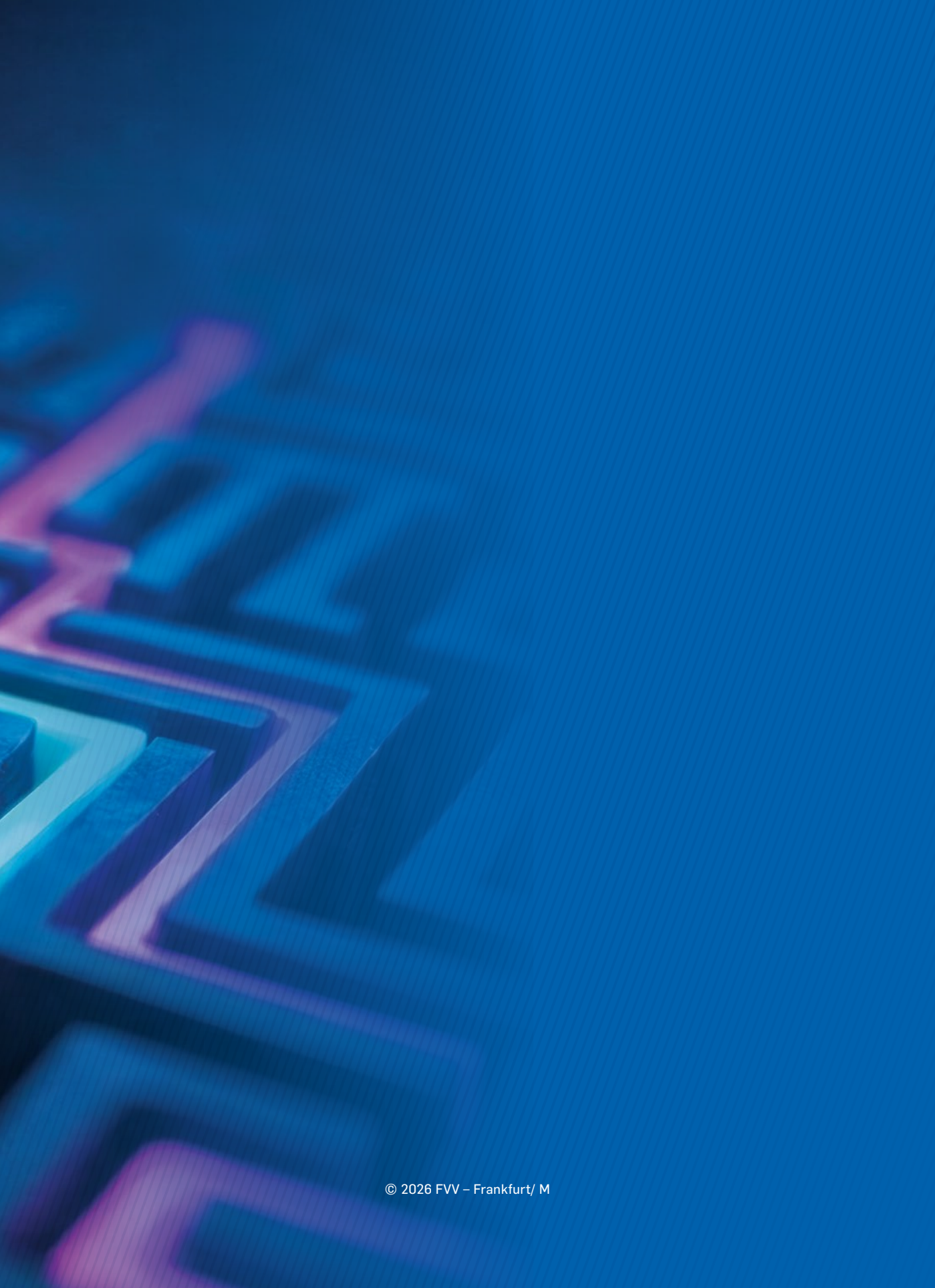
FVV ANNUAL MAGAZINE

PrimeMovers.

2026 »Everything starts with an idea«

Science for a moving society



»Everything starts with an idea«

Dear FVV members,
dear readers,

It all began just over 70 years ago with the idea of systematically coordinating pre-competitive research for medium-sized businesses, establishing shared standards to enable innovation to spread widely, and backing it all with state funding. Before long, this simple yet ingenious plan was put into action. The newly launched funding programme for Industrial Collective Research had an immediate impact – fostering a type of research that acts as a link between product-oriented development within a company and purely fundamental research conducted at universities and other scientific institutions; research that chiefly focuses on fundamental questions from industrial practice and generates knowledge with broad reach. Funding does not go to the companies directly, but to the research work performed by the scientific institutions that support them in pre-competitive development. Scientific questions are tackled collectively. The findings from the research projects are equally accessible to all companies and give no single company a competitive advantage. In addition, new impetus for fundamental scientific research can emerge from these projects, creating a knowledge cycle with an efficient transfer of results.

›This is a great idea‹, thought 27 companies from the engine and turbine industry, as they went on to found FVV in autumn 1956. Now, 70 years on, our research association has grown to encompass more than 150 member companies (→ p. 6). For more than 5,000 experts from global corporations and SMEs, as well as more than 200 research institutions, it offers a joint platform for generating the knowledge so urgently needed to maintain and enhance competitiveness as we move towards a sustainable, resource-efficient and climate-neutral economy.

» How is this knowledge acquired today? Where does innovation come from? First, companies must clearly define their **development needs.** Then it takes people to **turn this into ideas and move them forward, research** that works close to application, and **conditions** that do not stall good ideas before they can be put into practice.«

How is this knowledge acquired today? Where does innovation come from? First, companies must clearly define their development needs. Then it takes people to turn this into ideas and move them forward, research that works close to application, and conditions that do not stall good ideas before they can be put into practice.

In an interview (→ p. 8), Max Decker explains how FVV turns our member companies' need for pre-competitive research into feasible engineering solutions that benefit everyone. In other words, ideas worth following.

And with the pioneers (→ p. 28) from FVV's research and transfer network, we show that, through innovative collective research, we can make a vital contribution to a transition in energy, molecules, raw materials and powertrains – one that is ambitious in every sense. Together with their research partners, FVV member companies develop technologies and products that show how diverse the future of energy conversion systems is. We are all convinced that carbon neutrality can be achieved by 2045/2050 through a mix of technologies, provided that a suitable legal framework is created and companies are free to decide on their transformation strategies. Our partners in Japan and the authorities in China are leading the way with their New Energy Vehicle programmes, which do without any bans on specific technologies.

So where do we want to be along the long road to transformation five years from now, when FVV celebrates its 75th anniversary in 2031? What will be the ideas that drive us?

Application-orientated innovation funding that is open to a range of technologies and topics creates space for a wide range of disciplines to exchange ideas. In the new plenary talks at the start of the FVV Transfer + Networking Events (→ p. 16), we address key research questions, analyse market-orientated conditions that take climate protection, competitiveness and industrial value creation into account equally, and highlight successful examples from practice in our interdisciplinary network.

Our broad-based research programme (→ p. 84) examines core technological issues: increasing efficiency and thus conserving resources in all energy conversion systems; alternative powertrain solutions such as battery electric vehicles (BEV), plug-in hybrid vehicles (PHEV), range-extended electric vehicles (REEV); aeroplanes, ships or stationary installations powered by climate-neutral energy sources; conventional material topics in connection with innovative energy carriers, production methods and recycled materials; new fuel cell technologies. We are breaking new ground in order to develop technological concepts and ecosystems for carbon capture and storage (CCS) as well as carbon capture and utilisation (CCU) as part of comprehensive carbon management. We are focused on the security of our energy supply. We are looking for new material technologies, development tools and digital methods such as machine/reinforcement learning (ML/RL) and we are also addressing questions relating to digital responsibility.

We are committed to keeping the technological future open to good, competitive engineering solutions that meet global customer and market demands and that are developed jointly by talented scientists and engineers. We would be happy to present this concept to you and your staff in the form of a roadshow at your premises or in an online meeting. Please get in touch.

There is still a long way to go. Get involved: we look forward to talking to you about your ideas!

