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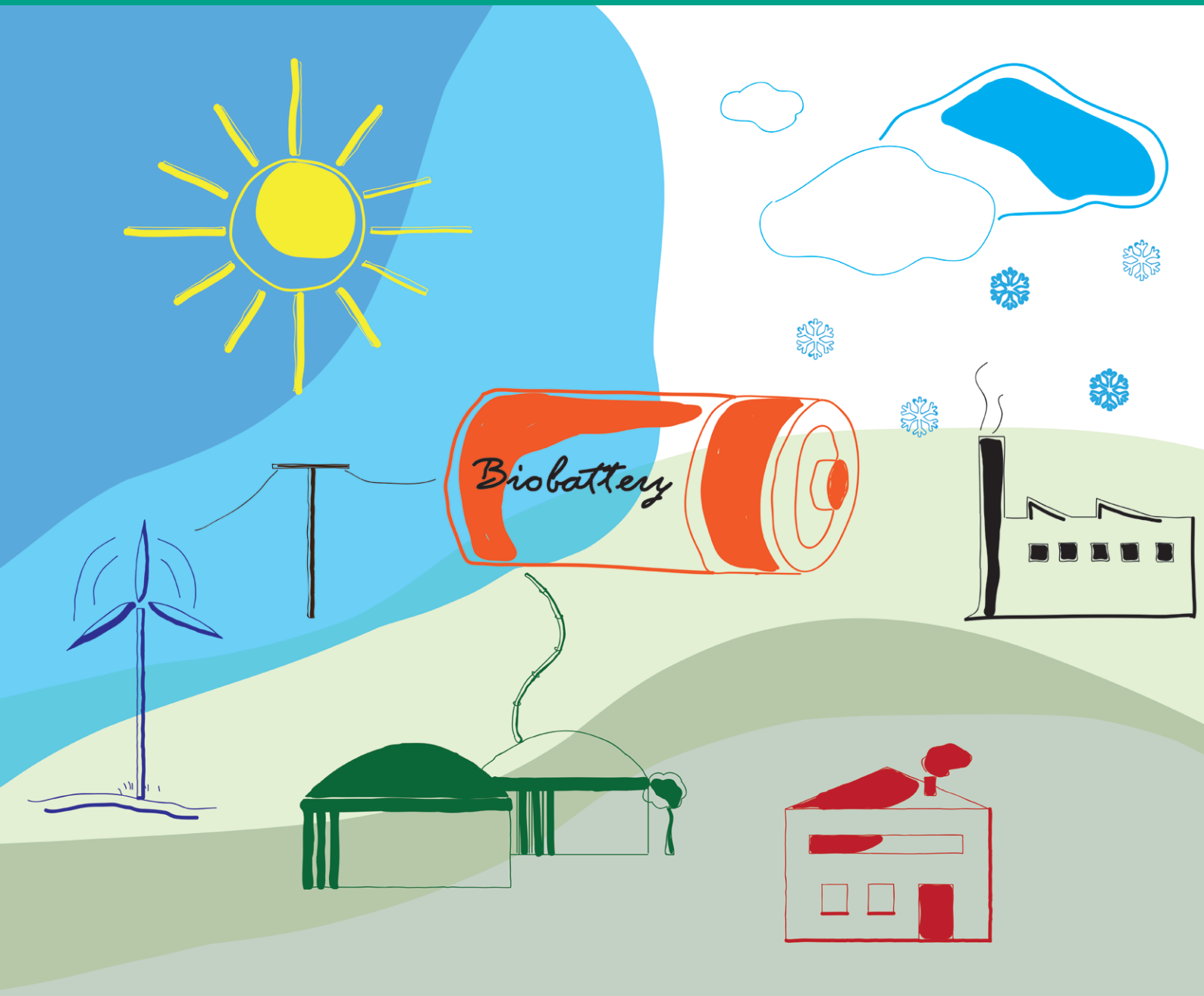
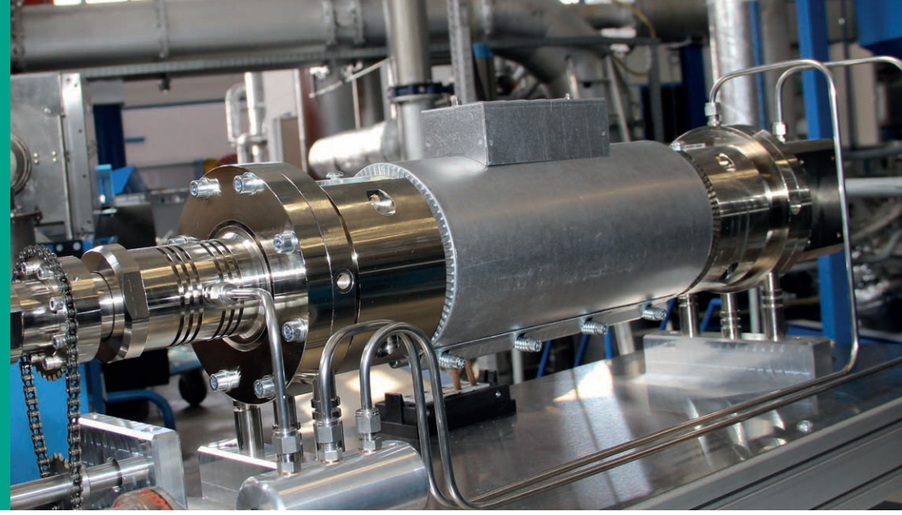
FRAUNHOFER INSTITUTE FOR ENVIRONMENTAL, SAFETY, AND ENERGY TECHNOLOGY UMSICHT
INSTITUTE BRANCH SULZBACH-ROSENBERG

