TECHNISCHE UNIVERSITÄT WIEN
Vienna | Austria

Institute of Chemical, Environmental and Bioscience Engineering
Getreidemarkt 9
1060 Vienna, Austria
www.vt.tuwien.ac.at/EN

# Flexible production of sustainable green fuels

## Superior development environment for the production of sustainable energy carriers—sourced from biogenic residues

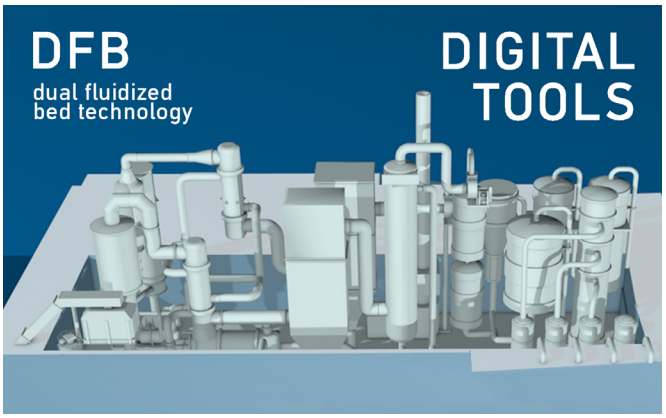
In order to reduce occurences of extreme weather, minimize upsurges in the number of climate refugees, and make survival in threatened regions possible, it is imperative to reduce $CO_2$ emissions and conserve biodiversity. To this end, the EU strives to reach the goals of broad decarbonisation as well as climate neutrality by the year 2050. The UN also targets the achievement of its Sustainable Development Goals by 2030: lowering $CO_2$-emissions, and massively increasing the use of sustainable energy carriers. Particularly stakeholders from the energy sector, energy-intensive industries, transportation and households must develop a climate-friendly, intelligent approach to energy use.

## Objectives

The research group “Industrial Plant Engineering and Application of Digital Methods”, led by Dr. Stefan Müller (previously led by Prof. Hermann Hofbauer), has set itself the goal of developing industrial plants capable of flexibly transforming biogenic residues and waste products into synthetic, sustainable fuels and energy carriers. The plants should be capable of using any locally-available biogenic residues as input. They should also be capable of producing an output of any mixture of fuels desired, according to regional economic targets and local demand.

## Solution

At the heart of these plants lies the dual fluidized bed process, or DFB for short. This process has been continuously developed and optimized for over 30 years by researchers at the TU Wien. During the fluidized bed process, combustion and gas production—which under normal circumstances occur together in the same reactor—are separated out into two different reactors. The bed material that circulates between the two reactors ensures optimal reaction processes and provides the desired heat input to the gasification process. In this manner, raw materials may be converted into high-quality synthetic- or product-gas through a highly efficient thermal process. The gas may then be processed further to obtain any energy carriers desired.




The great advantages of DFB technology lie in its flexibility of deployment as well as its ability to both process many different types of biogenic residue and to attain optimal product gas yields. It may even be possible to use $CO_2$ itself as a raw material—this possibility is presently being investigated in detail. The product gas is then purified and undergoes further processing (using the Fischer-Tropsch process as well as other conventional refinery methods) in order to obtain the desired end products.

## Results

Using DFB-technology, any and all of the typical products of an oil refinery can be generated, but they are produced from biomass, residual materials or waste products, instead of from crude oil. Hydrocarbons bound in waste materials are converted to whichever molecules or hydrocarbon chains are required. This makes possible the production of high-quality, sustainable fuels: all the way from “green” hydrogen, methane, hythane, and synthetic natural gas, to fluid bio-fuels such as climate-neutral gasoline, diesel, or jet fuel—it’s even possible to produce a host of organic commodity chemicals.

Raw input materials can consist of a variety of biogenic residues, such as forest wood waste, bark, agricultural and food production wastes—as well as segregated household waste, sewage sludge, or homogenised industrial and commercial waste. These materials can substitute for the exploitation and combustion of fossil fuels.

Industry specialists will find an experienced partner for cooperation in the research group “Industrial Plant Engineering and Application of Digital Methods” at TU Wien. Due to the presence of the Test Laboratory for Combustion Systems, as well as laboratory- and pilot-plants for the implementation and analysis of the entire process chain, R&D questions concerning the flexible production of green fuels and chemicals can be quickly and efficiently addressed, and answered in a detailed, well-founded manner. Starting in 2021, it is also now possible to conduct investigations at TU Wien on all the stages of product synthesis, starting from product gas to the desired end-products.

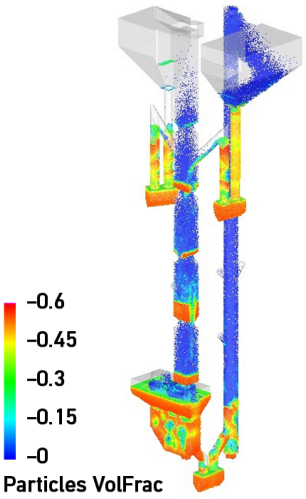
Plant operators and construction firms will find they are conscientiously and efficiently supported in the speedy evaluation and implementation of their plans, as well as the optimization of their sites, by a highly detailed level of process know-how and the most up-to-date digital methods.

## Potential partners

- energy-intensive industries
- energy suppliers
- plant construction firms
- plant operators who require innovative products and processes for their plants
- transport and logistics firms
- producers in sustainable agriculture, food production, and forestry
- research and development partners for the implementation of pilot projects

## Your benefits

- DFB technology enables the energy-efficient conversion of a variety of biogenic residues to fuels
- flexibly produce $CO_2$-neutral hydrogen, synthetic natural gas, methane, liquid fuels (using the Fischer-Tropsch process), or diverse organic commodity chemicals
- utilize and/or recycle $CO_2$ via the DFB process
- get access to an all-encompassing development environment for the optimization of implementation plans on an industrial scale
- production of sustainable fuels (Fischer-Tropsch products) with a system energy efficiency of between 50 to 80%
- make use of our experience in running a pilot plant of 100 kW (thermal)
- possibility of running tests along the entire process chain from raw materials to end products
- access to digital modelling and simulation tools, which serve a range of purposes, from the analysis of real-time performance parameters all the way to process design, control and optimization for scale-up




Digital tools for the simulation of all processes

- state-certified testing laboratory for the reliable characterisation of input materials is available
- gain a cooperative partner with over 30 years of experience in the thermo-chemical conversion of biogenic combustibles into a wide range of energy carriers and forms of energy
- competent consultation and assistance in the preparation, design, validation, implementation and operation as well as optimization of demonstration- and industrial-scale plants
- 7 commercial industrial-scale plants using DFB technology in existence – with a combustion heat capacity of 3.8 to 33 MW – in Austria, Germany, Sweden, Thailand and Japan
- obtain the right to use exclusive patents

## Contact

Dr. Stefan Müller
Univ.-Prof. Hermann Hofbauer
Univ.-Prof. Robert Mach

Research Unit of Fuel and
Energy System Engineering
Institute of Chemical, Environmental and
Bioscience Engineering (ICEBE)
Faculty of Technical Chemistry
TU Wien

www.tuwien.at/hm2021
+43 1 58801 166366
stefan.mueller@tuwien.ac.at, rema@tuwien.ac.at