PROF DR MARKUS SCHWADERLAPP
Chairman

MARTIN NITSCHE
Managing Director

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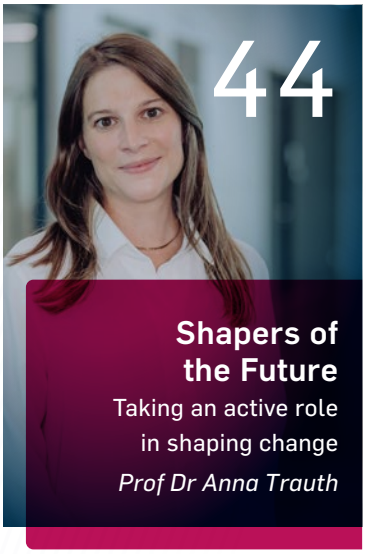
Shapers of the Future
New testing strategies for the use of materials under extreme conditions
Dominique Kießlich



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Shapers of the Future
Taking an active role in shaping change
Prof Dr Anna Trauth

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Shapers of the Future
I have always been a technology enthusiast
apl Prof Dr Marco Günther

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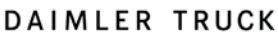
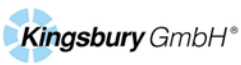
Science for a moving society

Who is driving our future?

You can find a detailed list of
*our **members** at → **www.fvv-net.de/en/network/members***

Science for a moving society

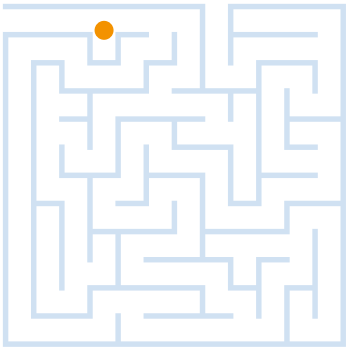
Great idea!
Why FVV's Industrial Collective Research works

» Letting collective intelligence find the solution ***is a great idea.«***

MAX DECKER, MSc

studied mechanical engineering at Bingen University of Applied Sciences and at the Otto von Guericke University of Magdeburg, focusing on product development, design and calculation. He then worked as a technical consultant in emissions legislation and homologation at VDMA eV's Transport department, before switching within the VDMA Group to the Engines and Systems association, where his work focused on international emissions legislation for engines and mobile machinery, and on power-to-X technologies. He took on the role of project manager at FVV in 2019 and since then has supported research projects in the fields of materials science and recycling, including critical raw materials and additive manufacturing, and in zero-impact emissions including non-exhaust emissions such as brake dust and tyre wear. In November 2025, Max Decker was appointed Deputy Managing Director of FVV, a role in which he heads the research programme.

Max Decker has also been Managing Director of the German Research Society for Automation and Microelectronics eV (DFAM) since July 2022. Like FVV, DFAM is an industrial research association within the Mechanical Engineering Research Federation eV (FKM), VDMA's knowledge and collaboration platform for research and innovation and industrial collective research (IGF).

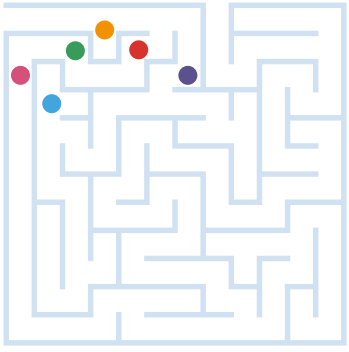


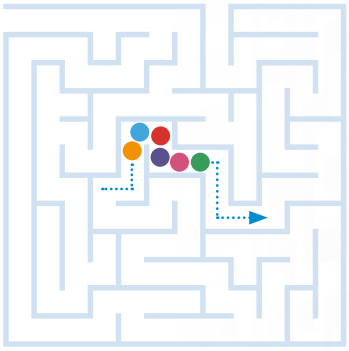
» Industrial research associations are based on three pillars: ***research, network and training.*** *At conferences, you meet people who are working on the same problem, which helps you to* ***see the bigger picture****. Because other scientists might approach problems in different ways, it opens up* ***new ways of looking at things.*** *«*

Mr Decker, you have been Deputy Managing Director of FVV since the end of last November and are in charge of the association's research programme. What challenges have you faced in your new role?

DECKER We are living in a fascinating time. New strategic issues are emerging, there is a great deal of restructuring, and people are looking for new solutions – all while a generational shift is underway. Everywhere I go, I see large numbers of members entering retirement or just leaving the workforce, including at institutes. The transition from the old to the new generation is proving to be a challenge at the moment, on top of the growing variety of topics. Younger people tend to spend more time in the digital world, and we need to look at whether our current ways of working and networking fit in with that, or whether we need to make some changes. We are currently thinking about how we can make the FVV Transfer + Networking Event fit for the future, so that we remain attractive to the younger generation.

There is no denying that the economic situation is quite tense. Companies are now sending just one employee to the conference instead of five, and that one person has to be everywhere all at once. We want to show the members more clearly what the benefits of the event are.





Why should more members attend the conference?

DECKER One reason to attend the conference is that it offers access to a large network. Industrial research associations are based on three pillars: research, network and training. At conferences, you meet people who are working on the same problem, which helps you to see the bigger picture. Because other scientists might approach problems in different ways, it opens up new ways of looking at things. I've seen this happen many times. You're talking about a problem, and then a new point comes up that you hadn't thought of before – and the others realise they hadn't even considered it from that angle. The conferences bring the collective intelligence of FVV together. You get to know the people working on the various projects, can talk to the professors leading the institutes, make new contacts – and perhaps even find a good job that way. We provide a secure space within the compliance rules and, of course, in line with the requirements of pre-competitive research.

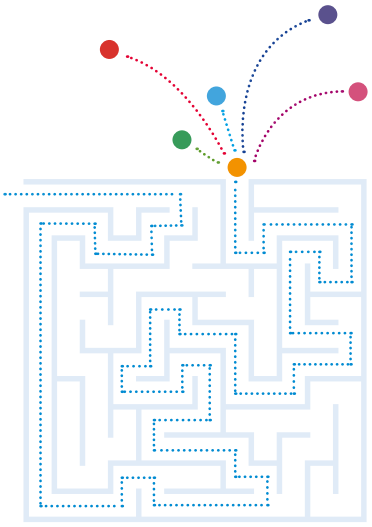
Is it true that many members still associate FVV mainly with automotive topics?

DECKER I think that those who still haven't noticed the structural changes of recent years are mainly people who've had little contact with FVV anyway. They remember the name from the old days and associate FVV mainly with internal combustion engines for cars. In fact, we have long had a much broader remit and are open to anything that members want to research in relation to powertrain and energy systems. We implement projects in numerous fields, such as energy conversion with fuel cells and electrolysers. Our members are also conducting research into materials science and tribology topics, e-fuels and hydrogen combustion projects, to name but a few.

Which topics do you plan to expand going forward, and are you noticing a decrease in automotive topics?

DECKER In terms of the powertrain, our members include a lot of people from the automotive sector and we have many topics related to large engines, so I wouldn't say that there has been a decrease. Developers of small engines are somewhat less represented – there is potential there. The new expert groups, such as those for electric motors or electrolysers, still need a bit more impetus and a few more projects. We are working on that.

The markets and industry are changing rapidly, and we currently have many drawers to fill with engineering solutions. When technology XY takes off, I can then open the corresponding drawer and have a solution ready to build on for my own development. This may cost money, but it means we are better prepared for future requirements.



The new topics come with a new generation of scientists. How do you plan to attract new members?

DECKER We have a lot of contact with universities and are constantly expanding our research network. I was recently in Graz at a meeting of the project user committee, and witnessed the following scene: A member of administrative staff at the institute was assigned to our project, but there were five other research associates in the lecture hall, listening to how an FVV project works. Those are five future engineers who know FVV and might later tell their company that they want to submit a project. Furthermore, the companies don't need to pay for a research project directly – a large part comes from public funding, rather than the company's budget. That makes FVV attractive, too.

Does FVV also attract members from other sectors?

DECKER Yes. The new Euro 7 emissions standard, for example, not only requires measurements on the exhaust, but also includes tyre and brake wear. In the emissions group, we suddenly have lots of new people from brake and tyre development – many new colleagues that we hadn't thought of before. We are delighted to see anyone who wants to get involved and implement projects. A lot of this development is through word of mouth, and sometimes companies are involved in a project as a guest, providing components or carrying out calculations. This often then leads to full membership, so you can see that here, too, a lot happens through the network.

