST4)

Bio2Geo – Entwicklung und Demonstration eines innovativen ökologischen Hybridkraftwerks für die Kopplung von Bioenergie mit Geothermie zur Versorgung unterschiedlicher Abnehmerstrukturen. Teilvorhaben: Gesamtheitliche Systemanalyse mit Fokus auf ökonomische Aspekte des Anlagenbetriebs, Bundesministerium für Wirtschaft und Energie/Projektträger Jülich, 01.10.2018–31.03.2021 (FKZ: 03ET1593B)

Bioplan W – Systemlösungen Bioenergie im Wärmesektor im Kontext zukünftiger Entwicklungen, Bundesministerium für Wirtschaft und Energie/Projektträger Jülich, 01.08.2016–31.03.2019 (FKZ: 03KB113A)

Calgonit – Entwicklung biogastoleranter Reinigungs- und Desinfektionsmittel zum Einsatz auf Agrarbetrieben mit Nutztierhaltung; Entwicklung eines stabilen Biogasprozesses auf Güllebasis unter Einwirkung von Stall- und Melkanlagen-Reinigungs- und Desinfektionsmitteln und zugehörigem internen Prüfstandard/Testverfahrens, Bundesministerium für Wirtschaft und Energie/Arbeitsgemeinschaft industrieller Forschungsvereinigungen, 01.07.2018–31.10.2020 (FKZ: ZF4077205RH8)

CIP – Entwicklung einer kostengünstigen Wertschöpfungskette für biobasierte Olefine und Komplexnährmedien auf Basis von Insektenbiomasse für die industrielle Anwendung, Bundesministerium für Wirtschaft und Energie/Projektträger Jülich, 01.10.2017–31.12.2019 (FKZ: 031B0338A)

Dampf-KWK – Entwicklung eines Klein-KWK-Dampfmotors zur Nachrüstung von Feuerungsanlagen im mittleren Leistungsbereich, Bundesministerium für Wirtschaft und Energie/Projektträger Jülich, 01.07.2016–30.06.2019 (FKZ: 03KB118A)

EIV – Begleitforschung Energiewende im Verkehr – Teilvorhaben: Ermittlung von Rohstoffpotentialen strombasierter Biokraftstoffoptionen und ökologische Bewertung von biokraftstoffbasierten Referenzszenarien, Bundesministerium für Wirtschaft und Energie/Projektträger Jülich, 01.06.2018–31.05.2022 (FKZ: 03EIV116E)

ELIRAS – Entwicklung eines Leitfades zur Auswahl von standortspezifisch angepassten Rühr- und Substrataufschlussverfahren für Biogasanlagen, Bundesministerium für Wirtschaft und Energie/Projektträger Jülich, 01.01.2015–31.06.2018 (FKZ: 03KB106)

GASASH – Thermo-chemische Konversion von Reststoffen in einem Vergaser-BHKW mit gekoppelter Aschegewinnung; Teilvorhaben: Untersuchungen zur Produktgasqualität, den BHKW-Emissionen, Emissionsminderungsmaßnahmen und der Ascheverwertung, Bundesministerium für Wirtschaft und Energie/Projektträger Jülich, 01.09.2018–31.08.2020 (FKZ: 03KB139A)

MiniGas – Optimierung u. Validierung v. Verfahren zur kombinierten Reduktion von Feinstaub u. sauren Schadgasen an Biomassefeuerungen; Teilvorhaben: Experimentelle Untersuchungen zur Kombination von SCR- u. Precoatverfahren an einem Gewebefilter, Bundesministerium für Wirtschaft und Energie/Projektträger Jülich, 01.09.2017–31.08.2020 (FKZ: 03KB131B)

MoBiFuels – Analyse und Beseitigung von Markthemmnissen von technisch modifizierten Bioenergieträgern, Bundesministerium für Wirtschaft und Energie/Projektträger Jülich, 01.11.2018–31.10.2021 (FKZ: 03KB136A)

NovoHTK – Vergärung von Hühnertrockenkot – Verfahrensentwicklung im Labormaßstab, Bundesministerium für Wirtschaft und Energie/Projektträger Jülich, 01.09.2018–31.08.2021 (FKZ: 03KB137A)

OptiMand – Optimierter Einsatz von Mühlennachprodukten zur bedarfsgerechten Energieproduktion durch innovative Überwachungs-, Mess- und Regelungsmethodik für die flexible Prozessführung, Bundesministerium für Wirtschaft und Energie/Projektträger Jülich, 15.09.2016–14.03.2019 (FKZ: 03KB115A)

OptDienE – Optionen zum netzdienlichen Betrieb von Einzelraumfeuerstätten; Teilvorhaben: Systemwirkung von Einzelraumfeuerstätten, Bundesministerium für Wirtschaft und Energie/Projektträger Jülich, 01.08.2018–31.03.2021 (FKZ: 031B0138A)

PlasmaCrack – Kläranlage –- PlasmaCrack: Nachweis der Faulgassteigerung und Reduktion endokriner Substanzen, Bundesministerium für Wirtschaft und Energie/VDI/VDE/IT, 01.09.2018–31.08.2021 (FKZ: 16KN041344)

ProgBegII – Programmbegleitung des BMWi-Förderprogramms "Energetische Biomassenutzung" Ausbau des Wissenstransfers, Bundesministerium für Wirtschaft und Energie/Projektträger Jülich, 01.07.2016–31.03.2020 (FKZ: 03KB001B)

SCRCOAT – Optimierung u. Validierung von Verfahren zur kombinierten Reduktion von Feinstaub u. sauren Schadgasen an Biomassefeuerungen; Teilvorhaben: Experimentelle Untersuchungen zur Kombination von SCR-u. Precoatverfahren an einem Gewebefilter, Bundesministerium für Wirtschaft und Energie/Projektträger Jülich, 01.09.2017–31.08.2020 (FKZ: 03KB135A)

Smarkt – Bewertung des Marktpotenzials und Systembeitrags von integrierten Bioenergiekonzepten, Bundesministerium für Wirtschaft und Energie/Projektträger Jülich, 01.09.2017–31.12.2019 (FKZ: 03KB130)

SNuKR – Steigerung des Nutzens von kleinen, biomassebefeuerten BHKWs durch bedarfsgerechte Regelung, Teilvorhaben: Entwicklung des Regelungsalgorithmus, Bundesministerium für Wirtschaft und Energie/Projektträger Jülich, 01.07.2017–30.06.2020 (FKZ: 03KB121A)

STEP – Verwertung strohbasierter Energiepellets und Geflügelmist in Biogasanlagen mit wärmeautarker Gärrestveredlung; Teilvorhaben: Verbesserung der Verbrennungseigenschaften projektspezifischer Gärreste, Bundesministerium für Wirtschaft und Energie/Projektträger Jülich, 01.08.2016–31.01.2019 (FKZ: 03KB116B)

stROhgas – Entwicklung eines Verfahrens zur Vergasung von asche- und chlorhaltiger Biomasse am Beispiel Stroh, Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit/Projektträger Jülich, 01.08.2013–30.04.2018 (FKZ: 03KB085B)

VergaOpt – Mittel- u. langfristige Sicherung des Holzvergaseranlagenbestandes u. Beitrag zu dessen weiterem Ausbau durch Erschließung preiswerter Brennstoffsortimente; Teilvorhaben: Brennstoffeigenschaften: Analyse u. Bewertung, Bundesministerium für Wirtschaft und Energie/Projektträger Jülich, 01.01.2018–30.06.2020 (FKZ: 03KB135A)

EU projects

BECOOL – Brazil-EU Cooperation for Development of Advanced Lignocellulosic Biofuels, EU/Horizon2020, 01.06.2017–31.05.2021 (GA 744821)

DEMETER – Demonstrating more efficient enzyme production to increase biogas yields, EU/Horizon2020, 01.08.2016–31.07.2019 (GA 720714)

DRALOD – Renewables-based drying technology for cost-effective valorisation of waste from the food processing industry, EU/Horizon2020, 01.08.2018–31.07.2020 (GA 820554)

HyFlexFuel – Hydrothermal liquefaction: Enhanced performance and feedstock flexibility for efficient biofuel production, EU/Horizon2020, 01.10.2017–30.09.2020 (GA 764734)

POWER4BIO – emPOWERing regional stakeholders for realising the full potential of European BIOeconomy, EU/Horizon2020, 01.10.2018–31.03.2021 (FKZ: GA 818351)

RecordBiomap – Research Coordination for a Low-Cost Biomethane Production at Small and Medium Scale Applications, EU/Horizon2020, 01.04.2016–30.9.2018 (GA 691611)

STAR-ProBio – Sustainability Transition Assessment and Research of Bio-based Products, EU/Horizon2020, 01.05.2017–30.04.2020 (GA 727740)

Service/Contract research

acatech – Energiesysteme der Zukunft (ESYS): Biomasse im Spannungsfeld zwischen Energie- und Klimapolitik: Strategien für eine nachhaltige Bioenergienutzung, Marktprojekt, 01.09.2017–31.08.2018

Adsolv – Anaerobic digestion of the hemicellulose fraction from an acetone based organosolv, Marktprojekt, 01.10.2018–01.01.2019

AVHOLPEL – Analyse und Verbrennung von Holz-

pelletchargen, Marktprojekt, 04.12.2017–30.04.2018
BEF-Sec – Sustainable production of bioenergy and soil conditioners from bio-residues in Pakistan for energy and food supply security, Marktprojekt, 31.12.2017–31.07.2019
BioPotB – Kurzstudie zur Untersuchung des nachhaltigen Biomassereststoffpotenzials im Umkreis von Berlin, Marktprojekt, 17.08.2018–31.01.2019
BLAU EKAM – Unterstützung von Ökopol bei der Aufstellung der Prüfvorschriften des "Blauen Engels" für Kaminöfen, Marktprojekt, 15.02.2018–28.02.2019
BlaueKa2 – Messung an Kaminöfen zur Bewertung einer Messvorschrift für eine Vergabegrundlage zum Blauen Engel für Kaminöfen, Marktprojekt, 14.08.2018–31.10.2018
C-DBFZ_A – Aufbau eines C-DBFZ in Hefei, University of Hefei, Marktprojekt, 01.07.2018–31.12.2021
CoFire2 – Begutachtung von Biowärme aus Mitverbrennung von Biomasse in konventionellen Heizkraftwerken, Marktprojekt, 01.01.2014–31.08.2019
Consulting Services for Biogas Project Hebei, Marktprojekt, 01.08.2015–31.12.2019
ECOCSTrK – Bestimmung von EC/OC-Gehalten aus Straßenkehrichtproben, Marktprojekt, 16.10.2017–30.04.2018
EFBGIZ1 – Analytical Comparison of EFB Mulching, Composting and Anaerobic Digestion Marktprojekt, 02.04.2018–29.06.2018 (FKZ: 81224240)
FLEXFEED – FlexFW Bewertung des Potenzials bedarfsgerechter Fütterung an der BGA Kompostwerk Weißenfels, Marktprojekt, 11.08.2017–28.02.2018
FS_VIETN – Machbarkeitsstudie Biogaspotentiale in An Giang, Marktprojekt, 01.07.2018–30.06.2019
GIZMEXIK – Überprüfung der Anlagensysteme für die Behandlung fester Siedlungsabfälle mit Schwerpunkt auf Biogasproduktion für Aguascalientes und Atlacomulco, GIZ, 09.07.2018–01.10.2018
GREENGAS – GreenGasCertification, Marktprojekt, 19.04.2017–18.04.2018 (IERC_2017_002)
Heizkreis-Netzwerk – Vorprojekt zur Etablierung von Bürgerforschung am DBFZ, Marktprojekt, 01.01.2018–31.10.2018
HemBio – Aktuelle Entwicklung und Perspektiven der Biogasproduktion aus Bioabfall und Gülle, Marktprojekt, 01.10.2017–30.04.2018
HTCHANF – Torf aus Hanf, Marktprojekt (FKZ: 2016LFE0014)
IEA Bioenergy Task 37 – Report IEA, Uni College Cork, Marktprojekt, 20.09.2016–31.12.2018
IEA Bioenergy Task 39 – Study on Survey on Advanced Fuels for Advanced Engines, Marktprojekt, 01.05.2017–01.01.2018
IEA Bioenergy – Country Reports, Germany – 2018 update, Bioenergy policies and status of implementation, 01.09.2018–30.09.2018
IEA Bioenergy inter-Task project on Measuring, governing and gaining support for sustainable bioenergy supply chains, 01.09.2016–30.11.2018
IEA Bioenergy Task 40 – Study on Transboundary flows of woody biomass waste streams in Europe, 01.09.2018–31.12.2018
IEA Bioenergy Task 40 – Study on Margin potential for a long-term sustainable wood pellet supply chain, 01.03.2018–31.12.2018
JTIGRAS – Unutilized biomass for renewable energy- technique and environmental benefits, Marktprojekt, 01.10.2016–31.03.2018 (FKZ: 3250005)
MethBos2 – Bioenergy Component – Advisory for biomass potential map development in Bosnia and Herzegovina, GIZ, 05.09.2017–30.08.2018
OmBRE – Ökobilanzen von Substratausgangsstoffen für Blumenerden und Kultursubstrate, Marktprojekt, 01.08.2016–01.01.2018
SIAAP – Klärschlamm und Abfall Paris, Marktprojekt, 01.01.2018–31.12.2021
SimGuide – Modellierung des Biogasprozesses, Marktprojekt, 01.08.2018–31.01.2020
TATBIO – Technoökonomische Analyse und Transformationspfade des energetischen Biomassepotentials, Marktprojekt, 10.10.2017–30.04.2019 (FKZ: 03MAP362)
TC454WG3 – CEN/TC 454 Working Group 3 Algae processing, Marktprojekt, 20.10.2017–25.02.2021
TF_EW – Technologiebewertung für Biomasse und Power-to-gas (biologische Methanisierung), Marktprojekt, 01.08.2016–31.01.2018
UFOKFA – Evaluierung der 1. BImSchV von 2010 – Evaluierung der 1. Novelle der 1. BImSchV von 2010, Marktprojekt, 01.12.2017–31.10.2018

WiFlxBio – Wirtschaftlichkeitsbetrachtungen zur Flexibilisierung von Bioenergieanlagen für das Projekt "SymBio", Marktprojekt, 05.10.2017–30.04.2018

Other funding bodies (donations, foundations, country)

Agread – Re-use of agricultural residues for energy production by anaerobic digestion, Deutscher akademischer Austauschdienst, 01.01.2018–31.12.2019 (FKZ: 57387582)
AUTOBUS Plug-and-Run-Prinzip – Automatische Integration von Wärme- und Stromerzeugern sowie Verbrauchern in eine Objektversorgung nach dem Plug-and-Run-Prinzip, Sächsische Aufbaubank, 01.08.2016–31.07.2019 (FKZ: 100250636)
Beratung DUH – Unterstützung der Informationskampagne "Clean Heat – Reducing particulate matter caused by wood burning", Deutsche Umwelthilfe e. V., 01.01.2016–31.01.2019
BIOGAS2030 – Optionen für Biogas-Bestandsanlagen bis 2030 aus ökonomischer und energiewirtschaftlicher Sicht, Umweltbundesamt, 20.01.2017–22.01.2019 (FKZ: 37EV 16 111)
Fermenthen – Production of light alkenes from biogas and excess electricity, Sächsische Aufbaubank, 01.10.2016–30.09.2019 (FKZ: 100244827)
GAZELLE – Ganzheitliche Regelung von Biogasanlagen zur Flexibilisierung und energetischen Optimierung, Sächsische Aufbaubank, 01.02.2017–31.01.2020 (FKZ: 100267056)
HTC-liq – Entwicklung eines hocheffizienten Kaskadenprozesses zur Aufbereitung von Prozesswässern aus hydrothermalen Prozessen, insbes. der hydrothermalen Carbonisierung mit Gewinnung von org. Säuren, anschließender energetischer Nutzung und Prozesswasserreinigung, Sächsische Aufbaubank, 01.04.2017–31.03.2020 (FKZ: 100283030)
KLEINMOT – AGN Kleinmotoren – Entwicklung eines effizienten Abgasbehandlungssystems für Dieselmotoren der Leistungsklasse < 19 kW bei Einsatz kohlenstoffreduzierter Kraftstoffe, Sächsische Aufbaubank, 01.08.2016–31.10.2018 (FKZ: 100241707)
Natmon – Naturschutzfachliches Monitoring des Ausbaus der erneuerbaren Energien im Strombereich und -entwicklung von Instrumenten zur Verminderung der Beeinträchtigung von Natur und Landschaft, Bundesamt für Naturschutz, 01.08.2015–31.07.2018 (FKZ: 351582270A)
SMILE V – Selbstmanagement Initiative Leipzig – SMILE, Sächsische Aufbaubank/Universität Leipzig, 01.10.2017–30.09.2020 (FKZ: 1493982655393)
Vollkat – Labortechnische Untersuchungen zur Entwicklung eines keramischen Vollkatalysators für Biomassefeuerungen – 1. Phase, Deutsche Bundesstiftung Umwelt, 01.01.2018–31.12.2018 (FKZ: 32996/01-24/0)
VORFI1 – Vorfinanzierung des EU-Projektantrages "Methane Energy Communitier (ERA-Net-RegSys Joint Call 2018)", Sächsische Aufbaubank, 03.07.2018–02.11.2018 (FKZ: 100338111)

PUBLICATIONS

Monographs

Zehn Jahre Biomasseforschung am DBFZ (2018). Leipzig: DBFZ. 60 S. ISBN: 978-3-946629-31-3.
Müller, L. (2018). *Optimierung des anaeroben Abbaus stickstoffhaltiger Verbindungen durch den Einsatz von Proteasen: Dissertation*. (Schriftenreihe Umweltingenieurwesen, 80). Rostock: Univ., Professur Abfall- und Stoffstromwirtschaft. 176 S. ISBN: 978-3-86009-475-4.
Schlüter, M. (2018). *Die Niedertemperatursynthese von Methan in Thermoöl-temperierten Plattenreaktoren: Dissertation*. (DBFZ-Report, 31). Leipzig: DBFZ. V, 143 S. ISBN: 978-3-946629-33-7.
Weinrich, S. (2018). *Praxisnahe Modellierung von Biogasanlagen: Dissertation*. (Schriftenreihe Umweltingenieurwesen, 76). Rostock: Univ., Professur Abfall- und Stoffstromwirtschaft. XXI, 259 S. ISBN: 978-3-86009-471-6.

