

MOBILITY IS CHANGING

AN INTERVIEW WITH

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The right powertrain is the one that best meets the changing needs of a society. As such, Peter Gutzmer, deputy CEO and CTO of Schaeffler and FVV board member, takes a dim view of the 'either/or' approach. He is convinced that the electrified combustion engine is one of the key elements of future mobility.

Professor Gutzmer, what role will the combustion engine play in 2050? _____

The answer to this question depends largely on political decisions. However, politics does not always merely follow logical factors, but also social trends. Accordingly, for now we shouldn't place the technology at the heart of our thinking, but ask ourselves the following: How is our social perception changing? How is our society changing? What are the consequences for the world of politics?

We are facing massive changes

Do you have an answer to these questions? _____

There are no definitive answers, but merely the conviction that we are facing massive changes in the coming 20 to 30 years. The most important future trends will be significantly influenced by megacities outside Europe. This will produce different mobility needs to which we will have to adjust. Intermodal transport with smooth transitions between various means of transport will thus be a matter of course in the city of the future. At the same time, it will become ever more important for a growing proportion of the global population to move between urban business centres in a time-efficient manner. Lower consumption of resources will become an increasingly key feature of all forms of transport, whether aircraft, high-speed train or automobile. There is a growing awareness of the need for environmentally friendly solutions.

How will the world of politics react to this? _____

We Europeans in particular are trying to force change – by banning combustion engines from city centres, for instance. In view of the expertise, industrial structure and jobs that we

have here, we should be intensively debating whether this is the right way forward. Furthermore, I don't think that people will give up the freedom that individual mobility affords them. Americans and Asians take climate and environmental protection just as seriously, but take a more pragmatic approach. This can also be seen in the powertrain technology: in these places, it's not about promoting either the combustion engine or electric mobility, or even banning individual technical solutions, but opting to develop several different strands. Japanese automobile manufacturers, for instance, have significantly stepped up research into the combustion engine. They have recognised that the combustion engine is also a key technology for future mobility.

Why should this be the case? _____

To a large extent, a vehicle's powertrain system determines the energy efficiency, environmental friendliness and sustainability of mobility. That is why it will remain of paramount importance in future to develop energy-efficient drive systems with extremely low emissions. The claim that a vehicle emits less CO₂ and fewer pollutants extends not only to its actual use, but also its entire life cycle, including the production process. Accordingly, we will have to look at emissions in their entirety in future – in other words, along the entire energy chain. Then people will soon recognise that electric mobility, although emission-free at local level, is no better than a good present-day combustion engine. Over the next 15 years, however, we expect the proportion of pure electric drive systems to be as high as 20 per cent and the proportion of 48-volt and plug-in hybrid drive systems to reach a total of 40 per cent. We are therefore assuming that around 80 per cent of the vehicles built worldwide in the next 15 years will have a combustion engine in conjunction with various forms of electrification. The vehicles' drive systems will definitely become more complex and require further FVV-led research focused on the entire system in addition to engine-specific considerations, possibly while also taking the infrastructure into account.

What would be a more pragmatic approach to an emission-free future? _____

A combined approach to finding a solution would be sustainable: in long-distance mobility and in many rural regions of the kind we have here in Europe, combustion engines should be powered by regeneratively produced fuel. In concrete terms, this means using the carbon dioxide produced by existing processes such as steel and cement production or energy generation, or even using the CO₂ from the air – and making fuel from regenerative sources. However, there will also be areas, such as megacities, where an emission-free environment at local level will be sensible and mandatory. In the long term an electric mobility culture will evolve in such places as soon as the battery technology is developed. Alternatively, we have to monitor the progress of fuel cell technology, but we see this being predominantly used in stationary applications.

And hybrid vehicles represent a form of bridging technology? _

The question is no longer whether the combustion engine will be electrified, but to what degree, because the driving profile and purchasing power of the customers should be taken into consideration when designing a hybrid drive system. It's about achieving a reasonable relationship between costs and fuel savings. I assume that plug-in hybrid vehicles with a large electric range will be of interest and become the standard above mid-size class vehicles. On the other hand, at a much lower cost the 48-volt hybrid already permits functions such as so-called coasting and – very important – regenerating huge amounts of energy when braking. It is even possible to drive electrically at low speeds with a 48-volt hybrid. This is sufficient, for instance, to allow a car to drive autonomously through a car park or from one traffic light to another. Hybrid drive systems will be the volume technology for at least the next 15 years.

And beyond the car? _____

If we look at heavy goods vehicles, ships or construction machinery, in my view the reciprocating engine is here to stay for as long as there are no other completely different battery systems available. They would not only have to feature a significantly higher energy density, but also have the longevity of today's engines. I don't know whether developments such as the lithium-oxygen battery will meet these requirements

A decentralised energy supply will become ever more important

one day. But we should in no way stop trying to improve current powertrain systems in the vague hope of some kind of technological breakthrough. The combustion engine in general – for instance as part of a decentralised energy supply with co-generation of heat and power – will survive, of that I am convinced. Decentralisation will become ever more important as more regenerative energy forms are developed, because the feed-in priority for regeneratively produced power is resulting in large-scale power stations becoming less and less worthwhile. At the same time, however, power supply at local level must be safeguarded whatever happens.