FVV has expanded its international presence. When it comes to new technologies in particular, are companies from the Far East a challenge for industry here?

DECKER We can learn a great deal from the way Japan or China approach certain topics, for example. If there is political will for something, things can be put into practice very quickly. Especially in Germany and the EU, there are so many regulations that slow processes down. If we could cut red tape and act more quickly, we would be able to respond better to our competitors. China is a great example. There, a target is set, but the route to get there is left open. Letting collective intelligence find the solution is a great idea.

When there are so many ideas for new projects, it must be difficult to decide which to fund?

DECKER Our own equity is generally oversubscribed, but it is clear that the need for research far exceeds the equity available. When it comes to

public funding, our first port of call is the Industrial Collective Research programme set up by the German Federal Ministry of Economic Affairs and Energy, where topic-specific panels of experts decide on the quality of the research proposal. Although this is difficult, we still have a very high success rate there. Over years, we have analysed what makes a good, application-focused research project and are able to give the research and technology performers advice on what they need to address in their application. Having an outside view is important.

What makes collective research special for you?

DECKER In Industrial Collective Research, it is highly innovative, application-orientated companies that take the lead. This then benefits all members of a research network. Time and again, I am surprised by how well collaboration between research institutes, industry and funding bodies works. Because Industrial Collective Research is open to all technologies and topics, it provides plenty of opportunity for exchange, including between different disciplines. This is crucial for identifying new developments early and putting them into practice.

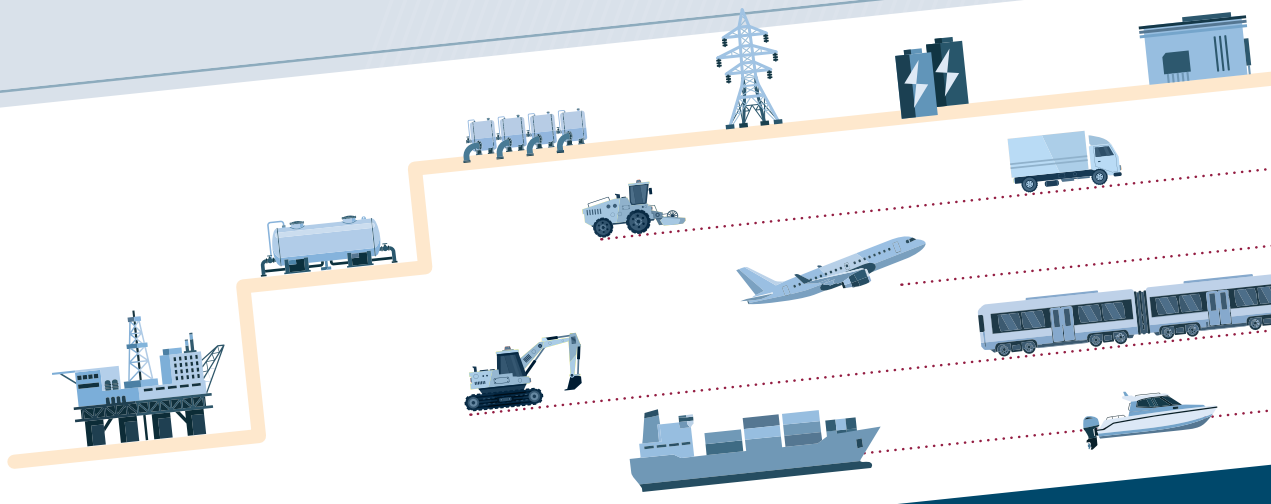
What do you particularly enjoy about your »new« job?

DECKER Because the research is pre-competitive, I find it fascinating to be there right at the beginning of a new idea and to see what it becomes. There are too many projects for me to get deeply involved in, but I get a sense of what is going on in technology. They say you learn something new every day. I learn a lot of new things every day! I love it. //

» In Industrial Collective Research, it is highly innovative, application-orientated companies that take the lead. ***This then benefits all members of a research network.*** *Time and again, I am surprised by how well collaboration between research institutes, industry and funding bodies works. Because Industrial Collective Research is* ***open to all technologies and topics****, it provides plenty of opportunity for exchange, including between different disciplines. This is* ***crucial for identifying new developments early and putting them into practice.*** *«*

The **FVV Membership Roadshow** is in the house

How does the FVV work? How do industry-driven research projects get off the ground? And how exactly can your staff get involved? With the FVV Membership Roadshow, we come directly to your company and give your teams a concise insight into our structures, working methods and research priorities.

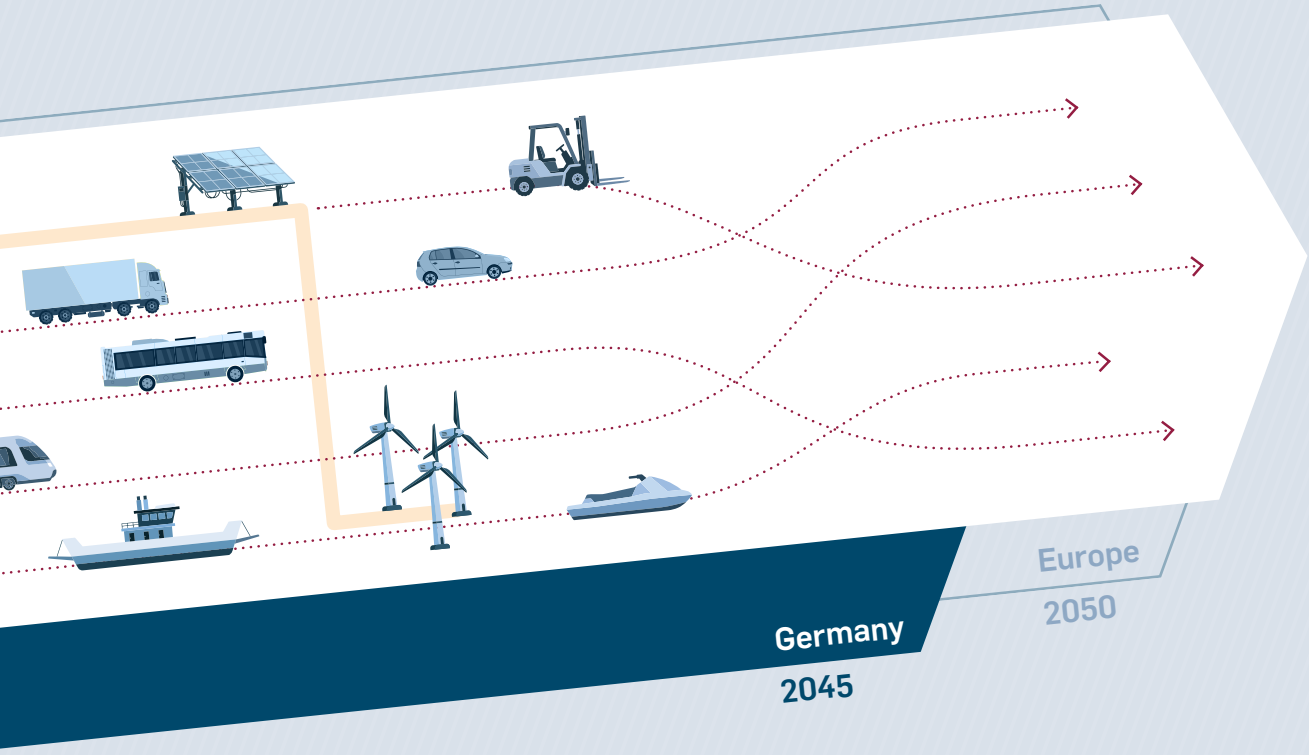


The focus is on the general and individual benefits of your membership: access to pre-competitive research, a strong international network of experts, targeted knowledge transfer and the opportunity to play an active role in shaping innovation across the entire value chain.

Raise the visibility of the FVV and its offerings within your company: Invite the FVV Membership Roadshow to your organisation!

Arrange a meeting with Martin Nitsche or the FVV project management team – online or on-site.

