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Decentralised power stations: greater efficiency through combined heat and power

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The micro gas turbine at the Institute of Combustion Technology

EnBW and DLR are jointly developing a micro gas turbine cogeneration system

Small Combined Heat and Power (CHP) plants – also known as cogeneration systems – which generate power and heat in the immediate vicinity of consumers, can augment the output of large power stations effectively and with low emissions, to the benefit of hospitals, industrial plants, nursery schools or even residential households. To drive forward the development of decentralised power plants, Energie Baden-Württemberg AG (EnBW) and the German Aerospace Center (Deutsches Zentrum für Luft und Raumfahrt; DLR) in Stuttgart have launched a collaborative project. The aim is to develop a small, natural-gas fuelled cogeneration system equipped with a micro gas turbine – generating both power and heat – and to implement this in a pilot plant.

The research project, sponsored by the German Federal Ministry of Economics and Technology (Bundesministerium für Wirtschaft und Technologie; BMWi), and called 'Natural-gas fuelled micro gas turbine cogeneration for decentralised energy supply' is a step in the joint 'Research Platform for Decentralised Energy' (Forschungsplattform für Dezentrale Energien) founded by the EnBW and DLR's Institute of Combustion Technology in Stuttgart at the end of 2008.

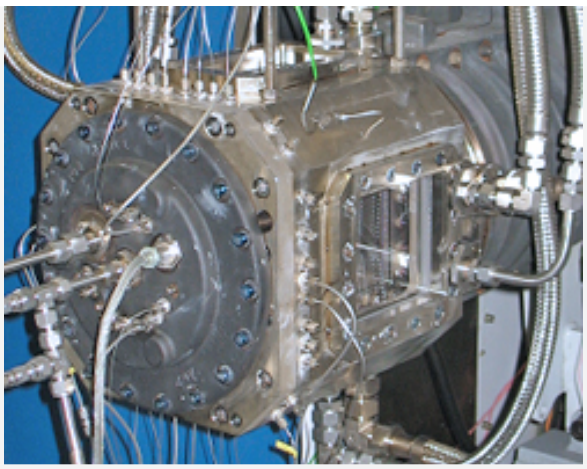
Start of the joint project at DLR

"The focus of our collaboration is directed towards advanced decentralised plants which provide heat as well as power and can convert the fuel efficiently and cost-effectively in the process," stated Prof. Johann-Dietrich Wörner, Chairman of the DLR Board, at the official project launch on 10 March 2010 in Stuttgart. These decentralised, small-scale power plants are well-suited to supply heat and power to individual industrial or agricultural businesses and their range of use extends to entire urban districts. They can be run on conventional fuels such as natural gas or diesel, as well as on biofuels. Depending on the application, up to 90 percent of the fuel input can be converted into energy.

"This project and the advanced technology it incorporates is intended to achieve substantial improvements in the cost-effectiveness of small-scale decentralised power plants. In the intelligent power networks of the future, when used as controllable installations, these power plants will come to play an even more important role than they already have," explained Dr Hans-Josel Zimmer, Technical Director of EnBW.

Micro gas turbine – fuel-flexible and low-emission

There is a micro gas turbine at the heart of the test power plant that the partners are developing and implementing in the course of this five-year research project. These small gas turbines have a the capacity to generate from a few kilowatts up to 500 kilowatts of electrical power. To achieve this, they use a jet of hot gas to drive a turbine that, in turn, drives a generator. The gas turbines offer several benefits that conventional engines are unable to deliver. They are flexible in terms of the fuel they use, they emit fewer pollutants and have a simple, low-maintenance design.



The optical combustion chamber of the micro gas turbine

Four years ago, DLR's Institute of Combustion Technology set up a Turbec T100 micro gas turbine in a laboratory. The turbine was modified for research purposes and equipped with an extensive range of measuring equipment. Among other things, DLR researchers devised an optically transparent combustion chamber which uses laser metrology to analyse the combustion processes within the chamber. The intention is to develop a new gas burner capable of running on various different fuels, delivering low emission levels and reliable operation. A further objective is to increase the efficiency rating of the entire plant by optimising the interaction of the components – this includes the piping, the

heat exchanger and the turbine itself, whose design is derived from mass-produced vehicle engine turbochargers.

Practical endurance test at EnBW

At a later stage in the project, EnBW will conduct practical tests of these joint developments. In a pilot plant created jointly with DLR researchers, EnBW wishes to carry out trials and to run endurance tests on the new components and plant concepts to determine their operational viability. This will enable important economic and technical parameters to be established for use with customers at a later date.

In the longer term, developers intend that this research on a CHP plant fuelled by natural gas will constitute essential groundwork. At a future date, these new plant concepts can also be extended to encompass further conventional and alternative fuels. In 2009, a project was launched as part of the research platform with the aim of optimising micro gas turbines to run on biogas.

Joint press release by EnBW and DLR

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