bioenergy2020+

K1 CENTRE UNDER THE COMET PROGRAMME
GRAZ + GÜSSING + WIESELBURG + PINKAFELD + TULLN

ideas with a future

Version 2017

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Ideas with a future

Graz · Güssing · Wieselburg · Pinkafeld · Tulln · 2017

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Your R&D partner for

- → Alternative biogenic fuels and substrates
- → Pretreatment and upgrading of residues
- → Fuel, substrate and ash characterisation
- → Low-emission and efficient biomass combustion systems
- → Small and microscale combined heat and power generation systems
- → Microgrids
- → Thermal gasification of biomass
- → Polygeneration
- → Synthetic chemicals and biofuels from biomass
- → Biogas and bioconversion
- → Algal biorefineries
- → Automation and control of thermal processes
- → Modelling and simulation of thermochemical processes
- → CFD-aided technology development
- → Custom software development
- → Special process engineering fields
- → Sustainable supply and value chains

What can BIOENERGY 2020+ do for you?

- → Cooperative research
- → Contract research
- → Consultancy and services
  - + Non-standardised analytical tasks
  - + Analytical and experimental evaluation of biogenic residuals
  - + Market and price analyses
  - + Technology evaluation
  - + Functional tests and evaluation of individual components
  - + Studies and expert reports
- → Target group-specific training and presentations
- → National and international networking activities

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At all costs biomass!

For decades, energy has been one of the most important topics in society. Here, the use of renewable energy sources, the protection of natural resources and the reduction of greenhouse gases are especially important. BIOENERGY 2020+ takes up these central challenges of our time. Based on the existing knowledge of our owner institutions and the work of our predecessor organisations, **RENET Austria** and **Austrian Bioenergy Centre GmbH** we have worked for more than 15 years on the development of new and advanced processes and technologies for providing heat, power and fuels from biomass, and have optimised existing processes and technologies. During this time we have continuously adapted our research activities to both scientific trends and industrial demands. Therefore, we have also started to work on value chains which include the conversion of biomass to intermediary products for non-energy industrial use. This brochure gives a broad overview of our research priorities and our fields of competence in which we can support our partners and customers using our expertise.

As a centre of excellence, BIOENERGY 2020+ combines the benefits of basic university research and application-oriented, technological knowledge, acquired during many years of project work. The expert knowledge on regional, national and international funding programmes that is necessary to apply for and manage research, development and demonstration projects represents a critical factor and is kept up-to-date through both permanent contact with the funding bodies and through continuous employee training.

In addition to our core task to carry out industry-driven research at an internationally competitive level, we also train young researchers and prepare them for careers in both academic and industrial research. Every year, therefore, we allow a considerable number of students to complete their academic theses (Bachelor‘s, Master‘s and Doctorates) based on BIOENERGY 2020+ projects. This continuous attention paid to young scientists guarantees that we can permanently maintain our scientific output at a considerably high level, measured on the number of peer-reviewed publications.

With 90 employees and more than 100 industrial and scientific cooperation partners, we have been able to create critical masses and to establish ourselves as one of the world‘s leading research institutions in our fields of expertise. We always endeavour to work with our numerous partners in order to drive knowledge transfer between science and industry on one side and the cooperation between the relevant actors in a variety of technology fields on the other. The COMET funding, which we can access until 2023 assuming a successful interim evaluation, is an important asset for achieving this, and we utilise it in particular for performing mid- to long-term and strategic research.

We hope to have aroused your interest in the contents of this brochure!

Walter HASLINGER
CEO

Roman SCHMID
CEO

Facts & figures

Centre **Overview**

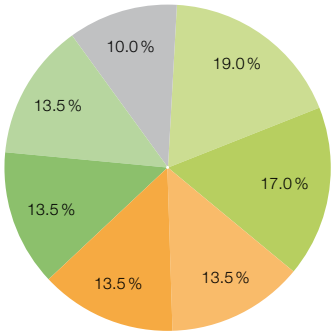
BIOENERGY 2020+ GmbH offers research, development, demonstration and other services in the field of biomass to energy to its customers. Part of its activities are executed as K1 centre of excellence, where the centre focusses on pre-competitive, industry related research funded through the COMET programme.
The centre's research activities cover all relevant technologies for the efficient and environmentally friendly provision of fuels, heat and power from biomass. In addition, the centre also researches options for the industrial, non-energy use of biomass, e.g. the production of primary products for the chemicals industry.
BIOENERGY 2020+ is organised into four areas. Three of them represent the technological fields of expertise.

These are:
→ **biomass combustion systems**
→ **biomass gasification systems and downstream syntheses**
→ **biogas and bioconversion systems**

In a fourth cross-cut and interlinking area we look at:

→ **sustainable supply and value-added chains**
→ **automation and control of thermochemical processes and thermal systems**
→ **CFD modelling of thermochemical biomass conversion processes**

BIOENERGY 2020+ is predominantly in public ownership: *(see figure)*
This allows for equidistant and credible access to industry partners.



19.0% Association of industry partners
17.0% Graz University of Technology
13.5% Vienna University of Technology
13.5% University of Natural Resources and Life Sciences, Vienna
13.5% University of Applied Science Burgenland
13.5% Republic of Austria, FJ/BLT Wieselburg
10.0% Joanneum Research Forschungsges.m.b.H.

History:
The company was founded in 2003 as the Austrian Bioenergy Centre GmbH as centre of competence and funded within the Kplus programme. In 2008 it was merged with RENET Austria, the sister network of competence funded within the Knet programme. The company was renamed BIOENERGY 2020+ when starting its research activities as a K1 centre as part of the COMET programme. After a successful submission in the 3rd call for K1 centres, the centre started into a second COMET funding period of 4+4 years in April 2015.

Organisation

BIOENERGY 2020+ GmbH **bodies**

General assembly:
Association of industry partners
Graz University of Technology
Vienna University of Technology
Republic of Austria
Joanneum Research Forschungsgesellschaft mbH
University of Natural Resources and Life Sciences, Vienna
University of Applied Sciences Burgenland GmbH

Supervisory board: In addition to the members of the general assembly, the supervisory board also includes representatives of the provinces of Burgenland, Lower Austria and Styria and the members of the BIOENERGY 2020+ employees council.

Strategy Board: The strategy board is the strategic steering body for all aspects of COMET research.

Facts and figures:
Employees: 87 employees/69.3 full time equivalent (on 30 Sept. 2016)
Turnover: ≥ 8 mill. €/year
Patents/licences: 4 patent families, 1 brand, 1 licence
Locations: 3 locations, 2 research sites

Highlights

You will find a selection from our **portfolio** on the next sixteen pages.

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Graz University of Technology, Institute of Thermal Engineering
Scientific Advisor: Christoph Schmidl, BIOENERGY 2020+

AREA 1

Biomass combustion systems

One of our core competences is biomass combustion, which is a key technology for replacing fossil energy sources in the heat market. Our technological expertise ranges from fireplaces and stoves through small scale boilers and on to large biomass combustion systems. On this basis, we cover all relevant research and development fields for biomass combustion and biomass-based combined heat and power (CHP).
The greatest challenges for small scale biomass combustion are to reduce emissions and increase efficiency, in particular in real operation; in medium to large scale biomass combustion and CHP systems the challenges are fuel flexibility, system availability and increasing electrical efficiency. The derived development fields are:

- → Extension of the resource base for the use as biomass fuel
- → Next-generation combustion technologies (e.g. extreme air staging, candle burner, …)
- → Technologies and methods for reducing gaseous and particulate emissions
- → Measures and technologies for increasing efficiency
- → Reduced emissions and increased efficiency in real applications
- → Dynamic evaluation methods (emissions, efficiency) for biomass combustion
- → Increasing system availability
- → Micro (< 5 kWel) and small scale CHP systems
- → Efficiency increase for medium to large scale steam CHP systems
- → Hybrid heat supply and CHP systems (combinations of biomass technologies with other energy supply technologies)

AREA 1 performance specifications

- **Characterisation and design of solid biomass fuels**
  Innovative, application-oriented methods for fuel characterisation, fuel tests, blending and additives, mechanical and thermal upgrading, off-gassing, corrosiveness, national and international standardisation
- **Development and optimisation of small boilers**
  Optimisation of geometries, air supply and control
- **Development of next-generation small boiler systems**
  New burner concepts, extremely staged combustion, new control concepts, and heat storage and distribution solutions for efficient and low-emission combustion and heat supply
- **Secondary technologies for emissions reduction**
  Component development, integration and optimisation of operations management
- **Development of micro and small CHP systems**
  Component development and optimisation, system integration and optimisation of thermoelectric generators, Stirling engines and steam processes
- **Fuel flexible, reliable and efficient medium to large scale boilers and CHP systems**
  Optimisation of material selection for heat exchangers and operating conditions for avoiding high- and low-temperature corrosion, fuel additives, enhancing electrical efficiency as a result of increased allowable steam parameters
- **Hybrid heat supply systems**
  Development and optimisation of modular or integrated heat supply systems consisting of a variety of technology combinations
- **Realistic evaluation methods**
  Development, optimisation and application of realistic technology and system characterisation and evaluation methods, deployment of these methods for technology and system development

The eternal candle…

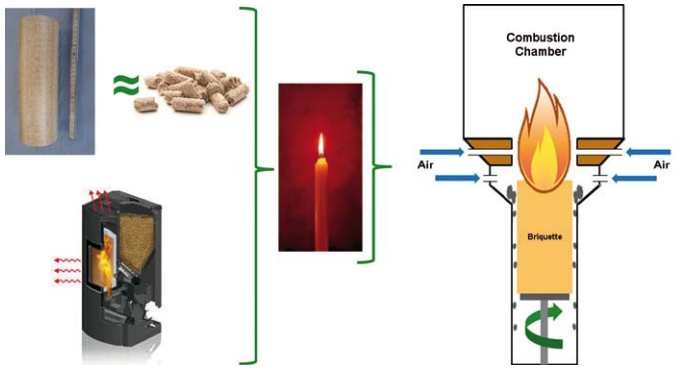
Development of a briquette stove using the candle combustion principle

The candle burner represents a new concept for individual room heating appliances in which wood-based fuels (wood briquettes) can be utilised at very low thermal loads. It combines the benefits of the highly efficient pellet-burning stove with the aesthetically pleasing flame of the conventional firewood stove:

- → Perfect adaptation to briquette geometry
- → Low heat output
- → Adjustable heat output
- → Stationary combustion conditions
- → Consumer comfort
- → Pleasing flame
- → Natural draught operation possible

The first candle burner prototype already reached emissions below the applicable emission limits for pellet stoves in Germany (1st BImSchV Stage 2) and Austria (15a B-VG), which are the most stringent in Europe. As the candle burner is able to burn for a long time (up to 10 h) without being reloaded, there are no excessive emissions such as in the traditional firewood stoves when loading a new batch of firewood logs. The further optimisation of this technology is subject to ongoing research activities.