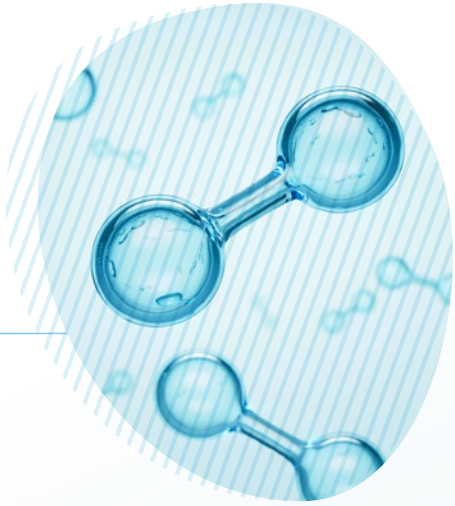
FVV contact
→ www.fvv-net.de/en/contact



Hydrogen as a key technology for the energy transition

Text: Richard Backhaus

The growing demand for transportation, coupled with increasing urbanisation and rising carbon dioxide (CO_2) emissions, is putting more and more pressure on policymakers, industry and science to develop sustainable energy systems for the global mobility in the future. The more than 1.6 billion registered vehicles worldwide currently emit more than 8 billion tonnes of CO_2 every year. At the same time, the number of vehicles globally is growing by more than 1.5 vehicles per second, pushing annual CO_2 emissions up by around 3.3 t every second. This trend clearly shows that incremental optimisations alone will not be enough to meet the climate goals set by policymakers and society for the transport sector. In order to successfully tackle the core environmental challenges of global mobility, the energy supply of the future needs to fulfil three main criteria: climate neutrality, security of supply, and economic viability. Renowned research institutions such as the Department of Advanced Powertrains (ALF) at Chemnitz University of Technology's Institute for Automotive Research (IAF), led by Professor Thomas von Unwerth, consider hydrogen (H_2) to be a promising option for decarbonising the energy sector through large-scale replacement of fossil energy carriers.



The researchers do not view the use of H_2 in fuel cells as a silver bullet, but rather as an essential building block of the energy transition, alongside battery-electric powertrains and, in certain applications, synthetic fuels.

» This defines the scope of what we mean by technology neutrality in the powertrain sector. By contrast, the burgeoning debate about the continued use of fossil fuels in the future is not useful at all. «

PROF DR THOMAS VON UNWERTH

Technological breakthroughs in fuel cell technology alone will not be enough to ensure market success in the future. The important thing is how they are integrated into society and economic systems. This was the theory put forward by Erik Pohl from the Department of Advanced Powertrains to kick off his keynote at FVV's autumn conference. Progress depends on scaling up electrolysis and fuel cell technologies, integrating systems into electricity, gas, and mobility networks, developing innovative materials to reduce the use of critical raw materials, establishing open research platforms and international cooperation, and implementing a sustainable training policy. »If all of these factors come together, hydrogen can indeed become a key technology for a post-fossil society. With its strong research landscape, technical expertise and industrial base, Germany has an outstanding opportunity to play a leading role here,« says von Unwerth.

Electrolysis and hydrogen generation potential

When it comes to the market potential of H_2 concepts, energy costs are a decisive factor. At present, these costs largely depend on the production process. While ›green‹ H_2 is CO_2-neutral, it comes with high production costs. Other processes to produce ›black‹ (from coal) or ›grey‹ (from natural gas) hydrogen, for example, are much less expensive and already available on a large scale today; however, they still generate CO_2 emissions. »To drive market activation forward, it may be useful in the short term to use the full colour spectrum of hydrogen generation, rather than waiting for sufficient green hydrogen to become available,« said Pohl at the conference.

» The transition to an H_2-based energy system definitely requires a systematic approach that ranges from renewable power generation at a global scale to electrolysis, storage and use. «

ERIC POHL

He emphasised that efficiency losses in electrolysis do not disqualify the technology per se, provided that sufficient ›free‹ renewable energy is available. In 2024 alone, more than 9 TWh of potentially usable green electricity in Germany was curtailed due to grid bottlenecks – energy that could be used for H_2 generation in future. However, Pohl is clear: »Even if we use this energy in the form of hydrogen, it will not be enough to make Germany energy self-sufficient. Instead, we, as an energy-intensive industrial country, will certainly need to import energy, just as we do today.« Global H_2 generation potential is projected to reach hundreds of millions of tonnes per year by 2050. In addition to further technical development of the electrolysers – particularly in terms of efficiency, material use and scalability – transport, storage and integration into the energy system are becoming increasingly important. The term »transportable electricity for long-duration storage« describes the advantage hydrogen offers compared to variable renewable energy carriers.

Battery and fuel cell – complementary technologies

The ›battery vs fuel cell‹ debate is not a question of either / or. In fact, the two technologies complement one another. While battery-electric powertrains primarily offer benefits in urban transport and in the low-load spectrum, H_2-based concepts are particularly suited to long-distance and heavy goods transport, and rail and maritime applications. »The refuelling times of H_2 lorries are comparable to those of diesel-powered vehicles, and the existing infrastructure can be used as a basis. For electric lorries, on the other hand, the entire network of parking areas along long-distance routes needs to be equipped with charging stations to meet demand even at peak times. Our analyses show that it will be almost impossible to build the infrastructure in Europe within a realistic time frame,« explains von Unwerth. Other aspects also come into play, such as the market for used lorries. Vehicles decommissioned in Europe today are often sold on internationally, for example to Africa. This business model is likely to be problematic for battery-electric lorries, as many regions of the world lack adequate charging infrastructure. As Pohl explained in his presentation, fuel cell vehicles could have better long-term market prospects in this context.

Critical raw materials and sustainability

Dependence on raw materials is one of the greatest challenges in introducing future powertrain systems at an acceptable cost. As well as rare earths, the focus for battery-electric powertrains is largely on lithium for the battery, while fuel cells predominantly rely on platinum. Platinum has been used for many years in automotive catalysts, resulting in a well-established market structure that can be readily adopted when internal combustion engines are replaced by fuel cell vehicles. For lithium, by contrast, a stable market landscape has yet to form, making market distortions likely, especially in the ramp-up phase. In the long term, however, a closed-loop recycling concept will have to be developed for all raw materials to ensure sustainability.

The Department of Advanced Powertrains' latest research focuses on material substitution and recycling, and on reducing critical raw materials. In addition, strategies for multi-criteria optimisation of stack and system components are being developed to improve efficiency, thermal management and lifespan. Artificial intelligence is increasingly supporting operating strategies, simulations and materials science, such as in identifying optimum catalyst compositions or predicting degradation mechanisms.

A core element of the research in Chemnitz is the ›open source stack‹ (OSS) concept. Its goal is to establish an open research platform for fuel cell and electrolysis applications, fostering transparent and collaborative further development.

» Open source approaches such as this encourage the exchange of expertise between universities, industry and start-ups, thus accelerating technology transfer. «

ERIC POHL

The Department of Advanced Powertrains is also involved in various European research programmes, including projects in the ›Fuel Cells and Hydrogen Joint Undertaking‹ (FCH JU), part of Horizon 2020. In order to meet the rising demand for specialist staff, Chemnitz University of Technology is now offering Germany's first master's programme for hydrogen technologies, combining basics of thermodynamics, electrochemistry and system technology with practical research and collaboration with industry. »We are thus closing the key gap between academic training and industrial application,« explains von Unwerth. The research results will then be transferred via the HZwo eV hydrogen technology cluster, which comprises more than 160 partner companies and also sponsors the Chemnitz-based Hydrogen Innovation Centre (HIC), the national innovation and technology centre funded by the federal government. //

The Department of Advanced Powertrains (ALF) at Chemnitz University of Technology conducts research in the field of electromobility, focusing on fuel cell powertrains. At the heart of the research in Chemnitz are the open source development platforms OSSys (Open Source System) and OSS (Open Source Stack). OSS is an open research platform for fuel cell and electrolysis applications designed to facilitate a transparent and efficient transfer of knowledge and technology and to support the collaborative development of components and systems.