You were talking about long-distance mobility. What is the situation regarding sustainable air traffic? _____

Air traffic is growing relatively steadily at a rate of five per cent a year. Here, too, aircraft will still be powered by gas turbines and liquid fuel in future. This is also the reason why work on developing turbines must continue and research must be conducted into new regenerative fuels.

What kind of technological potential does the combustion engine still have in terms of reducing CO₂ emissions? _____

The reciprocating engine itself – in other words, without electrification or the influence of new fuels – still has potential of at least 10 to 15 per cent.

What are the most important areas of research that need to be investigated here? _____

There is still a great deal of potential in the area of variability, from cylinder deactivation to variable compression. Then there is high-pressure fuel injection, friction and real-time monitoring of the combustion process using suitable sensors and electronics. It will ultimately be a number of individual measures that will lead to the thermodynamic efficiency rising above 50 per cent at the optimum operating point – we are currently at just below 45 per cent with today's high-speed diesel engines, so there is still a little way to go.

Efficiency at the optimum operating point is one thing, but consumption in real traffic conditions is quite another. _____

Every engineer must indeed ensure that their technical solutions work in all operating and environmental conditions, if at all possible – even though this can be very challenging. As such, it is necessary to not only look at the individual components, but the entire system – in other words, the combination of the combustion engine with other worlds. At the same time, it is also about examining the interaction with the gearbox and vehicle, embedding the solution in a partially electrified system and establishing links with the infrastructure.

These sound like complex and thus also expensive solutions. _____

In its history, the combustion engine has ultimately always managed to survive under new political and technological conditions. My impression is that we will find many solutions that will cost less than the fines that will be imposed from 2021 for exceeding the fleet average CO₂ emissions limit.

What role can the FVV play here? _____

The FVV plays a key role in the continuing development of the German combustion engine industry, possibly even with a global focus in future by integrating industry partners from other countries. We can continue to work together there on a pre-competitive basis in the area of basic research without any concerns. And that not only goes for engine and turbine manufacturers, but also their suppliers and service providers. The

The perfect interface between research and industry

FVV represents the perfect interface between research, higher education establishments and this industry. There is still potential when it comes to forming links with associations and especially the world of politics. As such, we have a very good basis for unlocking the existing theoretical potential in all the necessary dimensions of efficiency and also exploring environmental issues relating to drive systems by means of coordinated joint research and communicating these aspects even more clearly. Among the global competition, we currently recognise that the FVV structure at least serves as a model for other industrialised nations.

Will the FVV focus more strongly on electrification in future? _

It is first necessary to make a distinction between the various forms of electrification. The FVV must pay particular attention to hybridisation issues. The most important characteristic here is not just the position of the e-motor in an electrified drive-



train, but the voltage of the system. Mild hybrid or 48-volt systems mainly represent a solution integrated in combustion engines. This means that they support the combustion engine in a way that significantly improves its performance. It is clear to me that this belongs at the heart of the FVV. Hybridisation with high-voltage technology is more likely to come via the gearbox or gearbox function. With that, I don't just mean the installation position for the electric motor, the bell housing of an automatic gearbox or the transmission housing, but also the logic behind such systems: on the one hand, they should make it possible to recuperate energy and drive on electric power; on the other hand, like a gearbox, they should shift the load points in the combustion engine to bring about more favourable consumption figures. In this respect, research into such systems at our drive technology sister organisation – the FVA, with which the FVV is already cooperating – has thus far been in good hands. But even with these high-voltage systems, questions arise that primarily relate to the further optimisation of the combustion engine in the first instance.

For example? _____
Well, there's the question relating to the most suitable combustion process. Of particular interest to hybrid vehicles are the Atkinson and Miller cycles, which combine good consumption figures with relatively low specific power. The power peaks can be absorbed by the electric motor. In terms of hybrid vehicles with a high electrical range, we must also look at how the operating strategy and thus the entire design of the engine changes. This is a challenge well suited to the FVV. Due to the fewer numbers produced overall, today's hybrid engines are derivatives of existing engines taken from a company's construction kit. But research of the kind conducted at the FVV has to go further and think ahead. In future we will have to work even harder on system-optimised solutions. Accordingly, basic research must also use interdisciplinary approaches to look at the combination of combustion engine, gearbox, electric motor and electronics as well as infrastruc-

tural issues. Here, too, I am convinced that there will have to be new methods of cooperation between research associations.

For most people, the car also has an emotional element, to date at least. How is the future looking? _____
There is no mobility without emotions, even though the subject is increasingly being dealt with in a rational way. If we want to get people behind new mobility concepts or alternative drive systems, we would do well to develop emotional products and create the right environment for them. As far as the question of what rouses emotions is concerned, it can certainly differ from one generation to the next. As engineers, we tend to stick to strictly rational arguments. That is also the right thing to do when it comes to technical matters – and yet we shouldn't assume that we will convince end customers and other stakeholders of a specific solution.

What form of mobility rouses particular emotions in you? _____
I love taking one of my classic cars for a drive. But motor sport is also especially emotional for me, although it's not really about a particular formula or class, but the overall experience. I find the engine sound important here, but it isn't the only criterion. I enjoy the classic 24-hour race in Le Mans as much as the innovative Formula E. It's just like real life: we should move away from 'either/or' towards 'both/and'.

There is no mobility without emotions

 **Photo:** It isn't just sports equipment that is made in Herzogenaurach, but also drive components and systems.