The candle burner represents a completely new concept. Following the issue of a registered design, the national patent application was also successfully completed and issued in May 2015 (Pat. no. 514525). The international patent application is being jointly prepared with corporate partners. Additional licensees are welcome. ■



From the idea to the prototype. The candle burner‘s transport chute offers space for two vertically loaded briquettes. They are transported upwards mechanically, allowing the desired heat output to be adjusted (between 1.8 and 4 kW). Thanks to the stationary combustion conditions the benefits of the briquettes (homogeneous fuel of standardised quality) are optimally utilised resulting in the formation of minimal emissions.

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"Biomass combustion systems" highlights

Air quality and biomass – realistic airborne pollutant reduction test methods

The performance tests compliant with applicable EN standards for determining the emissions and efficiency of firewood and pellet stoves are currently being performed under quasi-steady state operating conditions. The results achieved under these 'optimal' conditions form the basis for verification of adherence to the applicable legal requirements. However, transient and user-specific operating conditions, typical for practical operation, are not taken into consideration sufficiently. Type testing results for emissions and efficiency therefore cannot be achieved in practice under field conditions. In order to achieve better type testing relevance in terms of operations in practice there is an urgent need to design more practical testing procedures and measurement methods. The European research project beReal has successfully developed new testing methods for firewood and pellet stoves. These test procedures and conditions are based on extensive, practical empirical data and their influencing factors. Compared to current EN standards, the new beReal testing methods better reveal quality-specific differences in terms of emissions and efficiency in practice. Long-term implementation in a test standard or in the mid-term in a quality label can therefore make a substantial contribution to further real-life-oriented technology development.

In addition to climate change, air quality is the dominating topic in European environmental policy. Particulates (PM 10, PM 2.5) have been under discussion for years as a principal air pollutant and limit values continuously tightened. The main reason for this development is the negative health effect of increased particulate concentrations in the ambient air. In addition to the group parameter PM (particulate matter) the hazard potentials of individual substances have also been analysed in recent years. Amongst the particularly dangerous (carcinogenic) group of polycyclic aromatic hydrocarbons (PAHs) the individual substance benzo[a]pyrene was chosen as representative and its concentration in ambient air was limited. The limit value in force since January 2013 is 1 ng/m³ (annual mean). Preliminary measurements at several monitoring stations in Austria – especially in alpine regions and during the winter months – have shown considerable violations of this limit value.

Biomass combustion was identified as a main source of benzo[a]pyrene in several studies. However, biomass combustion is not always the same. The studies demonstrate that room heaters (firewood stoves and inserts) and ovens can emit considerably more than 10 µg/Nm³. Investigations into current projects at BIOENERGY 2020+ reveal that automatic combustion systems emit practically no benzo[a]pyrene whilst stationary operation (<0.1 µg/Nm³). During starting and stopping, however, similar emissions to single room heaters were identified. The quintessence of this is that the emission of atmospheric pollutants is not only influenced by the kind of appliance, but that in reality the implementation of the appliance in the heating system and the end users themselves play an enormous role. ■

www.bereal-project.eu

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Corrosion in biomass combustion systems

Corrosion on the flue gas side of heat exchangers in biomass-fired boilers leads to a significant reduction in the lifetime of the affected components and can lead to unplanned shutdowns. In order to prevent corrosion biomass-fired boilers are often operated with rather conservative operating parameters at the cost of efficiency. Despite these measures corrosion cannot always be prevented. The use of low-quality fuels (poor forest wood chip qualities and agricultural fuels), in particular, enhances the risk of such damage.

BIOENERGY 2020+ has been investigating this topic for several years. Here, the use of online corrosion sensors has proven particularly fruitful. These sensors allow corrosion detection in biomass-fired boilers during operation in real-time. The high-temperature corrosion resistance of superheater steels in biomass-fired steam boiler systems has already been investigated in this way in large-scale applications. The results allow the next generation of boilers to be operated with improved steam parameters and thus with greater efficiency without shortening the lifetime of the system. In addition, the results contribute to minimising corrosion damage in existing facilities. Besides the ecological benefits this also increases the economical competitiveness of power generation from biomass compared to fossil fuels.

Currently, online corrosion sensors are also used to investigate low-temperature corrosion, which affects the cold end of biomass-fired boilers in particular. Besides online corrosion sensors the investigations also incorporate extensive analyses of fuels, condensates and ash depositions, in order to identify the boundary conditions for the occurrence of low-temperature corrosion. Initial results show that acid formation in the flue gas and salts in the ash depositions can be responsible for corrosion. Especially too low heat exchanger surface temperatures can lead to high corrosion rates.

Our aim is to provide practice-relevant solutions to avoid corrosion in terms of specifying surface temperatures, material selection for the affected components and the identification of corrosion mechanisms as a function of the used fuel. ■

Corrosion sensor after use

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AREA 2

Biomass gasification systems

The exploitation of biomass by gasification is at the core of our field of expertise. By thermal gasification we can exploit a variety of biogenic resources as product gases or synthesis gas. This technology plays an important role in our vision of a modern and sustainable energy supply.

The applications include:

- traditional combined heat and power (CHP) by means of coupling with gas engines, implemented in an output range of 100–5,000 kWel,
- effective prime movers for larger facilities (>5,000 kWel) – gas turbines,
- micro gas turbines in the smallest output range (50-250 kWel),
- high-temperature fuel cells as an interesting perspective for the future, whereby technical development for power units >1 kWel is currently still underway.

In addition to this direct energy use the product gas can also be used as synthesis gas for a variety of downstream processes and applications. Storable energy carriers can be provided grid bound (SNG) or liquid. The latter (methanol, FT fuels, …) may also serve as raw materials for further use in the chemical industry. Finally, the production of hydrogen from biomass represents another interesting perspective for the future.

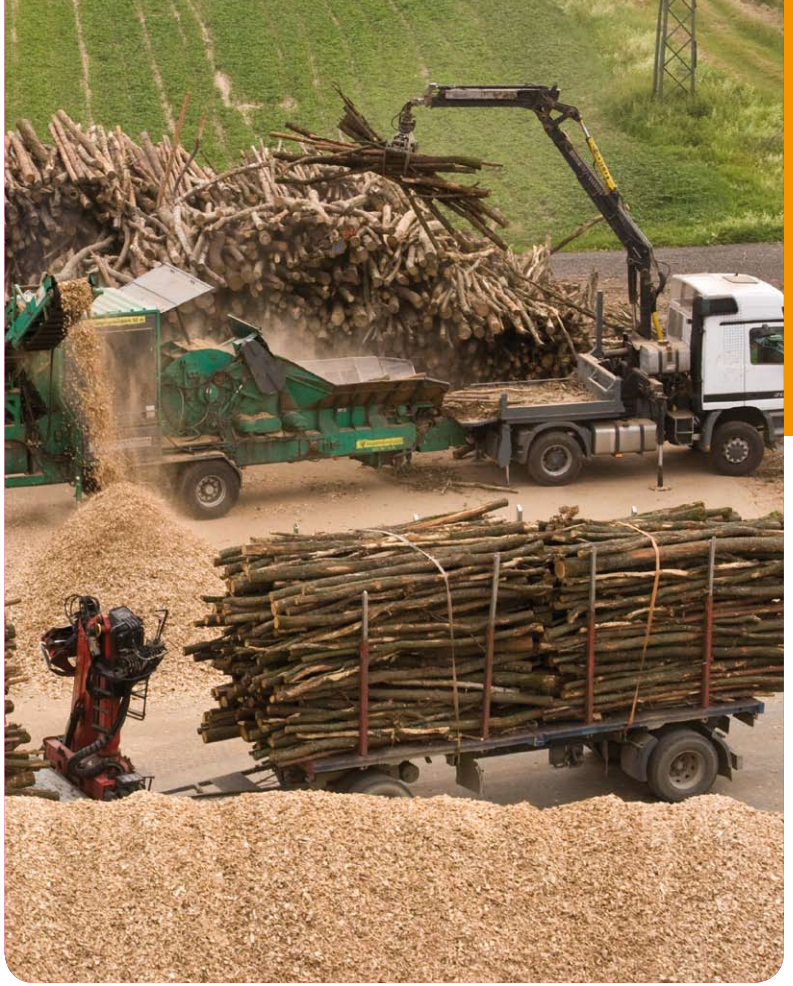
The development and optimisation of the necessary processes is divided along the production chain into the fields of gas production, gas treatment and gas utilisation. This results in a series of developments for individual process steps or for the process as a whole and the associated infrastructure including measuring and analysis technology.

AREA 2 performance specifications

- **Gas production**
  Further development of relevant processes, such as pyrolysis, fluidised bed gasification, staged gasification for thermal conversion of biogenic resources, residues and wastes into product and synthesis gas, and other valuable materials
- **Gas treatment**
  Development and application of suitable methods for cleaning and upgrading product or synthesis gas, independent of generation and application
- **Gas use**
  Investigation of a variety of applications for gas use, among others product gas for industrial processes (e.g. high-temperature heat), CHP of product gas and synthesis gas applications
- **Process development and optimisation**
  Pyrolysis including fractionated product recovery, fluidised bed gasification with a particular focus on the dual fluid gasification technology (lignocellulosic biomass, biogenic residues, sewage sludge, etc.), staged gasification (lignocellulosic biomass, straw, WDB (waste derived biomass)), gas scrubbing for segregation of impurities and undesired components and carbon dioxide, hot gas scrubbing for a variety of applications, testing of various operating resources for gasification and gas scrubbing, integration of biomass gasification in industrial processes, integration of biomass gasification and industrial carbon dioxide separation in power-to-gas concepts (PtG)
- **Measuring and analysis technology**
  Development and refinement of existing methods and the development of new methods for determination of gas components, and for evaluating the increasing quality requirements on product gas and synthesis gas

"Biomass gasification systems" highlights

Thermal gasification of biogenic residues



The process gas produced during thermal gasification of biomass is traditionally used in combined heat and power systems to generate power and heat. However, it can also be used in fuel cells to generate power or as synthesis gas in manufacturing platform chemicals for the chemical industry. In order to increase their cost-effectiveness, industrial scale thermal gasification systems must be able to handle feedstock of lower quality than wood. In many cases the ash melting behaviour of these fuel assortments poses challenges for the operation of the plants. This was investigated in industrial scale facilities (up to 16 MW fuel input), which require 8,000 h/annum of operation. Slag formation and deposit build-up could be reduced and the catalytic influence of the ash on gasification was demonstrated. With the support of BIOENERGY 2020+ an industrial scale dual fluidized bed gasifier was able to convert its operations to the use of low grade wood with a high percentage of bark and thin branches. With an output of 5 MW electric, electrical efficiencies of around 30 % are achieved in this plant, parallel with a heat efficiency to district heating of around 50 %. ■

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Development of thermal biomass gasification – away from the jewels

Currently, a mineral is used as bed material for thermal biomass gasification in dual fluidised beds, which is also used as a gemstone: olivine. In addition to its function as a heat carrier, this mineral is also required to catalytically improve gasification reactions and reduce tars in the product gas. However, the mineral is not available globally and costly in operations (~150–200 €/t). BIOENERGY 2020+ investigations have demonstrated that the ash from the utilised biomass interacts with the bed material and forms a layer on the particle surface, whose composition is similar to the composition of the biomass ash. This ash layer contributes considerably to the catalytic properties of the bed material. In order to reduce operating costs efforts are being made to replace olivine by a globally available, economical and nevertheless catalytic mineral. This mineral must allow the formation of a stable catalytic ash layer on the bed material surface by interaction with the biomass ash and simultaneously prevent ash melting at temperatures up to 1,000 °C maximum.