Collected editions

Lenz, V.; Thrän, D.; Pfeiffer, D. (Hrsg.) (2018). Schröder, T.; Lenz, V.; Sonntag, J. von; Ulbricht, T.; Khalsa, J. Hari Arti; Heidecke, P.; Stahl, E.; Schön, C.; Hartmann, H.; Kuptz, D.; Woltersdorf, N.; Kunde, R.; Adeili, M.; Volz, F. *Methods for*

Measuring Emissions of Particulate Matter from Solid Biomass Combustion. (Series of the funding programme "Biomass energy use", 8). Leipzig: DBFZ. 161 S. ISBN: 978-3-946629-28-3.

Murphy, J. (Hrsg.) (2018). Weinrich, S.; Schäfer, F.; Bochmann, G.; Liebetrau, J. *Value of batch tests for biogas potential analysis: Method comparison and challenges of substrate and efficiency evaluation of biogas plants*. (IEA Bioenergy Task 37). [s.l.]: IEA Bioenergy. 42 S. ISBN: 978-1-910154-48-9.

Conference proceedings/Conference reader

1. Deutsches Doktorandenkolloquium Bioenergie: 20./21. September 2018 (2018). [online]. (Tagungsreader, 13). Leipzig: DBFZ. 339 S. ISBN: 978-3-946629-35-1. [1. Deutsches Doktorandenkolloquium Bioenergie, Leipzig, 20.–21.09.2018].

9. Fachgespräch Partikelabscheider in häuslichen Feuerungen: 21. März 2018 (2018). [online]. (Tagungsreader, 10). Leipzig: DBFZ. 149 S. ISBN: 978-3-946629-29-0. [9. Fachgespräch Partikelabscheider in häuslichen Feuerungen, Leipzig, 21.03.2018].

DBFZ-Jahrestagung 2018: Energie & Stoffe aus Biomasse: Konkurrenten oder Partner? 19./20. September 2018 (2018). [online]. (Tagungsreader, 11). Leipzig: DBFZ. 419 S. ISBN: 978-3-946629-32-0. [DBFZ-Jahrestagung, Leipzig, 218.–20.09.2018].

HTP-Fachforum 2018: Hydrothermale Prozesse zur stofflichen und energetischen Wertschöpfung. 19./20. September 2018 (2018). [online]. (Tagungsreader, 12). Leipzig: DBFZ. 285 S. ISBN: 978-3-946629-34-4. [4. HTP-Fachforum, Leipzig, 19.–20.09.2018].

Nelles, M. (Hrsg.) (2018). *12. Rostocker Bioenergieforum: am 28. und 29. Juni 2018 an der Universität Rostock. Tagungsband*. (Schriftenreihe Umweltingenieurwesen, 78). Rostock: Univ., Professur Abfall- und Stoffstromwirtschaft. 406 S. ISBN: 978-3-86009-473-0. [12. Rostocker Bioenergieforum, Rostock, 28.–29.06.2018].

Nelles, M. (Hrsg.) (2018). *18. Dialog Abfallwirtschaft MV: Aktuelle Entwicklungen in der Abfall- und Ressourcenwirtschaft. 27. Juni 2018, Tagungsband*. (Schriftenreihe Umweltingenieurwesen, 77). Rostock: Univ., Professur Abfall- und Stoffstromwirtschaft. 152 S. ISBN: 978-3-86009-472-3. [18. Dialog Abfallwirtschaft MV, Rostock, 27.06.2018].

Book contributions

Lenz, V.; Rönsch, C.; Schaubach, K.; Bohnet, S.; Thrän, D. (2018). Transitioning the Heat Supply System: Challenges with Special Focus on Bioenergy in the Context of Urban Areas. In: Kabisch, S.; Koch, F.; Gawel, E.; Haase, A.; Knapp, S.; Krellenberg, K.; Nivala, J.; Zehnsdorf, Andreas (Hrsg.) *Urban Transformations: Sustainable Urban Development Through Resource Efficiency, Quality of Life and Resilience*. Cham: Springer. (Future City, 10). ISBN: 978-3-319-59323-4. S. 173–196. DOI: 10.1007/978-3-319-59324-1_10.

Majer, S.; Wurster, S.; Moosmann, D.; Ladu, L.; Sumfleth, B.; Thrän, D. (2018). Gaps and Research Demand for Sustainability Certification and Standardisation in a Sustainable Bio-Based Economy in the EU. In: Morone, P. (Hrsg.) *Sustainability Transition Towards a BioBased Economy: New Technologies, New Products, New Policie*. Basel: MDPI. ISBN: 978-3-03897-380-5. S. 186–229.

Müller-Langer, F.; Klemm, M.; Schneider, J. (2018). Biofuels Production Processes and Technologies. In: Riazi, M.R.; Chiaramonti, David (Hrsg.) *Biofuels Production and Processing Technology*. Boca Raton, FL (USA): CRC Press. ISBN: 978-1-4987-7893-0. S. 153–182.

Stinner, W.; Deuker, A.; Schmalfuß, T.; Brock, C.; Rensberg, N.; Denysenko, V.; Trainer, P.; Möller, K.; Zang, J.; Janke, L.; Morsen Leandro, W.; Oehmichen, K.; Popp, D.; Daniel-Gromke, J. (2018). Perennial and Intercrop Legumes as Energy Crops for Biogas Production. In: Meena, R. Swaroop; Das, A.; Yadav, G. Singh; Lal, Rattan (Hrsg.) *Legumes for Soil Health and Sustainable Management*. Singapore: Springer Singapore. ISBN: 978-981-13-0252-7. S. 139–171.

Contributions in conference proceedings

Barchmann, T.; Daniel-Gromke, J.; Schmalfuß, T.; Denysenko, V.; Rensberg, N.; Liebetrau, J.; Nelles, M. (2018). Strategien und Perspektiven für Biogas in Deutschland im Rahmen der Sektorenkopplung. In: Nelles, M. (Hrsg.) *12. Rostocker Bioenergieforum: am 28. und 29. Juni 2018 an der Universität Rostock. Tagungsband*. Rostock: Univ., Professur Abfall- und Stoffstromwirtschaft. (Schriftenreihe Umweltingenieurwesen, 78). ISBN: 978-3-86009-473-0. S. 89–108.

Bienert, K.; Shakya, S.; Fischer, E.; Schumacher, B.; Rojas, M.; Rogstrand, G.: Ziekinski, M.; Dębowski, M. (2018). Technologies for biomethane production in small and medium scale applications: assessment within the european project record biomap. In: Persson, M.; Scarlat, N.; Grassi, A.; Helm, P. (Hrsg.) *Papers of the 26th European Biomass Conference: Setting the cource for a biobased economy. Extracted from the Proceedings of International Conference held in Copenhagen, Denmark, 14–17 May 2018*. Florenz (Italien): ETA-Florence Renewable Energies. ISBN: 978-88-89407-18-9. S. 586–591. DOI: 10.5071/26thEUBCE2018-2DO.1.2.

Brookmann, H.; Loewen, A.; Ganagin, W.; Nelles, M. (2018). Einsatz von Stroh in der ReBi-Anlage zur hochflexiblen Stromerzeugung. In: Nelles, M. (Hrsg.) *12. Rostocker Bioenergieforum: am 28. und 29. Juni 2018 an der Universität Rostock. Tagungsband*. Rostock: Univ., Professur Abfall- und Stoffstromwirtschaft. (Schriftenreihe Umweltingenieurwesen, 78). ISBN: 978-3-86009-473-0. S. 163–173.

Daniel-Gromke, J.; Liebetrau, J.; Denysenko, V.; Rensberg, N.; Nelles, M. (2018). Aktuelle Entwicklungen bei der Erzeugung und Nutzung von Biogas. In: *Biogas 2018: 11. Innovationskongress. Osnabrück, 29. und 30. Mai 2018, Deutsche Bundesstiftung Umwelt, Zentrum für Umweltkommunikation, Tagungsband*. Hildesheim: ProFair Consult+Project GmbH. ISBN: 978-3-947777-00-6. S. 15–31.

Dotzauer, M.; Szarka, N.; Haufe, H.; Krautkremer, B.; Wern, B.; Dahmen, N.; Millinger, M. (2018). Innovationsbedarfe für Bioenergieanwendungen. In: *Innovationen für die Energiewende: Beiträge zur FVEE-Jahrestagung 2017*. Berlin: FVEE. (FVEE-Themen). S. 58–60.

Ebersbach, E.; Link, F.; Grilc, M.; Böhm, J.; Schröder, J.; Hauschild, S.; Seiffert, M. (2018). Schnelltest zur Alterungsnachstellung von Dieselabgaskatalysatoren im Betrieb mit Biokraftstoffen. In: *Abschluss- und Zwischenberichte der Forschungsstellen Motoren: Frühjahrstagung 2018. Tagungsband, 2018, Bad Neuenahr*. Frankfurt am Main: FVV. (Heft R, 582). S. 207–246.

Emmerich, A.-S.; Engler, N.; Nelles, M. (2018). Recycling von Polymeren mittels Hydrothermaler Carbonisierung. In: Bockreis, A.; Faulstich, M.; Flamme, S.; Kranert, M.; Mocker, M.; Nelles, M.; Quicker, P.; Rettenberger, G.; Rotter, Vera Susanne (Hrsg.) *8. Wissenschaftskongress Abfall- und Ressourcenwirtschaft: Tagungsband. am 15. und 16. März 2018 an der Universität für Bodenkultur (BOKU) Wien*. Innsbruck: Innsbruck University Press. ISBN: 978-3-903187-10-8. S. 133–136.

Emmerich, A.-S.; Engler, N.; Nelles, M. (2018). Recycling von Polymeren mittels Hydrothermaler Carbonisierung. In: Nelles, M. (Hrsg.) *18. Dialog Abfallwirtschaft MV: Aktuelle Entwicklungen in der Abfall- und Ressourcenwirtschaft. 27. Juni 2018, Tagungsband*. Rostock: Univ., Professur Abfall- und Stoffstromwirtschaft. (Schriftenreihe Umweltingenieurwesen, 77). ISBN: 978-3-86009-472-3. S. 89–95.

Gawel, E.; Eichhorn, M.; O'Keeffe, S.; Dotzauer, M.; Lenz, V.; Schmiedt, J. E.; Stryi-Hipp, G. (2018). Raumwirkungen innovativer Konzepte und Technologien. In: *Innovationen für die Energiewende: Beiträge zur FVEE-Jahrestagung 2017*. Berlin: FVEE. (FVEE-Themen). S. 23–27.

Gilbert, M.; Nietzold, A.; Müller, M.; Ullmann, G.; Hartmann, I.; Krause, H. (2018). Slagging of ashes from miscanthus versus wood and methods to inhibit slagging. In: *World Sustainable Energy Days 2018: Conference Proceedings*. Wels (Österreich).

Janke, L.; Weinrich, S.; Leite, A. F.; Sträuber, H.; Radetski, C. M.; Nikolausz, M.; Nelles, M.; Stinner, W. (2018). Year-round biogas production in sugarcane biorefineries: process stability, optimization and performance of a two-stage reactor system. In: Clarke, W. P.; Cossu, r.; Matsuto, T.; Nelles, M.; Stegmann, R.; Liu, Jianguo (Hrsg.) *Venice 2018: 7th International Symposium on Energy from Biomass and Waste*. ISBN: 978-88-6265-013-7.

Kirstein, N.; Witt, J. (2018). Der Strohmarkt in Dänemark: Ein Erfolgsmodell mit Übertragbarkeit auf Deutschland? In: Nelles, M. (Hrsg.) *12. Rostocker Bioenergieforum: am 28. und*

29. Juni 2018 an der Universität Rostock. Tagungsband. Rostock: Univ., Professur Abfall- und Stoffstromwirtschaft. (Schriftenreihe Umweltingenieurwesen, 78). ISBN: 978-3-86009-473-0. S. 49–60.

Kopf, R.; Scholwin, F.; Nelles, M. (2018). Technischer Systemvergleich verfahrenstechnischer biochemischer Energieanlagen (Biogas). In: Nelles, M. (Hrsg.) *12. Rostocker Bioenergieforum: am 28. und 29. Juni 2018 an der Universität Rostock. Tagungsband*. Rostock: Univ., Professur Abfall- und Stoffstromwirtschaft. (Schriftenreihe Umweltingenieurwesen, 78). ISBN: 978-3-86009-473-0. S. 153–162.

Kuptz, D.; Schreiber, K.; Schulmeyer, F.; Zeng, T.; Pollex, A.; Zelinski, V.; Volgmann, M.; Borchert, H.; Hartmann, H. (2018). Meeting fuel specifications of Enplus wood chips by screening and drying of forest residues. In: *51st International symposium of forest mechanization: 24th–28th September 2018, Madrid, Spain. Proceedings*. [s.l.]: Fundación Conde del Valle de Salazar. ISBN: 978-84-96442-84-9. S. 229–246.

Lahl, B.; Endres, H.-J.; Nelles, M. (2018). Entwicklung von thermoplastischen endlosfaserverstärkten Strukturbauteilen aus biobasierten und recycelten Werkstoffen. In: Bockreis, A.; Faulstich, M.; Flamme, S.; Kranert, M.; Mocker, M.; Nelles, M.; Quicker, P.; Rettenberger, G.; Rotter, Vera Susanne (Hrsg.) *8. Wissenschaftskongress Abfall- und Ressourcenwirtschaft: Tagungsband. am 15. und 16. März 2018 an der Universität für Bodenkultur (BOKU) Wien*. Innsbruck: Innsbruck University Press. ISBN: 978-3-903187-10-8. S. 95–100.

Link, F.; Ebersbach, E.; Gläser, R.; Schröder, J.; Hauschild, S.; Müller-Langer, F. (2018). Novel Approaches for Rapid Diesel Catalyst Aging in Operation with Biofuels. In: *16. FAD-Konferenz Herausforderung – Abgasnachbehandlung für Dieselmotoren: 7.11.–8.11.2018 in Dresden. Beiträge*. Dresden: FAD. S. 157–168.

Nassour, A.; Hemidat, S.; Chaabane, W.; Eickhoff, I.; Nelles, M. (2018). Aktuelle Entwicklungen in der Abfallwirtschaft im Arabischen Raum. In: Nelles, M. (Hrsg.) *18. Dialog Abfallwirtschaft MV: Aktuelle Entwicklungen in der Abfall- und Ressourcenwirtschaft. 27. Juni 2018, Tagungsband*. Rostock: Univ., Professur Abfall- und Stoffstromwirtschaft. (Schriftenreihe Umweltingenieurwesen, 77). ISBN: 978-3-86009-472-3. S. 97–109.

Nelles, M.; Brosowski, A.; Morscheck, G.; Schüch, A. (2018). Biogenic Waste and Residues in Germany: Amount, Current Utilization and Perspectives. In: Ghosh, S. Kumar (Hrsg.) *Utilization and Management of Bioresources: Proceedings of 6th IconSWM 2016*. Singapore: Springer. ISBN: 978-981-10-5348-1. S. 3–12. DOI: 10.1007/978-981-10-5349-8_1.

Nelles, M.; Eickhoff, I.; Morscheck, G.; Zhou, Y. H. (2018). Aktuelle Entwicklungen der Abfallwirtschaft in China. In: *Recy & DepoTech 2018: Vorträge-Konferenzband zur 14. Recy & DepoTech-Konferenz: Montanuniversität Leoben, Österreich, 7.–9. November 2018*. Leoben (Österreich): Abfallverwertungstechnik & Abfallwirtschaft Eigenverlag. ISBN: 978-3-200-05874-3. S. 701–706.

Nelles, M.; Eickhoff, I.; Morscheck, G.; Zhou, Y. H. (2018). Waste Management in China. In: *Recy & DepoTech 2018: Vorträge-Konferenzband zur 14. Recy & DepoTech-Konferenz : Montanuniversität Leoben, Österreich, 7.–9. November 2018*. Leoben (Österreich): Abfallverwertungstechnik & Abfallwirtschaft Eigenverlag. ISBN: 978-3-200-05874-3. S. 922.