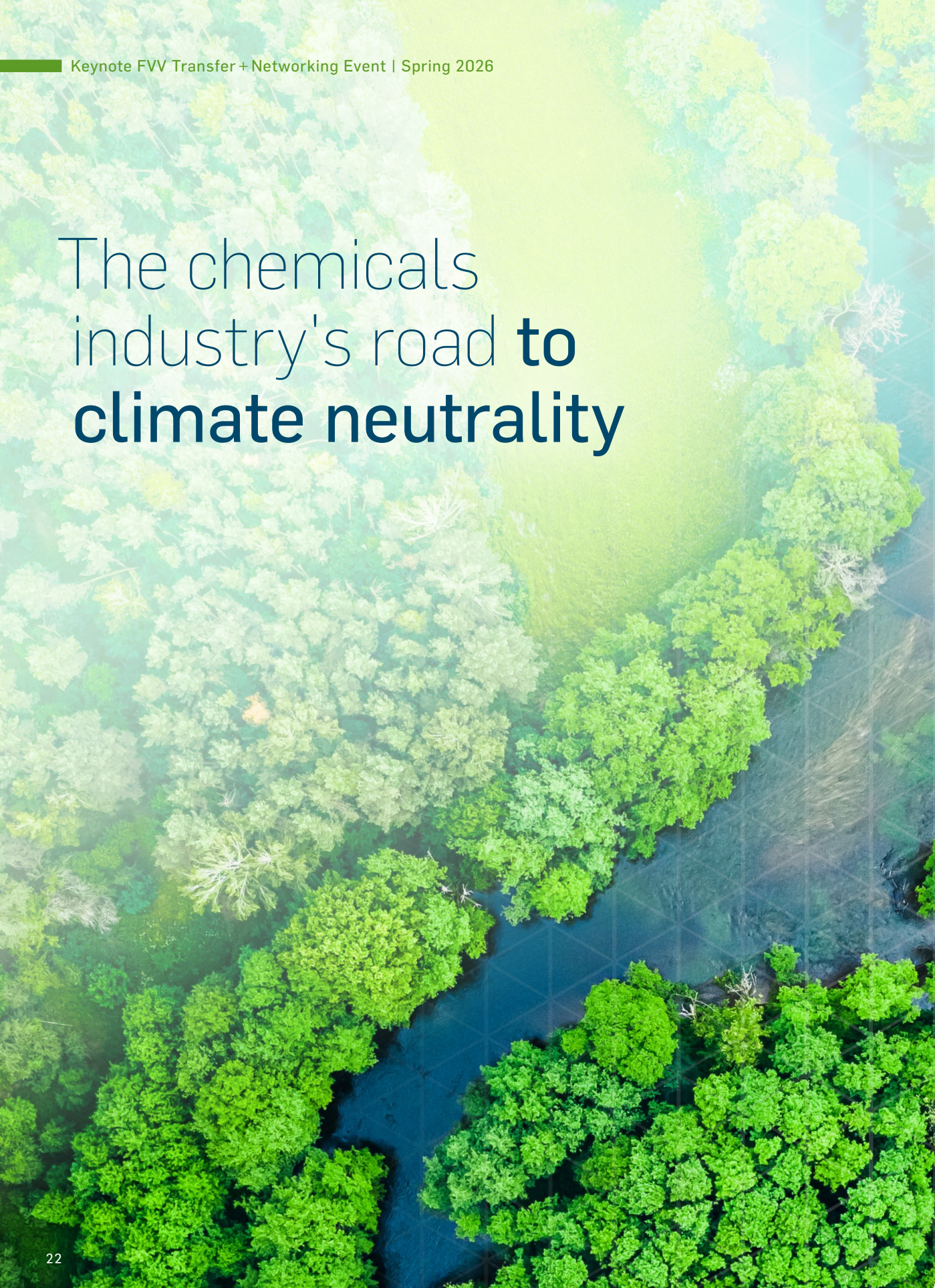
PROF DR ING THOMAS VON UNWERTH

has been heading the Department of Advanced Powertrains since 2010. He has also been Managing Director of the Institute for Automotive Research (IAF) since 2014 and Chair of the Saxon HZwo eV innovation cluster for hydrogen and fuel cells since 2018.

ERIK POHL, MSc

is Team Leader Simulation & Models in the fuel cells research field.

The chemicals industry's road **to climate neutrality**



Text: Richard Backhaus

Transforming the chemical industry towards climate neutrality is one of the most challenging tasks in industrial decarbonisation. As an energy-intensive industry that is closely woven into global value chains, it is both a major emitter of greenhouse gases and a key enabler of sustainable technologies. In his plenary speech, Dr Kai Ehrhardt, Vice President Reaction Engineering and Executive Expert at BASF SE, examined the key elements needed for the chemical industry to achieve net-zero CO_2 emissions by 2050, looking at the technological, systemic and economic dimensions.

DR ING KAI EHRHARDT

is Vice President Reaction Engineering and Executive Expert at BASF SE's Ludwigshafen site. He has been with the company since 1999, having previously studied Process Engineering at Karlsruhe Institute of Technology (KIT) and the Massachusetts Institute of Technology (MIT).

Dr Ehrhardt is a member of the Board of Trustees of the Max Planck Institute for Dynamics of Complex Technical Systems in Magdeburg and Deputy Chair of the Chemical Reaction Engineering Section at the DECHEMA Gesellschaft für Chemische Technik und Biotechnologie eV in Frankfurt/ M.

Chemical reaction engineering forms the core of the process industry's expertise and competitiveness – from raw material extraction through to the chemical and petrochemical sectors to the food and pharmaceutical industries, which in turn supply every one of the manufacturing and processing sectors.

BASF's strategy is built around a long-term transformation aligned with the EU's climate targets. The aim is to cut direct and indirect emissions significantly by 2030, before achieving climate neutrality across the entire value chain by 2050. The defossilisation concept lays out a step-by-step reduction in emissions through the use of renewable energy, efficiency gains, low-emission steam generation and new climate-friendly technologies.

In parallel, the product portfolio is being reshaped towards solutions that deliver measurable sustainability benefits. According to Ehrhardt, this shift is closely tied to market demand, as investments and technological changes are heavily influenced by what customers are willing to pay.

» We are investing hundreds of millions of euros each year in these measures, and we regularly adjust our plans to align with technological and economic developments. «

DR KAI EHRHARDT

The first step in BASF's defossilisation plan is to swiftly implement easy-to-deliver optimisations and measures underpinned by a clearly defined business model. The second step is shaped by a focus on market demand. This will be achieved by securing increasing volumes of renewable raw materials and expanding the range of products with sustainable properties to match customer needs. The final step is the reconfiguration of production plants – decarbonising existing plants and investing in competitive new technologies, in perpetual alignment with customer demand and the net-zero targets.

A key element in this is the systematic recording of greenhouse gas emissions along the value chain, so that emissions and emission savings can be documented transparently. Digital tools make it possible to calculate emissions for a large number of products, taking into account process energy, raw materials and upstream emissions from suppliers – which at BASF account for around 50 % of total emissions. This information matters not only for internal optimisations, but is also relevant for customer decision-making and regulatory requirements.

Technological and systemic approaches

Switching the chemical industry's raw-material base is a central pillar of the transformation. BASF is increasingly moving away from fossil sources towards renewable sources and circular carbon solutions. This includes both the use of bio-based materials and the integration of recycling flows. These more environmentally friendly raw materials are typically processed alongside conventional base products in existing plants, with the share of bio-based and recycled materials accounted for

BASF is a global leader in the chemical industry. With an annual turnover of EUR 59.7 billion in 2025, the company supplies its more than 75,000 customers worldwide across its Chemicals, Materials, Industrial Solutions, Agricultural Solutions, Nutrition & Care, and Surface Technologies segments with products that meet business and society's current and future requirements regarding sustainability and climate neutrality.

BASF's product and process innovations support its customers on their journey to climate neutrality and play a major role in reducing the carbon footprint (PCF) of their products. The company itself is also making significant progress towards achieving net-zero CO_2 emissions, for example by investing increasingly in renewable energies to run its plants, and turning its attention to the use of bio-based and recycled raw materials.

The eFurnace demonstration plant at the Ludwigshafen site with process equipment and pipework for the manufacture of basic chemicals and for the development of energy-efficient production technologies // © BASF SE

via the mass balance approach. »This method allows sustainable raw materials to be allocated to specific products on paper, without having to fully separate the physical material flows. This enables a gradual economic transformation while still making use of the existing infrastructure,« explained Ehrhardt.

BASF is concentrating its decarbonisation efforts in particular on key processes at the start of industrial value chains, as this is where the greatest emissions reduction potential lies. A range of technological options is available for these processes, each assessed on the basis of efficiency, costs and investment needs. Alongside electrification, the use of hydrogen and processes for carbon capture and storage also play a key role.

