Karlsruhe Institute of Technology

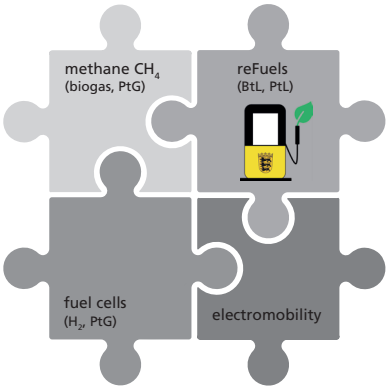
Division III – Mechanical and Electrical Engineering

Institute of Internal Combustion Engines (IFKM)

reFuels – Rethinking Fuels

Regenerative Fuels as Building Blocks for CO_2-neutral Mobility

In addition to measures such as the expansion of electric mobility, the use of regeneratively produced fuels is a promising contribution to CO_2-neutral mobility. After all, shipping, air, and rail traffic, which involve covering long distances or transporting heavy loads, will continue to require liquid fuels in the future. Renewable fuels can be produced from carbonaceous residues from agriculture and forestry (Biomass-to-Liquid - BtL) as well as by direct synthesis from CO_2 and electrolysis hydrogen using electrical energy from renewable sources (Power-to-Liquid - PtL).



reFuels as building blocks for CO_2-neutral mobility.

In the research initiative "reFuels – Rethinking Fuels", various KIT institutes are working on the efficient production and use of regenerative fuels in cooperation with the State of Baden-Württemberg and numerous partners from the automotive, automotive supply, and mineral oil industries. The aim is to enable all vehicles – including the existing fleet – to run with regenerative fuels in order to create a fast complementary solution for CO_2-neutral mobility.

A Holistic Approach – from Production to Application

The project pursues a holistic approach in the following three areas:

Cluster A: Provision of reFuels

The pilot plants available at KIT provide fuel components that can be used in blends with basic fuels or directly as fuels. During operation of the pilot plants, business and economic indicators along the entire value chain are to be determined, based on raw materials used and electricity from renewable sources.

The mass and energy balances drawn up allow adequate consideration of reFuels production costs. Based on these balances, the researchers develop logistics concepts for the provision of raw materials and energy sources and identify suitable locations for a demonstration plant, for which a concept has been developed using the Mineraloelraffinerie Oberrhein (MiRO) as an example.

Whether automobile, ship, or rail transport: CO_2 emissions from fossil fuels contribute significantly to climate change. reFuels researches regenerative fuels – completely CO_2-neutral with the same energy density (Photos above: KIT, Photos below: pixabay)

Cluster B: Application of reFuels

A small fleet of test vehicles and demonstration vehicles will be operated with the fuels produced in the pilot plants. These fleet tests as well as tests on engine test benches are intended to ensure that emissions from the use of reFuels do not exceed those of fossil fuels. In addition, aspects such as the interaction with the materials used in vehicles and potential effects on the driving behavior experienced by the driver will be investigated.

Cluster C: Technology Partnership reFuels

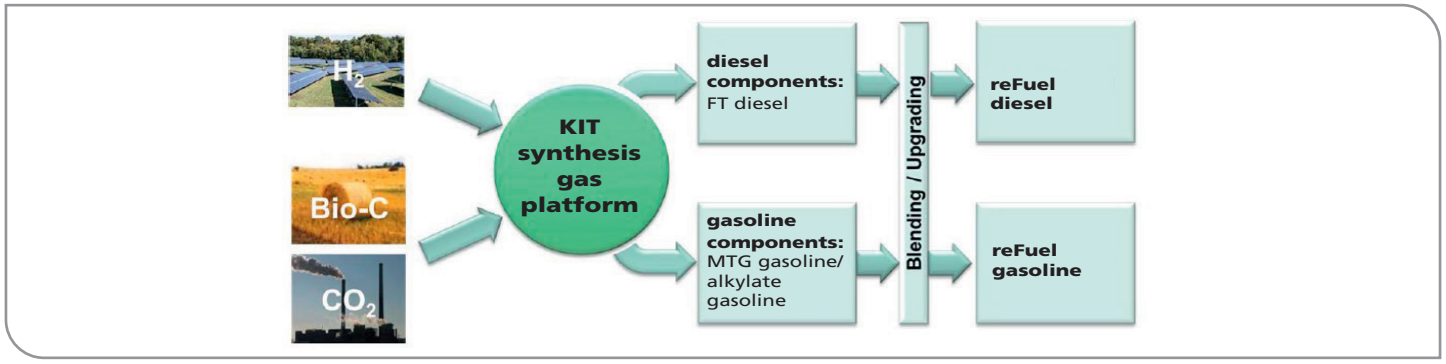
A life cycle assessment of the synthesis and use of these fuels (life cycle analysis) ensures a holistic view. Despite the use of energy and materials from renewable sources, this results in remaining CO_2 equivalents or other impact factors such as land use and water consumption.

The results of the assessments on fuel production and use will be discussed with representatives of civil society, such as trade unions, employers, consumer and environmental associations. The aim is to inform the public about the framework conditions and opportunities for the production and use of reFuels in order to create social acceptance of these fuels.

Different Production Methods

The project is based on a synthesis gas platform set up at KIT. This includes the further development of different processes for fuel production, such as Fischer-Tropsch synthesis (FT) or the methanol-to-gasoline (MtG) process. Both processes form the basis for the conversion of available carbon and hydrogen compounds into longer-chain hydrocarbons such as diesel or gasoline fuels, which are liquid under standard conditions. The quantities of energy and raw materials used as well as the efficiency of the synthesis constitute the main balance parameters.

With bioliq® and Energy Lab 2.0, KIT has two platforms for the production of reFuels. The bioliq® process, which can be used to produce high-quality fuels from biogenic residues such as straw, is already available in a plant that can synthesize gasoline. The Energy Lab 2.0 is a worldwide unique plant network that combines state-of-the-art technologies for the production and use of electrical, thermal, and chemical energy, such as gas turbines, power-to-methane, and hydrogen electrolysis, and from these can produce different fuel components.



reFuels production routes, which are based on the KIT synthesis gas platform and the bioliq® and Energy Lab 2.0 infrastructures (Illustration: KIT).

Karlsruhe Institute of Technology (KIT)
Rintheimer Querallee 2
76131 Karlsruhe, Germany

Dr. Olaf Toedter
Institute of Internal Combustion Engines
Phone: +49 721 608-43639
Email: olaf.toedter@kit.edu
www.ifkm.kit.edu
www.refuels.de

Christoph Kölle
Overall Communication
Phone: +49 721 608-41112
Email: christoph.koelle@kit.edu

Baden-Württemberg
MINISTERIUM FÜR VERKEHR

strategiedialog automobilwirtschaft BW

Karlsruhe Institute of Technology (KIT) · President Professor Dr.-Ing. Holger Hanselka · Kaiserstraße 12 · 76131 Karlsruhe, Germany · www.kit.edu