Nelles, M.; Morscheck, G.; Nassour, A. (2018). Internationale Entwicklungen bei der mechanischen, mechanisch-biologischen und stoffstromspezfischen Abfallbehandlung. In: Wiemer, K.; Kern, M.; Raussen, Thomas (Hrsg.) *Bioabfall- und stoffspezifische Verwertung*. Witzenhausen: Witzenhausen-Institut für Abfall, Umwelt und Energie GmbH. (Neues aus Forschung und Praxis). ISBN: 3-928673-76-9. S. 537–555.

Pfeiffer, D.; Szarka, N.; Thrän, D. (2018). Perspectives for the application of biogenic residues and organic wastes for energy use. In: Clarke, W. P.; Cossu, r.; Matsuto, T.; Nelles, M.; Stegmann, R.; Liu, Jianguo (Hrsg.) *Venice 2018: 7th International Symposium on Energy from Biomass and Waste*. ISBN: 978-88-6265-013-7.

Reinelt, T.; Liebetrau, J. (2018). Überwachung und Minderung betriebsbedingter Methan-emissionen aus Über-/Unterdrucksicherungen der Gasspeicher von Biogasanlagen. In: VDI Wissensforum GmbH (Hrsg.) *5. VDI-Fachtagung Emissionsminderung 2018: Stand- Konzepte-Fortschritte. Nürnberg, 12. und 13. Juni 2018*. Düsseldorf: VDI. (VDI-Berichte, 2327). ISBN: 978-3-18-092327-7. S. 173–186.

Reißmann, D.; Thrän, D.; Bezama, A. (2018). Is There a Best Way for the Hydrothermal Treatment of Moist Bio-Waste?: First Experiences from a Multi-Criteria Decision-Making Approach. In: Persson, M.; Scarlat, N.; Grassi, A.; Helm, P. (Hrsg.) *Papers of the 26th European Biomass Conference: Setting the cource for a biobased economy. Extracted from the Proceedings of International Conference held in Copenhagen, Denmark, 14–17 May 2018*. Florenz (Italien): ETA-Florence Renewable Energies. ISBN: 978-88-89407-18-9. S. 1039–1043. DOI: 10.5071/26thEUBCE2018-3DO.9.2.

Schliermann, T.; Hartmann, I.; Dizaji, H. B.; Zeng, T.; Schneider, D.; Wassersleben, S.; Enke, D.; Jobst, T.; Lange, A.; Roelofs, F.; Fellner, A.; Schneider, P. (2018). High quality biogenic silica from combined energetic and material utilization of agricultural residues. In: Clarke, W. P.; Cossu, r.; Matsuto, T.; Nelles, M.; Stegmann, R.; Liu, Jianguo (Hrsg.) *Venice 2018: 7th International Symposium on Energy from Biomass and Waste*. ISBN: 978-88-6265-013-7.

Schliermann, T.; Hartmann, I.; Schneider, D.; Wassersleben, S.; Enke, D.; Jobst, T.; Lange, A.; Roelofs, F.; Fellner, A.; Schneider, P. (2018). Hochwertiges biogenes Silika aus landwirtschaftlichen Reststoffen. In: Nelles, M. (Hrsg.) *12. Rostocker Bioenergieforum: am 28. und 29. Juni 2018 an der Universität Rostock. Tagungsband*. Rostock: Univ., Professur Abfall- und Stoffstromwirtschaft. (Schriftenreihe Umweltingenieurwesen, 78). ISBN: 978-3-86009-473-0. S. 287–294.

Schliermann, T.; Hartmann, I.; Schneider, D.; Wassersleben, S.; Enke, D.; Jobst, T.; Lange, A.; Roelofs, F.; Fellner, A.; Schneider, P.: "Combined energetic and material utilization of agricultural residues", Tagungsband, 7th ICET, 12.–13.06.2018, Hefei, China.

Schneider, J.; Dietrich, S.; Rönsch, S. (2018). Conversion of CO and CO_2 from biomass gasifiers and biogas plants by direct synthesis of short chain hydrocarbons. In: Held, J. (Hrsg.) *REGATEC 2018: Bringing science, technology and industry together*. Lund (Schweden): Renewable Energy Technology International AB. ISBN: 978-91-981149-4-2. S. 101–102.

Schumacher, B.; Pröter, J.; Liebetrau, J.; Nelles, M. (2018). Pre-treatment of cattle manure with pressure swing conditioning and its effects on biogas production. In: Clarke, W. P.; Cossu, r.; Matsuto, T.; Nelles, M.; Stegmann, R.; Liu, Jianguo (Hrsg.) *Venice 2018: 7th International Symposium on Energy from Biomass and Waste*. ISBN: 978-88-6265-013-7.

Schwarz, S.; Zuberbühler, U.; Schmidt, M.; Kretzschmar, J.; Friedrich, A.; Schrör, R.; Hebling, C.; Calnan, S.; Peters, R.; Dittmeyer, R.; Harnisch, F.; Nagel, T. (2018). Power-to-X: Technologien für Übermorgen?! In: *Innovationen für die Energiewende: Beiträge zur FVEE-Jahrestagung 2017*. Berlin: FVEE. (FVEE-Themen). S. 49–52.

Seiffert, M. (2018). Hot Dewatering of Thermal and thermochemical Pre-Treated Sludge Fractions. In: Clarke, W. P.; Cossu, r.; Matsuto, T.; Nelles, M.; Stegmann, R.; Liu, Jianguo (Hrsg.) *Venice 2018: 7th International Symposium on Energy from Biomass and Waste*. ISBN: 978-88-6265-013-7.

Sprafke, J.; Nelles, M.; Schüch, A. (2018). Case study for a Biogas-Solar thermal hybrid plant for a dairy in the MENA region. In: Held, J. (Hrsg.) *REGATEC 2018: Bringing science, technology and industry together*. Lund (Schweden): Renewable Energy Technology International AB. ISBN: 978-91-981149-4-2. S. 103–104.

Sprafke, J.; Thabit, Q.; Nelles, M.; Schüch, A. (2018). Solar-Biogas-Hybridanlage in industrieller Anwendung. In: Nelles, M. (Hrsg.) *12. Rostocker Bioenergieforum: am 28. und 29. Juni 2018 an der Universität Rostock. Tagungsband*. Rostock: Univ., Professur Abfall- und Stoffstromwirtschaft. (Schriftenreihe Umweltingenieurwesen, 78). ISBN: 978-3-86009-473-0. S. 175–183.

Stinner, W.; Schmalfuß, T.; Döhler, H.; Wedwitschka, H.; Gallegalos, D.; Denysenko, V.; Deuker, A. (2018). Kann die Vergärung von Stroh ökonomisch sein? In: *Bayerische Biogasfachtagung mit begleitender Ausstellung: Stroh, Gras, Biogas. Innovative Verfahren zur Nutzung von Ernteresten in Biogasanlagen*. Hildesheim: ProFair Consult+Project GmbH. S. 31–38.

Contributions to reports

Dotzauer, M.; Pfeiffer, D.; Thrän, D.; Lenz, V.; Pohl, M.; Müller-Langer, F. (2018). Technologiebericht 1.1: Bioenergie innerhalb des Forschungsprojektes TF_Energiewende. In: Viebahn, P.;

Zelt, O.; Fischedick, M.; Wietschel, M.; Hirzel, S.; Horst, Juri (Hrsg.) *Technologien für die Energiewende*: *Technologiebericht – Band 1. Teilbericht 2 zum Teilprojekt A im Rahmen des strategischen BMWi-Leitprojekts "Trends und Perspektiven der Energieforschung"*. Wuppertal: Wuppertal Institut für Klima, Umwelt, Energie gGmbH. (Wuppertal Report, 13.1). S. 11–83.

Poster in conference proceedings

Brosowski, A.; Mantau, U.; Mahro, B.; Noke, A.; Richter, F.; Krause, T.; Bischof, R.; Hering, T.; Blanke, C.; Bill, R.; Thrän, D. (2018). Nationales Ressourcenmonitoring von biogenen Reststoffen, Abfällen und Nebenprodukten. In: *1. Deutsches Doktorandenkolloquium Bioenergie*: *20./21. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 13). ISBN: 978-3-946629-35-1. S. 290–291.

Butt, S. (2018). High Temperature Oxidation of Pollutants on Solid State Catalysts. In: *1. Deutsches Doktorandenkolloquium Bioenergie*: *20./21. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 13). ISBN: 978-3-946629-35-1. S. 254–255.

Dernbecher, A.; Hartmann, I. (2018). Experimentelle und numerische Untersuchung einer Scheitholzfeuerung. In: *1. Deutsches Doktorandenkolloquium Bioenergie*: *20./21. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 13). ISBN: 978-3-946629-35-1. S. 266–267.

Eickhoff, I.; Nelles, M.; Engler, N.; Sänger, D. (2018). Development of an innovative process to digest press water from mixed household waste. In: *1. Deutsches Doktorandenkolloquium Bioenergie*: *20./21. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 13). ISBN: 978-3-946629-35-1. S. 240–241.

Gökgöz, F.; Denysenko, V.; Rensberg, N.; Daniel-Gromke, J.; Liebetrau, J. (2018). Koppelung von Strom- und dezentraler Kraftstofferzeugung in Biogasanlagen: Flexibilisierungsansatz und Potenzialstudie. In: *1. Deutsches Doktorandenkolloquium Bioenergie*: *20./21. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 13). ISBN: 978-3-946629-35-1. S. 248–249.

Hahn, A. (2018). Systematische Einordnung von Bioenergie-CO_2-Technologien zur Anwendung in Energieszenarien. In: *1. Deutsches Doktorandenkolloquium Bioenergie*: *20./21. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 13). ISBN: 978-3-946629-35-1. S. 302–303.

Kar, I.; O'Keeffe, S.; Thrän, D.; Franko, U. (2018). Including soil impacts within a regional life cycle assessment of biobased products. In: *1. Deutsches Doktorandenkolloquium Bioenergie*: *20./21. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 13). ISBN: 978-3-946629-35-1. S. 300–301.

Kirchner, D.; Thrän, D. (2018). Entwicklung und Diskussion von Planungs- und Auslegungsmethoden für Biogashybrid-Inselsysteme unter Berücksichtigung der flexiblen bedarfsorientierten Biogaserzeugung. In: *1. Deutsches Doktorandenkolloquium Bioenergie*: *20./21. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 13). ISBN: 978-3-946629-35-1. S. 246–247.

Kirstein, N.; Hennig, C.; Thrän, D. (2018). Zukünftige Nutzung biogener Festbrennstoffe vor dem Hintergrund des Zwei-Grad-Ziels. In: *1. Deutsches Doktorandenkolloquium Bioenergie*: *20./21. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 13). ISBN: 978-3-946629-35-1. S. 292–293.

Kirsten, C.; Lenz, V.; Schröter, H.-W.; Repke, J.-U. (2018). Bindemechanismen: Was hält ein Pellet zusammen? In: *1. Deutsches Doktorandenkolloquium Bioenergie*: *20./21. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 13). ISBN: 978-3-946629-35-1. S. 268–269.

Köchermann, J.; Schreiber, J.; Klemm, M. (2018). Production of furfural from D-xylose and organosolv hemicellulose in water/ethanol mixtures. In: *1. Deutsches Doktorandenkolloquium Bioenergie*: *20./21. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 13). ISBN: 978-3-946629-35-1. S. 286–287.

Krüger, D. (2018). Hochflexible Stromerzeugung durch Mikro-KWK-Systeme unter Nutzung von Holzkohle. In: *1. Deutsches Doktorandenkolloquium Bioenergie*: *20./21. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 13). ISBN: 978-3-946629-35-1. S. 260–261.

Kurth, M.; Rönsch, S. (2018). Entwicklung einer wasserabscheidenden Membran zur Umsatzsteigerung des Methanisierungsprozesses. In: *1. Deutsches Doktorandenkolloquium Bioenergie*: *20./21. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 13). ISBN: 978-3-946629-35-1. S. 280–281.

Müller, M. (2018). Charakterisierung und Integration für Oxidationskatalysatoren in Biomasse-Kleinfeuerungsanlagen. In: *1. Deutsches Doktorandenkolloquium Bioenergie*: *20./21. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 13). ISBN: 978-3-946629-35-1. S. 256–257.

Nitzsche, R.; Gröngröft, A.; Kraume, M. (2018). Gewinnung von Hemicellulosezuckern aus Holzhydrolysaten mittels Adsorption und Membranfiltration. In: *1. Deutsches Doktorandenkolloquium Bioenergie*: *20./21. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 13). ISBN: 978-3-946629-35-1. S. 282–284.

Pfeiffer, A.; Kalcher, J. (2018). Datenschätze finden, analysieren und visualisieren: Eine Karte sagt mehr als 1000 Worte! In: *1. Deutsches Doktorandenkolloquium Bioenergie*: *20./21. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 13). ISBN: 978-3-946629-35-1. S. 306–307.

Reißmann, D.; Bezama, A.; Thrän, D. (2018). Künftige Entwicklungspfade für Hydrothermale Prozesse in Deutschland bis 2030. In: *1. Deutsches Doktorandenkolloquium Bioenergie*: *20./21. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 13). ISBN: 978-3-946629-35-1. S. 270–271.

Sumfleth, B. (2018). Certification of low ILUC risks in emerging markets. In: *1. Deutsches Doktorandenkolloquium Bioenergie*: *20./21. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 13). ISBN: 978-3-946629-35-1. S. 298–299.

Winkler, M.; Weinrich, S. (2018). Modellbasierte Prozessoptimierung von Biogasanlagen. In: *1. Deutsches Doktorandenkolloquium Bioenergie*: *20./21. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 13). ISBN: 978-3-946629-35-1. S. 244–245.

Zareihassangheshlaghi, A.; Beidaghy Dizaji, H.; Bidabadi, M.; Hartmann, I.; Lenz, V.; Enke, D.; Zeng, T. (2018). Impact of Varying Heating Regimes on Biogenic Silica Obtained from Rice Husk. In: *1. Deutsches Doktorandenkolloquium Bioenergie*: *20./21. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 13). ISBN: 978-3-946629-35-1. S. 258–259.

Zhou, Y.; Engler, N.; Nelles, M. (2018). Products from food waste by HTC treatment and their utilization in anaerobic digestion. In: *1. Deutsches Doktorandenkolloquium Bioenergie*: *20./21. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 13). ISBN: 978-3-946629-35-1. S. 242–243.

Abstracts in conference proceedings/ conference reader

Antwi, E.; Schüch, A.; Engler, N.; Nelles, M. (2018). The effect of hydrothermal pre-treatment on the biogas yield of cocoa pods. In: *1. Deutsches Doktorandenkolloquium Bioenergie*: *20./21. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 13). ISBN: 978-3-946629-35-1. S. 82.

Bindig, R. (2018). Verfahren zur Entwicklung von Katalysatoren für die Emissionsminderung an Verbrennungsanlagen: Vom Labor in die Praxis. In: *1. Deutsches Doktorandenkolloquium Bioenergie*: *20./21. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 13). ISBN: 978-3-946629-35-1. S. 112–123.

Brosowski, A.; Mantau, U.; Mahro, B.; Noke, A.; Richter, F.; Krause, T.; Bischof, R.; Hering, T.; Blanke, C.; Szarka, N.; Bill, R.; Thrän, D. (2018). Nachhaltige Rohstoffbasis für die stoffliche und energetische Nutzung. In: *DBFZ-Jahrestagung 2018*: *Energie & Stoffe aus Biomasse: Konkurrenten oder Partner? 19./20. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 11). ISBN: 978-3-946629-32-0. S. 40–52.

Büchner, D.; Lenz, V. (2018). Wandel von der reinen Wärmebereitstellung zur smarten Wärme-Kraft-Kopplung in integrierten Systemen. In: *DBFZ-Jahrestagung 2018*: *Energie & Stoffe aus Biomasse: Konkurrenten oder Partner? 19./20. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 11). ISBN: 978-3-946629-32-0. S. 174–186.

Daniel-Gromke, J. (2018). Workshop: Flexibilisierung von Biogasanlagen. In: *DBFZ-Jahrestagung 2018*: *Energie & Stoffe aus Biomasse: Konkurrenten oder Partner? 19./20. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 11). ISBN: 978-3-946629-32-0. S. 324–336.

Dietrich, S.; Schneider, J. (2018). Biogas upgrading to high-calorific natural gas by synthesis of light hydrocarbons. In: *1. Deutsches Doktorandenkolloquium Bioenergie*: *20./21. September*

2018. [online]. Leipzig: DBFZ. (Tagungsreader, 13). ISBN: 978-3-946629-35-1. S. 156–170.

Hartmann, I. (2018). Minderung der Emissionen aus Scheitholzöfen durch ein zweistufiges integriertes Katalysatormodul. In: *9. Fachgespräch Partikelabscheider in häuslichen Feuerungen*: *21. März 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 10). ISBN: 978-3-946629-29-0. S. 56–62.

Köchermann, J.; Schreiber, J.; Klemm, M. (2018). Production of furfural from D-xylose and organosolv hemicellulose in water/ethanol mixtures. In: *HTP-Fachforum 2018*: *Hydrothermale Prozesse zur stofflichen und energetischen Wertschöpfung*. *19./20. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 12). ISBN: 978-3-946629-34-4. S. 118–129.

König, M. (2018). Katalytische Reduktion von Stickoxiden bei der Verbrennung biogener Reststoffe. In: *DBFZ-Jahrestagung 2018*: *Energie & Stoffe aus Biomasse: Konkurrenten oder Partner? 19./20. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 11). ISBN: 978-3-946629-32-0. S. 244–253.

