

They're getting hotter



Efficient power plant technology through redesigning the combustion process

At Irsching in Upper Bavaria, a next-generation gas turbine is just being put into service. With its combined cycle generator it will achieve an efficiency rating of 60 percent – a record level of which the owner, SIEMENS AG, is justifiably proud. The company works with DLR to test innovative new combustion concepts. The two partners have a common objective: to develop power plants that are more efficient and less polluting. This article by **Dr. Werner Krebs of SIEMENS' Energy Sector Fossil Power Generation Division** describes the challenge involved from the company's perspective.

The new combined cycle power plant (CCPP) is the most efficient in the world, and can be regarded as a significant milestone along the road to preventing carbon-dioxide emissions. High levels of efficiency are crucial if electricity is to go on being marketed at viable prices despite the expense

of capturing CO₂. SIEMENS is working hard to improve efficiency levels even further in the power plants of the future. Moreover it is still necessary to run gas turbines on other fuels such as hydrogen or syngases produced from coal. Hydrogen is produced from syngas or natural gas;

the carbon content of the fuel gas is separated out in advance in the form of CO₂.

Gas turbine combustion technology plays a key role in this. Combustion in highly efficient gas turbines, which are characterised by high tempera-

tures and high pressure ratios, must be kept stable across a wide operating range. The reactivity of the combustion mixture rises sharply in line with the proportion of hydrogen it contains, and this is something that must be taken into account in the design of the gas turbine combustion chamber.

SIEMENS is thus working intensively to develop novel combustion concepts and to test their ability to measure up to the demands that future gas turbine power plants will have to meet. So the partnership with DLR is extremely valuable to SIEMENS. The two organisations are collaborating on the development of new combustion technology using the FLOX burner. These activities have the sup-

port of the Federal Ministry of Economics' COORETEC initiative.

With this new combustion concept, high-momentum air/fuel mixture jets are injected into a hot reactive gas mixture, stabilising the flame. In contrast to traditional combustion systems, which are stabilised through a swirled flow, this concept offers the prospect of high combustion stability, resulting from the high level of turbulence in the combustion zone and the recirculation-free premix zone.

DLR also has a test rig where novel combustion concepts can be tested under conditions approximating those inside a gas turbine. By means of optical diagnostic techniques, flame stabilisation can be precisely

analysed and the appropriate design parameters established. Today's design process also increasingly involves multidimensional numerical computation methods. These enable combustion processes to be broken down for detailed study.

DLR is making valuable contributions towards developing these methods, allowing precise description of flame progress, nitric oxide emissions and unsteady flame phenomena. This information can ultimately be used to design a combustion concept that has been successfully tried and tested in the lab into a fully functional gas turbine combustion chamber.

COORETEC is an initiative of the Federal Ministry of Economics and Technology (BMWi). (The acronym denotes CO₂ Reduction Technologies in Power Stations). Within the initiative, industrial companies and research associations come together in joint projects to develop a future-proof fossil-fuelled power plant. A two-strand strategy is being pursued:

- Development of technologies designed to improve power plant efficiency
- Development of technologies for the capture and transportation of CO₂ with a view to its long-term, secure storage in geological formations

www.cooretec.de



At the high-pressure test rig of the Institute of Combustion Technology in Stuttgart, new and innovative burner and combustion chamber concepts are being tested under realistic conditions.