In pilot facilities, BIOENERGY 2020+ investigates the catalytic properties of various bed materials in terms of their influence on the gasification process. Thereby we are able to explain the layer formation mechanism for a variety of minerals. This know-how allows us to design the layer formation by using additives and by specific operating conditions of the process.

Olivine, the current bed material, contains small quantities of heavy metals. By abrasion in the fluidised bed these end up in the biomass ash. This prevents further use of the ash. The use of an alternative – heavy metal-free – bed material therefore opens up the opportunity for further use of this inorganic thermal gasification residue, i.e. the ash. Cost-effective biomass feedstock contains a considerable amount of nutrients taken up by the plant over time. Returning these nutrients to the natural nutrient cycle following energy utilisation of the biomass can contribute to adding more value to the process. ■

Currently, the mineral olivine is difficult to replace in thermal biomass gasification. BIOENERGY 2020+ is searching for alternatives.

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159 litre Fischer-Tropsch diesel **per day**

Fischer-Tropsch synthesis is an industrial scale process originally developed in the German Ruhr region in 1925 by Franz Fischer and Hans Tropsch for converting carbon monoxide/hydrogen mixtures into hydrocarbons. During the Second World War, in particular, the Fischer-Tropsch method was extremely important in Germany, because it was able to cope with the demand for liquid fuels produced from domestic coal supplies.

The method was rediscovered in recent years, but with a different prefix: currently, FT synthesis is used by oil companies such as Shell or Exxon to generate high-quality diesel constituents from non-exploitable natural gas deposits. During combustion FT diesel has the advantage, compared to fossil diesel, that the particle, CO and hydrocarbon emissions are lower.

Similar to the other syntheses, synthesis gas from biomass steam gasification also serves as the raw material for FT diesel. The research activities of BIOENERGY 2020+ in this field (biomass to FT diesel) were of pioneering relevance for the technological advancement.

The laboratory facility installed by Vienna University of Technology in 2005 as part of an EU project and in cooperation with industry partners in Güssing produced 5-10 kilograms of FT diesel per day. Five years later, gas scrubbing was scaled up to 1 barrel (159 litres) per day, in collaboration with industry partners, whereby a different FT-reactor concept was used (microchannel technology). In 2015 the project on scaling up the slurry FT reactor technology developed by BIOENERGY 2020+ and Vienna University of Technology started. As of mid-2016 the slurry reactor is complete and is available at the Technikum Güssing for advanced R&D work. Based on the data produced from the 1 barrel/day slurry FT reactor, scaling up to demonstration scale can be done. ■

Fischer-Tropsch laboratory facility with gas scrubbing: The synthesis gas is converted to FT diesel in the catalyst filled slurry reactor at temperatures between 200 and 300 °C and at pressures from 20 to 30 bar. Figure: Compression (left), FT reactor (centre), product separation (right)

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AREA 3

Bioconversion and biogas systems

In the field of biotechnological conversion of biomass into energy and/or materials we cooperate closely with the University of Natural Resources and Applied Life Sciences, Vienna (IFA Tulln). We jointly aim to maximise the cascading use of resources. Our core competence in this research area is the further development of biogas technology due its's capabilities to valorise residues and waste and to supply storable energy (biomethane) from renewable resources. Our research interests in the field of biogas technology focus on:

- → Integration of biogas plants in the overall energy system
- → Intensification and optimisation of the use of residues in biogas plants and stable fermentation of substrates with high protein content
- → Pretreatment of poorly degradable substrates to improve microbiological conversion and use of additives to increase microbiological activity (e.g. trace elements, enzymes)
- → Processing of biogas digestate to biofertilisers

The second field of activities is bioconversion. We consider a variety of different processes, with algae biotechnology being an already established main pillar. Other activities cover the biotechnological transformation of residues or CO_2 into a variety of different products (fuels, platform chemicals, high-quality products for the chemical industry, etc.). Overall, our research interests address the following fields of bioconversion systems:

- → New and further development, and process scale-up, in algae biotechnology
- → Desulphurisation processes and nutrient recovery
- → Refining problematic waste (e.g. slaughterhouse waste)
- → ABE (acetone, butanol, ethanol) fermentation based on residues

AREA 3 performance specifications

- **Biogas technology**
  Characterisation of different substrates for biogas processes (dry matter, organic dry matter, COD – chemical oxygen demand, total nitrogen, NH_4 – nitrogen, etc.), determination of biomethane yields using batch tests, feasibility studies for biogas projects, optimisation of the mono-digestion of industrial residues (continuous anaerobic digestion (AD) experiments), monitoring and optimisation of industrial biogas plants
- **Microalgae biotechnology**
  Screening of algae strains, testing and comparison of different cultivation systems (tubular photobioreactor, sleeve bag system, etc.), process scale-up from lab scale to pilot scale, downstream processing (harvesting, biomass processing, extraction of useful substances, etc.), supply of algae biomass, further development of algae biorefinery processes
- **Nutrient recovery and nutrient availability**
  Process engineering for refining biogas digestate to biofertilisers (sieving, centrifugation, use of flocculants, ultrafiltration, …) bioavailability of trace elements, development of desulphurisation processes (chemical, microbiological), further development of nutrient recovery processes (ammonia, phosphate, sulphur, microelements)
- **Further bioconversion processes**
  Biomethanation and biological upgrading of biogas to biomethane, biological conversion of hydrogen and carbon dioxide to acetic acid, refining of problematic wastes (e.g. slaughterhouse waste), production of volatile fatty acids from biogenic residues, further development of ABE fermentation

"Bioconversion and biogas systems" highlight

Abattoir biorefinery: electricity, heat and added value products from **abattoir waste**

Slaughterhouses generate large amounts of abattoir by-products (ABP) which require comprehensive treatment steps due to National and European hygienic regulations. ABPs are very perishable goods and represent a source of risk to environment and public health. Thus its disposal is mandatory and strictly regulated within European Union. The state of the art treatment is rendering, a very energy and cost intensive process. As a response to the outbreak of the BSE crisis, European Union immediately banned rendered animal proteins from human and animal food chains. Hence, by-products from abattoirs turned from a valuable product to a problematic waste and the safe disposal as well as the enormous food price drop during the last decade put a severe economic burden on meat production. In order to appropriately counteract to the given economic situation, one of the biggest Austrian abattoirs sought for new strategies and measures in terms of process efficiency, energy supply as well as waste management concepts. The key was that waste was no longer regarded as waste, but instead as a resource.

During the course of several research projects BIOENERGY 2020+ was able to compile a variety of measures and technical developments in collaboration with Institute for Chemical and Energy Engineering at BOKU and implement them on site.

The anaerobic exploitation of abattoir wastes as monofermentation was successfully demonstrated for the first time globally, both at the laboratory and the industrial scale. The two main obstacles (high nitrogen and fat contents in the substrate) were overcome by appropriate process adaptations. This means that the company can provide its own energy almost autonomously and deliver a major contribution to reducing greenhouse gases. Thanks to cogeneration, the biogas with a methane content of 70 % is converted to heat and power. The power is fed into the grid and the heat into the company's heating network via intermediate storage.

By a combination of this unique waste utilisation with geothermal energy 100 % of the company's heating demand and 50 % of its power demand can be covered. Project implementation not only reduced the annual operating costs for waste disposal and energy supply by 60 %, but also CO_2 emission by 5.2 million kg. In addition, a valuable biological fertiliser is acquired by fermentation, which is rich in essential soil nutrients.

The development and implementation of a sanitation process reduced the specific heat input by 2/3. By cascading the exhaust heat from the refrigeration system, an annual saving of 650,000 kg CO_2 and a reduction in natural gas consumption of 80 % is achieved.

The synergistic coupling of waste utilisation, supply of energy and plant nutrient provision, and the reduction of greenhouse gas emissions achieved by developing and implementing a variety of different technologies, led to new standards in resource efficiency and waste management in foodstuffs operations.

In a follow-up project, PRO-VAL (started in August 2016), work is being carried out on further optimisation and thus on an increase in the added value from the by-products and wastes from meat production.

The aim of the project is to develop a method for increasing the overall facility efficiency and thus the degree of energy self-sufficiency. This will be achieved using a special pretreatment, and by the reduction and conditioning of specific wastewater fractions. In addition, possibilities of blood recycling will be considered. The focus here is on microbiological production and conversion of carboxylic acids to biobased chemical products or precursor products such as, for example, polyhydroxyalkanoates. ■

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SUBAREA 4.1

Sustainable supply and value chains

In this field of expertise we study those aspects of bioenergy involving the entire value chain, from the resource to the final product, and its market.
The value chain starts with the biomass resources, which may originate from agriculture and forestry, waste management or from other sources such as algae biorefineries, for example. These resources are provided in the necessary quality for a variety of facilities such as stoves, boilers, biomass-fired CHP, biofuels production or biogas plants. The different value chains deliver different bioenergy products or services: heat; power; solid, gaseous or liquid fuel; fuel for transportation. In biorefineries also products for non-energy applications can be produced, eg. platform chemicals or bioplastics.
These differing products must be competitive in various markets. To achieve this, it is necessary to consider customer demands and customer behaviour, to carefully study prices and pricing mechanisms, and to analyse and model markets. Moreover, it is necessary to know the relevant regulations and guidelines and to help shape them where possible. The exchange of information with experts and stakeholders, as well as providing tailor-made training opportunities, round off our support for industry. Bioenergy value chains – that is the entire chain from the resource to the market – are sustainable if they are future-proof. This means that they must be able to compete in all sustainability fields – economically, ecologically and socially – against other products on the market.
In the cross-cutting field of ‘sustainable supply and value chains’, we cooperate with the three thematic biomass conversion fields (AREA 1, 2 & 3) in order to create sustainable value chains.