# BIOBATTERY: GOAL-ORIENTED USE AND STORAGE OF SURPLUS ENERGY





**Germany‘s energy transformation sets special challenges for the country as an industrial location. Today renewable energy sources already cover a fifth of electricity needs. However, transforming energy from fluctuating sources such as sun and wind does not yet allow us to forego conventional power stations completely, which we still rely on to deliver balancing energy. Solutions are needed that guarantee a temporal separation of generation and use of power.**

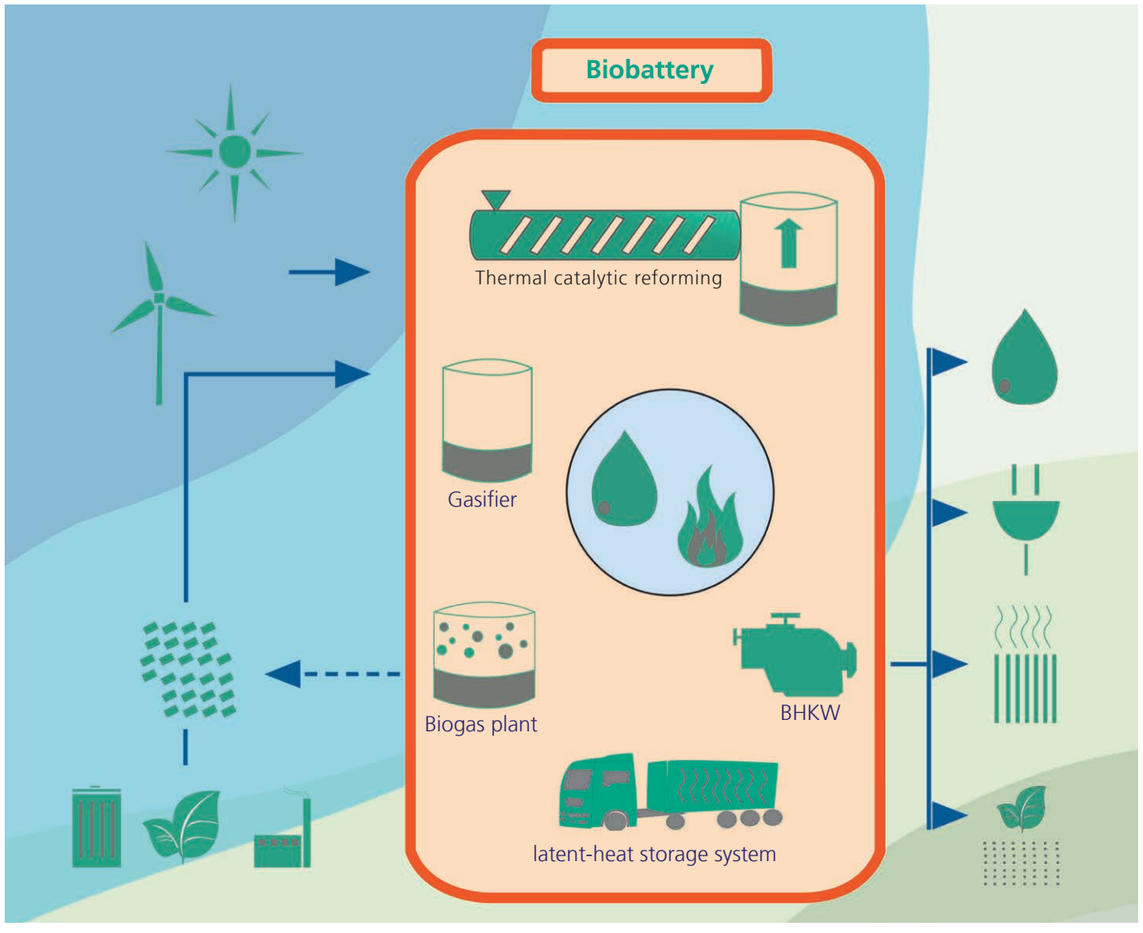
## Conversion of energy is the key

The idea of the biobattery from the Fraunhofer Institute for Environmental Safety and Energy Technology UMSICHT branch in Sulzbach-Rosenberg is to allow energy to be stored over different time periods. The biobattery stands for a pool of several environmentally friendly technologies. Biogas plants, thermal storage systems, gasifiers, thermal catalytic reforming and motors for energy generation form the centre of the concept. Excess electricity from renewable energy, biogenous residual materials and other organic waste serve as the input. Through a combination of high temperature heat storage systems, thermal decomposition and an integrated reforming stage, residual biomass and excess electricity are transformed into the products oil, gas and bio-coke.

The 7500 biogas plants in Germany present a great potential for the biobattery. Through thermal catalytic reforming in conjunction with combined gasification, the residue from anaerobic fermentation can be transformed and converted into liquid, solid or gas products. In the subsequent phase separation, the liquid phase is then separated into an aqueous and an oil phase. The isolated process water, which has a high content of biodegradable short-chain carbon compounds, can be fed back into the biogas system to increase the biogas yield. The reformer oil is produced and treated, as well as the gas, is used to generate electricity and heat in a generator in a combined heat and power (CHP) plant. Alternatively, the reformer gas as well as the reformer oil can be used for gasification. The syngas then produced with its high heating value is utilised energetically in CHP plant. The solid residue char (biochar) can be used as fertiliser or soil improver. Alternatively, the char, together with the reformer water, can be used for hydrogen production.

