



Using a wide range of fuels

EnBW is banking
on diversity for
our future energy supply

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Research, Development and Demonstration

EnBW Energie Baden-Württemberg AG is working on concepts for future energy supply which are reliable, safe, environmental friendly, and affordable. Exploring technologies for a sustainable energy production is the main focus of EnBW's R&D department including three main objectives: never to release more emissions than the environment can absorb; to produce energy as cheap as possible in terms of total costs; and to expand the existing pool of energy resources for future generations. Innovative energy sources such as renewable fuels are already contributing significantly to resource conservation and climate protection. EnBW's researchers are also investigating the options for preserving resources and lowering CO₂ emissions of existing conventional power plants.

One approach focuses on power plants fuelled by natural gas. In the light of the limited availability of natural gas, the important question is whether natural gas can be at least partly substituted by alternative fuels like syngas from biomass or coal. This would increase considerably the flexibility of natural gas power plants. The main technological challenge is to ensure a safe, reliable, and low-emission gas turbine operation without damaging the combustor or the turbine. A technical solution allowing existing natural gas power plants to be operated with a wider range of fuels, e.g. syngas, would be very attractive, thus reducing the dependency on natural gas.

The scientific fundamentals of such a solution are being investigated by the research partners DLR, University of Stuttgart and ZSW in collaboration with industrial partners in a two-and-a-half-years research project on fuel flexible combined cycle power plants with optional CO₂-free operation. The project is funded with Euro 3.85 million, provided equally by the state of Baden-Württemberg and the industrial partners Alstom Power Generation AG and EnBW Energie Baden-Würt-

temberg AG. The research project has two main objectives: to develop a process for reforming synthetic fuel (syngas) that can be combusted safely and with minimal emissions (project part A) and to investigate how a gas turbine burner needs to be modified in order to take into account the different combustion properties of syngas in comparison with natural gas (project part B).

A 200 kilowatt pilot test plant is currently being constructed at the Institute of Process Engineering and Power Plant Technology (IVD), University of Stuttgart, which will incorporate a fluidised bed gasifier for syngas reforming from coal, wood or other types of biomass. During the gasification step, the solid fuel is converted into a gas mixture that mostly consists of hydrogen (H₂) and carbon monoxide (CO). The goal of the investigations in the pilot plant is to evaluate how syngas can be produced with a well-defined and reproducible gas quality in order to use this gas as a gas turbine fuel. Using syngas also entails the option of implementing a more economical CO₂ separation step at a later stage. Baden-Württemberg's Zentrum

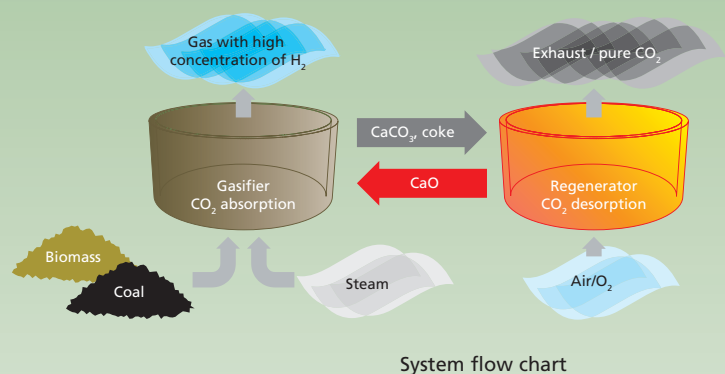
für Sonnenenergie- und Wasserstoff-Forschung (ZSW) is currently investigating substrates for separating CO₂ which can be tested and deployed in a second fluidised bed reactor.

Syngas with its very high reactivity – and potentially composition fluctuations depending on the gasification process – is very demanding as a gas turbine fuel, both in terms of emissions and operational stability. Unlike natural gas, syngas contains a high amount of hydrogen which is the reason for the very high flame temperature and flame speed, the later being the reason for a high flashback risk. The necessity of combustor modifications to bypass the problems of combustor damage or higher NO_x levels are the challenges in syngas combustion. The characteristics of syngas combustion are currently investigated in part B of the project by the Institute of Combustion Technology at DLR Stuttgart.

The aspects of advanced combustor cooling which is necessary in syngas fuelled gas turbines are being investigated at the Institute of Aerospace Thermodynamics (ITLR), University of Stuttgart.



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Equipment to extract alternative fuel gases from solid fuels has become an relevant -after treatment technology – a pilot plant for advanced wood gasification set up in Arnsherg by Stadtwerke Düsseldorf, an EnBW holding