AREA 4.1 performance specifications

- **Investigation of biomass resources**
  Evaluation of potentials, development of logistics and supply chain concepts
- **Development and investigation of pretreatment and upgrading technologies**
  Mechanical: shredding, sorting, pelletisation; Thermal: drying, torrefaction, pyrolysis
- **Ecological evaluation**
  Compilation of greenhouse gas balances up to complete life-cycle assessment (LCA)
- **Techno-economic evaluation of biobased value chains**
  For innovative bioenergy value chains such as those based on torrefied biomass; for alternative utilisation paths in the context of biorefineries such as for bioplastics
- **Market analysis**
  Analysis of bioenergy markets, stakeholder surveys, compilation of market and price models including scenario modelling
- **Networking**
  Networking and information dispersal at the national and international level (e.g. publishing the ‚Biobased Future‘ newsletter, participation in IEA Bioenergy)
- **Training and knowledge conveying**
  Conception and presenting tailor-made training and workshops at a variety of levels for a variety of target audiences.

Mobile biomass furnaces for drying purposes

Operation of the mobile wood chips fired drier

Drying is an important process in the supply and value chains of agricultural products. Often fossil energy is still used for drying. In order to ensure cost-effectiveness the heat generating unit of such facilities should be mobile in order to allow their flexible use.

Since 2006, and in collaboration with an Austrian agricultural machinery company, BIOENERGY 2020+ has been developing lightweight and transportable biomass furnaces for hot air production as the base units for decentralised drying facilities. Depending on the design, agricultural goods such as hay, grain, maize or fuels such as chips and firewood can be dried in these facilities.

The core element of the biomass-fired hot air generator is, in addition to grate firing, the flue gas/air heat exchanger. Built in lightweight it has to exchange the necessary heat in limited volume whilst still maintaining a reasonable lifetime. The mobile devices are already available for the fuel wood chips in the performance classes 150 kW, 250 kW and 750 kW. A device with a rated output of 2,500 kW is currently under development. In addition, even more compact, 50 kW and 150 kW devices were developed especially for pellet fuels for commercial applications.

The aim is to further develop these in future for use of alternative fuels such as waste wood. ■

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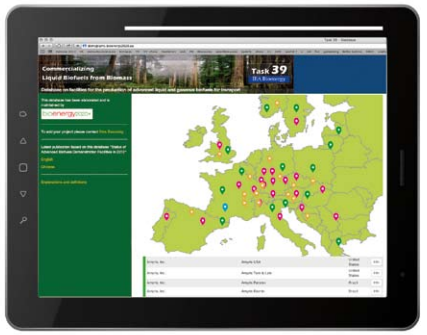
Straw in the tank

The blending of biodiesel and ethanol from vegetable oils or maize to fossil fuels is already reality – the production of fuels from agricultural and forestry by-products, however, remains under development. The EU, the USA, Brazil and China are attempting to introduce such advanced biofuels to the market and are therefore providing funding for testing suitable technologies in pilot and demonstration facilities. Several demonstration facilities for the production of ethanol from lignocellulosic resources went into operation at industrial scales in 2014 and 2015.

On behalf of a global network of experts of the International Energy Agency, the BIOENERGY 2020+ follows the development of these technologies and has created a web-based, interactive map for this purpose. http://demoplants.bioenergy2020.eu shows more than 180 on-going projects on the research, development and demonstration of the production of advanced biofuels around the globe. ■



The report on the status of implementation in 2012 contains the descriptions of 71 projects and can be downloaded from the Internet at www.task39.org. The database is updated annually. The interactive map with the up-to-date status can be accessed at http://demoplants.bioenergy2020.eu.

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SUBAREA 4.2

Automation and control

The working group on automation and control originally focussed on the model-based control of biomass grate furnaces. Starting from horizontally moving grate furnaces with refractory-lined secondary combustion zones and water boilers with nominal boiler capacities in the range of 200 to 300 kW, we developed model-based controls for biomass boilers in a capacity range from 30 kW to 15 MW. We dealt with a variety of grate technologies and different boiler types (warm and hot water, steam, thermal oil). Over time the work fields expanded in two fundamental directions: (i) superordinate control and operation management strategies (load management) including the associated forecasting methods for heat demand and solar yield, and (ii) the control of other thermal or thermochemical applications such as medium-scale solar thermal systems or specific processes of dual fluidized bed steam gasification systems.

The various activities can be summarised as modelling, simulation, automation and control of a variety of thermochemical and thermal processes and systems, and can be fundamentally categorised in the following three research and development fields:

1. Control of biomass conversion plants
2. Control of other energy supply technologies and processes
3. Superordinate control and operation management of hybrid energy systems

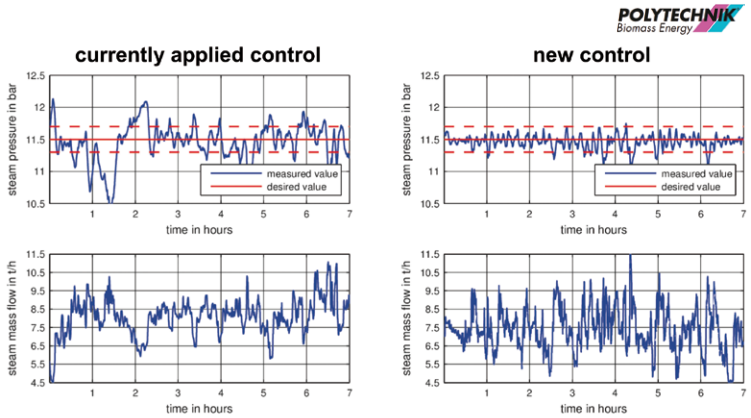
In all of these fields the objective is to mathematically model the dynamic characteristics primarily responsible for the operating behaviour in order to use them as a basis for the development of model-based control strategies. The final goal is always to advance these control concepts to market maturity in order to actually bring the increases in efficiency or reductions in pollutant emissions achieved by the improved control to practical applications.

SUBAREA 4.2 performance specifications

- **Measuring technology and automation technology**
  Measurement of control-relevant process variables and implementation of model-based control algorithms in basic automation systems
  Test bench automation for automated execution of test runs
- **Modelling of dynamic characteristics**
  Development and parametrisation of mathematical models describing the dynamic characteristics of the investigated processes and systems as a basis for model-based control strategies
- **Simulation of dynamic behaviour**
  Numerical simulation of the dynamic behaviour of the investigated processes and systems (primarily used as a tool within control development)
- **Control development**
  Development of (model-based) controllers and design of observers (estimators) for process variables not measurable during operation (also suitable for monitoring and fault diagnostics)
- **Implementation and validation of the controllers**
  Practical implementation (in collaboration with company partners)
  Evaluation of the achieved control and operating behaviour
- **Know-how transfer**
  Support and training of company partners during development (to market maturity)

From basic research to market maturity

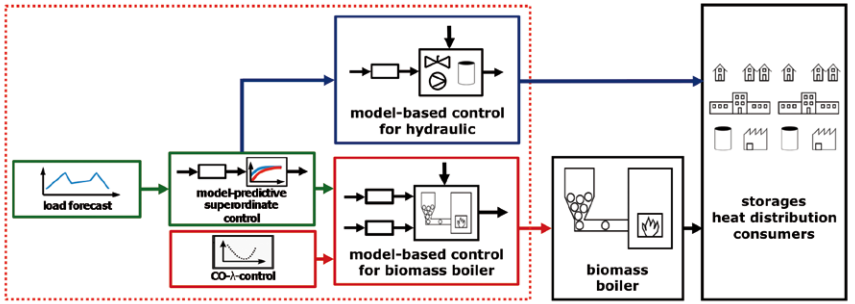
With the development of a model-based control strategy for biomass boilers, BIOENERGY 2020+ entered new scientific and technological territory. Initially, the scientific fundamentals had to be developed making use of an in-house pilot plant. To do so, mathematical models for all relevant parts of the plant have been developed and validated experimentally. In cooperation with a well-known Austrian boiler manufacturer, the control has been further developed to market maturity. Parallel to the development, a comprehensive know-how transfer to the company partner took place. The boiler manufacturer in question is now able to independently equip his plants with model-based controls. An extensively instrumented pilot plant and the acquired scientific know-how of BIOENERGY 2020+ are available for further developments. ■



Exemplary Comparison of the steam pressure of a biomass steam boiler providing steam for the dairy industry (left: conventional control, right: stabilization by model-based control)

Modular development – not only for biomass

Regardless of the variety of applications, the mathematical models are always based on the principles of heat transfer, fluid mechanics and thermodynamics – in short, of physics and chemistry. Over time, this structured approach gave rise to comprehensive methodological knowledge and thus to a range of models for various components and devices. The applicability of these models extends far beyond biomass utilisation. The same systematic approach was also followed during the control development as well as the final implementation. In addition to the reusability of the knowledge and expertise gained, another resulting advantage is the increased modularity of the developed controllers. For our company partners this provides the benefit that newly developed controllers can be combined with existing control modules as required. ■



Different control tasks addressed in biomass heating plants – methodological approach enables modularization

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SUBAREA 4.3

Modelling and simulation

Our expertise covers the development, validation and application of innovative simulation tools for developing and optimising new technologies for the energetic utilisation of a broad spectrum of biomass fuels.
We have many years of experience in CFD modelling and in the implementation of reaction kinetics and thermodynamic simulations. These modelling techniques form the basis for the step-wise and continuous development of advanced, multidimensional models, following the vision of developing the virtual biomass conversion plant.
Model development in subarea modelling and simulation is driven by industry demand and currently deals with the following topics:

→ Thermal conversion of solid biomass

→ Ash-related problems

→ Gas phase reactions and emissions

→ Tailor-made software development

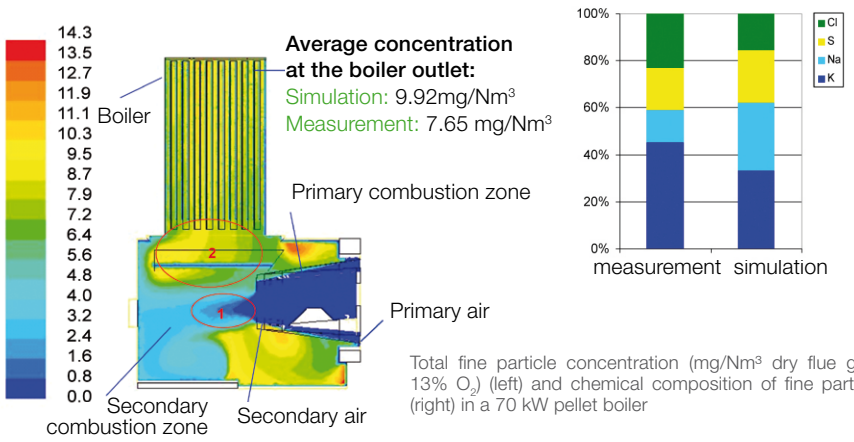
In addition to developing models, BIOENERGY 2020+ has many years of experience in applying the models to support technology developments and plant optimisation. Such work was carried out in close cooperation with the other areas in the centre and the company partners in order to ensure a targeted performance of the simulations and the efficient and applicable implementation of their results.