Hydrogen as a feedstock and energy carrier

In many sectors, such as transport, hydrogen is primarily seen as a potential molecular energy carrier. The chemical industry, however, needs hydrogen on a large scale as a process gas, given the molecular make-up of the chemical products it manufactures. »What is critical in this context is that hydrogen is more valuable when used as a process gas than when it is burned for heat,« explained Ehrhardt. Furthermore, if fossil feedstocks such as natural gas or naphtha are phased out altogether or used only to a limited extent, and replaced by biogenic feedstocks, recyclates or CO_2, the demand for hydrogen will rise further.

Providing green hydrogen via electrolysis is energy intensive and presents real challenges in terms of scaling and cost. Alternative routes such as methane pyrolysis offer promising prospects here, as they can produce hydrogen with comparatively low energy input and very low carbon dioxide emissions.

In parallel, the electrification of chemical processes is becoming increasingly important. A broad supply of renewable electricity is essential for this. Given the sheer scale of their emissions, energy intensive key processes are a particular focus – such as steam cracking, in which long-chain hydrocarbons are thermally broken down into short-chain molecules through the addition of superheated steam. New sites and production plants offer the opportunity to integrate innovative technologies from the outset and so achieve significantly lower emissions than conventional plants. Significant progress can be made by combining renewable energy supply sources, electrified processes and integrated material cycles. »One example is our new Verbund site at Zhanjiang in southern China. There, we are using state-of-the art technologies that allow us to cut the carbon footprint by around 50 % compared with a conventional gas-fired petrochemical site,« said Ehrhardt. At the same time, transforming existing plants remains a central challenge, as these account for the bulk of current production capacity. A large-scale heat pump system for harnessing waste heat is set to begin operations at the Ludwigshafen site in 2027. Converting waste process heat from the steam cracker into usable steam can significantly cut the use of fossil fuels. In conventional superheated steam generation in boilers, switching from natural gas to alternative energy sources such as electricity or hydrogen also offers reducing emissions.

For emissions that are technically hard to avoid, carbon capture and storage is an essential complement. Implementing solutions of this kind, however, will require suitable regulatory frameworks and the development of the corresponding transport and storage infrastructure, Ehrhardt noted. International cooperation, he added, is pivotal here, as suitable storage sites are not available in every region and such cooperation allows for more economical scaling.

» We expect green hydrogen to remain comparably scarce and expensive for the foreseeable future. Because we urgently need it as a process gas, our focus lies on electrifying steam generation and on direct electric heating of chemical processes. «

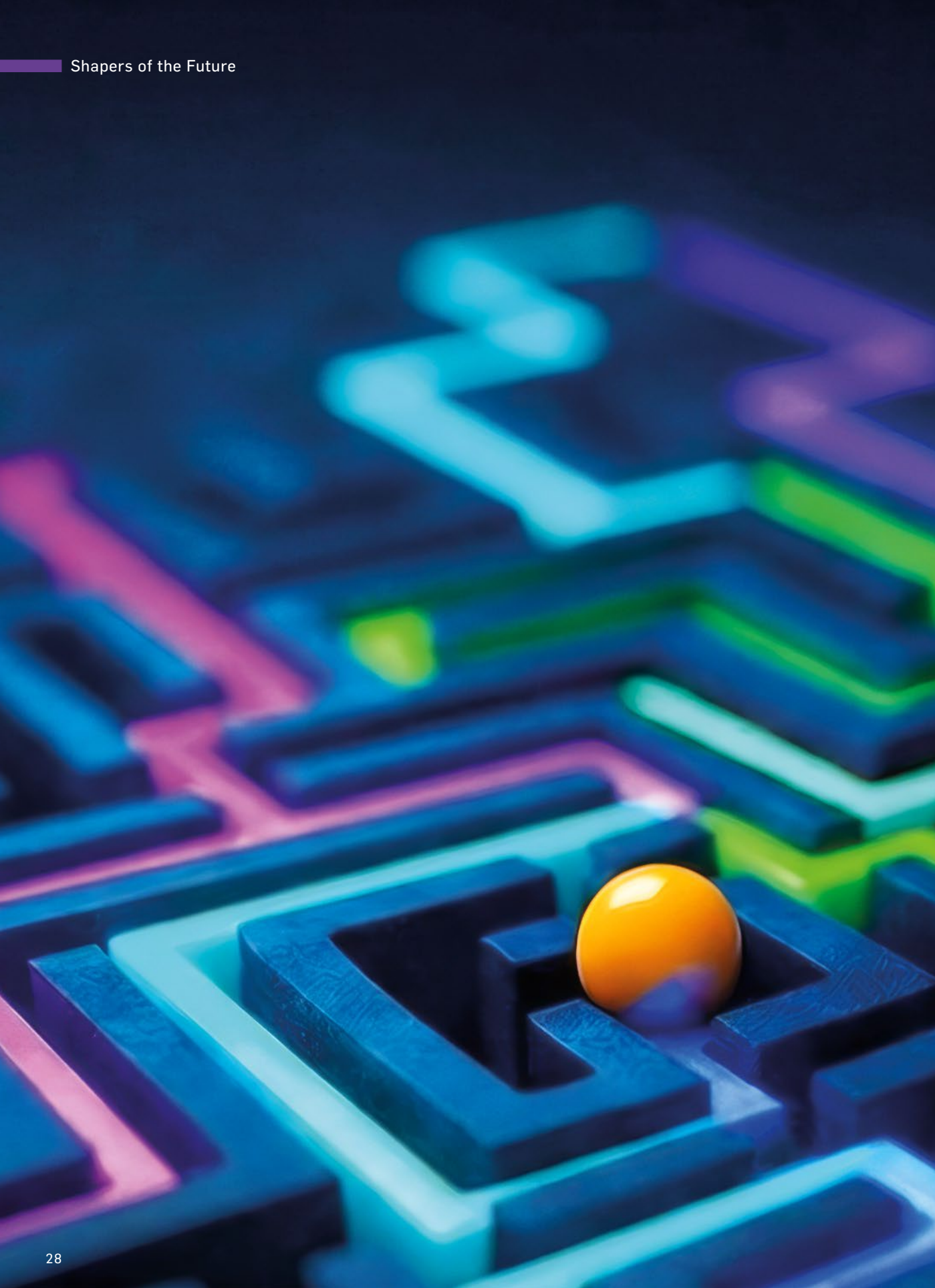
DR KAI EHRHARDT

Transformation has to be economically viable

As the keynote made clear, decarbonising the chemicals industry is a complex, long-term process that combines technological innovation, systemic integration and the economic framework. Success will hinge largely on how well efficiency gains, new technologies and shifting market dynamics can be married into a coherent transformation pathway.

The chemical industry has a pivotal role to play in this regard, as its products and processes have an impact well beyond the sector itself and can therefore make a decisive contribution to global climate neutrality. In addition to the technological aspects, the economic dimension is also crucial. The transformation calls for significant investment and pushes up manufacturing costs, while the willingness to pay for sustainable products is currently limited. »This creates a tension between environmental goals and economic viability. Policy instruments such as carbon pricing, regulation and funding programmes can support the green transformation, but they have economic consequences and shape global competition,« said Ehrhardt. //

BASF Carbon Management - construction of the test facility for methane pyrolysis: Climate protection is a central component of the BASF strategy. For many years, the company has been continuously reducing its CO_2 emissions. For further significant reduction, innovative processes such as methane pyrolysis are developed as part of the Carbon Management R&D Program. In the project funded by the Federal Ministry of Education and Research (Germany), BASF researchers are working on a new reactor concept in which hydrogen can be produced without CO_2 emissions. The construction of a test facility is a decisive step towards large-scale implementation. Thomas Fohrer tests the valve station of the test facility at the Verbund site in Ludwigshafen (Germany). // © BASF SE



Shapers of **the Future**

The FVV is making an important contributionto the transformation of the energy and transport systems through innovative collective research. We are firmly convinced that climate neutrality can be achieved by 2045 through a mix of technologies provided that the legal framework is put in place and companies are free to choose their transformation strategies.

FVV member companies are developing technologies and products that show that the future of energy conversion systems lies in their diversity. However, the younger generation of managerssometimes tackles challenges differently from theirpeers, challenging processes and established structures.

In brief profiles, we introduce people who are working to make engines and power units, vehicles and machines more efficient, cleaner and more durable.