## High Efficiency

Optimal energy output is at the heart of the work surrounding the biobattery. The efficiency of the concept can be increased additionally by use of latent heat storage systems. In this way, the low temperature heat not needed on site is transported by mobile heat storage systems to where it is needed, and used there, increasing the efficiency of the system as a whole.
A particular advantage of the biobattery is the possibility for individual adjustment of the technological components to the local conditions.



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**Fraunhofer UMSICHT**

**Since 1990 the research institute in Sulzbach-Rosenberg develops concepts and processes for direct application. The target focus is the efficient use of energy, raw and functional materials. Within the Center for Energy Storage the main research interests are the development of integrated and decentralized energy conversion and storage solutions.**

Topics include, among others, heat and chemical storages, energy from biomass and waste, resource management and recycling, as well as the development of innovative materials and coatings for energy technological applications. Integrated process monitoring for efficient, sustainable and economical solutions are central to our work. The research institute in Sulzbach-Rosenberg, which is located in the metropolis-region of Nuremberg employs about 70 staff members (2012). On 1st July 2012 the established research institute in Sulzbach-Rosenberg joined Fraunhofer UMSICHT located in Oberhausen as an institute branch. In 2012 the entire Fraunhofer UMSICHT realized an annual turnover of 30.5 million € and employed 460 staff members. The institute advances sustainable economizing, environmentally friendly technologies, and innovative activities in order to improve the quality of life for humans and to promote the innovation capacity of the national economy. At present, the Fraunhofer-Gesellschaft maintains 66 institutes and independent research units. The majority of the more than 22 000 staff are qualified scientists and engineers, who work with an annual research budget of 1.9 billion euros. Fraunhofer is the leading organization for applied research.