SUBAREA 4.3 performance specifications

- **Simulation of thermal conversion of solid biomass (combustion, gasification, pyrolysis, torrefaction)**
  Simulation of grate furnaces with detailed 3D CFD packed bed model; modelling the principal processes in the fuel bed, simulation of pulverised burners, optimisation of the geometry of biomass-fired boilers and furnaces, sensitivity analyses of the relevant influencing parameters on biomass combustion on the grate
- **Analysis of ash-related problems**
  Investigation of the emissions of coarse fly ash particles (silicate and salt particles) and fine particles; simulation of deposit formation (condensation of ash-forming vapours, and fine and coarse particulate deposits); investigation of high-temperature corrosion in biomass-fired boilers
- **Gas phase reactions and emissions**
  Simulation of gas emissions (e.g. CO and NOx) in biomass combustion systems; hybrid model for gas phase combustion (for laminar to highly turbulent flows with detailed reaction mechanisms), streak formation model for considering the effect of gas streaks raised from the fuel bed on mixing and the reaction rate; CFD models for the formation and destruction of PAH and soot; optimisation of injection system for secondary air and recirculated flue gas
- **Automation of CFD simulations**
  Development of a tool for automatic execution of CFD-based parameter studies for optimising biomass furnaces (minimisation of volume of combustion chamber, reduction of excess air and the recirculation ratio (efficiency, operating costs), reduction of CO and NOx emissions, as well as temperature and flue gas velocity peaks)
- **Tailor-made software development and training**
  Development of tailor-made software based on OpenFOAM and ANSYS FLUENT, as well as training at different levels

Ash-related **problems**

We carried out considerable research work in recent years in order to evaluate the formation of ash deposits and particulate emissions (coarse and fine particles) in biomass-fired systems. In the course of this work a CFD-based model was developed, which incorporates the following relevant processes: condensation of ash vapours (direct wall condensation and fine particle formation), deposition of fine particles, and both salt- and silica-rich coarse fly ash particles, as well as the removal (erosion) of the deposit layer by non-sticky coarse fly ash particles. Moreover, two CFD-based models for describing high-temperature corrosion in biomass-fired boilers were developed (a fast empirical model, and a detailed model taking transport processes and chemical reactions into consideration). The existing model is currently being refined to implement detailed sulphation kinetics in the gas phase. Further work focuses on catalytic effects of certain species, for example of: iron oxide layer on the sulphation rate of already deposited chlorides, because these processes represent a key reaction in high-temperature corrosion. ■



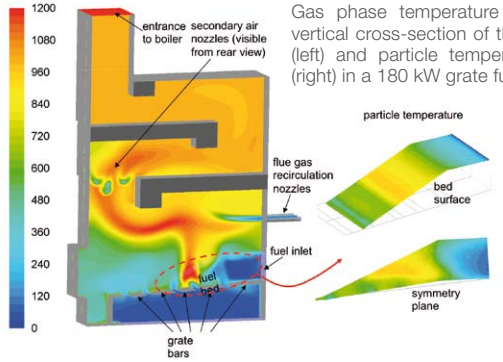
Total fine particle concentration (mg/Nm³ dry flue gas, 13% O_2) (left) and chemical composition of fine particle (right) in a 70 kW pellet boiler

Virtual **biomass combustion systems**

Packed bed & gas phase combustion models

We developed a 3D CFD model for simulating grate furnaces, which treats the biomass fuel bed as an ensemble of thermally thick particles, which combust on the grate. The model describes the characteristics of the thermal conversion, such as the temperature gradient inside the particle and the parallel drying, pyrolysis and char combustion. It was also expanded to include the torrefaction and gasification in fixed beds. Ongoing work is more precisely describing the movement of particles on the grate and to model the release of N compounds and ash-forming elements.

In collaboration with TU Graz, we have developed a NOx post-processor model for biomass combustion systems based on Eddy Dissipation Concept and detailed reaction mechanisms. Common eddy break-up models were developed for highly turbulent flows. However, in small scale biomass combustion systems and the region above the fuel bed, mixing is strongly influenced by laminar and moderately turbulent zones. In order to improve the reliability of the models in these areas, a gas phase reaction model was developed for laminar to highly turbulent flows (hybrid model) and a streak formation model to take into consideration the influence of the gas streaks raised from the fuel bed on the mixing and reaction rates. CFD models for the formation and destruction of PAH and soot are currently being researched. ■



Gas phase temperature [°C] in a vertical cross-section of the furnace (left) and particle temperature [°C] (right) in a 180 kW grate furnace

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“Data, Analysis and Measuring Technology” working group – an important partner in many areas

Many of the projects of BIOENERGY 2020+ require chemical analyses. Most of these analyses are not outsourced but carried out by the centre’s internal chemical laboratory. A wide range of different analytical techniques is used covering the examination of biogenic raw materials, ashes, slags, deposits, dusts, sludges and condensates. Therefore, the chemical analysis group represents an important support for the excellent and internationally competitive research and development work performed in the different areas of BIOENERGY 2020+.

Innovative analysis and measuring methods are also developed project-specifically to address issues arising during ongoing research work. Cooperation agreements with universities assure that external laboratories and analysis equipment are available, if required, and synergy effects are efficiently utilized. This guarantees a high degree of flexibility in the solution of analytical and measurement tasks associated with the use of biomass and substitute fuels for the generation of energy. Besides the support of internal projects, the available equipment and expertise of the staff is also offered as a service to external customers in various fields.

… some of our routine analytical techniques

- calorific value, water content and ash content of fuels
- chemical characterisation of fuels, ashes, slags and dusts
- determination of carbon, hydrogen, nitrogen
- determination of chlorine and sulphur
- determination of ash-forming elements (K, Ca, Na, Si, Al, Fe, …)
- determination of heavy metals
- melting behaviour of ash

Our equipment is described on the following pages.

The analytical data collected create a consistent database for technological developments and simulation work. They are incorporated into the development of European standards for biogenic fuels and determination methods for their examination as well as into the compilation of a comprehensive biomass and ash database. Hence, the Data, Analysis and Measuring Technology working group also fulfils an important networking function between the individual areas. ■

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The technical equipment of BIOENERGY 2020+

Measurement data and analysis results are essential to technical research and development. Our well-equipped laboratories and test plants form the basis for our investigations and calculations. Because a measurement is a measurement and often detailed questions also need to be clarified.
The central interface is the **Data, Analysis and Measuring Technology working group** in Graz.

Graz

Test plants

- technical lab with test stands test stands for research and development of combustion plants, gasification / pyrolysis plants, and control engineering
- 180 kW_{th} biomass grate furnace with hot water boiler
- 50 kW_{th} grate furnace coupled with an electrically heated drop tube
- laboratory reactor – for the simulation of grate combustion in laboratory scale
- single particle reactor – for investigation of the conversion behaviour of single particles (e.g. single pellets)
- hydraulic test benches for generation of defined load conditions for boilers on test stands
- staged high-temperature gasification plant with fluid de-slagging (30 kg/h)
- amin scrubber for CO_2 seperation, 5 kg/h CO_2 (mobile, for use on external systems)
- hot gas desulphuration and CO shift catalysis, 20 m^3/h

Measurement equipment and analysis

- conventional flue gas analysers (O_2, CO, CO_2, NO, NO_2, NOx, SO_2, H_2, CH_4)
- hydrocarbon analyser (FID)
- multicomponent FT-IR analyser
- particle measurement equipment
  - flue gas dilution units for particle sampling (porous tube diluters, turbulent mixer)
  - Dekati cyclones
  - Dekati gravimetric impactor (DGI)
  - electric cascade impactor – ELPI (Dekati)
  - total dust measurement equipment according to VDI 2066
- suction pyrometer for flue gas temperature measurement (radiation-corrected)
- online corrosion probe for high-temperature and low-temperature applications
- deposition probes (in-house developments)
- gas sampling apparatus for determining the concentrations of HCl, SO_x, NH_3 and gaseous heavy metals in flue gases
- methodology and equipment for measuring tar and of chemically reactive compounds in product gases of gasification / pyrolysis processes
- equipment for measuring flow rates, temperatures, pressures and humidities in gases
- hardware and software for data acquisition and measurement data analysis

Analysis equipment and laboratory equipment

- water purification systems (TKA GenPure, TKA Pacific UP/UPW)
- sample grinding/sample preparation (Fritsch cutting, rotor, monomills)
- sample preparation equipment (Paar Multiwave 3000, AOD 1)
- calorimeter (IKA C200)
- elemental analyser (LECO RC-612-C)
- atomic absorption spectrometer (GBC Avanta Sigma, flame and graphite tube AAS)
- inductively coupled argon plasma emission spectrometer (SPECTRO ARCOS)
- inductively coupled argon plasma mass spectrometer (AGILENT 7700x)
- UV/VIS spectrometer (GBC Cintra 20)
- liquid chromatograph (Dionex ICS 90, AGILENT 1200)
- thermogravimetry – TGA/DTG/DSC coupled with mass spectrometry (NETZSCH STA 409 CD-QMS Skimmer)
- heating microscope with automatic image analysis (HESSE Instruments)

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Güssing

Test plants

- synthesis gas from biomass gasification with availability of several thousand hours per year
- laboratory scale FT synthesis for conversion of 5 Nm^3/h of of synthesis gas to liquid fuels
- pilot scale FT synthesis for the production of 1 barrel/day and FT crude product (Naphtha, diesel, waxes)
- laboratory scale synthesis of mixed alcohols for conversion of 1 – 2 Nm^3/h of synthesis gas into mixed alcohols
- product gas pretreatment to synthesis gas quality for 40 Nm^3/h of product gas (removal of catalyst poisons such as sulphur, compression to 25 bar)
- test plant for separation of hydrogen from the product gas and purification of the hydrogen to fuel cell quality
- vacuum rectification with 20 litre capacity
- hot gas preparation for high temperature fuel cells

Measurement equipment and analysis

- gas chromatograph with TCD and FID detector for analysis of product gas and synthesis gases incl. hydrocarbons up to C4 (Perkin Elmer Clarus 500)
- gas chromatograph with SCD detector for analysis of sulphur compounds with a detection limit of 10ppb (Perkin Elmer Clarus 580)
- gas chromatograph with FID detector for simulated distillation for analysis of hydrocarbons from C9 to C60 (Pekrin Elmer Clarus 500)
- gas chromatograph with TCD and FID detector for online analysis of BTX and naphthalene (Perkin Elmer Clarus 500)