Advancing decarbonisation with fuel cells

Presumably, says **Dr Tore Fischer**, he would have ended up studying traditional natural sciences after graduating from high school, perhaps physics or mathematics. However, the Hamburg native grew up in Hanover, where only two subjects interested him enough to study them after high school: mechanical engineering or gravitational physics. The latter seemed too abstract to him, **so he opted for mechanical engineering with a specialisation in automotive engineering instead.**

His fascination with hydrogen developed slowly. Even though he was not studying it, he attended the fuel cell lecture twice out of interest during his studies. He would actually have become a »Prime Mover«. However, a change in professorship at the university prompted him to reorient himself. After all, thermal turbomachinery also sounded interesting. »It was a similar topic, but with more speed and less imbalance,« he laughs. By the sixth semester at the latest, he knew he was heading in the direction of turbomachinery. Fischer worked on large radial compressors, moved into numerical analysis, and ended up with exhaust gas turbochargers. During his PhD, he came into contact with fuel cell technology for the first time, working on a radial fan for fuel cells as part of a public research project. From then on, »the hydrogen topic has always been there.«

After five years of research, the engineer left the university in 2017. »I had set myself this timeline and then wanted to do something practical. However, it wasn't the best time, as there were only two suitable positions in the turbocharger field at the time, one in Mexico and one in China.« While certainly interesting, this was not what Fischer had in mind. He used his contacts and broadened his circle of interests. At the time, fuel cell technology was on the rise, and in 2018, FISCHER Spindle Group AG in Herzogenbuchsee, Switzerland, reintegrated its previously outsourced compressor division – a perfect fit. In 2020, the division was spun off as FISCHER Fuel Cell Compressor AG (FFCC), and Fischer completed his doctorate in the same year. Now, with a team of three, he is responsible for making the current generation of compressors more robust for large-scale production. At that time, there were collaborations with VW and the Canadian fuel cell pioneer Ballard Power Systems, for example. Fischer is tasked with tackling the classic issues of improving quality and reducing costs. He took responsibility for the test field two years ago and became head of pre-development.

Text: Mathias Heerwagen

DR ING TORE FISCHER

is Head of Pre-Development at FISCHER Fuel Cell Compressor AG. Following his studies at Leibniz University Hannover, where he specialised in energy technology components and vehicle systems, he spent five years working as a research assistant at the Institute for Turbomachinery and Fluid Dynamics.

In 2018, he joined FISCHER AG in Herzogenbuchsee as Head of Industrialisation. In 2020, he successfully completed his doctorate on the design of radial compressors for active map extension measures.

Since 2023, he has headed the advanced development department, leading a team of eleven responsible for developing air-bearing, electrically driven turbochargers for supplying air to the cathode of fuel cells in the 50-300 kW power range.

He has also represented FISCHER Fuel Cell Compressor AG in the FVV's innovation and transfer network and the fuel cell expert group since 2024.

FISCHER Fuel Cell Compressor AG (FFCC) is a technology leader in the field of air compressors for fuel cell technology. Headquartered in Herzogenbuchsee, Switzerland, it is part of the FISCHER Spindle Group AG.

The company's high-tech product portfolio, based on patented spiral groove bearing technology, enables efficiency gains of over 20% compared to conventional bearing technologies. These innovative solutions enable FFCC to play a key role in the development and industrialisation of fuel cell systems for leading companies.

Since the beginning of 2025, FFCC has been certified according to IATF 16949, an important milestone forming the basis for larger-scale production and a key requirement for several major customers.

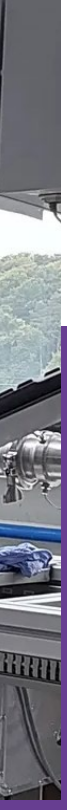
Precision work at the test bench: compressors as a key component of the fuel cell for efficient and high-performance systems.

In his day-to-day work, Tore Fischer frequently offers guidance to his team of eleven young people on projects. »They're eager to be innovative, so it's important to channel their energy in the right direction,« says the engineer. As well as decentralised energy generation, where fuel cells excel in terms of power density, Fischer believes that trucks, buses, boats and small ferries are the ideal areas of application. »That will clearly be the market when we phase out combustion engines. I don't foresee fuel cells being used in passenger cars in the next few years, as too much money has been invested in battery development and production.«

But what do turbomachines have to do with fuel cells? »Every fuel cell needs compressors to generate power efficiently. The greater the number of oxygen molecules per square centimetre of cell surface area, the greater the energy generation – higher boost pressure means greater power,« Fischer explains. For fuel cells with a stack output of between 50 and 300 kW in stationary applications, the boost pressure is between 1.5 and 2 bar. Up to 2.7 bar is applied when the fuel cell generates energy in vehicles.

Fischer faced several challenges during development, not all of which were technical in nature. For example, the air used in the fuel cell's chemical reaction must be completely clean and free of oil. »We need oil-free bearings for the compressor shaft, but none of the ›old‹ technologies work for this,« says Fischer. Foil bearings could be one solution. However, FFCC has developed an unusual air bearing for the market that does not require foil, replacing oil with air, and achieving a bearing clearance in the range of hundredths rather than tenths of a millimetre. These particularly low-loss bearings can only be manufactured with a great deal of technical expertise and precision machinery. And who invented them? In this case, it wasn't the Swiss. The development dates back to a NASA patent from the 1960s. Fuel cell exhaust gas is also »unsuitable for a turbomachine« because the water vapour has a low temperature and high humidity and liquid water content. Accordingly, the electric motors and air bearings of the compressors must be well sealed.

In addition to the technical challenges, Tore Fischer occasionally struggles with the mentality in this country. »While the Japanese simply develop a fuel cell car, launch it on the market and gather field experience, in Europe a system is developed, ten prototypes are built for a fleet trial and then the next system is immediately developed, because that is much more exciting than bringing one to series production,« he says, describing a problem he occasionally observes on the OEM side.



From a technological perspective, he also disapproves of certain political decisions. When funds are channelled into defence rather than the energy transition, companies feel the impact, and the least established technologies are scaled back. VW discontinued fuel cell development years ago and Audi and Bosch are scaling back their activities, but FISCHER Fuel Cell Compressor AG is experiencing growth. The company's key strength lies in its almost complete in-house development and production capabilities, covering areas such as aerodynamics, bearings, cooling and electric motors. However, the engines are produced externally, representing virtually the only component not developed in-house. This breadth and depth of production is one of the reasons for FVV membership.

» The FVV provides insight into pre-competitive research in many areas, including combustion engines. Topics covered include ammonia and hydrogen combustion, and exhaust gas aftertreatment. This allows us to keep up to date with the latest developments. «

DR TORE FISCHER

This is important for understanding the market. »I fought for five years to get us, as a Swiss company, to become a member of the FVV. The network of peers is attractive, and we make intensive use of the knowledge in THEMIS because it helps us to progress,« explains Fischer, who is currently preparing his own project and is about to submit his proposal. He had to do some internal lobbying to become a member, as the research association is hardly known in Switzerland. However, he believes that membership is incredibly valuable for SMEs with small research budgets and that it would be useful to communicate the benefits more effectively in order to attract more SMEs. After all, collective research also helps to reduce costs, which is an important point because: »The focus is currently on costs, and these fall sharply as production volumes increase. You can see this with electric cars: thanks to subsidies, the same model now costs roughly the same as the combustion engine version. And that was a development that took about ten years.« This demonstrates the potential of a technology that is politically desired, promoted, and put into series production.

Fischer ventures a glimpse into the future. Provided that politicians set the course in the right direction, he is convinced that fuel cell technology will be successful. »Except for aeroplanes and large ships, I believe it is the energy source we need in terms of renewables, grid stability, and decarbonising road transport.« Technically, we are already close to what is feasible, but Fischer still sees potential for improvement in terms of power density. For example, the use of a turbine on the compressor can increase shaft power by up to 40 per cent, thus enabling significantly larger fuel cell systems to be ›ventilated‹ in the same installation space.

Tore Fischer's decision to keep his combustion engine car is proof that he is planning for the long term and sustainability. The eight-year-old car is expected to last another seven years, after which Fischer could well consider buying a fuel cell car if the refuelling infrastructure is suitable and the price is reasonable. He knows that the costs have to come down. //

New testing strategies for the **use of materials under extreme conditions**

Text: Mathias Heerwagen

In some gas turbines for power generation, hydrogen is already being blended into the natural gas to reduce CO_2 emissions. But for other applications, there is insufficient knowledge about the **effect of hydrogen at high temperatures**. As part of a project, researchers under the direction of Dominique Kießlich are developing new testing concepts and examining material behaviour in the presence of hydrogen.

