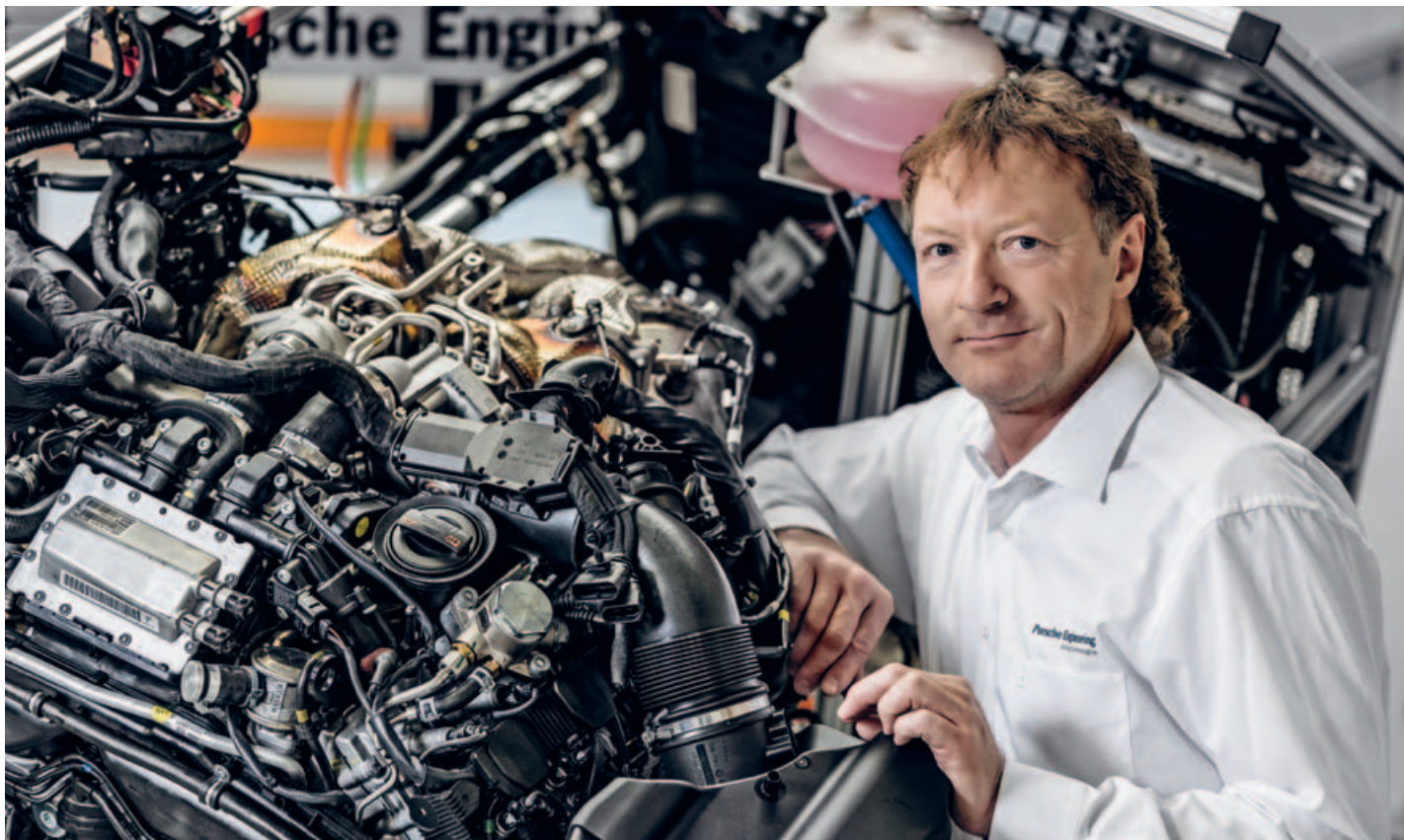


It's All in the Mix

_____ Will the engine—in particular the combustion engine—continue to be the heart of every vehicle in the future as well? To find out how a passionate engine developer answers this question and to get some insight into the challenges, trends, and technologies that will be important going forward, we spoke with Klaus Fuoss, head of engine development at Porsche Engineering.