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Wieselburg

Test plants

- 8 hydronic test stands for research and development of (biomass) boilers
- 3 test stands for research and development of room heaters
- natural draught chimney for room sealed operation (balanced flue gas system)
- test stand with dilution tunnel for particle emission measurements according to the EPA method
- central heat dissipation system with 600 kW cooling capacity
- 6 electronically controlled hydronic test systems for the operation of boilers under varying load by simulation of any heat demand curve
- calorimetric chamber for direct determination of the efficiency of room heating appliances
- boiler and buffer storages for system tests of complete heating systems with the ability of simulating a secondary heat source (e.g. solar thermal systems)
- various close to serial production prototype boilers and stoves with different nominal power for fuel and component testing
- test furnance for catalyst evaluation
- lab-scale pellet press and cutting mill for production of test fuels
- pilotplant scale drying facility
- kinetic test apparatus adapted for pellet storage tests under adjustable atmosphere

Measurement equipment and analysis

- 8 multicomponent exhaust gas analysers for emission measurement (Emerson NGA 2000, Horiba Enda 680, Horiba PG350 and VA3000, Rbr Ecom SGS-Plus and J2KN, Servomex Servopro 4900, M & A ThermoFID)
- particulate matter sampling equipment according to EN 13284-1
- hydrogen chloride measurement equipment made of Titanium
- measurement device for the determination of benzo (a) pyrene in exhaust gases
- gas chromatograph with FID / TCD for the determination of CO_2, CO, CH_4, VOC
- thermal imaging camera with a measurement range from -50 to 350 °C
- various scales for combustion experiments within the range from 300 to 3,000 kg
- various sensors and transmitter for pressure, temperature, current and voltage, flue gas and air flow, etc.
- programmable controller for data acquisition, recording and plant control as well as individual software solutions for visualisation and evaluation
- mobile and customisable equipment for long-term monitoring
- individual recording of the controller data of different heat generators
- soxhlet equipment to determine the total extract
- muffle furnace with a temperature range up to 1,100 °C

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Pinkafeld

The listed test plants, measuring and analysis equipment at the Pinkafeld campus are owned by the scientific partner and for synergy reasons are rented by BIOENERGY 2020+ as needed for a specific project.

Test plants

- pilot plants for preparation/processing of biomass fuels and waste (milling, mixing, pelleting, pellet testing, …)
- biomass/pellet boiler test stand (80 kW) for carrying out combustion test incl. peripheral equipment (flue gas measuring devices, storage, …)
- the latest technical infrastructure for realisation of requirement-oriented test facilities in the field of thermal process engineering

Measurement equipment and analysis

- various equipment for the preparation of solid matter laboratory samples (cutting mill, ultracentrifugal mill, …)
- equipment for the analysis of physical parameters such as moisture content, ash content, calorific value and particle size analysis
- flue gas analysis (flame ionisation detection, non-dispersive IR absorption, UV resonance absorption spectroscopy, cascade impactor)
- gas chromatograph: 2 mobile gas chromatographs (detectors: FID, ECD)
- photometers (Dr. Lange CADAS 200, Dr. Lange Lasa 50)
- gas chromatograph with mass spectrometer (GC-MS) for qualitative and quantitative analysis of gaseous and liquid samples. Analytical pyrolysis device coupled to the GC-MS for qualitative and quantitative analysis of solid samples
- test facility for lambda oxygen sensors for determination of measurement precision and interference errors due to trace gases

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Tulln

The listed test plants, measuring and analysis equipment at the Tulln campus are owned by the scientific partner and for synergy reasons are rented by BIOENERGY 2020+ as needed for a specific project.

Test plants

- 4 sterile laboratory fermentation reactors incl. on-line exhaust gas analysis (CH_4, CO_2, O_2, H_2)
- laboratory, pilot and technical fermentation reactors (2-500 L)
- mobile batch fermenting station (Eudiometer)
- laboratory membrane bioreactors
- biomass disintegration unit (thermal/thermo-chemical)
- photobioreactor (volume: 2.4 m^3)

Measurement equipment and analysis

Laboratory specially equipped for biogas research

- photometer
- HPLC (HP 7890A, Agilent)
- GC-FID, GC-TCD
- ion chromatography
- capillary zone electrophoresis
- PAM (Pulse Amplitude Modulation)
- fluorescence measurement device
- particle size measurement device
- FOS / TAC
- volatile fatty acids determination
- determination of biomass (organic) dry matter
- nitrate, phosphate, ammonium determination
- protein-, carbohydrate-, lipid-content-determination

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IEA AMF ExCo 51, 2-5 Mai 2016
in Chicago, USA

BIOENERGY 2020+ in the **International Energy Agency***

* Find further informations under **http://www.bmvit.gv.at/innovation/energie_umwelt/iea_forschungskooperation.html**

The development of sustainable energy systems is a global challenge, which BIOENERGY 2020+ GmbH is facing by participating in International Energy Agency (IEA) Technology Collaboration Programmes, among other things. The Austrian Federal Ministry for Transport, Innovation and Technology (Bundesministerium für Verkehr, Technologie und Innovationen [bmvit]) supports these technology initiatives and funds the participation of Austrian researchers in various **IEA Bioenergy tasks** (= topics).
Together with its scientific partners Vienna University of Technology and University of Natural Resources and Life Science, Vienna BIOENERGY 2020+ represents Austria in:

- → the IEA Bioenergy Executive Committee, the agreement's controlling body (Manfred Wörgetter)
- → Task 32 – Biomass Combustion and Co-firing (Christoph Schmidl)
- → Task 33 – Gasification of Biomass and Waste (Reinhard Rauch)
- → Task 37 – Energy from Biogas (Bernhard Drosg)
- → Task 39 – Commercializing Conventional and Advanced Liquid Biofuels from Biomass (Dina Bacovsky)

In Task 55 of IEA Solar Heating & Cooling Programme we are part of an Austrian consortium (Markus Gölles). In addition, BIOENERGY 2020+ heads the secretariat of the Advanced Motor Fuels Technology Collaboration Programme. This IEA network is dedicated to the decarbonisation of the transport sector using alternative fuels employed in modern combustion engines. In the networks, recent developments are discussed, research demand determined and the barriers against dissemination of innovative technologies identified. Where necessary, studies and reviews are compiled. The Austrian representatives publicise Austrian activities internationally and forward information from the networks to bmvit and national stakeholders. In addition, the cumulated knowledge and analyses are incorporated in IEA technology policy recommendations. IEA publications such as the World Energy Outlook and Energy Technology Perspectives are based in part on contributions and work by the experts in these technology initiatives. BIOENERGY 2020+ and its partners profit multiply from participation in the IEA Bioenergy and Advanced Motor Fuels networks:

- → We are aware at an early stage of international policy, economic, industry and business trends.
- → The information we provide helps Austrian RTD policy in focussing its programmes and the funding bodies in defining R&D priorities.
- → The exchange of views with other scientists expands our staff's horizons and facilitates R&D at the highest international level.
- → This simplifies the transfer of scientific knowledge into international standards.
- → The contacts made lead to joint projects, the results of our research are made known, and thus accessible, globally.
- → We distribute information on the expertise and technologies of our corporate partners and help to increase export opportunities. ■

"Founded in 1979, IEA Bioenergy has evolved into the most important global hub for the development of clean and affordable bioenergy technologies. On the way to a 'zero carbon society' our researchers learn the world's needs and our industry can demonstrate what it is capable of."

Manfred Wörgetter

"Collaboration with international experts allows me to view biofuels not only from a European perspective, but also through the eyes of the USA, Japan, China and Thailand, for example, where the boundary conditions are completely different."

Dina Bacovsky

Educational function

Research and teaching

Our work in the field of bioenergy goes beyond technological research and development, it also contributes to the field of **academic training and vocational development** as well as the **communication and dissemination of knowledge**.

→ **29 dissertations** (completed)

→ **60 degree papers** (completed)

→ **160 reviewed papers**

→ **260 presentations at conferences**

Since the beginning of the COMET programme (01.04.2008).
Status: 30.09.2016 ■

Our staff has teaching positions at the following institutions:

→ **University of Natural Resources and Life Sciences, Vienna**

→ **University of Applied Sciences Wiener Neustadt**

→ **University of Applied Sciences Campus Vienna**

→ **Graz University of Technology**

→ **University of Applied Sciences Burgenland**

→ **University of Applied Sciences Joanneum**

→ **Joanneum in Kapfenberg**

→ **Vienna University of Technology**

National and international partners

Innovation needs strong partners

National project partners

AAT Abwasser und Abfalltechnik GmbH Wolfurt
AE&E Austria GmbH & Co KG Raaba
AEE - Arbeitsgemeinschaft ERNEUERBARE ENERGIE Niederösterreich - Vienna Vienna
agnion Highterm Research GmbH Graz
Agrana Research & Innovation Center GmbH Vienna
Ahrens Schornsteintechnik GmbH Wieselburg an der Erlauf
Andritz AG Graz-Andritz
Anton Paar GmbH Graz-Straßgang
Austroflamm GmbH Krenglbach
Axiom Angewandte Prozesstechnik Gmb Ebreichsdorf
BDI BioLife Science GmbH Grambach
BEA Institut für Bioenergie GmbH Vienna
BEFA Handelsgesellschaft m.b.H. Vienna
Bernecker + Rainer Industrie Elektronik GesmbH Eggelsberg
Bertsch Energy GmbH & Co KG Bludenz
Bilfinger Bohr- und Rohrtechnik GmbH Vienna
Binderholz GmbH Fügen
Bioenergie Kufstein GmbH Kufstein
Biogas Strem Errichtungs-BetriebsgmbH & Co KG Strem
Biomasse-Kraftwerk Güssing GmbH & Co KG Güssing
BioSNG Güssing GmbH Güssing
BT-Wolfgang Binder GmbH Gleisdorf
BWS Best Waste Solution GmbH Unterpurkla
CCB - Centrum für Chemie und Biomedizin Innsbruck
Chamottewaren- und Thonöfenfabrik Aug. Rath jun. GmbH Krummnußbaum
Christof Project GmbH Gratkorn
CS Combustion Solutions GmbH Vienna
CTP Chemisch-Thermische Prozesstechnik GmbH Graz
Durst Phototechnik Digital Technology GmbH Lienz, Osttirol
EEC Erneuerbare Energie Consulting Wieselburg
Elk Fertighaus AG Schrems, Niederösterreich
Energie Burgenland Biomasse GmbH&Co KG Heiligenkreuz im Lafnitztal
Energie Agentur Steiermark GmbH Graz
Energie Steiermark AG Graz
Epcos OHG Deutschlandsberg
Erber Future Business GmbH Herzogenburg
ETA Heiztechnik GmbH Hofkirchen an der Trattnach
EVN AG Maria Enzersdorf am Gebirge
Fachverband der Holzindustrie Österreich Vienna
Fernwärme Genossenschaft Krumbach eGen Krumbach
Fernwärmeversorgung Stams GmbH Stams
Fitroleum Biochemicals GmbH Bruck an der Leitha
Franz Binder GmbH Fügen
Frauscher Thermal Motors GmbH Sankt Marienkirchen bei Schärding
Fritz Egger GmbH & Co OG St. Johann in Tirol
Fröling Heizkessel- und Behälterbau Grieskirchen
GILLES Energie- und Umwelttechnik GmbH & Co KG Gmunden
Glechner Ges.m.b.H. Mattighofen
Großfurtner Rudolf GmbH Utzenaich
Guntamatic Heiztechnik GmbH Peuerbach
Güssing Energy Technologies GmbH Güssing
Güssing Renewable Energy GmbH Güssing
Haas + Sohn Ofentechnik GmbH Puch bei Hallein
Hafnertec Bicker GmbH Ybbs an der Donau
Hargassner GesmbH Weng im Innkreis
Hasslacher Preding Holzindustrie GmbH Preding
Heger Edelstahl GesmbH Schardenberg
Herz Energietechnik GmbH Pinkafeld
HET Heiz- & Energietechnik Entwicklungs GmbH Seekirchen/ Wallersee
Highterm Research Ges.m.b.H. Graz
Holzindustrie Pfeifer GesmbH.&CoKG Kundl
Hoval Gesellschaft mbH Marchtrenk
Ing. Aigner Energie Contracting GmbH Neuhofen an der Krems
Ing. Leo Riebenbauer GmbH Pinggau
Institut Dr. Franz Siegfried Wagner Lebring
ISG Energy GmbH Heiligenbrunn
Johannes Pabst GmbH Zeltweg
Josef Lumper Purgstall an der Erlauf
Kachelofenverband Österreich Vienna
Kälte- und Systemtechnik GmbH Freundorf
Kelag Wärme GmbH Villach
Komptech GmbH Frohnleiten
KWB Kraft und Wärme aus Biomasse GmbH St. Margarethen/Raab
LASCO Heu - Technik GmbH Lochen
Linde-Gas GmbH Österreich Stadl-Paura
Lohberger Heiz- und Kochgeräte Technologie GmbH Schalchen, OÖ
Lumper Josef Purgstall an der Erlauf
Marienhütte GesmbH Graz
Mayer & Sannoufeh GmbH Scheibbs
Mayr-Melnhof Pellets Leoben GmbH Leoben
Mondi Uncoated Fine & Kraft Paper GmbH Vienna
Müller Abfallprojekte GmbH Weibern
Ochsner Wärmepumpen GmbH Linz
ÖGUT Vienna
ÖkoFEN Forschungs- und EntwicklungsgesmbH Niederkappel
OMV Refining & Marketing GmbH Vienna
ORTNER GmbH Loosdorf
Papierholz Austria GmbH St. Gertraud
Pink GmbH Langenwang
Polytechnik Luft- u.Feuerungstechnik GmbH Weissenbach an der Triesting
proPellets Austria Wolfsgraben
RamJet Power GmbH Steinhaus
Regelungs-Verteilerbau GesmbH Graz
REPOTEC - Renewable Power Technologies Umwelttechnik GmbH & Co KG Vienna
RIKA Innovative Ofentechnik GmbH Micheldorf
Rohkraft Ing.Karl Pfiel GmbH Reidling
RVB Regelungs-Verteilerbau GmbH Graz
RZ Pellets GmbH Ybbs an der Donau
Scheuch GmbH Aurolzmünster
Schiedel AG Vienna
Schmid energy solutions GmbH Lieboch
SEA - Save Energy Austria GmbH Wolfsgraben
SEEGEN Salzburger Erneuerbare Energie Gen.m.b.H. Grödig
sht - Heiztechnik aus Salzburg GmbH Bergheim bei Salzburg
s.nahwareme.at Energiecontracting GmbH Thalgau
Solarfocus GmbH Sankt Ulrich bei Steyr
S.O.L.I.D. Gesellschaft für Solarinstallation und Design GmbH Graz
Sonnenplatz Großschönau GmbH Großschönau
Stadtwärme Lienz Produktions- und Vertriebs GmbH Lienz
Stadtwerke Schwaz GmbH Schwaz
Stadtwerke Wörgl GmbH Wörgl
Steirische Gas-Wärme GmbH Graz-Liebenau
SynCraft Engineering GmbH Schwaz
TBES GmbH Zöbern
TIWAG - Tiroler Wasserkraft AG Innsbruck
Toby Hafner Systeme Kachelofen-Ganzhausheizungsanlagen GmbH Götzis
Umweltdienst Burgenland GmbH Oberpullendorf
Vereinigung Österreichischer Kesselliefernten Vienna
Viessmann GmbH Steinhaus bei Wels
voestalpine Stahl GmbH Linz
Voigt + Wipp Industrial Research GmbH Vienna
Labor Dr. Wallner Lebring-Sankt Margarethen
Vienna Energie GmbH Vienna
Windhager Zentralheizung Technik GmbH Seekirchen am Wallersee
World-Direct eBusiness solutions GmbH Vienna/Sistrans

International partners

AEBIOM - The European Biomass Association Belgium
AIR LIQUIDE Forschung und Entwicklung GmbH Germany
Array Industries b.v Netherlands
ASEE The American Society of Engineering Education USA
ATech elektronika d.o.o. Slovenia
Biomin Germany GmbH Germany
BTEC Biomass Thermal Energy Council USA
Ceramiques Tecniques et Industrielles S.a. France
Elcogas S.A. Spain
Extraflame S.p.A. Italy
European Membrane House Belgium
Evonik Technology & Infrastructure GmbH Germany
Foster Wheeler Italiana SRL Italy
HDG-Bavaria GmbH Germany
HETAS Ltd. Great Britain
Hitachi Zosen Inova AG Switzerland
Hovalwerk AG Liechtenstein
HWAM A/S Denmark
Justus GmbH Germany
LAMTEC Mess- und Regeltechnik GmbH & Co KG Germany
LEDA - Werk GmbH & Co KG Germany
LINDE AG Germany
LIQTECH International Denmark
MCZ Group S.p.A Italy
Palazzetti Lelio S.p.A Italy
Pellet Club Japan Japan
PKN Orlen S.A. Poland
Stüv SA Belgium
SWU Energie GmbH Germany
Thermodynamiki S.A. Greece
UNICONFORT srl Italy
Unipetrol RPA s.r.o. Czech Republic
Verbia Nano Technology S.L. Spain
Viessmann Werke GmbH & CoKG Germany
Vyncke Energietechniek n.v. Belgium
West Biofuels USA

5 steps – the route to collaboration

Cooperation with BIOENERGY 2020+

1

Step 1: You have an idea, would like to optimise products, processes or services and thus develop your competitive advantage. Contact our centre and talk to us about your problem.

2

Step 2: If we are able to assist you we will discuss how to implement your project as a contract research activity or discuss whether a long-term partnership as part of the COMET programme or another national or EU funding programme would make more sense.

3

Step 3:

3.1.) Contract research: We will promptly compile an individual offer adapted to suit your needs. If this lives up to your expectations, we will begin work once the offer has been accepted!

3.2.) Partnership as part of the COMET programme or other funding programmes: a joint project is defined.

4

Step 4: In a highly efficient decision-making process, the strategic relevance and the economic implementability of the project are internally evaluated. For COMET projects, the Strategy Board decides within a maximum of two to three months on acceptance of your company as a partner and on project implementation.

5

Step 5: As the basis for collaboration you sign the framework conditions, which – in cooperation with FFG – are written into our COMET agreement, and you become our corporate partner. This allows you to profit in the long term from our collaboration. A tailor-made cooperation agreement for the defined project is signed by both sides in order to guarantee smooth project running.

If you are also interested in working on the strategic alignment of our centre, opportunities for joining our Association of industry partners in the K1 centre BIOENERGY2020+ are also available. Members of this association, which is also the largest joint owner of our centre, are represented in all bodies.

Reasons why YOU, in particular, should collaborate with us?

- BIOENERGY 2020+ is the only research centre that has extensively and successfully dealt with the field of bioenergy for years. We are characterised by our great expertise.
- As a COMET centre of expertise we represent both an interface and a link between science and industry. That is, you exploit our scientific expertise for your long term economic benefit and we profit from the business opportunities you offer.
- Personal service and close cooperation help you to achieve your objectives faster.
- Our excellent national and international networks help to drive your internationalisation endeavours and find suitable partners.
- Modern R&D infrastructure, which would otherwise need to be expensively developed, is already available at the centre and can be used for your project at any time. With COMET and other funded projects, BIOENERGY 2020+ offers an unbeatable price/performance ratio.
- More than 70 scientific staff members work together in a multidisciplinary team in order to find joint solutions. We guarantee the highest level of scientific and technological expertise.
- Motivated staff, who identify 100 % with the joint projects, are our key to your success.
- BIOENERGY 2020+ successfully carries out policy consultations and can therefore help to remove additional barriers.

Cooperation with scientific partners?

Cooperation with scientific partners is important to us. In this case, too, the fundamentals of our collaboration are set down in the same COMET agreement. The collaboration ist defined in a project specific cooperation agreement. Here, the exchange of knowledge and scientific collaboration are at the forefront. Each partner profits from the scientific expertise of the other.

People and research

Top-level research lives on interesting, forward-looking problems, well-educated personnel and staff-oriented working conditions. Scientific creativity requires an offset outside of the office and laboratory, and a balance between profession, family, personal hobbies and continuing professional development (CPD) is therefore a substantial success factor even for highly qualified academics. This applies to people both with and without care obligations. It is certainly in the company‘s own interest to attract more women with technical-natural sciences expertise and to offer them career opportunities. Experience has shown that an increase in diversity in terms of personnel, coupled with good management, leads to more creativity, innovation and an improvement in the working atmosphere.
In order to integrate the topic of reconcilability in the company and define measures for its development, BIOENERGY 2020+ participated in the ‚job and family‘ (berufundfamilie) audit initiated by the Austrian Federal Ministry for Families and Youth (Bundesministerium für Wirtschaft, Familie und Jugend). Following the initial certificate awarded in 2008, the centre was certified with the quality mark again for a further three years in November 2011.
The staff-oriented corporate culture was implemented with the greatest possible flexibility: the freedom of the individual is as important as self-responsibility in professional work. Together with the staff, individually agreed part-time and home-office concepts are developed. Staff discussions are supplemented by return-to-work talks before and after a leave of absence and when planning parental part-time working. The process, from pregnancy until return to work, is openly discussed and planned. The same applies to paternity leave and parental part-time employment.