Kretzschmar, J.; Liebetrau, J. (2018). Konzepte zur Kombination von stofflicher und energetischer Biomassenutzung in Biogasanlagen. In: *DBFZ-Jahrestagung 2018*: *Energie & Stoffe aus Biomasse: Konkurrenten oder Partner? 19./20. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 11). ISBN: 978-3-946629-32-0. S. 118–131.

Lauer, M.; Thrän, D. (2018). Gesamtwirtschaftliche Bewertung von Biogasanlagen als Flexibilitätsoption im Stromsystem der Zukunft. In: *1. Deutsches Doktorandenkolloquium Bioenergie*: *20./21. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 13). ISBN: 978-3-946629-35-1. S. 214–222.

Mauky, E. (2018). Modellbasiertes Regelungskonzept für eine bedarfsorientierte Biogasproduktion. In: *1. Deutsches Doktorandenkolloquium Bioenergie*: *20./21. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 13). ISBN: 978-3-946629-35-1. S. 54–64.

Nelles, M. (2018). Energetische und stoffliche Verwertung von biogenen Abfällen und Reststoffen. In: *1. Deutsches Doktorandenkolloquium Bioenergie*: *20./21. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 13). ISBN: 978-3-946629-35-1. S. 12–33.

Nelles, M.; Hartmann, I.; Lenz, V.; Liebetrau, J.; Müller-Langer, F.; Thrän, D. (2018). Energetische und stoffliche Verwertung von biogenen Abfällen und Reststoffen. In: *HTP-Fachforum 2018*: *Hydrothermale Prozesse zur stofflichen und energetischen Wertschöpfung*. *19./20. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 12). ISBN: 978-3-946629-34-4. S. 224–244.

Nelles, M.; Hartmann, I.; Lenz, V.; Liebetrau, J.; Müller-Langer, F.; Thrän, D. (2018). Energetische und Stoffliche Verwertung von biogenen Abfällen und Reststoffen. In: *DBFZ-Jahrestagung 2018*: *Energie & Stoffe aus Biomasse: Konkurrenten oder Partner? 19./20. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 11). ISBN: 978-3-946629-32-0. S. 350–370.

Nitzsche, R.; Gröngröft, A.; Kraume, M. (2018). Adsorption of lignin from beech wood hydrolysate using polymeric resins and zeolite: Equilibrium and kinetic modeling. In: *30. Deutsche Zeolith-Tagung – Jahrestreffen der ProcessNet-Fachgruppe Adsorption*: *28. Februar–2. März 2018*. *Book of Abstracts*. [s.l.]: [s.n.]. S. 30–31.

Nitzsche, R.; Gröngröft, A.; Kraume, M. (2018). Leistungsbewertung enger Ultrafiltrationsmembranen zur Isolierung von Hemicellulose und Lignin aus Buchenholzhydrolysaten mittels Response Surface Methodology. In: *Jahrestreffen der ProcessNet-Fachgruppen Fluidverfahrentechnik, Membrantechnik und Mischvorgänge*: *27.–28. Februar 2018*. *Kurzfassungen*. [s.l.]: [s.n.]. S. 60–61.

Prill, F.; Schiller, S.; Schmid, H.-J.; Hartmann, I.; König, M.; Müller, M. (2018). Kombinierte Minderung von Feinstaub und Schadgasen am Beispiel der Verbrennung von biogenen Reststoffen. In: *DBFZ-Jahrestagung 2018*: *Energie & Stoffe aus Biomasse: Konkurrenten oder Partner? 19./20. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 11). ISBN: 978-3-946629-32-0. S. 228–243.

Reinelt, T. (2018). Vermeidung betriebsbedingter Methanemissionen aus Über-/Unterdrucksicherungen durch Maßnahmen des Biogasspeichermanagements. In: *1. Deutsches Doktorandenkolloquium Bioenergie*: *20./21. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 13). ISBN: 978-3-946629-35-1. S. 66–81.

Reißmann, D.; Bezama, A.; Thrän, D. (2018). Wohin die Reise gehen könnte … Potentielle Entwicklungspfade der Hydrothermalen Verwertung wässriger biogener Rest- und Abfallstoffe in Deutschland bis 2030. In: *HTP-Fachforum 2018*: *Hydrothermale Prozesse zur stofflichen und energetischen Wertschöpfung*. *19./20. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 12). ISBN: 978-3-946629-34-4. S. 194–203.

Thrän, D.; Billig, E.; Braune, M.; Hahn, A.; Hennig, C.; Klemm, M.; Lenz, V.; Szarka, N. (2018). Bioenergy in a CO_2 Economy. In: *HTP-Fachforum 2018*: *Hydrothermale Prozesse zur stofflichen und energetischen Wertschöpfung*. *19./20. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 12). ISBN: 978-3-946629-34-4. S. 246-252.

Thrän, D.; Billig, E.; Braune, M.; Hahn, A.; Hennig, C.; Klemm, M.; Lenz, V.; Szarka, N. (2018). Bioenergy in a CO_2 Economy. In: *1. Deutsches Doktorandenkolloquium Bioenergie*: *20./21. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 13). ISBN: 978-3-946629-35-1. S. 34–40.

Thrän, D.; Billig, E.; Braune, M.; Hahn, A.; Hennig, C.; Klemm, M.; Lenz, V.; Szarka, N. (2018). Bioenergy in a CO_2 Economy. In: *DBFZ-Jahrestagung 2018*: *Energie & Stoffe aus Biomasse: Konkurrenten oder Partner? 19./20. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 11). ISBN: 978-3-946629-32-0. S. 372–378.

Thrän, D.; Lenz, V.; Liebetrau, J.; Majer, S.; Müller-Langer, F.; Braune, M.; Oehmichen, K.; Pfeiffer, D. (2018). Is there enough for everything and everyone?: Bioenergy between different expectations. In: *HTP-Fachforum 2018*: *Hydrothermale Prozesse zur stofflichen und energetischen Wertschöpfung*. *19./20. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 12). ISBN: 978-3-946629-34-4. S. 10–19.

Thrän, D.; Lenz, V.; Liebetrau, J.; Majer, S.; Müller-Langer, F.; Braune, M.; Oehmichen, K.; Pfeiffer, D. (2018). Is there enough for everything and everyone?: Bioenergy between different expectations. In: *DBFZ-Jahrestagung 2018*: *Energie & Stoffe aus Biomasse: Konkurrenten oder Partner? 19./20. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 11). ISBN: 978-3-946629-32-0. S. 10–19.

Zeng, T. (2018). Dedicated mechanical fuel pre-treatment of low quality woody and non-woody residue fuels in order to optimize their emission and combustion behavior in small scale appliances. In: *1. Deutsches Doktorandenkolloquium Bioenergie*: *20./21. September 2018*. [online]. Leipzig: DBFZ. (Tagungsreader, 13). ISBN: 978-3-946629-35-1. S. 110.

Journal articles (peer reviewed)

Açikkalp, E.; Zeng, T.; Ortwein, A.; Burkhardt, H.; Klenk, W. (2018). "Exergy, Exergoeconomic and Enviroeconomic Evaluation of a Biomass Boiler-Steam Engine Micro-CHP System". *Chemical Engineering & Technology* (ISSN: 0930-7516), Vol. 41, Nr. 11. S. 2141–2149. DOI: 10.1002/ceat.201800041.

Elberg, K.; Steuer, P.; Habermann, U.; Lenz, J.; Nelles, M.; Südekum, K.-H. (2018). "A small scale in vitro system for high throughput gas production analysis: A comparison with the Hohenheim gas test". *Animal Feed Science and Technology* (ISSN: 0377-8401), Nr. 241. S. 8–14. DOI: 10.1016/j.anifeedsci.2018.04.001.

Hadef, A.; Mameri, A.; Tabet, F.; Aouachria, Z. (2018). "Effect of the addition of H_2 and H_2O on the polluting species in a counter-flow diffusion flame of biogas in flameless regime". *International Journal of Hydrogen Energy* (ISSN: 0360-3199), Vol. 43, Nr. 6. S. 3475–3481. DOI: 10.1016/j.ijhydene.2017.11.159.

Hemidat, S.; Jaar, M.; Nassour, A.; Nelles, M. (2018). "Monitoring of Composting Process Parameters: A Case Study in Jordan". *Waste and Biomass Valorization* (ISSN: 1877-2641), Vol. 9, Nr. 12. S. 2257–2274. DOI: 10.1007/s12649-018-0197-x.

Janke, L.; Weinrich, S.; Leite, A. F.; Sträuber, H.; Radetski, C. M.; Nikolausz, M.; Nelles, M.; Stinner, W. (2018). "Year-round biogas production in sugarcane biorefineries: Process stability, optimization and performance of a two-stage reactor system". *Energy Conversion and Management* (ISSN: 0196-8904), Vol. 168, Nr. 168. S. 188–199. DOI: 10.1016/j.enconman.2018.04.101.

Köchermann, J.; Görsch, K.; Wirth, B.; Mühlenberg, J.; Klemm, M. (2018). "Hydrothermal carbonization: Temperature influence on hydrochar and aqueous phase composition during process water recirculation". *Journal of Environmental Chemical Engineering* (ISSN: 2213-3437), Vol. 6, Nr. 4. S. 5481–5487. DOI: 10.1016/j.jece.2018.07.053.

Köchermann, J.; Mühlenberg, J.; Klemm, M. (2018). "Kinetics of Hydrothermal Furfural Production from Organosolv Hemicellulose and d -Xylose". *Industrial & Engineering Chemistry Research* (ISSN: 0888-5885), Vol. 57, Nr. 43. S. 14417–14427. DOI: 10.1021/acs.iecr.8b03402.

Kretzschmar, J.; Böhme, P.; Liebetrau, J.; Mertig, M.; Harnisch, F. (2018). "Microbial Electrochemical Sensors for Anaerobic Digestion Process Control: Performance of Electroactive Biofilms under Real Conditions". *Chemical Engineering & Technology* (ISSN: 0930-7516), Vol. 41, Nr. 4. S. 687–695. DOI: 10.1002/ceat.201700539.

Kröger, M.; Klemm, M.; Nelles, M. (2018). "Hydrothermal Disintegration and Extraction of Different Microalgae Species". *Energies* (ISSN: 1996-1073), Vol. 11, Nr. 2. DOI: 10.3390/en11020450.

Lv, Z.; Jiang, J.; Liebetrau, J.; Richnow, H.-H.; Fischer, A.; Ács, N.; Nikolausz, M. (2018). "Ammonium Chloride vs Urea-Induced Ammonia Inhibition of the Biogas Process Assessed by Stable Isotope Analysis". *Chemical Engineering & Technology* (ISSN: 0930-7516), Vol. 41, Nr. 4. S. 671–679. DOI: 10.1002/ceat.201700482.

Mameri, A.; Tabet, F.; Hadef, A. (2018). "MILD combustion of hydrogenated biogas under several operating conditions in an opposed jet configuration". *International Journal of Hydrogen Energy* (ISSN: 0360-3199), Vol. 43, Nr. 6. S. 3566–3576. DOI: 10.1016/j.ijhydene.2017.04.273.

Matthischke, S.; Roensch, S.; Güttel, R. (2018). "Start-up Time and Load Range for the Methanation of Carbon Dioxide in a Fixed-Bed Recycle Reactor". *Industrial & Engineering Chemistry Research* (ISSN: 0888-5885), Vol. 57, Nr. 18. S. 6391–6400. DOI: 10.1021/acs.iecr.8b00755.

May, T.; Polag, D.; Keppler, F.; Greule, M.; Müller, L.; König, H. (2018). "Methane oxidation in industrial biogas plants: insights in a novel methanotrophic environment evidenced by pmoA gene analyses and stable isotope labelling studies". *Journal of Biotechnology* (ISSN: 01681656), Nr. 270. S. 77–84. DOI: 10.1016/j.jbiotec.2018.01.022.

Millinger, M.; Thrän, D. (2018). "Biomass price developments inhibit biofuel investments and research in Germany: The crucial future role of high yields". *Journal of Cleaner Production* (ISSN: 0959-6526), Nr. 172. S. 1654–1663. DOI: 10.1016/j.jclepro.2016.11.175.

Olsson, O.; Roos, A.; Guisson, R.; Bruce, L.; Lamers, P.; Hektor, B.; Thrän, D.; Hartley, D.; Ponitka, J.; Hildebrandt, J. (2018). "Time to tear down the pyramids?: A critique of cascading hierarchies as a policy tool". *WIREs* (ISSN: 2041-840X), Vol. 7, Nr. 2. S. e279. DOI: 10.1002/wene.279.

Pollex, A.; Zeng, T.; Khalsa, J. H. A.; Erler, U.; Schmersahl, R.; Schön, C.; Kuptz, D.; Lenz, V.; Nelles, M. (2018). "Content of potassium and other aerosol forming elements in commercially available wood pellet batches". *Fuel* (ISSN: 0016-2361), Nr. 232. S. 384–394. DOI: 10.1016/j.fuel.2018.06.001.

Reißmann, D.; Thrän, D.; Bezama, A. (2018). "How to identify suitable ways for the hydrothermal treatment of wet bio-waste?: A critical review and methods proposal". *Waste Management & Research* (ISSN: 0734-242X), Vol. 36, Nr. 10. S. 912-923. DOI: 10.1177/0734242X18785735.

Reißmann, D.; Thrän, D.; Bezama, A. (2018). "Hydrothermal processes as treatment paths for biogenic residues in Germany: A review of the technology, sustainability and legal aspects". *Journal of Cleaner Production* (ISSN: 0959-6526), Nr. 172. S. 239–252. DOI: 10.1016/j.jclepro.2017.10.151.

Reißmann, D.; Thrän, D.; Bezama, A. (2018). "Techno-economic and environmental suitability criteria of hydrothermal processes for treating biogenic residues: A SWOT analysis approach". *Journal of Cleaner Production* (ISSN: 0959-6526), Nr. 200. S. 293–304. DOI: 10.1016/j.jclepro.2018.07.280.

Scheftelowitz, M.; Becker, R.; Thrän, D. (2018). "Improved power provision from biomass: A retrospective on the impacts of German energy policy". *Biomass and Bioenergy* (ISSN: 0961-9534), Nr. 111. S. 1–12. DOI: 10.1016/j.biombioe.2018.01.010.

Schneider, J.; Struve, M.; Trommler, U.; Schlüter, M.; Seidel, L.; Dietrich, S.; Rönsch, S. (2018). "Performance of supported and unsupported Fe and Co catalysts for the direct synthesis of light alkenes from synthesis gas". *Fuel Processing Technology* (ISSN: 0378-3820), Nr. 170. S. 64–78. DOI: 10.1016/j.fuproc.2017.10.018.

Sedlmayer, I.; Arshadi, M.; Haslinger, W.; Hofbauer, H.; Larsson, I.; Lönnermark, A.; Nilsson, C.; Pollex, A.; Schmidl, C.; Stelte, W.; Wopienka, E.; Bauer-Emhofer, W. (2018). "Determination of off-gassing and self-heating potential of wood pellets: Method comparison and correlation analysis". *Fuel* (ISSN: 0016-2361), Vol. 234. S. 894–903. DOI: 10.1016/j.fuel.2018.07.117.

Siebert, A.; Bezama, A.; O'Keeffe, S.; Thrän, D. (2018). "Social life cycle assessment: In pursuit of a framework for assessing wood-based products from bioeconomy regions in Germany". *The International Journal of Life Cycle Assessment* (ISSN: 0948-3349), Vol. 23, Nr. 3. S. 651–662. DOI: 10.1007/s11367-016-1066-0.

Siebert, A.; Bezama, A.; O'Keeffe, S.; Thrän, D. (2018). "Social life cycle assessment indices and indicators to monitor the social implications of wood-based products". *Journal of Cleaner Production* (ISSN: 0959-6526), Nr. 172. S. 4074–4084. DOI: 10.1016/j.jclepro.2017.02.146.

Sträuber, H.; Bühlingen, F.; Kleinsteuber, S.; Zechendorf, M. (2018). "Carboxylic acid production from ensiled crops in anaerobic solid-state fermentation: Trace elements as pH controlling agents support microbial chain elongation with lactic acid". *Engineering in Life Sciences* (ISSN: 1618-2863), Vol. 18, Nr. 7. S. 447–458. DOI: 10.1002/elsc.201700186.

Szarka, N.; Wolfbauer, J.; Bezama, A. (2018). "A systems dynamics approach for supporting regional decisions on the energetic use of regional biomass residues". *Waste Management & Research* (ISSN: 0734-242X), Vol. 36, Nr. 4. S. 332–341. DOI: 10.1177/0734242X18757626.

Thrän, D.; Billig, E.; Brosowski, A.; Klemm, M.; Seitz, S. B.; Witt, J. (2018). "Bioenergy Carriers: From Smoothly Treated Biomass towards Solid and Gaseous Biofuels". *Chemie Ingenieur Technik* (ISSN: 1522-2640), Vol. 90, Nr. 1–2. S. 68–84. DOI: 10.1002/cite.201700083.

Valera-Medina, A.; Giles, A.; Pugh, D.; Morris, S.; Pohl, M.; Ortwein, A. (2018). "Investigation of combustion of emulated biogas in a gas turbine test rig". *Journal of Thermal Science* (ISSN: 1003-2169), Vol. 27, Nr. 4. S. 331–340. DOI: 10.1007/s11630-018-1024-1.

