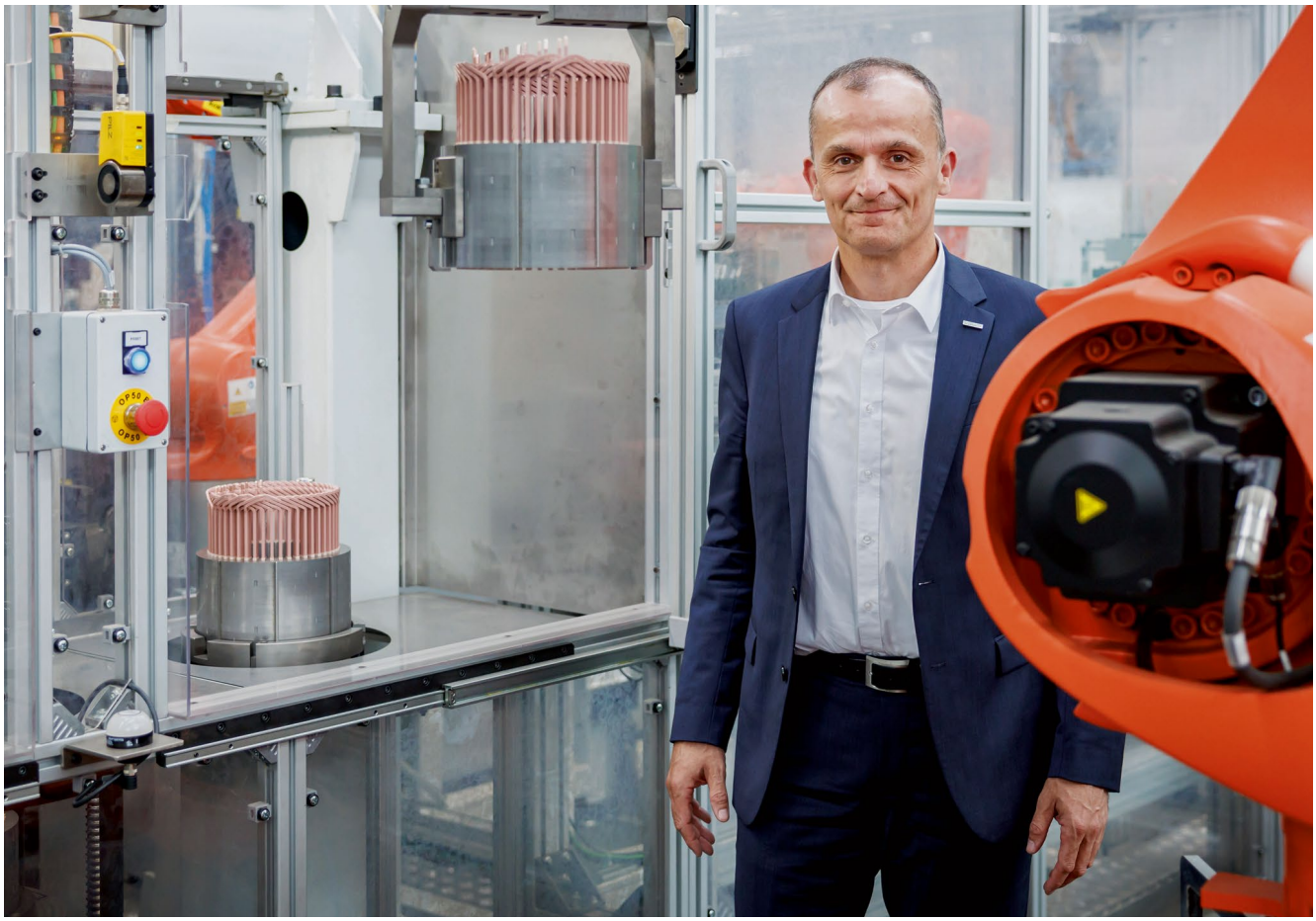

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"We will have and must have serial-parallel hybrids"

Demand for hybrid vehicles is currently on the rise again, and manufacturers are expanding their range accordingly. Matthias Zink, CEO Automotive Technologies at Schaeffler and President of the European Association of Automotive Suppliers CLEPA, talks in an interview about the reasons for the increased demand, new technical approaches for future hybrid drives and explains how the development fits in with the EU's Green Deal.

MTZ _ Matthias Zink, what do you believe are the reasons why the number of new vehicles with hybrid drive systems is currently increasing worldwide?