Interview by Frederic Damköhler, Nadine Guhl Photo by Jörg Eberl



Porsche Engineering *Mr. Fuoss, with all the talk about electromobility these days, how do you view the future of the combustion engine?*

Fuoss The combustion engine is alive and well. It will remain the primary source of propulsion in our cars for a long time to come. But biofuels and natural gas will play a growing role as an additional source of power. Over the long term, I believe a healthy mix of current fuels, biofuels, and natural

gas will become the standard, though the actual development and ultimate success of biofuels will depend heavily on creating a favorable political climate. With regard to fuel consumption development of current vehicles, considerable potential for improvements can still be exploited through hybridization, downsizing, and energy management. Lightweight construction and reduced friction—particularly with regard to engines—are also increasingly the focus of attention.

What are the greatest challenges in engine development?

Fuoss Among the greatest challenges are the reduction of PM (particulate matter) and CO₂ emissions. Both are subject to binding legislation—and the standards are high. Lightweight construction is no longer just an issue in body development; engine development is increasingly affected as well. There are weight targets for engines, so even during the design phase we have to

think about multiple integration of functions and components as well as what materials are used. While downsizing always creates opportunities, at the same time it requires attention to counteracting the associated higher stress on components. To address this, efforts are underway to master higher injection pressures in both gasoline and diesel engines. Moreover, in the future it will be increasingly important to find cost-effective solutions for worldwide use of engines in general. Here we face the challenge of developing concepts in such a way that they are compliant in different markets. The question is when a global solution makes sense and when it makes sense to differentiate according to local demands.

How is engine development at Porsche Engineering proceeding in order to be ready to address these future challenges?

Fuoss We maintain a constant focus on expanding our expertise in the relevant fields such as the simulation of gas exchange and mixture formation. We are also expanding our knowledge and methods with regard to lightweight construction. As an engineering service provider within the Porsche Group, we also profit immensely from our involvement in series development projects. We thus look at every single development step from an OEM perspective and we are accustomed to thinking that one step further; that is, to look at the vehicle as a whole. As a rule, that's exactly what our customers appreciate.

How far can you go with downsizing? Is the end of the road in view?

Fuoss In the next stage, the mass market will be dominated by 1.0- to 1.5-liter engines putting out the same power as today's 1.5- to 2.0-liter engines. Further downsizing only makes sense with

reduced vehicle masses. There will also be a reduction in the number of cylinders, as it is not possible to endlessly reduce the individual cylinder displacement volume—I think we'll see two- and three-cylinder engines on the mass market. But here it is crucial to ensure that this does not cause negative impact in terms of comfort.

What is the outlook with regard to power? Is there a limit?

Fuoss The limits are ultimately defined by the customer. There will presumably always be demand for very powerful cars. Looking at the mass market—let's say 75 to 110 hp—this level of power will remain relatively constant. The objective here has to be reduced fuel consumption with the same level of performance, especially with regard to CO₂ targets.

What kind of engine would you someday like to develop?

Fuoss That's a tough question, since I have had the opportunity to work on nearly every common type of engine and number of cylinders, but a high-revving V12 could be interesting. But I can just as easily imagine working on a "best in class" high-efficiency engine.

How will we get around in 30 years?

Fuoss In 30 years we will predominantly be driving around in hybrid vehicles with engines that have been successfully downsized. We are also the generation that will get electric vehicles going in a big way and learn to really work with this new technology so that generations to come will no longer have any inhibitions in this regard. So in the future there will be a mix of fuel cell- and battery-powered vehicles, plug-in hybrids, hybrids as well as vehicles with combustion engines. But these vehicles will increasingly draw their power from

CO₂-neutral electricity and CO₂-neutral fuels and thus be truly sustainable.

If you hadn't become an engine developer, what would you have done instead?

Fuoss That's hard to imagine. I probably would have become a person who always wanted to be an engine development engineer. ■

Klaus Fuoss

As the son of a self-employed auto mechanic, his passion for cars and engines was stoked in his childhood. After his studies at Stuttgart University, the engineering graduate spent several years working in the advanced engine development department at Audi AG in Neckarsulm, Germany, before joining Porsche in 1996. As an engine design specialist, he worked on several engine projects for Porsche AG and was also involved in the "Harley-Davidson V-Rod" project. In 2003, Klaus Fuoss moved to the U.S. and spent over four years with Mercury Marine, where he headed up the engine design division (outboard motors). Once back in Germany, in October 2007 Klaus Fuoss took over as head of engine development at Porsche Engineering.