Witing, F.; Prays, N.; O'Keeffe, S.; Gründling, R.; Gebel, M.; Kurzer, H.-J.; Daniel-Gromke, J.; Franko, U. (2018). "Biogas production and changes in soil carbon input: A regional analysis". *Geoderma* (ISSN: 0016-7061), Nr. 320. S. 105–114. DOI: 10.1016/j.geoderma.2018.01.030.

Zech, K.; Dietrich, S.; Reichmuth, M.; Weindorf, W.; Müller-Langer, F. (2018). "Techno-economic assessment of a renewable bio-jet-fuel production using power-to-gas". *Applied Energy* (ISSN: 0306-2619), Nr. 231. S. 997–1006. DOI: 10.1016/j.apenergy.2018.09.169.

Zehnsdorf, A.; Moeller, L.; Stabenau, N.; Bauer, A.; Wedwitschka, H.; Gallegos, D.; Stinner, W.; Herbes, C. (2018). "Biomass potential analysis of aquatic biomass and challenges for its use as a non-conventional substrate in anaerobic digestion plants". *Engineering in Life Sciences* (ISSN: 1618-2863), Vol. 18, Nr. 7. S. 492–497. DOI: 10.1002/elsc.201800032.

Zeng, T.; Pollex, A.; Weller, N.; Lenz, V.; Nelles, M. (2018). "Blended biomass pellets as fuel for small scale combustion appliances: Effect of blending on slag formation in the bottom ash and pre-evaluation options". *Fuel* (ISSN: 0016-2361), Nr. 212. S. 108–116. DOI: 10.1016/j.fuel.2017.10.036.

Zhou, Y.; Engler, N.; Nelles, M. (2018). "Symbiotic relationship between hydrothermal carbonization technology and anaerobic digestion for food waste in China". *Bioresource Technology* (ISSN: 0960-8524), Nr. 260. S. 404–412. DOI: 10.1016/j.biortech.2018.03.102.

Zhou, Y.; Liu, Y.; Li, Y.; He, Z.; Xu, Q.; Chen, Y.; Street, J.; Guo, H.; Nelles, M. (2018). "Multicolor carbon nanodots from food waste and their heavy metal ion detection application". *RSC Advances* (ISSN: 2046-2069), Vol. 8, Nr. 42. S. 23657–23662. DOI: 10.1039/c8ra03272f.

Open Access Articles (peer reviewed)

Bauer, A.; Moeller, L.; Wedwitschka, H.; Stinner, W.; Zehnsdorf, A. (2018). "Anaerobic digestion of mixed silage of waterweed biomass and wheat straw in a long-term semi-continuous biogas production process". *Energy, Sustainability and Society* (ISSN: 2192-0567), Vol. 8, Nr. 4. DOI: 10.1186/s13705-017-0145-9.

Becker, R.; Thrän, D. (2018). "Optimal Siting of Wind Farms in Wind Energy Dominated Power Systems". *Energies* (ISSN: 1996-1073), Vol. 11, Nr. 4. DOI: 10.3390/en11040978.

Bonk, F.; Popp, D.; Weinrich, S.; Sträuber, H.; Kleinsteuber, S.; Harms, H.; Centler, F. (2018). "Am-

monia Inhibition of Anaerobic Volatile Fatty Acid Degrading Microbial Communities". *Frontiers in Microbiology* (ISSN: 1664-302X), Nr. 9. DOI: 10.3389/fmicb.2018.02921.

Bonk, F.; Popp, D.; Weinrich, S.; Sträuber, H.; Kleinsteuber, S.; Harms, H.; Centler, F. (2018). "Intermittent fasting for microbes: How discontinuous feeding increases functional stability in anaerobic digestion". *Biotechnology for Biofuels* (ISSN: 1754-6834), Vol. 11. DOI: 10.1186/s13068-018-1279-5.

Candra, D. I.; Hartmann, K.; Nelles, M. (2018). "Economic Optimal Implementation of Virtual Power Plants in the German Power Market". *Energies* (ISSN: 1996-1073), Vol. 11, Nr. 9. DOI: 10.3390/en11092365.

Chaabane, W.; Nassour, A.; Nelles, M. (2018). "Solid Waste Management Key Indicator Development for Hotels: A Tunisian Case Study Analysis". *Recycling* (ISSN: 2313-4321), Vol. 3, Nr. 4. DOI: 10.3390/recycling3040056.

Daniel-Gromke, J.; Rensberg, N.; Denysenko, V.; Stinner, W.; Schmalfuß, T.; Scheftelowitz, M.; Nelles, M.; Liebetrau, J. (2018). "Current Developments in Production and Utilization of Biogas and Biomethane in Germany". *Chemie Ingenieur Technik* (ISSN: 1522-2640), Vol. 90, Nr. 1–2. S. 17–35. DOI: 10.1002/cite.201700077.

Gallegos, D.; Wedwitschka, H.; Moeller, L.; Weinrich, S.; Zehnsdorf, A.; Nelles, M.; Stinner, W. (2018). "Mixed silage of Elodea and wheat straw as a substrate for energy production in anaerobic digestion plants". *Energy, Sustainability and Society* (ISSN: 2192-0567), Vol. 8, Nr. 7. DOI: 10.1186/s13705-018-0148-1.

Hafner, S. D.; Koch, K.; Carrere, H.; Astals, S.; Weinrich, S.; Rennuit, C. (2018). "Software for biogas research: Tools for measurement and prediction of methane production". *SoftwareX* (ISSN: 2352-7110), Nr. 7. S. 205–210. DOI: 10.1016/j.softx.2018.06.005.

Horschig, T.; Adams, P. W.R.; Gawel, E.; Thrän, D. (2018). "How to decarbonize the natural gas sector: A dynamic simulation approach for the market development estimation of renewable gas in Germany". *Applied Energy* (ISSN: 0306-2619), Nr. 213. S. 555–572. DOI: 10.1016/j.apenergy.2017.11.016.

Kohler, H.; Ojha, B.; Illyaskutty, N.; Hartmann, I.; Thiel, C.; Eisinger, K.; Dambacher, M. (2018). "In situ high-temperature gas sensors: Continuous monitoring of the combustion quality of different wood combustion systems and optimization of combustion process". *Journal of Sensors and Sensor Systems* (ISSN: 2194-8771), Vol. 7, Nr. 1. S. 161–167. DOI: 10.5194/jsss-7-161-2018.

Lauer, M.; Hansen, J. K.; Lamers, P.; Thrän, D. (2018). "Making money from waste: The economic viability of producing biogas and biomethane in the Idaho dairy industry". *Applied Energy* (ISSN: 0306-2619), Nr. 222. S. 621–636. DOI: 10.1016/j.apenergy.2018.04.026.

Lauer, M.; Thrän, D. (2018). "Flexible Biogas in Future Energy Systems: Sleeping Beauty for a Cheaper Power Generation". *Energies* (ISSN: 1996-1073), Vol. 11, Nr. 4. DOI: 10.3390/en11040761.

Majer, S.; Wurster, S.; Moosmann, D.; Ladu, L.; Sumfleth, B.; Thrän, D. (2018). "Gaps and Research Demand for Sustainability Certification and Standardisation in a Sustainable Bio-Based Economy in the EU". *Sustainability* (ISSN: 2071-1050), Vol. 10, Nr. 7. DOI: 10.3390/su10072455.

Maus, I.; Rumming, M.; Bergmann, I.; Heeg, K.; Pohl, M.; Nettmann, E.; Jaenicke, S.; Blom, J.; Pühler, A.; Schlüter, A.; Sczyrba, A.; Klocke, M. (2018). "Characterization of Bathyarchaeota genomes assembled from metagenomes of biofilms residing in mesophilic and thermophilic biogas reactors". *Biotechnology for Biofuels* (ISSN: 1754-6834), Nr. 11. DOI: 10.1186/s13068-018-1162-4.

Millinger, M.; Meisel, K.; Budzinski, M.; Thrän, D. (2018). "Relative Greenhouse Gas Abatement Cost Competitiveness of Biofuels in Germany". *Energies* (ISSN: 1996-1073), Vol. 11, Nr. 3. DOI: 10.3390/en11030615.

Moeller, L.; Bauer, A.; Wedwitschka, H.; Stinner, W.; Zehnsdorf, A. (2018). "Crop Characteristics of Aquatic Macrophytes for Use as a Substrate in Anaerobic Digestion Plants: A Study from Germany". *Energies* (ISSN: 1996-1073), Vol. 11, Nr. 11. DOI: 10.3390/en11113016.

Pfeiffer, D.; Thrän, D. (2018). "One Century of Bioenergy in Germany: Wildcard and Advanced Technology". *Chemie Ingenieur Technik* (ISSN: 1522-2640), Vol. 90, Nr. 11. S. 1676–1698. DOI: 10.1002/cite.201800154.

Purkus, A.; Gawel, E.; Szarka, N.; Lauer, M.; Lenz, V.; Ortwein, A.; Tafarte, P.; Eichhorn, M.; Thrän, D. (2018). "Contributions of flexible power generation from biomass to a secure and cost-effective electricity supply: a review of potentials, incentives and obstacles in Germany". *Energy, Sustainability and Society* (ISSN: 2192-0567), Vol. 8, Nr. 1. S. 18. DOI: 10.1186/s13705-018-0157-0.

Reißmann, D.; Thrän, D.; Bezama, A. (2018). "Key Development Factors of Hydrothermal Processes in Germany by 2030: A Fuzzy Logic Analysis". *Energies* (ISSN: 1996-1073), Vol. 11, Nr. 12. DOI: 10.3390/en11123532.

Siebert, A.; O'Keeffe, S.; Bezama, A.; Zeug, W.; Thrän, D. (2018). "How not to compare apples and oranges: Generate context-specific performance reference points for a social life cycle assessment model". *Journal of Cleaner Production* (ISSN: 0959-6526), Nr. 198. S. 587–600. DOI: 10.1016/j.jclepro.2018.06.298.

Stabenau, N.; Zehnsdorf, A.; Rönicke, H.; Wedwitschka, H.; Moeller, L.; Ibrahim, B.; Stinner, W. (2018). "A potential phosphorous fertilizer for organic farming: Recovery of phosphorous resources in the course of bioenergy production through anaerobic digestion of aquatic macrophytes". *Energy Research & Social Science* (ISSN: 2214-6296), Vol. 8, Nr. 16. DOI: 10.1186/s13705-018-0155-2.

Weiner, B.; Breulmann, M.; Wedwitschka, H.; Fühner, C.; Kopinke, F.-D. (2018). "Wet Oxidation of Process Waters from the Hydrothermal Carbonization of Sewage Sludge". *Chemie Ingenieur Technik*, Vol. 90, H. 6. S. 872–880. DOI: 10.1002/cite.201700050

Journal articles (not peer reviewed)

Clauß, T.; Reinelt, T. (2018). "European harmonisation of methods to quantify methane emissions from biogas plants (MetHarmo)". *Newsletter ERA-NET Bioenergy/BESTF3*, Nr. October. S. 7–8.

Daniel-Gromke, J.; Rensberg, N.; Denysenko, V.; Oehmichen, K.; Beil, M.; Beyrich, W.; Trommler, M. (2018). "Verbundvorhaben ‚Biogas 2030': Optionen für Biogasanlagen bis zum Jahr 2030". *DVGW Energie-, Wasser-Praxis* (ISSN: 0341-0323), Nr. 2. S. 30–33.

Hartmann, I.; Kerner, S.; Jessberger, A. (2018). "Verbrennung von zerkleinerten Holzbriketts in automatisch beschickten Kleinfeuerungsanlagen". *Umweltmagazin* (ISSN: 0173-363X), Vol. 48, Nr. 1/2. S. 32–34.

Lenz, V.; Naumann, K.; Denysenko, V.; Daniel-Gromke, J.; Rensberg, N.; Rönsch, C.; Janczik, S.; Maslaton, M.; Hilgedieck, J.; Kaltschmitt, M. (2018). "Erneuerbare Energien". *BWK: Das Energie-Fachmagazin* (ISSN: 1618-193X), Vol. 70, Nr. 5. S. 56–81.

Liebetrau, J.; Kleinsteuber, S.; Jacobi, H.-F.; Pfeiffer, D. (2018). "Editorial: Monitoring and Process Control of Anaerobic Digestion Plants". *Chemical Engineering & Technology* (ISSN: 0930-7516), Vol. 41, Nr. 4. S. 670. DOI: 10.1002/ceat.201870045.

Nassour, A.; Hemidat, S.; Chaabane, W., Eickhoff, I.; Nelles, M. (2018). "Aktuelle Entwicklungen in der Abfallwirtschaft im arabischen Raum". *Müll und Abfall* (ISSN: 0027-2957), Vol. 50, Nr. 4. S. 160–166.

Nelles, M. (2018). "Editorial: Internationale Abfallwirtschaft: Unterstützung aus Deutschland sehr gefragt". *Müll und Abfall* (ISSN: 0027-2957), Vol. 50, Nr. 4. S. 157.

Nelles, M.; Pivato, A. (2018). "Editorial: Special Section: Biological Waste to Energy". *Waste Management* (ISSN: 0956-053X), Vol. 71. S. 603–604. DOI: 10.1016/j.wasman.2017.11.046.

Schäfer, F.; Zechendorf, M.; Pröter, J.; Leiker, M. (2018). "Mit Eisen gegen Schwefel". *Bauern Zeitung* (ISSN: 2194-2579), Nr. 12. S. 2–3.

Szarka, N. (2018). "Forschen an smarten Konzept". *Stadt + Werk* (ISSN: 2193-195X), Nr. 7/8. S. 26–27.

Thrän, D. (2018). "Energiewende durch Digitalisierung erst möglich?". *Energie aus Pflanzen* (ISSN: 2194-6744), Vol. 22, Nr. 6. S. 54–55.

Thrän, D.; Pfeiffer, D. (2018). "Editorial: Biomass Energy Use: Bioenergy – Flexible and Integrated Into the Next Age". *Chemical Engineering & Technology* (ISSN: 0930-7516), Vol. 41, Nr. 11. S. 2100. DOI: 10.1002/ceat.201870115.

Witt, J.; Magdowski, A.; Janczik, S.; Kirstein, N.; Christ, D.; Hilgedieck, J.; Kaltschmitt, M. (2018). "Erneuerbare Energien weltweit: Globaler Stand 2017". *BWK: Das Energie-Fachmagazin* (ISSN: 1618-193X), Vol. 70, Nr. 7/8. S. 15–35.

Reports, background papers, statements etc.

Barisic, Z.; Baumann, F.-M.; Grimm, C.; Hartmann, H.; Heikrodt, K.; Huenges, E.; Kaltschmitt, M.; Maslaton, M.; Müller, S.; Pitz-Paal, R.; Stryi-Hipp, G.; Schulz, D.; Skiba, M.; Stuible, A.; Theobald, S.; Daniel-Gromke, J.; Janczik, S.; Lenz, V.; Magdowski, A.; Müller-Langer, F.; Rensberg, N.; Rönsch, C.; Witt, J. (2018). *Regenerative Energien*. Düsseldorf. VDI. 108 S.

Jahresbericht 2017 (2018). Leipzig. DBFZ. 195 S. ISBN: 978-3-946629-25-2.

Hildebrandt, J.; Bezama, A.; Thrän, D.; Jähkel, A. (2018). *Handbuch: Anwendung des MCDA Tools für ein Nachhaltigkeitsmonitoring auf der Web- Plattform "D-Sight®". FKZ 031A078A*. Leipzig. Bundesministeriums für Bildung und Forschung (BMBF). 26 S.

Scheftelowitz, M.; Thrän, D.; Liebetrau, J.; Lenz, V.; Lauer, M.; Dotzauer, M.; Daniel-Gromke, J.; Witt, J.; Nelles, M. (2018). *Stellungnahme zum EEG 2017*. Leipzig. DBFZ. 12 S.

Siebert, A.; Bezama, A.; Zeug, W.; O'Keeffe, S.; Thrän, D.; Jähkel, A. (2018). *Bericht RESPONSA: Regional Spezifisches Contextualisiertes Social life cycle Assessment. FKZ 031A078A*. Leipzig. Bundesministeriums für Bildung und Forschung (BMBF). 37 S.

Presentations

Antwi, E.; Schüch, A.; Engler, N.; Nelles, M. (2018). *The effect of hydrothermal pre-treatment on the biogas yield of cocoa pods*. Vortrag gehalten: 1. Deutsches Doktorandenkolloquium Bioenergie, Leipzig, 20.–21.09.2018.

Barchmann, T.; Daniel-Gromke, J.; Schmalfuß, T.; Denysenko, V.; Rensberg, N.; Liebetrau, J.; Nelles, M. (2018). *Strategien und Perspektiven für Biogas in Deutschland im Rahmen der Sektorenkopplung*. Vortrag gehalten: 12. Rostocker Bioenergieforum, Rostock, 28.–29.06.2018.

Barchmann, T.; Dotzauer, M. (2018). *Flexibilisierung von Biogasanlagen und optimierte Wärmenutzungskonzepte*. Vortrag gehalten: Biogas-Experten-Workshop "Bio2020Plus", Erfurt, 29.11.2018.

Barchmann, T.; Mauky, E.; Kornatz, P.; Rensberg, N.; Kretzschmar, J. (2018). *Neues aus der Forschung: Forschungsvorhaben GAZELLE. Ganzheitlich flexibler Betrieb*. Vortrag gehalten: Messe energy decentral – FlexForum, Hannover, 14.11.2018.

