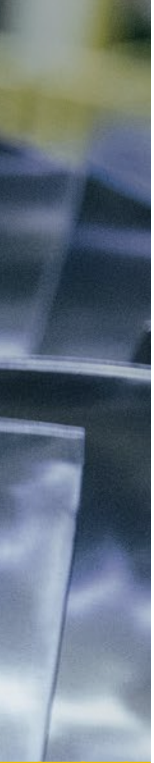
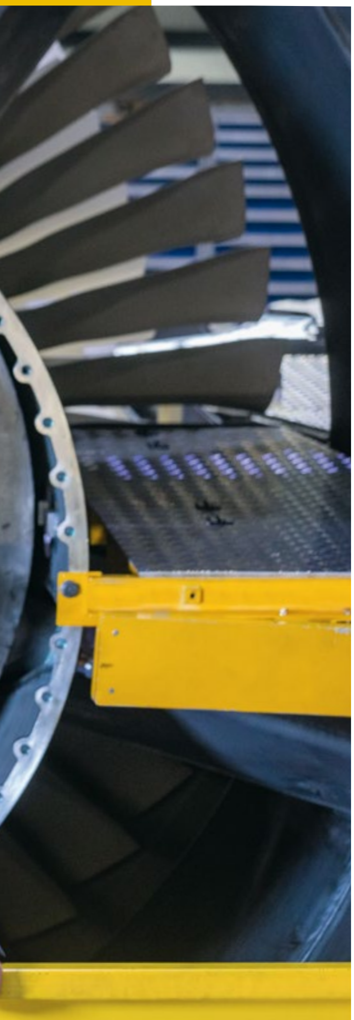
Photos: Dirk Lässig



»Long-term, cost-efficient **security of supply**«

Christopher Steinwachs, the Deputy President of the FVV, explains the role that gas turbines and other turbomachines play in the energy mix of the future.



Mr. Steinwachs, in Germany during the first quarter of 2020, more electricity was generated from renewable energies than with conventional energy carriers. What is your assessment of this as an engineer and turbomachinery specialist?
In principle, the transformation of the energy sector is absolutely the right step. But if we are to achieve the climate goals and become completely carbon-neutral by 2050, we will need more technologies alongside wind turbines and PV modules. As sun and wind are not always available, energy needs to be stored, for example by chemical means or in batteries. In order to guarantee long-term, cost-efficient security of supply, we have to come up with other ideas. I believe that turbomachinery will continue to play a decisive role.

So the energy sector is characterised by renewable energy. What effect will that have on the way gas turbines are operated?
The plants will be run in a much more cyclical manner than they are at the moment. Even large 800-megawatt installations with combined heat and power will be started up and shut down several times a day. This is already happening today in Germany. That means that we have to design gas and steam turbines for a greater cyclical load than a few years ago, when turbines ran at base load for many thousands of hours a year. As we develop these, we can then look at different, more cost-efficient materials, for example. After all, if they run for significantly fewer operating hours in the future – perhaps just 1,000 rather than 8,000 hours a year – investment costs will play an even more important role.

In future, gas turbines will be run not only in a more cyclical manner, but also with synthetic fuels. Which technical changes are needed to run them with hydrogen?
When hydrogen burns, its flame speed is around three times higher than that of methane, and the time until auto-ignition is only around a third as long at the given temperature. We need to ensure that the combustion does not become unstable or take place too close to the metal walls, as this could damage the combustion chamber. This is a major challenge, especially in the case of high hydrogen contents. And, of course, the emission limits also have to be adhered to.

What experiences have been gathered with partial or complete operation with hydrogen to date?
When using the current turbines in the portfolio of new plants, we can already admix up to 30 % hydrogen with fuels for the large gas turbines, usually natural gas. We have recently sold commercial plants that are operated in this manner. With a hydrogen content of more than 50 %, the topics of flame speed, emissions and the time of auto-ignition become increasingly important. This is what we are working on. But the amount of development work required and the costs for enabling a higher hydrogen content are not linear. Getting from 70 to 100 % takes exponentially more work than the jump from 30 to 50 %.

»In pre-competitive research, we share ideas and often achieve results more quickly together.«

As part of EUTurbines – the European association for turbine manufacturers – we have committed ourselves to achieving 100 % hydrogen combustion in our machines by 2030. And we can be proud of that!

Are such large quantities of hydrogen – from renewable sources – even available?
That is certainly a problem. As I mentioned, Siemens Energy aims to switch its gas turbines to 100 % hydrogen by 2030. The roadmap stipulates that we start with the smaller turbines, as sufficient quantities of hydrogen cannot currently be made available for the larger machines. The volumetric flows in the large machines are enormous – a 350-megawatt gas turbine sucks in around a tonne of air every second, and the fuel needs to be available for that. This is not yet possible with green hydrogen. For pure hydrogen operation we will initially use smaller gas turbines anyway, such as those with a capacity of 25 megawatts. Hydrogen can already be provided on that scale today.

Will maximum efficiency remain the primary goal of development under these conditions?
In Irsching in 2008, we commissioned a combined gas/steam turbine power plant with an electrical efficiency of 60.75 % – a world record at the time. Now, ten years later, the electrical efficiency of a power plant like this is around 63 %. A great deal of research is required in order to attain further, relatively small, increases in efficiency. Alongside efficiency, we are also constantly balancing other very important parameters in order to maximise the benefits for the customer. So it is an important development goal – alongside others.

What are the other research and development goals in your view?
Above all, we need to enable even more flexible operation with 100 % hydrogen while also adhering to the NOx emission limits. And, of course, there is the development with regard to cyclical loading, which is greater than it was a few years ago.

What can and should Industrial Collective Research contribute to this?
We are collaborating closely for example, with aircraft engine manufacturers such as Rolls-Royce and MTU. This is pre-competitive research, for instance in order to find the right materials for the combustion of hydrogen or to control combustion instabilities. Additive manufacturing is another goal. These are topics that we in Europe need to move forward. Conventional topics such as the design of turbine blades with regard to vibrations also remain crucially important. These need to be incorporated into FVV's pre-competitive research.

How important is the FVV's work in your view?
In this pre-competitive research, we share ideas and often achieve results more quickly together than we could alone. We have access to important research findings we would not otherwise have. And one thing the FVV does really well, and that we have benefited from, is its collaboration with universities. This is really important in order to attract talented young staff.

You have been Deputy President of the FVV since the end of 2019. How would you describe your experiences so far?
Unfortunately we have only had video conferences due to the COVID-19 crisis. In a company, this works very well in many fields. But in a network in which you only see each other at two or three meetings a year, personal contact is important. I hope this will be possible again soon.

Thank you for the interview, Mr. Steinwachs. //

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has been responsible for the global production network of hot gas components in gas turbines at Siemens Energy since August 2019. Before this, he headed the global research and development organisation for all gas and steam turbines and generators at Siemens. Steinwachs has been at Siemens since 1992, and joined the FVV Board in 2016. He was elected Deputy President in November 2019.