BIOENERGY 2020+ also continues to work on improving the corporate working atmosphere. In 2016 the company has carried out an extensive FEMtech career project, during the course of which the recruitment procedure, career opportunities, working conditions and the work atmosphere were evaluated and further developed. The newly installed work council monitors the project and the resulting measures, as does the centre‘s equality officer. In addition, there are initiatives for promoting healthy working practices and measures for both self-management and time-management with the aim of avoiding stressful situations, increasing the well-being of our staff and thereby also positively influencing the efficiency and quality of our research and development work.
Dr. Walter Haslinger, technical-scientific CEO exemplifies the corporate philosophy. Before becoming CEO he was head of the Wieselburg office for many years. During his time there the father of two also took advantage of the opportunities for parental part-time work and paternal leave. Following his return from paternal leave he became the centre‘s CEO. ■

“When we began in 2003, we were only a handful of staff at Wieselburg; in recent years we have maintained an average of 45 headcounts. Many colleagues who began working in the company directly after finishing university are now parents of small children and still working. These often almost erratic changes in the staff structure, together with an already variable and demanding professional profile, have challenged us again and again in the past and demand a high degree of flexibility. The fact that, and the manner in which, individual challenges are tackled is often related to the fact that numerous staff were involved in these structural changes, and that the initiatives of individuals are valued and often taken up and implemented. For me, this is an important plus in staff job satisfaction.”
Elisabeth Wopienka (Unit Head)

“To me, work @ BIOENERGY 2020+ means: extremely interesting content, diverse duties and a high level of temporal and spatial flexibility. This is also reflected in our diverse team. The openness and support provided by our management facilitate additional awareness for and implementation of measures for reconciling work with other aspects of life – for both men and women. I enjoy being here!”
Monika Enigl (Senior Researcher and Equality Officer)

“The nice thing about my job at BIOENERGY 2020+ is clearly the multifaceted work. New tasks await me every day, from the laboratory to project management, which allow me a multidisciplinary view beyond my immediate field.”
Lydia Rachbauer (Researcher)

“What I like best are the flexible working hours and the possibility, of working from home (home office) if need be, which allows me to spend sufficient time with my family.”
Stefan Retschitzegger (Unit Head)

“Flexible working hours, a pleasant work atmosphere and an understanding of family obligations allow me to maintain a balance between work and family.”
Bernhard Drosg (Area Manager)

“As a father and a commuter I enjoy the benefits of paternal part-time working, flexible working hours and the home office, and yet BIOENERGY 2020+ continues to make efforts to improve my working conditions – albeit not altruistically, because this is reflected in my high motivation, commitment and loyalty to my employer.”
Manuel Schwabl (Unit Head)

“The opportunity for part-time working with a flexible beginning/end of work and working from home offer a high degree of personal fulfilment, in addition to a high level of satisfaction within the family.”
Barbara Rehling (Senior Researcher)

“To me, the reconcilability of family and profession has two important facets. Personal and professional. Both have one thing in common: they are driven by self-interest. On the personal side, I primarily want to be daddy to my children, to see them develop and possibly even influence that development slightly. Together with my partner, I also want to present a counter-image to the parental roles I myself experienced. To me, the professional side is no less characterised by self-interest: The expertise of our staff forms the basis for our success. Expertise is the sum of knowledge and experience, and a small degree of personnel fluctuation is therefore a must for long-term durability. The introduction of measures for reconciling family and profession – and in particular in terms of our key personnel – was and remains a strategic decision for binding these colleagues to the centre in the long-term.”
Walter Haslinger (CEO)

Funding bodies of the **Federal Provinces**

Burgenland

In Burgenland, **Wirtschaft Burgenland GmbH** as the funding body and FTI Burgenland GmbH providing content-related input, are intended to foster and expand RTI (research, technology, innovation) expertise in the region.
Hence, in 2014 the **RTI Strategy Burgenland 2025** was deployed with the objective to substantially increase the regional RTI activities within the stated time frame, in order to secure the future development of the region and its population. The focus of activities lies within the fields of sustainable energy, sustainable quality of life and intelligent processes, technologies and products.
In this context, the research activities of BIOENERGY 2020+ are especially important! In collaboration with companies and research institutions pioneering solutions for the sustainable use of renewable resources are developed and support the ‚energy revolution'. In addition to providing regional impulses for business and society, the high national and international visibility of the centre of excellence is an important signal that documents the technological leadership of Austria in this very important field.

FORSCHUNG TECHNOLOGIE INNOVATION BURGENLAND

WIRTSCHAFT BURGENLAND GMBH

Styria

The state of Styria has set itself ambitious targets in its **Economic Strategy Styria 2025 – Growth through Innovation** (Wirtschafts- und Tourismusstrategie Steiermark 2025 – Wachstum durch Innovation). Targeted measures revolving around the lead topics of mobility, green-tech and health-tech aim to turn Styria into a European benchmark for intelligent change to a knowledge-based production society. Here, innovation, and research and development (R&D), form the state's core strategies in the coming years. With a current R&D quota of 4.8 percent, Styria today is already one of the most innovative business regions in Europe.
The Styrian centres of excellence, taking up a central position as the link between scientific and economic research, make a significant contribution to the high R&D quota. Implementation of the COMET programme (Competence Centres for Excellent Technologies) has so far been highly successful. As one of 25 Styrian COMET centres and projects (as of 11/2016), BIOENERGY 2020+, with its topical priorities in the energy utilisation of biomass, contributes substantially to the constant increase in knowledge. It is anticipated that innovative, Styrian companies will grow as a result of the special focus on these pioneering and green technologies.

SFG
On behalf of the minister for economy

Das Land Steiermark

Lower Austria

If research institutes, training establishments and commercial enterprises at a given location form a single unit in order to perform internationally recognised top-level research and provide economic impulses, we refer to a Technopol location with pioneering standards. Wieselburg is the most recent Technopol location in Lower Austria and is regarded as an international centre for bioenergy, agricultural and foodstuffs technologies. With these technology fields, the Wieselburg Technopol is building on the decades-long tradition of the **Mostviertel** agricultural region in the fields of agriculture and forestry, and agricultural engineering.

Wieselburg is currently host to 216 high-tech jobs in five defined technology fields, 160 of them in research. The Wieselburg Technopol is managed organisationally by **ecoplus**, the Business Agency of Lower Austria.. With the BIOENERGY 2020+ centre of excellence, an internationally recognised research group in the fields of energy efficiency and renewables has taken its place in the **Technologie- und Forschungszentrum Wieselburg-Land** (TFZ).

That this research focus and the investments in active technology policy pay off is also confirmed by studies performed by the renowned **Economica Institut für Wirtschaftsforschung**. The Technopol locations deliver high gross value-added effects, which in turn directly benefit Lower Austria and thus reinforce regional value-added chains.

www.ecoplus.at/technopol_wieselburg

A strong Team

The employees of BIOENERGY 2020+

Ordinary Association Members | as of November 2016

Association of industry partners in the K1 centre BIOENERGY 2020+

AAT Abwasser- und Abfalltechnik GmbH
Konrad-Doppelmayr-Straße 17, 6960 Wolfurt

Aigner Energie Contracting GmbH Kremstalstraße 18,
4501 Neuhofen an der Krems

ANSYS Germany GmbH Birkenweg 14a, D-64295 Darmstadt

Energie Burgenland Biomasse GmbH & Co KG Kasernenstraße 10,
7000 Eisenstadt

HET Heiz- und Energietechnik Entwicklungs GmbH
Obertrumer Landesstraße 7,5201 Seekirchen/Wallersee

JOSEF BERTSCH Gesellschaft mbH & Co Herrengasse 23, 6700 Bludenz

KWB – Kraft und Wärme aus Biomasse GmbH
Industriestr. 235, 8321 St. Magarethen a.d. Raab

LAMTEC Meß- und Regeltechnik GmbH + Co. KG
Wiesenstraße 6, D-69190 Walldorf

Viessmann Holzfeuerungsanlagen GmbH
Neulandstr. 30, 6971 Hard a. Bodensee

Mondi Uncoated Fine & Kraft Paper GmbH Kelsenstrasse 7, 1032 Wien

Österreichischer Kachelofenverband Dassanowskyweg 8,1220 Wien

Ortner GmbH Hürmer Straße 36, 3382 Loosdorf/Melk

Repotec Umwelttechnik GmbH Europastraße 1, 7540 Güssing

R+M Ressourcen+Management GmbH Marktgasse 34, 7434 Bernstein

RIKA Metallwarenges.m.b.H. & Co KG Müllerviertel 20, 4563 Micheldorf

R(o)HKRAFT Ing. Karl Pfiel GmbH Schulgasse 6, 3454 Reidling

Rudolf Großfurtner GmbH Hofmark 1, 4972 Utzemaich

TIWAG-Tiroler Wasserkraft AG Eduard-Wallnöfer-Platz 2, 6020 Innsbruck

Umweltdienst Burgenland GmbH Rottwiese, 7350 Oberpullendorf

Statements by industry partners

In the field of biogas technology research, BIOENERGY 2020+ represents the superlative within Austria – and in my opinion worldwide – because the best possible use is made of optimal cooperation between industry/technology manufacturers and science and industry/technology users. At the same time, BIOENERGY 2020+ is flexible enough to embrace newcomers to research and industry. Changes driving future!

Karl PFIEL, Managing Director of R(o)HKRAFT GmbH

Although KWB itself operates a large research and development centre, we continuously and happily fall back on the expertise and the infrastructure of BIOENERGY 2020+. Collaboration with the centre of expertise is simple and uncomplicated. We are also very professionally supported in the management of research/funded projects.

Jürgen MARKON, Head of Technology & Product Management
KWB GmbH

The team at BIOENERGY 2020+ wholly convinced me from the very first hour of our cooperation. The partnership is conducted on a competent, open-minded, flexible and ambitious basis and shows how, working together, research institutes and industry can meet the challenges of the future through an efficient and market-oriented approach and with a focus on sustainability.

Manfred HUBER, Director of Ortner GmbH

The cascading use of the raw material wood is of central importance in ensuring a sustainable future for our society: it begins with the production of sawn timber and leads through use as a material in the paper and panel industry to recycling for energy purposes. BIOENERGY 2020+ is therefore an important research partner for us in this field!

Leo ARPA, Head of R&D Paper – Mondi Europe & International

In BIOENERGY 2020+ we have found a partner who unifies scientific work with practice-oriented project objectives. Thanks to the great staff commitment and the highly constructive collaboration, it is simply fun to work on joint projects.

Ralf LAKATOS, CEO
LAMTEC Meß- und Regeltechnik für Feuerungen GmbH & Co. KG

BIOENERGY 2020+ provides us, as a medium-sized company, with an opportunity to participate in current research and development work, and to profit from it. This contributes to the continuous development and improvement of our products.

Philipp KOLBITSCH, Product Manager
Solid Fuel Power Plants, Bertsch Energy GmbH & CoKG

BIOENERGY 2020+ also offers small companies the opportunity to participate in top-level international research. In this way, innovative bioenergy companies can gain a clear competitive advantage.

Christian AICHERNIG, CEO Repotec GmbH & Co KG