Beidaghy Dizaji, H.; Schliermann, T.; Hartmann, I.; Zeng, T.; Schneider, D.; Wassersleben, S.; Enke, D.; Jobst, T.; Lange, A.; Roelofs, F.; Fellner, A.; Schneider, P. (2018). *High quality biogenic silica from combined energetic and material utilization of agricultural residues*. Vortrag gehalten: 7th International Symposium on Energy from Biomass and Waste, Venedig (Italien), 15.–18.10.2018.

Bienert, K. (2018). *Record Biomap Project: Introduction & Objectives*. Vortrag gehalten: Webinar "Innovative technologies for biomethane production in small and medium scale applications", [online], 21.02.2018.

Bienert, K. (2018). *Comparative Impact Assessment of biomethane related innovations*. Vortrag gehalten: 3rd Workshop of Record Biomap, Töreboda (Sweden), 22.03.2018.

Bienert, K.; Shakya, S.; Fischer, E.; Schumacher, B.; Rojas Arboleda, M.; Rogstrand, G.; Zielinski, M.; Dębowski, M. (2018). *Technologies for biomethane production in small and medium scale applications: Assessment within the European Project RECORD BIOMAP*. Vortrag gehalten: 26th European Biomass Conference and Exhibition, Kopenhagen (Dänemark), 14.–17.05.2018.

Bindig, R. (2018). *Verfahren zur Entwicklung von Katalysatoren für die Emissionsminderung an Verbrennungsanlagen: Vom Labor in die Praxis*. Vortrag gehalten: 1. Deutsches Doktorandenkolloquium Bioenergie, Leipzig, 20.–21.09.2018.

Brosowski, A. (2018). *Impact of Residues: Mobilisation of Residues for Bio-CH_4-Production*. Vortrag gehalten: Workshop "Bio-CH_4 and H_2 Production Based on Local Feedstocks", Frankfurt am Main, 13.12.2018.

Brosowski, A.; Mantau, U.; Mahro, B.; Noke, A.; Richter, F.; Krause, T.; Bischof, R.; Hering, T.; Blanke, C.; Szarka, N.; Bill, R.; Thrän, D. (2018). *Nachhaltige Rohstoffbasis für die stoffliche und energetische Nutzung*. Vortrag gehalten: DBFZ-Jahrestagung, Leipzig, 19.–20.09.2018.

Brosowski, A.; Mantau, U.; Mahro, B.; Noke, A.; Richter, F.; Raussen, T.; Krause, T.; Bischof, R.; Hering, T.; Warsitzka, C.; Blanke, C.; Szarka, N.; Thrän, D. (2018). *Biomassepotenziale von Rest- und Abfallstoffen: Status quo in Deutschland*. Vortrag gehalten: 12. Bad Hersfelder Biomasseforum, Bad Hersfeld, 07.11.2018.

Büchner, D. (2018). *Novel control methods for existing heating appliances*. Vortrag gehalten: World Sustainable Energy Days, Wels (Österreich), 28.02.–01.03.2018.

Büchner, D.; Lenz, V. (2018). *Erkenntnisse zum Gesundheits- und Arbeitsschutz basierend auf der toxikologischen Relevanz der Feinstäube von Biomasseverbrennungsanlagen*. Vortrag gehalten: AG Treffen Vergasung von Biomasse, Amberg, 16.04.2018.

Büchner, D.; Lenz, V. (2018). *Wandel von der reinen Wärmebereitstellung zur smarten Wärme-Kraft-Kopplung in integrierten Systemen*. Vortrag gehalten: DBFZ-Jahrestagung, Leipzig, 19.–20.09.2018.

Clauß, T. (2018). *The results of the MetHarmo measurement campaigns and presentation of the harmonized guideline*. Vortrag gehalten: Workshop MetHarmo, Lund (Schweden), 01.02.2018.

Clauß, T.; Reinelt, T. (2018). *The MetHarmo project: European harmonisation of methods to quantify methane emissions from biogas plants*. Vortrag gehalten: Workshop MetHarmo, Lund (Schweden), 01.02.2018.

Daniel-Gromke, J. (2018). *Workshop Flexibilisierung von Biogasanlagen*. Vortrag gehalten: DBFZ-Jahrestagung, Leipzig, 19.-20.09.2018.

Daniel-Gromke, J.; Denysenko, V.; Rensberg, N.; Barchmann, T.; Schmalfuß, T.; Oehmichen, K.; Stinner, W. (2018). *Optionen für den Weiterbetrieb von Biogasanlagen – Ergebnisse einer Konzeptbewertung und Szenarienanalyse zur Umsetzung zukunftsfähiger Anlagenkonzepte*. Vortrag gehalten: BIOGAS Convention, Hannover, 13.–16.11.2018.

Daniel-Gromke, J.; Kretzschmar, J.; Stinner, W.; Barchmann, T.; Denysenko, V.; Rensberg, N.; Liebetrau, J. (2018). *Beitrag von Biogas im Rahmen der Sektorkopplung*. Vortrag gehalten: Expertenfrühstück "Die Rolle des Gassektors in der Energiewende", Berlin, 22.03.2018.

Daniel-Gromke, J.; Rensberg, N.; Denysenko, V. (2018). *Umfang der Wärmenutzung von Biogasanlagen: aktuelle Befragungs- und Forschungsergebnisse*. Vortrag gehalten: AGEE-Stat Fachgespräch "Bilanzierung der Wärmenutzung von Biogasanlagen", Berlin, 25.04.2018.

Daniel-Gromke, J.; Rensberg, N.; Denysenko, V.; Stinner, W. (2018). *Biogaserzeugung in Deutschland: Stand und Perspektiven*. Vortrag gehalten: Ringvorlesung "Zukunftsfähige Landwirtschaft. Agrarenergie heute. Wie steht es um erneuerbare Energien aus der Landwirtschaft?", Halle, 13.12.2018.

Dietrich, S. (2018). *Biogas upgrading to high-calorific natural gas by synthesis of light hydrocarbons*. Vortrag gehalten: 1. Deutsches Doktorandenkolloqium Bioenergie, Leipzig, 21.09.2018.

Dietrich, S.; Schneider, J.; Rönsch, S. (2018). *Biogasaufbereitung zu H-Gas durch direkte Synthese kurzkettiger Kohlenwasserstoffe*. Vortrag gehalten: Jahrestreffen der ProcessNet-Fachgruppe Energieverfahrenstechnik, Frankfurt am Main, 07.03.2018.

Dotzauer, M. (2018). *Smart Bioenergy: Innovations for a sustainable future*. Vortrag gehalten: Besuchergruppe Universität Leipzig, VL "Bioenergiesysteme", Leipzig, 15.05.2018.

Dotzauer, M. (2018). *Bioenergie rentabel flexibilisieren: Vergleich von Betriebsstrategien für Biogasanlagen*. Vortrag gehalten: 12. Rostocker Bioenergieforum, Rostock, 28.–29.06.2018.

Eichhorn, M.; Erdmann, G.; Oehmichen, G.; Schinkel, B.; Thrän, D. (2018). *How to Monitor the Impacts of Renewable Energy Technologies on Nature and Landscape Protection*. Vortrag gehalten: 11th SEEP Conference, Glasgow (Schottland), 08.–11.05.2018.

Eichhorn, M.; Erdmann, G.; Ponitka, J.; Sachs, M.; Thrän, D. (2018). *25 Years of Wind Power Development in Germany*. Vortrag gehalten: 11th SEEP Conference, Glasgow (Schottland), 08.-11.05.2018.

Eichhorn, M.; Tafarte, P.; Masurowski, F.; Becker, R.; Thrän, D. (2018). *Sustainable Allocation of Wind Power in Germany: A Distance-Based Approach*. Vortrag gehalten: UFZ Energy Days, Leipzig, 24.–25.09.2018.

Ekanthalu, V. S.; Morscheck, G.; Narra, S.; Nelles, M. (2018). *Hydrothermal carbonization: A sustainable approach to deal with the challenges in sewage sludge management*. Vortrag gehalten: 8th IconSWM, Guntur (Indien), 22.–24.11.2018.

Fritsche, U.; Mai-Moulin, T.; Junginger, M.; Kline, K.; Thiffault, E.; Thrän, D. (2018). *Positions, perception and vision of stakeholder groups on*

bioenergy: Key Results. Vortrag gehalten: IEA Bioenergy Triennial Summit, San Francisco, CA (USA), 07.–09.11.2018.

Görsch, K.; Podschun, J.; Klemm, M.; Tutsch, M. (2018). *Hydrothermal conversion of lignocellulosic sugars to furans*. Vortrag gehalten: Exploring lignocellulosic biomass, Reims (Frankreich), 26.–29.06.2018.

Hahn, A. (2018). *Who is driving BECCS research?: A co-authorship network analysis*. Vortrag gehalten: International Conference on Negative CO_2 Emissions, Göteborg (Schweden), 22.–24.05.2018.

Hartmann, I. (2018). *Minderung der Emissionen aus Scheitholzöfen durch ein zweistufiges integriertes Katalysatormodul*. Vortrag gehalten: 9. Fachgespräch "Partikelabscheider in häuslichen Feuerungen", Leipzig, 21.03.2018.

Hartmann, I.; Bindig, R. (2018). *Möglichkeiten, Limitierungen und Entwicklungsbedarf zur katalytischen Emissionsminderung*. Vortrag gehalten: VDI-Forum: Emissionen aus Biogasanlagen, Leipzig, 27.06.2018.

Hartmann, I.; Schliermann, T. (2018). *Kombinierte energetische und stoffliche Nutzung von Agrarreststoffen*. Vortrag gehalten: Berlin, 10.12.2018.

Hennig, C. (2018). *Global wood pellet markets: Key regions, developments and governance*. Vortrag gehalten: IEA Bioenergy Triennial Summit, San Francisco, CA (USA), 07.11.2018.

Kar, I.; O'Keeffe, S.; Franko, U.; Thrän, D. (2018). *Including Soil Impacts within a Regional Life Cycle Assessment*. Vortrag gehalten: UFZ Energy Days, Leipzig, 24.–25.09.2018.

Kirstein, N. (2018). *Der Strohmarkt in Dänemark: Ein Erfolgsmodell mit Übertragbarkeit auf Deutschland?* Vortrag gehalten: 12. Rostocker Bioenergieforum, Rostock, 28.-29.06.2018.

Kirsten, C. (2018). *Auswirkung der Gärrestzusammensetzung auf die Pelletierbarkeit*. Vortrag gehalten: Leipziger Fachgespräche Feste Biomasse, Leipzig, 26.02.2018.

Köchermann, J.; Schreiber, J.; Klemm, M. (2018). *Production of furfural from D-xylose and organosolv hemicellulose in water/ethanol mixtures*. Vortrag gehalten: HTP-Fachforum, Leipzig, 20.09.2018.

Kretzschmar, J.; Liebetrau, J. (2018). *Konzepte zur Kombination von stofflicher und energetischer Biomassenutzung in Biogasanlagen*. Vortrag gehalten: DBFZ-Jahrestagung, Leipzig, 19.–20.09.2018.

Kretzschmar, J.; Weinrich, S.; Liebetrau, J. (2018). *Stand der Flexibilisierung der Biogaserzeugung und Projektbeispiele des DBFZ*. Vortrag gehalten: FNR Fachgespräch "Flexibilisierung der Biogaserzeugung", Gülzow-Prüzen, 05.05.2018.

Kretzschmar, J.; Weinrich, S.; Mauky, E. (2018). *Dynamische Biogasgaserzeugung zur Flexibilisierung: Innovationen aus der Forschung an der Schwelle zur Umsetzung*. Vortrag gehalten: Flexperten Treffen, Kassel, 15.–16.02.2018.

Kurth, M. (2018). *Herstellung, Charakterisierung und Modellierung von wasserselektiven Membranen zur Umsatzsteigerung der Methanisierung: Vorstellung des Promotionsvorhabens*. Vortrag gehalten: Doktorandenkolloquium dbta, Berlin, 20.12.2018.

Lauer, M. (2018). *Gesamtwirtschaftliche Bewertung von Biogasanlagen als Flexibilitätsoption im Stromsystem der Zukunft*. Vortrag gehalten: 1. Deutsches Doktorandenkolloquium Bioenergie, Leipzig, 20.–21.09.2018.

Lauer, M.; Thrän, D. (2018). *Economic assessment of flexible power generation from biogas plants in Germany's future electricity system*. Vortrag gehalten: International Conference on Power and Energy Technology, Lille (Frankreich), 04.–06.07.2018.

Lenz, V. (2018). *Richtungsweisende Forschung oder Forschungsorganisation: Herausforderungen der außeruniversitären Forschung*. Vortrag gehalten: Tagung "Energie – Karrieren und Berufsfelder", Hamburg, 16.03.2018.

Lenz, V. (2018). *Wärmebereitstellung aus Biomasse in Deutschland: heute und in Zukunft*. Vortrag gehalten: 57. FARE-Sitzung, Düsseldorf, 22.03.2018.

Lenz, V. (2018). *Grundlegende Voruntersuchungen zum Einsatz kleiner Holzpellets in Pelletöfen zur Emissionsminderung*. Vortrag gehalten: 22. Arbeitskreis Holzfeuerungen, Straubing, 06.–07.06.2018.

Lenz, V. (2018). *Overview of decentral sector coupling with biomass*. Vortrag gehalten: Biomass to Power and Heat, Zittau, 06.–07.06.2018.

Lenz, V. (2018). *Technical solutions to reduce BC and UFP from residential burning*. Vortrag gehalten: Clean Heat – How to reduce UFP and BC from residential burning?, Brüssel (Belgien), 18.10.2018.

Lenz, V.; Hartmann, I. (2018). Bericht aus der AG Technologie. Vortrag gehalten: FNR, Ausschuss zur Lenkung und Koordinierung von "Maßnahmen zur Weiterentwicklung von automatisch beschickten Kleinfeuerungsanlagen für feste Biobrennstoffe", LA "Feste Biobrennstoffe", EnergyDecentral 2018, Hannover, 13.–16.11.2018.

Lenz, V.; Jordan, M.; Thrän, D. (2018). *Ergebnisdarstellung Projekt Bio-Strom-Wärme und Technologieworkshop im Projekt BioplanW*. Vortrag gehalten: Technologieworkshop Projekt BioplanW, Leipzig, 17.04.2018.

Liebetrau, J. (2018). *Methane Emissions from the Energy Sector: Towards a European Methane Strategy*. Vortrag gehalten: EU Sustainable Energy Week, Brüssel (Belgien), 04.–08.06.2018.

Liebetrau, J. (2018). *Scientific approach for the demonstration of an enzyme effect during anaerobic digestion*. Vortrag gehalten: Ecomondo, Rimini (Italien), 06.–09.11.2018.

Liebetrau, J.; Daniel-Gromke, J.; Rensberg, N.; Denysenko, V.; Stinner, W. (2018). *Manure utilisation in biogas plants in Germany*. Vortrag gehalten: Fortschrittt Gülle und Gärrest, Schwäbisch-Hall, 16.–18.10.2018.

Liebetrau, J.; Müller, L. (2018). *Biochemische Desintegration mittels effizienter Enzyme für den Biogasprozess*. Vortrag gehalten: Biogas Expo & Congress, Offenburg, 31.–01.02.2018.

Liebetrau, J.; Reinelt, T.; Agostini, A. (2018). *Methods for measurement, results and effect on greenhouse gas balance of electricity produced*. Vortrag gehalten: [Webinar], [online], 2018.

Liebetrau, J.; Reinelt, T.; Agostini, A. (2018). *Fugitive methane emissions from biogas facilities*. Vortrag gehalten: IEA Bioenergy Task 37 Workshop Anaerobic Digestion in the Circular Economy, Cork (Irland), 06.09.2018.

Liebetrau, J.; Wedwitschka, H. (2018). *How to comine insect farming with a biogas process?* Vortrag gehalten: Circular economy in the food system, Jyväskylä (Finnland), 08.03.2018.

Link, F.; Müller-Langer, F. (2018). *Novel Approaches for Rapid Diesel Catalyst Aging in Operation with Biofuels*. Vortrag gehalten: 16. FAD-Konferenz, Dresden, 07.–08.11.2018.

Majer, S.; Moosmann, D.; Wurster, S.; Ladu, L.; Thrän, D. (2018). *Gaps and Research Demand Analysis from Current Certification and Standardisation in a Sustainable Biobased Economy*. Vortrag gehalten: 26th European Biomass Conference and Exhibition, Kopenhagen (Dänemark), 14.–17.05.2018.

Majer, S.; Oehmichen, K.; Meisel, K. (2018). *Smart Bioenergy and sustainability assessment at the DBFZ*. Vortrag gehalten: Besuchergruppe Universität Leipzig, VL "Material flow management", Leipzig, 07.11.2018.

Mario König (2018). *Katalytische Reduktion von Stickoxiden bei der Verbrennung biogener Reststoffe*. Vortrag gehalten: DBFZ-Jahrestagung, Leipzig, 19.–20.09.2018.

Matthischke, S.; Rönsch, S.; Güttel, R. (2018). *The recirculation of product gas to enhance the unsteady operation window of fixed-bed reactors*. Vortrag gehalten: Annual Meeting on Reaction Engineering, Marienberg, 08.05.2018.