ZINK _ I think that there is a certain disillusionment after the initial experiences with all-electric battery-powered vehicles. In North America, for example, this is due to issues such as the electric driving range of BEVs, charging possibilities on long journeys, or the vehicles' towing capacity. Perhaps it is also

Dipl.-Ing. Matthias Zink (born 1969), studied Mechanical Engineering with a focus on Automotive Engineering at the University of Karlsruhe. He began his career as a Test Engineer at LuK in 1994. In the following years, he held various management positions before taking over responsibility for the Clutch Systems business unit in 2006. In 2012, he took over the management of Schaeffler Automotive Asia/Pacific in China. Zink returned in 2014 and initially headed the Transmission Technologies business unit. In July 2014, he was appointed President of the Transmission Systems business division. As CEO Automotive at Schaeffler, Zink has been responsible for the Transmission Systems business division and the Research and Development department of the Automotive Technologies division since January 2017 and for the E-Mobility business division since January 2018. In January 2019, he also assumed responsibility for the Engine and Chassis Systems business division and Global Key Account Management. Zink has also been President of the CLEPA European Association of Automotive Suppliers since January 2024.

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a factor there, as in Europe, that the early adopters' demand for BEVs is satisfied for the time being. In Germany, reduced subsidies for BEVs and the high costs of electricity for charging also play a role. In the meantime, we can now clearly see the increased demand for hybrid vehicles in the order situation: our customers are setting up new hybrid projects and expanding existing ones. For the Ford F150 in the USA, for example, we are supplying the P2 hybrid module in significantly higher numbers than we initially expected.

In Europe and North America, parallel P2 hybrids have so far been common as "add-on" solutions. What are the factors that inhibit manufacturers from switching to highly electrified serial-parallel drive systems, in the way they have become established in China?

"We are working on a completely new transmission topology"

One inhibiting factor has been the EU's Green Deal, with its very strict requirements for reducing CO_2 emissions. For that reason, many European manufacturers have chosen to pursue the direct route to BEVs. It is of course easier and, I think, understandable to install a hybrid module as an add-on to an existing transmission, either a torque converter automatic or a dual-clutch transmission. If the ban on internal combustion engines were to come into force 2035 as planned, this strategy would probably not have been the wrong one. However, we can now see that the barriers for introducing BEVs are higher than expected, especially for entry-level vehicles. Therefore, in my opinion, it is certainly worth reconsidering the introduction of seria-parallel hybrid transmissions.

What is your assessment of the prospects for such dedicated solutions in Europe – and how promising are add-on hybrids for the future?

I can specifically say that we are also working on a serial-parallel hybrid transmission for a high-volume manufacturer in Europe, in other words on a completely new transmission topology. And in this case too, this manufacturer is already asking for larger quantities

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"We install a very powerful electric machine in order to enable drivers to experience the benefits of electric driving", says Zink

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"We are now seeing the first indications that there might be a shift from a Green Deal to an Industrial Deal", says Zink

than we originally expected. Such serial-parallel hybrid transmissions could become even more important. But nevertheless, I am not saying that add-on hybrid transmissions will no longer have a role to play. In the DQ400 dual-clutch transmission from Volkswagen, for example, we can see a reduction in the number of gears and a high level of functional integration of electrification. And there are certainly other options as far as costs and performance and concerned.

What impact does a Dedicated Hybrid Transmission, or DHT, have on the selection and design of the internal combustion engine used?
There is no clear answer to this question. A very large Japanese manufacturer, for example, is focusing more on "de-contenting", in other words the mechanical simplification of the engine. They can do this because their power-split hybrid transmission design allows for meeting the optimum point in the efficiency map over a wide range. Other manufacturers, for example, use an electrically variable camshaft to make engine restarts more elegant and efficient. For certain applications, it might also make sense to continue using turbocharging. But ultimately, the question is: What does the engine's map look like, what proportion of the vehicle's driving power does it contribute, and how does the interaction with the transmission work? Whatever the case, we at Schaeffler are continuing to work intensively on further optimizing internal combustion engines in terms of their efficiency. For example, one important point is onboard monitoring of emissions. An engine that is not continuously running requires new heat management solutions, for example to prevent the catalytic converter from cooling down.

"A hybrid drive system with two electric motors can be more economical than a P2 hybrid"

In serial-parallel hybrids, we need to consider the question of when the vehicle operates as a serial hybrid or as a parallel hybrid – and how many gears you need for this …
That depends on the vehicle segment, on how much top speed I want to allow, and on how much gear spread I need. In China, we also see P1/P3 drive systems with three or four gears, which then make it possible to provide a little more power from the engine. But if you design a serial-parallel drive system consistently from the outset – with plug-in capability for the electric power – you actually only need one gear for parallel operation. In the solution that we are currently developing with a customer, we use a clutch that enables the vehicle to drive electrically for a lot of the time even in hybrid operation and to minimize series operation in the WLTP and real traffic. We only need one gear for parallel operation and can reach a top speed of 180 km/h – which is actually sufficient and in keeping with the times.