Mauky, E. (2018). *Modellbasiertes Regelungskonzept für eine bedarfsorientierte Biogasproduktion*. Vortrag gehalten: 1. Deutsches Doktorandenkolloquium Bioenergie, Leipzig, 20.–21.09.2018.

Meisel, K. (2018). *Tracking flow of bio-materials with LCA and MFA*. Vortrag gehalten: 7th International Summer School on Life Cycle Approaches to Sustainable Regional Development, Leipzig, 25.–28.10.2018.

Meisel, K.; Nitzsche, R.; Gröngröft, A. (2018). *Life cycle assessment of new biorefinery concepts producing platform and specialty chemicals based on woody biomass*. Vortrag gehalten: 26th European Biomass Conference and Exhibition, Kopenhagen (Dänemark), 14.–17.05.2018.

Millinger, M.; Thrän, D. (2018). *Optimal biofuel futures: the role of functional units and fuel suitability*. Vortrag gehalten: 9th International Conference on Biofuels and Bioenergy, Edinburgh (Schottland), 29.–30.03.2018.

Morscheck, G.; Ekanthalu, V. S.; Narra, S.; Nelles, M. (2018). *Sewage Sludge Disposal in Germany: Status and Need for Changes*. Vortrag gehalten: 8th IconSWM, Guntur (Indien), 22.–24.11.2018.

Müller, M.; Schenk, J. (2018). *Smart Bioenergy: new developments for energetic and integrated material use of biomas*. Vortrag gehalten: 4th National Scientific Conference "Renewable Energy Sources: Theory and Practice", Opole (Polen), 10.10.2018.

Müller, N. (2018). *Influence factors on the Biomeiler process: Results of the Wittenberg-Project 2017 and Design of Experiments for Leipzig 2018*. Vortrag gehalten: 3rd Biomeiler Congress, Leipzig, 06.10.2018.

Müller-Langer, F.; Etzold, H.; Naumann, K. (2018). *BTx and PTx as competitors or companions: a systemic assessment*. Vortrag gehalten: 8th ETIP Stakeholder Plenary Meeting, Brüssel (Belgien), 12.04.2018.

Müller-Langer, F.; Etzold, H.; Naumann, K. (2018). *Opportunities and challenges of synfuels*. Vortrag gehalten: Methanation and 2nd Generation Fuels, Nürnberg, 24.–25.05.2018.

Müller-Langer, F.; Naumann, K.; Etzold, H. (2018). *Status und Perspektiven biogener Kraftstoffe sowie Synergien mit PTx*. Vortrag gehalten: Power to Gas in der Praxis. Potenzial und Erfahrungsbericht, Haßfurt, 20.11.2018.

Naumann, K. (2018). *Renewable fuels: Comparison of BTx and PTx systems*. Vortrag gehalten: Kraftstoffe der Zukunft, Berlin, 23.01.2018.

Nelles, M. (2018). *Energetische und stoffliche Verwertung von biogenen Abfällen und Reststoffen*. Vortrag gehalten: 1. Deutsches Doktorandenkolloquium Bioenergie, Leipzig, 20.–21.09.2018.

Nelles, M. (2018). *Biogenic waste and residues in the energy system of the future*. Vortrag gehalten: 7th International Symposium on Energy from Biomass and Waste, Venedig (Italien), 15.–18.10.2018.

Nelles, M. (2018). *Bioenergy from Organic Waste and Residues in the Future Energy System and Circular Economy*. Vortrag gehalten: ISWA, Kuala Lumpur (Malaysia), 22.–24.10.2018.

Nelles, M.; Brosowski, A.; Liebetrau, J.; Seiffert, M. (2018). *Smart Bioenergy: Innovationen für eine nachhaltige Zukunft*. Vortrag gehalten: Besuch KTBL-Hauptgeschäftsführer Dr. Martin Kunisch & Vereinspräsident Prof. Dr. Eberhard Hartung, Leipzig, 14.08.2018.

Nelles, M.; Hartmann, I.; Lenz, V.; Liebetrau, J.; Müller-Langer, F.; Thrän, D. (2018). Energetische und Stoffliche Verwertung von biogenen Abfällen und Reststoffen. Vortrag gehalten: DBFZ-Jahrestagung, Leipzig, 19.09.2018.

Nelles, M.; Nassour, A. (2018). *Status and Development of the Circular Economy in Germany*. Vortrag gehalten: 8th IconSWM, Guntur (Indien), 22.–24.11.2018.

Nelles, M.; Stinner, W.; Schaller, S. (2018). *Biogenic Waste and Residues in Germany and China: Amounts, Challenges and technical Solutions*. Vortrag gehalten: Sino-German Cooperation on Waste and Resource Management, Shangai (China), 03.–05.05.2018.

Nelles, M.; Thrän, D.; Lenz, V.; Haufe, H. (2018). *Die Rolle der Bioenergie im Wärmemarkt Empfehlungen für eine Bioenergie-Wärmestrategie*. Vortrag gehalten: Parlamentarisches Mittagessen, Berlin, 04.06.2018.

Nitzsche, R.; Gröngröft, A.; Kraume, M. (2018). *Leistungsbewertung enger UF-Membranen zur Isolierung von Hemicellulose und Lignin aus Buchenholzhydrolysat mittels Response Surface Methodology*. Vortrag gehalten: Jahrestreffen der ProcessNet-Fachgruppe Membrantechnik, München, 28.02.2018.

Nitzsche, R.; Gröngröft, A.; Kraume, M. (2018). *Adsorption of lignin from beech wood hydrolysate using polymeric resins and zeolite: Equilibrium and kinetic modelling*. Vortrag gehalten: Jahrestreffen der ProcessNet-Fachgruppe Adsorption, Kiel, 01.03.2018.

O'Keeffe, S.; Franko, U.; Oehmichen, K.; Daniel-Gromke, J.; Thrän, D. (2018). *[Assessing the GHG Performance of Regional Biogas Systems Using a Life Cycle Approach]*. Vortrag gehalten: UFZ Energy Days, Leipzig, 24.–25.09.2018.

Pfeiffer, D.; Brosowski, A.; Thrän, D. (2018). *Perspectives for the application of biogenic residues and organic wastes for energy use: Output of the Research Network BIOENERGY of the German Ministry of Economic Affairs and Energy*. Vortrag gehalten: 7th International Symposium on Energy from Biomass and Waste, Venedig (Italien), 15.–18.10.2018.

Pohl, M.; Postel, J. (2018). *New Measuring Methods for Commercial Scale Biogas Plants*. Vortrag gehalten: Large Scale Bioenergy Lab 2 Workshop, Oeversee, 29.01.2018.

Pohl, M.; Postel, J.; Stur, M.; Liebetrau, J. (2018). *Energy efficiency evaluation of 60 agricultural biogas plants- methodologies and challenges*. Vortrag gehalten: 12th International Biomass Conference & Expo, Atlanta, GA (USA), 16.–18.04.2018.

Reinelt, T. (2018). *Emissionsminderung an Biogasanlagen: Fallbeispiel Über-/Unterdrucksicherung*. Vortrag gehalten: Leipziger Biogas-Fachgespräch, Nossen, 27.02.2018.

Reinelt, T. (2018). *Vermeidung betriebsbedingter Methanemissionen aus Über-/Unterdrucksicherungen (ÜUDS) durch Maßnahmen des Biogasaspeichermanagements*. Vortrag gehalten: 1. Deutsches Doktorandenkolloquium Bioenergie, Leipzig, 20.–21.09.2018.

Reinelt, T. (2018). *Vermeidung betriebsbedingter Methanemissionen aus Über-/Unterdrucksicherungen (ÜUDS) durch Maßnahmen des Biogasspeichermanagements*. Vortrag gehalten: 50. Biogasfachtagung Thüringen, Erfurt, 07.11.2018.

Reinelt, T.; Clauß, T. (2018). *Vorstellung Projekt "BetEmBGA- Betriebsbedingte Emissionen von biogasanlagen": Teilvorhaben I & II*. Vortrag gehalten: Workshop Qualifizierung des Leitfadens und der Checkliste zur immissionsschutzrechtlichen Überwachung genehmungsbedürftiger Biogasanlagen, Nossen, 28.05.2018.

Reinelt, T.; Clauß, T.; Liebetrau, J. (2018). *Methane emissions from biogas plants*. Vortrag gehalten: Workshop MetHarmo, Lund (Schweden), 01.02.2018.

Reinelt, T.; Clauß, T.; Rensberg, N.; Liebetrau, J. (2018). *Methanemissionen aus Bestandsbiogasanlagen: Minderung und Betriebsoptimierung*. Vortrag gehalten: Leipziger Biogas-Fachgespräch, Nossen, 27.02.2018.

Reinelt, T.; Liebetrau, J. (2018). Überwachung und Minderung betriebsbedingter Methanemmisionen aus Über./Unterdrucksicherungen der Gasspeicher von Biogasanlagen. Vortrag gehalten: VDI-Wissensforum "Emissionsminderung", Nürnberg, 12.–13.06.2018.

Schaller, S. (2018). *Renewable energy options in the context of Togo with special focus on bioenergy*. Vortrag gehalten: WASCAL-Workshop on Energy Challenges and Solutions in Togo, Lomé (Togo), 13.04.2018.

Schaller, S. (2018). *Renewable energy options and challenges in Ghana*. Vortrag gehalten: WASCAL-Workshop on Energy Challenges and Solutions in Ghana, Accra (Ghana), 16.04.2018.

Schaller, S. (2018). *Smart Bioenergy: Innovationen für eine nachhaltige Zukunft*. Vortrag gehalten: Besuch der KAS, Berlin, 08.06.2018.

Schaller, S.; Pollex, A.; Hartmann, I.; Majer, S.; Pröter, J. (2018). *DBFZ: Ansätze zur Bioökonomieforschung*. Vortrag gehalten: Besuch am BMEL, Berlin, 08.06.2018.

Schliermann, T. (2018). *Schwerpunkt 3: Verwertung von Ernterückständen, insbesondere Stroh*. Vortrag gehalten: Workshop C-DBFZ, Hefei (China), 11.06.2018.

Schliermann, T.; Hartmann, I.; Schneider, D.; Wassersleben, S.; Enke, D.; Jobst, T.; Lange, A.; Roelofs, F.; Fellner, A.; Schneider, P. (2018). *Combined energetic and material utilization of agricultural residues*. Vortrag gehalten: 7th ICET, Hefei (China), 12.–13.06.2018.

Schliermann, T.; Hartmann, I.; Schneider, D.; Wassersleben, S.; Enke, D.; Jobst, T.; Lange, A.; Roelofs, F.; Fellner, A.; Schneider, P. (2018). *Hochwertiges biogenes Silika aus landwirtschaftlichen Reststoffen*. Vortrag gehalten: 12. Rostocker Bioenergieforum, Rostock, 28.–29.06.2018.

Schmalfuß, T. (2018). *Utilisation of Agricultural Waste Material and Residues*. Vortrag gehalten: Deutsch-Griechische Fachkonferenz "Bioenergie im Agrar- und Tourismussektor", Thessaloniki (Griechenland), 19.06.2018.

Schneider, J. (2018). *Bioraffinerie-Prozesse am DBFZ zur stofflichen und energetischen Nutzung Erneuerbarer Energien*. Vortrag gehalten: Energiecluster trifft Wissenschaft, Leipzig, 19.06.2018.

Schumacher, B.; Hofmann, J.; Pröter, J. (2018). *Der Biogasprozess in Abhängigkeit von Substrataufschluss und Durchmischung*. Vortrag gehalten: Biogasfachgespräch "Einfluss der Substrataufbereitung auf den Biogasprozess. Was können Enzyme, Mühlen und Co. wirklich leisten?", Leipzig, 28.11.2018.

Schumacher, B.; Pröter, J.; Liebetrau, J.; Nelles, M. (2018). *Pre-treatment of cattle manure with pressure swing conditioning and its effects on biogas production*. Vortrag gehalten: 7th International Symposium on Energy from Biomass and Waste, Venedig (Italien), 15.–18.10.2018.

Schumacher, B.; Stinner, W. (2018). *Agricultural residues to biogas: Current scientific questions*. Vortrag gehalten: Kick-Off Workshop on Sino-German Strategic Alliance for Advanced Biomethane Technology, Hangzhou (China), 31.10.2018.

Schumacher, B.; Stinner, W.; Stützer, M. (2018). *Wasserpflanzen als energiequelle: Nutzungsoptionen für Gewässer*. Vortrag gehalten: Cleantech in der Lausitz – Innovation umsetzen, Spremberg, 12.06.2018.

Stinner, W. (2018). *Biogas Utilization of Agricultural Residues*. Vortrag gehalten: 7th International Conference on Environmental Technology and Knowledge Transfer, Hefei (China), 12.–13.06.2018.

Stinner, W.; Schmalfuß, T.; Döhler, H.; Gallegos, D.; Janke, L.; Wedwitschka, H.; Deuker, A. (2018). *Kann die Vergärung von Stroh ökonomisch sein?* Vortrag gehalten: 2. Bayerische Biogasfachtagung Stroh, Gras, Dingolfing, 24.01.2018.

Stupak, I.; Smith, T.; Clarke, N.; Scott Bentsen, N.; Dale, V.; van Dam, J.; Diaz-Chavez, R.; Eppler, U.; Fritsche, U.; Futter, M.; Gan, J.; Hakala, K.; Horschig, T.; Junginger, M.; Kline, K.; Larsen, S.; Lalonde, C.; Mansoor, M.; Mai-Moulin, T.; Nair, S.; Nichiforel, L.; Palviainen, M.; Stanturf, J.; Schaubach, K.; Tilvikiene, V.; Titus, B.; Thrän, D.; Ukonmaanaho, L.; Wellisch, M. (2018). *Governing sustainability of biomass producing landscapes and biomass-based supply chains: Key messages from a conference on state of the art and future prospects*. Vortrag gehalten: 26th European Biomass Conference and Exhibition, Kopenhagen (Dänemark), 14.–17.05.2018.

Szarka, N.; Thrän, D. (2018). *The role of biomass for negative emissions in Germany*. Vortrag gehalten: International Conference on Negative CO_2 Emissions, Göteborg (Schweden), 22.–24.05.2018.

Teitge, S.; Narra, S.; Eickhoff, I.; Nelles, M. (2018). *Development of a material recycling process for carbon and glass fibre reinforced composites*. Vortrag gehalten: XXIX International Mineral Processing Congress, Moskau (Russland), 15.–21.09.2018.

Thiel, C.; Hartmann, I.; Matthes, M.; Eisinger, K. (2018). *Emissionsminderung und Effizienzsteigerung an Kaminöfen mittels eines Nachrüstmoduls*. Vortrag gehalten: Holzenergie-Tagung Baden-Württemberg/ALS Kolloquium, Rottenburg am Neckar, 22.11.2018.

Thrän, D. (2018). *Stakeholder-Erwartungen an ein Bioökonomie-Monitoring*. Vortrag gehalten: SYMOBIO Statuskonferenz, Berlin, 21.03.2018.

Thrän, D. (2018). *AG Bioenergie*. Vortrag gehalten: Berlin, 24.04.2018.

Thrän, D. (2018). *Smart Bioenergy: Innovationen für eine nachhaltige Zukunft*. Vortrag gehalten: Besuch von Thomas Bareiß – parlamentarischer Staatssekretär (BMWi), Leipzig, 27.08.2018.

Thrän, D.; Billig, E.; Braune, M.; Hahn, A.; Hennig, C.; Klemm, M.; Lenz, V.; Szarka, N. (2018). *Die Rolle der Bioenergie in einer CO_2-Wirtschaft*. Vortrag gehalten: DBFZ-Jahrestagung, Leipzig, 19.–20.09.2018.

Thrän, D.; Billig, E.; Braune, M.; Hahn, A.; Hennig, C.; Klemm, M.; Lenz, V.; Szarka, N. (2018). *Bioenergy in a CO_2 Economy*. Vortrag gehalten: 1. Deutsches Doktorandenkolloquium Bioenergie, Leipzig, 20.–21.09.2018.

Thrän, D.; Brosowski, A.; Dotzauer, M. (2018). *Forschungsfelder des Bereichs des DBFZ: Bereichs Bioenergiesysteme (BS) und des UFZ-Department Bioenergie (BEN)*. Vortrag gehalten: Deutsches Institut für Wirtschaftsforschung (DIW), Berlin, 19.01.2018.

Thrän, D.; Dotzauer, M. (2018). *Sitzung des Energiebeirat Sachsen: Sektorkopplung und Bioenergie*. Vortrag gehalten: Energiebeiratssitzung, Chemnitz, 18.04.2018.

Thrän, D.; Dotzauer, M.; Hennig, C.; Majer, S.; Scheftelowitz, M. (2018). *Erwartungen an die Rolle der Bioenergie zur Erreichung des Pariser Abkommens*. Vortrag gehalten: FVEE-Dinnerspeech, Leipzig, 26.04.2018.

Thrän, D.; Gawel, E. (2018). *Energy Landscapes of Today and Tomorrow: Welcome and Introduction*. Vortrag gehalten: UFZ Energy Days, Leipzig, 24.–25.09.2018.

Thrän, D.; Koblenz, B.; Daniel-Gromke, J.; Stinner, W. (2018). *Alternative Energiepflanzen: Stand der Nutzung*. Vortrag gehalten: 1. Fachgespräch "Energiepflanzen", Berlin, 10.09.2018.

Thrän, D.; Lange, N.; Oehmichen, K.; Majer, S.; Meisel, K.; Koblenz, B.; Horschig, T. (2018). *Bioenergie: Stand und Perspektiven*. Vortrag gehalten: Expertenforum der Deutschen Wildtier Stiftung, Berlin, 29.10.2018.

Thrän, D.; Lauer, M.; Haufe, H.; Schmidt-Baum, T.; Eichhorn, M. (2018). *Förderung erneuerbarer Energien über das EEG: Auswirkungen auf die Entwicklung ländlicher Räume am Beispiel Wind, PV und Biomasse*. Vortrag gehalten: 10. Berliner Forum, Berlin, 22.10.2018.

Thrän, D.; Lenz, V.; Liebetrau, J.; Majer, S.; Müller-Langer, F.; Braune, M.; Oehmichen, K.; Pfeiffer, D. (2018). *Is there enough for everything and everyone?: Bioenergy between different expectations*. Vortrag gehalten: DBFZ-Jahrestagung, Leipzig, 19.–20.09.2018.

Thrän, D.; Lenz, V.; Liebetrau, J.; Wille-Haußmann, B.; Krautkremer, B.; Kneiske, T.; Dahmen, M.; Yang Shu, D.; Bau, U.; Kolb, T.; Lehneis, R. (2018). *Flexibler Einsatz von KWK, BHKW, Biogas-Anlagen durch moderne IKT*. Vortrag gehalten: FVEE-Jahrestagung, Berlin, 18.10.2018.

Thrän, D.; Millinger, M.; Meisel, K. (2018). *Modelling Least-Cost Deployment of Biofuels for Achieving Climate Targets in Germany under the Renewable Energy Directive II-Proposal*. Vortrag gehalten: 26th European Biomass Conference and Exhibition, Kopenhagen (Dänemark), 14.–17.05.2018.

Thrän, D.; Schaubach, K.; Horschig, T. (2018). *Stakeholder perception and influence in the German biogas sector*. Vortrag gehalten: 26th European Biomass Conference and Exhibition, Kopenhagen (Dänemark), 14.–17.05.2018.

Ulbricht, T.; Hartmann, I. (2018). *Entwicklungen im Bereich der Einzelraumfeuerungen*. Vortrag gehalten: Mittwochs im MUEEF: Optimales Heizen mit Holz – Für eine saubere Umwelt, Mainz, 14.11.2018.

Weinrich, S.; Pröter, J. (2018). *Estimating biogas potential and degradation kinetics in anaerobic digestion: Critical evaluation of different experimental setups and model structures*. Vortrag gehalten: Biogas Science, Turin (Italien), 18.09.2018.

Wirth, B.; Seiffert, M. (2018). *Production of magnetic hydrochars via hydrothermal carbonization (HTC) of metallic residues and wood*. Vortrag gehalten: 255th ACS National Meeting and Exposition, New Orleans, LA (USA), 18.–22.03.2018.

Zechendorf, M. (2018). *Nico-Spurenelemente durch Engergiepflanzen: Stoffströme und Handlungsempfehlungen für eine optimierte Prozessbiologie in Biogasanlagen*. Vortrag gehalten: Fachtagung NiCo, Göttingen, 13.03.2018.

Zeng, T. (2018). *Dedicated mechanical fuel pre-treatment of low quality woody and non-woody residue fuels in order to optimize their emission and combustion behavior in small scale appliances*. Vortrag gehalten: 1. Deutsches Doktorandenkolloquium Bioenergie, Leipzig, 20.–21.09.2018.

Poster

Brosowski, A.; Mantau, U.; Mahro, B.; Noke, A.; Richter, F.; Krause, T.; Bischof, R.; Hering, T.; Blanke, C.; Bill, R.; Thrän, D. (2018). *Nationales Ressourcenmonitoring für biogene Reststoffe, Nebenprodukte und Abfälle*. Poster präsentiert: 1. Deutsches Doktorandenkolloquium Bioenergie, Leipzig, 20.–21.09.2018.

Brosowski, A.; Mantau, U.; Mahro, B.; Noke, A.; Richter, F.; Krause, T.; Bischof, R.; Hering, T.; Blanke, C.; Bill, R.; Thrän, D. (2018). *Nationales Ressourcenmonitoring von biogenen Reststoffen, Abfällen und Nebenprodukten*. Poster präsentiert: 1. Deutsches Doktorandenkolloquium Bioenergie, Leipzig, 20.–21.09.2018.

Butt, S. (2018). *High Temperature Oxidation of Pollutants on Solid State Catalysts*. Poster präsentiert: 1. Deutsches Doktorandenkolloquium Bioenergie, Leipzig, 20.–21.09.2018.

Daniel-Gromke, J.; Schmalfuß, T.; Rensberg, N.; Denysenko, V. (2018). *eMikroBGAA: Effiziente Mikro-Biogasaufbereitungsanlagen Kleinstaufbereitungsanlagen – Wirtschaftlichkeit und Potenziale*. Poster präsentiert: Hannover, 23.–27.04.2018.

Dernbecher, A. (2018). *Experimentelle und numerische Untersuchung einer Scheitholzfeuerung*. Poster präsentiert: 1. Deutsches Doktorandenkolloquium Bioenergie, Leipzig, 20.–21.09.2018.

Eickhoff, I.; Nelles, M.; Engler, N.; Sänger, D. (2018). *Development of an innovative process to digest press water from mixed household waste*. Poster präsentiert: 1. Deutsches Doktorandenkolloquium Bioenergie, Leipzig, 20.–21.09.2018.

Fischer, E.; Bienert, K.; Schumacher, B.; Bellmann, V.; Rogstrand, G.; Zielinski, M.; Zielinska, M.; Cydzik-Kwiatkowska, A.; Glowacka-Gil, A. (2018). *The Biomethane Map of Europe*. Poster präsentiert: Biogas Expo & Congress, Offenburg, 31.01.–01.02.2018.

Frieß, M.; Zanter, K. D.; Hartmann, I. (2018). *Cryptomelane as an efficient catalyst for the exhaust aftertreatment of wood firing systems*. Poster präsentiert: 51. Jahrestreffen Deutscher Katalytiker, Weimar, 14.–16.03.2018.

Gökgöz, F.; Denysenko, V.; Rensberg, N.; Daniel-Gromke, J.; Liebetrau, J. (2018). *Koppelung von Strom- und dezentraler Kraftstofferzeu-*

gung in Biogasanlagen: Flexibilisierungsansatz und Potenzialstudie. Poster präsentiert: 1. Deutsches Doktorandenkolloquium Bioenergie, Leipzig, 20.–21.09.2018.

Grimm, A.; Enke, D.; Roppertz, A.; Hartmann, I.; Frieß, M. (2018). *Synthesis of rice husk silica supported base metal catalysts for exhaust gas treatment*. Poster präsentiert: DBFZ-Jahrestagung, Leipzig, 19.–20.09.2018.

Hahn, A.; Szarka, N. (2018). *Systematische Einordnung von Bioenergie-CO_2-Technologien zur Anwendung in Energieszenarien*. Poster präsentiert: 1. Deutsches Doktorandenkolloquium Bioenergie, Leipzig, 20.–21.09.2018.

Hahn, A.; Szarka, N.; Thrän, D. (2018). *Who is driving BECCS research?: A co-authorship network analysis*. Poster präsentiert: International Conference on Negative CO_2 Emissions, Göteborg (Schweden), 22.–24.05.2018.

Haufe, H.; Ulbricht, T. (2018). *Bürger schaffen Wissen: Kaminöfen und ihre Wirkung auf die Umwelt*. Poster präsentiert: Lange Nacht der Wissenschaften, Leipzig, 22.06.2018.

Horschig, T.; Thrän, D. (2018). *Market share estimation of biomethane and promising business opportunities in Germany using a system dynamics modelling approach*. Poster präsentiert: 26th European Biomass Conference and Exhibition, Kopenhagen (Dänemark), 14.–17.05.2018.

Kalcher, J.; Pfeiffer, A. (2018). *Datenschätze finden, analysieren und visualisieren: Eine Karte sagt mehr als 1000 Worte!* Poster präsentiert: 1. Deutsches Doktorandenkolloquium Bioenergie, Leipzig, 20.–21.09.2018.

Kar, I. (2018). *Including soil impacts within a regional life cycle assessment of biobased products*. Poster präsentiert: 1. Deutsches Doktorandenkolloquium Bioenergie, Leipzig, 20.–21.09.2018.

Kirchner, D.; Thrän, D. (2018). *Entwicklung und Diskussion von Planungs- und Auslegungsmethoden für Biogashybrid-Inselsysteme unter Berücksichtigung der flexiblen bedarfsorientierten Biogaserzeugung*. Poster präsentiert: 1. Deutsches Doktorandenkolloquium Bioenergie, Leipzig, 20.–21.09.2018.

Kirstein, N.; Hennig, C.; Thrän, D. (2018). *Zukünftige Nutzung biogener Festbrennstoffe vor dem Hintergrund des Zwei-Grad-Ziels. Session Systemanalyse Bioenergie*. Poster präsentiert: 1. Deutsches Doktorandenkolloquium Bioenergie, Leipzig, 20.–21.09.2018.

Kirsten, C.; Lenz, V.; Schröder, H.-W.; Repke, J.-U. (2018). *Bindemechanismen: Was hält ein Pellet zusammen?* Poster präsentiert: 1. Deutsches Doktorandenkolloquium Bioenergie, Leipzig, 20.–21.09.2018.

Köchermann, J.; Schreiber, J.; Klemm, M. (2018). *Production of furfural from D-xylose and organosolv hemicellulose in water/ethanol mixtures*. Poster präsentiert: 1. Deutsches Doktorandenkolloquium Bioenergie, Leipzig, 20.–21.09.2018.

Krüger, D. (2018). *Hochflexible Stromerzeugung durch Mikro-KWK-Systeme unter Nutzung von Holzkohle*. Poster präsentiert: 1. Deutsches Doktorandenkolloquium Bioenergie, Leipzig, 20.–21.09.2018.

Kurth, M.; Rönsch, S. (2018). *Entwicklung einer wasserabscheidenden Membran zur Umsatzsteigerung des Methanisierungsprozesses*. Poster präsentiert: 1. Deutsches Doktorandenkolloquium Bioenergie, Leipzig, 20.–21.09.2018.

Majer, S.; Oehmichen, K.; Hennig, C.; Thrän, D. (2018). *Carbon footprinting for Biomethane in the EU RED and EU ETS context*. Poster präsentiert: 26th European Biomass Conference and Exhibition, Kopenhagen (Dänemark), 14.–17.05.2018.

Matthischke, S.; Rönsch, S.; Güttel, R. (2018). *Power-to-Methan: Lastflexibilität und Reaktordesign von Festbettreaktoren für den instationären Betrieb*. Poster präsentiert: Jahrestreffen der ProcessNet-Fachgruppe Energieverfahrenstechnik, Frankfurt am Main, 07.–08.03.2018.

Müller, L.; Liebetrau, J.; Hinz, S.; Koetsier, M.; Floor, R. (2018). *Biochemical disintegration for anaerobic digestion by using more efficent enzymes: Aims and approaches of the H2020-project DEMETER*. Poster präsentiert: Conference of the European Biogas Association, Antwerpen (Belgien), 24.–26.01.2018.

Müller, M. (2018). *Charakterisierung und Integration für Oxidationskatalysatoren in Biomasse-Kleinfeuerungsanlagen*. Poster präsentiert: 1. Deutsches Doktorandenkolloquium Bioenergie, Leipzig, 20.–21.09.2018.

Müller, M. (2018). *Charakterisierung und Integration von Oxidationskatalysatoren in Biomassekleinfeuerungen*. Poster präsentiert: 1. Deutsches Doktorandenkolloquium Bioenergie, Leipzig, 20.–21.09.2018.

Nitzsche, R.; Gröngröft, A.; Kraume, M. (2018). *Gewinnung von Hemicellulosezuckern aus Holzhydrolysaten mittels Adsorption und Membranfiltration*. Poster präsentiert: 1. Deutsches Doktorandenkolloquium Bioenergie, Leipzig, 20.–21.09.2018.

Oehmichen, K.; Majer, S.; Zech, K. (2018). *Climate impact of advanced aviation fuels based on hydrogenated vegetable oils*. Poster präsentiert: 26th European Biomass Conference and Exhibition, Kopenhagen (Dänemark), 14.–17.05.2018.

Reißmann, D.; Bezama, A.; Thrän, D. (2018). *Künftige Entwicklungspfade für Hydrothermale Prozesse in Deutschland bis 2030*. Poster präsentiert: 1. Deutsches Doktorandenkolloquium Bioenergie, Leipzig, 20.–21.09.2018.

Rogstrand, G.; Olsson, H.; Bienert, K.; Bellmann, V.; Fischer, E.; Schumacher, B.; Zielinski, M.; Dębowski, M.; Jaranowska, P.; Glowacka-Gil, A. (2018). *Research Coordination for a Low-Cost Biomethane Production: The Biomethane Map of Europe*. Poster präsentiert: 26th European Biomass Conference and Exhibition, Kopenhagen (Dänemark), 14.–17.05.2018.

Schneider, J.; Dietrich, S.; Rönsch, S. (2018). *Conversion of CO and CO_2 from biomass gasifiers and biogas plants by direct synthesis of short-chain hydrocarbons*. Poster präsentiert: 5th International Conference on Renewable Energy Gas Technology, Toulouse (Frankreich), 03.–04.05.2018.

Sumfleth, B. (2018). *Certification of low ILUC risks in emerging markets: Review Paper of the Dissertation Project of Beike Sumfleth1*. Poster präsentiert: 1. Deutsches Doktorandenkolloquium Bioenergie, Leipzig, 20.–21.09.2018.

Unruh, M.; Honsberg, M.; Ostendorf, R.; Willer, U.; Bartram, M.; Sepp, S.; Sacher, J.; Müller, U. (2018). *PhotoBioSense – Dual getriebener photonischer Sensor zur Überwachung von Biogasanlagen.* Poster präsentiert: Statusseminar Photonik in den Lebenswissenschaften, Hamburg 28.11.2018

Winkler, M.; Weinrich, S. (2018). *Modellbasierte Prozessoptimierung von Biogasanlagen*. Poster präsentiert: 1. Deutsches Doktorandenkolloquium Bioenergie, Leipzig, 20.–21.09.2018.

Zareihassangheshlaghi, A.; Beidaghy Dizaji, H.; Zeng, T.; Hartmann, I.; Lenz, V.; Enke, D.; Bidabadi, M. (2018). *Impact of Varying Heating Regimes on Biogenic Silica Obtained from Rice Husk*. Poster präsentiert: 1. Deutsches Doktorandenkolloquium Bioenergie, Leipzig, 20.–21.09.2018.

Zhou, Y.; Engler, N.; Nelles, M. (2018). *Products from food waste by HTC treatment and their utilization in anaerobic digestion*. Poster präsentiert: 1. Deutsches Doktorandenkolloquium Bioenergie, Leipzig, 20.–21.09.2018.

Research data

Hartmann, I.; Günther, S. (2018) "Emission measurement data of a wood log stove with an integrated two-stage catalytic converter module". Mendeley Data, v1 DOI: /10.17632/2xcp6rytgw.1

Kohler, H.; Ojha, B.; Illyaskutty, N.; Hartmann, I.; Thiel, C.; Eisinger, K.; & Dambacher, M. (2018). "Dataset supplementing H. Kohler, B. Ojha, N. Illyaskutty, I. Hartmann, C. Thiel, K. Eisinger, M. Dambacher: In situ high-temperature gas sensors: continuous monitoring of the combustion quality of different wood combustion systems and optimization of combustion process, Journal of Sensors and Sensor Systems (JSSS), 2018". Zenodo, v1. DOI: 10.5281/zenodo.1189998

IMPRINT

Published by:
DBFZ Deutsches Biomasseforschungszentrum gemeinnützige GmbH, Leipzig, an enterprise of the German Government 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
04347 Leipzig
Phone: +49 (0)341 2434-112
Fax: +49 (0)341 2434-133
E-Mail: info@dbfz.de

General Management:
Prof. Dr. Michael Nelles (Scientific Managing Director)
Daniel Mayer (Administrative Managing Director)

Editing/V.i.S.d.P.: Paul Trainer
Responsibility for the content of the brochure lies with the publishers.

ISBN: 978-3-946629-38-2

Printed by: Osiris Druck, printed on recycled paper with vegetable oil based inks

Pictures: : If not indicated on the image: DBFZ, Jan Gutzeit, Kai und Kristin Fotografie, Adobe Stock. Frontpage: DBFZ/Countrypixel – stock.adobe.com (First row, centre)

Design/DTP: Stefanie Bader

With support from

Federal Ministry of Food and Agriculture

by decision of the German Bundestag

HTP
Hydrothermale Prozesse

5TH FORUM ON HYDROTHERMAL PROCESSES

25/26 September 2019 in Leipzig (Germany)
Further information:
www.htp-inno.de

DBFZ Deutsches Biomasseforschungszentrum
gemeinnützige GmbH
Torgauer Straße 116
04347 Leipzig
Phone: +49 (0)341 2434-112
Fax: +49 (0)341 2434-133
E-mail: info@dbfz.de

www.dbfz.de