In German, people often mention the "rubber band effect" of continuous variable drives. How can we make serial hybrids attractive to drivers who want to have a fixed relationship between engine speed and driving speed?
We know this from our own experience with Audi's Multitronic CVT, which we were involved in. Gear shifts were even simulated to increase the acceptance of this type of transmission. However, I believe that there is now a greater willingness among end customers to accept a wider range of different operating states, whether using an engine to provide additional power or driving purely with electric power. In our hybrid transmission, we install a very powerful electric machine in order to enable drivers to experience the benefits of electric driving. And an internal combustion engine is also on board to provide more range if needed. I think this also shows many end customers that this type of hybrid drive system is not just a compromise solution, but a step towards electric driving.

To what extent can dedicated hybrid drive systems be seen as an opportunity to create synergy effects in the powertrain and the vehicle platform based on BEVs?
At Schaeffler, we see a 100-% opportunity. Through our merger with Vitesco, we are further expanding our expertise that is required for this. Everything that we develop here, whether it is stator packages, hairpin technology, power electronics as double inverters, etc. – we need all of this both for BEVs and for hybrid drive systems. And we have a lot of knowledge relating to installation space, thermal management, and

cooling, even including the control unit architecture and the "software-defined vehicle", where there are great similarities. And if you look at a multimode transmission like this: leave out the generator, and you basically have an electric axle with a differential. Of course, the big discussion at OEMs is whether to have a mixed platform or a pure BEV platform. I believe that they would be well-advised to continue building mixed platforms perhaps for the next two decades. However, there is already one Japanese manufacturer whose platform is primarily aimed at BEVs, but is at the same time backward compatible for hybridization. I think this is a very interesting approach.

If we think five to ten years ahead – which hybrid architectures will come and which will disappear?
I am firmly convinced that, for front transverse applications, we will have – and must have – a serial-parallel hybrid structure. You will probably see more than what we currently have under development. And I do believe that such solutions will replace a lot of dual-clutch transmissions and automatic transmissions in the next ten years in order to get the best that is possible out of the internal combustion engines that are still coming onto the market. We have calculated it several times and found that a hybrid drive system with two electric motors is in fact more economical than a P2 hybrid if it is consistently produced in large volumes. If the CO_2 requirements remain in place in Europe as planned, and if the internal combustion engine still continues to play a role, we will need dedicated hybrid structures like these.

Plug-in hybrids have had a very difficult time lately as far as public opinion is concerned. What opportunities do you see for a comeback and what can be done to make their intended use more attractive?
There were often cases where plug-in hybrids were incentivized, but their users hardly ever charged them. In my opinion, everything depends on the real driving profile. How could regulations be created that take this real driving profile into account? In fact, such discussions are already underway on the European level. If a good technology is used consistently and the combustion engine is only used to drive the vehicle when it is absolutely necessary, I don't know what would speak against plug-in hybrids. It is also a question of communication, because it is also a matter of the ecosystem of the entire energy supply. I believe that there is still some scope for the regulators to position the plug-in hybrid as a sensible part of the overall system as a means of actually achieving low real-world energy consumption.

What chances do you see of hybrids being generally viewed more positively again in the considerations of the EU regulators?
That is a difficult question, and it's one that I would like to answer in my second capacity as President of CLEPA. Even before the EU elections, we already had active discussions with EU Commissioners such as Thierry Breton and Wopke Hoekstra, and we will continue to intensify these. As part of the EU's Green Deal, it was decided that the quasi ban on internal combustion engines planned for 2035 should be reviewed again in 2026 and an appraisal of the overall situation should be made. We are now seeing the first indications that there might be a shift from a Green Deal to an "Industrial Deal". In other words, we would take a more differentiated look at the overall system of energy supply and transportation. There is a relatively high probability of coming to the conclusion that we will not have the necessary ecosystem in 2035 to enable us to do without the internal combustion engine. However, that does not mean that we should move away from the idea of electric mobility. That would be the wrong reaction. The task that we have set ourselves with the Green Deal is huge. What we need is a credible, well-communicated step-by-step plan, an openness to different technologies – and that includes hybrid drive systems.

Mr. Zink, thank you very much for the interesting conversation.

INTERVIEW: Gernot Goppelt