First impressions are not always accurate. If you had asked Dominique Kießlich at secondary school what she wanted to do when she was older, she would not have pictured herself in a technical field. The thought of her working at Rolls-Royce, developing materials for use in aircraft engines, would have seemed far-fetched. She had a healthy respect for the science subjects, especially maths and physics. »But then I realised that maths and physics were actually going really well, especially when you knuckle down, work hard and try to understand how it all fits together,« says Kießlich. She was good with numbers and originally planned to study economics after leaving school, but ultimately chose to take on a challenge in a field where she felt less at home: combining economics and technology in industrial engineering.

Wanting to gain industry experience early on in her career, Kießlich wrote her final thesis on joining technology at Salzgitter Mannesmann Forschung. »That was where I discovered my passion for working with materials and a wide range of different production processes. I found it absolutely fascinating to see how the red-hot molten iron flowed out of the furnace during tapping. And when the warm slabs were transported around the site, you could feel the heat coming off them even from inside passing cars,« the engineer says enthusiastically.

For her master's, she chose to go all in, studying mechanical engineering at the University of Paderborn. As well as deepening her knowledge of metallic materials and manufacturing technology,

she spent two semesters catching up on basic topics such as thermodynamics and powertrain technology. It was a challenging time, but Kießlich knows that ambition will take you a long way. She wrote her master's thesis at Rolls-Royce Deutschland (RRD), and her enthusiasm is infectious even four years later. »I learned so much during that time. I learned which materials are used and encountered nickel-based alloys for the first time. I was fascinated by how the material and the production process work together and by the complexity of the product.« The cooperation seems to have worked out well for both sides: after graduating, Kießlich stayed on at Rolls-Royce in Dahlewitz, near Berlin, initially as a materials engineer. Taking on a project on the development of new materials for high-performance gearboxes, she became familiar not only with technical matters, but also with the requirements for material qualification, risk analysis and industrial implementation

New materials for extreme conditions

It was at Rolls-Royce that Dominique Kießlich first came into contact with FVV, specifically due to the particular topic of aircraft propulsion, which could play a more important role for the company in the future. »Aircraft propulsion is a field of extreme conditions and high temperatures, so it is important to know how materials behave under the additional influence of hydrogen, and which test methods are necessary to determine these effects,« says Kießlich, explaining where research is needed. Although the use of hydrogen in aircraft engines currently remains extremely challenging for weight and storage reasons, Rolls-Royce is already preparing for potential applications in the future. Manufacturers in other industries can also benefit from the results. In stationary gas turbines, for example, the proportion of hydrogen is set to rise in future to reduce CO_2 emissions.

Together with partners from industry and research, Dominique Kießlich has initiated the project ›Efficient H_2-HT test‹ → FVV project number 1534. The goal is to research an efficient testing strategy for examining the microstructure-dependent material behaviour under the influence of hydrogen at increased temperatures, as the project description puts it. After a long lead time, coordination with numerous research and industry partners, and the preparation of the project proposal, the project finally received both the green light and financial support. FVV contributed more than € 200,000 of its own funds, with the German Federal Ministry of Economic Affairs and Energy adding almost three-quarters of a million euros. The extensive project involves an unusually high number of research institutes in order to match the complexity of testing in a hydrogen environment. Material tests under these special conditions are also demanding and costly. As project coordinator, Dominique Kießlich carries great responsibility.

ROLLS-ROYCE DEUTSCHLAND

Rolls-Royce Deutschland is a manufacturer of aircraft engines with official approval to develop, manufacture and maintain modern turbine engines. The Dahlewitz site is the group's competence centre for twin-shaft engines, and home to the development and final assembly of all BR700 and Pearl engines. To date, around 9,000 engines have been delivered from the Dahlewitz site. In total, Rolls-Royce Deutschland services around 8,500 engines in operation worldwide and employs around 10,000 people in Germany. As well as developing and producing modern engine components, Rolls-Royce Deutschland is actively researching future propulsion concepts and innovative technologies. New materials, advanced production processes and the qualification of materials for future requirements play a major role here – including with regard to sustainable aviation and alternative energy sources.

Most of the specialist work is carried out by research partners, with Rolls-Royce as the industry partner providing material-related services, materials, expertise and more. »Our role is mainly to support and advise, and of course we benefit from the results,« says Kießlich. As part of the validation strategy, the scientists test at material level rather than at component level. Round specimens in various geometries, some drilled hollow, are used for the basic material characterisation.

Complex testing takes time

In general, the effect of hydrogen on materials was studied some time ago. So why is this new project necessary? »In the past, research has looked at individual methods, such as the production of sample geometries, a test setup or individual test conditions. What is missing is a holistic consideration of all these parameters,« explains Kießlich, outlining the project goal. »We are examining different test approaches and plan to use the findings to derive a testing concept to assess the sensitivity of components under the influence of hydrogen at high temperatures.« This is no easy undertaking, as the complexity of the test approaches means that scientists need a great deal of time for material testing. Although the project has been running for two years already, it is too early to draw final conclusions. But Kießlich says they are on the right track and have already seen some material effects that none of the members of the consortium had expected – but from which they can now learn a great deal.

FVV membership pays off

That is exactly what makes FVV membership so valuable: the data and contacts generated are available to all members. »Rolls-Royce benefits from FVV every step of the way,« says Kießlich. »We can put engine-related topics on the agenda and exchange ideas with other scientists, manufacturers and research institutes.« The material data and test methods generated in the project may be important in developing future applications and standards. In addition, the company now knows what topics need to be addressed in future and which research institutes could be involved as partners. Dominique Kießlich has learned that FVV's real added value lies in its network. As well as providing funding from its own resources, FVV offers administrative support. In Dirk Bösel, Kießlich has found a dedicated point of contact for advice and support.

Dominique Kießlich has been working in materials and production process development at Rolls-Royce Deutschland for four years now. Her goal is to help make aircraft engines more efficient and sustainable through new materials and production processes.

Even her spare time revolves around materials, albeit from the construction industry – she is currently in the process of renovating a block of flats together with her husband. When not involved in the renovations, she loves to stay active and spend time outdoors, hiking in summer and snowboarding in winter. //

DOMINIQUE KIEßLICH, MSc

is an engineer in Material and Production at Rolls-Royce Deutschland Ltd & Co KG. Having studied industrial engineering at TH Wildau and mechanical engineering at the University of Paderborn, she joined Rolls-Royce Deutschland as a materials engineer in 2018, working on the development of a high-performance gearbox for aircraft engines. She then worked as a project lead at the Composite Technology Center (CTC GmbH) in Stade, gaining experience in the development of production processes for fibre-composite structures. Since returning to Rolls-Royce Deutschland in 2022, she has been focusing on innovative production technologies and materials for future aviation applications. For FVV, she is working on a project to develop an efficient testing strategy for materials in a hydrogen environment.

1534 // Efficient testing strategy for examining the microstructure-dependent material behaviour under the influence of hydrogen at increased temperatures

Using hydrogen as an energy carrier offers the potential to significantly reduce CO_2 emissions, thus making an important contribution to achieving climate targets. In the energy and mobility sector, the use of hydrogen as a combustion or process gas forms the basis for emission-free operation. The materials used in the relevant systems are exposed to elevated temperatures, raising the issue of hydrogen embrittlement given these new exposure parameters. Hydrogen embrittlement describes the process in which metals can be damaged when they come into contact with pressurised hydrogen, potentially leading to premature, often spontaneous failure. To ensure safe operation, it is essential to understand the effects of hydrogen on material behaviour at elevated temperatures – including considering the materials' varying microstructures. The autoclave technology used to date – which is very time-consuming and costly, characterised by limited availability, and unsuitable for high test temperatures – will be unable to meet future demand. The goal of the project is to develop alternative testing concepts based on hollow-specimen and precharging methods and use them together with a set of suitable test parameters in efficient material characterisation at elevated temperatures. This is intended to provide industry, and SMEs in particular, with cost-effective, easy-to-use and thus widely available and standardisable test concepts that allow them to assess materials for their suitability under hydrogen conditions and to implement reliable component designs. The test concept is being developed using five widely available high-temperature alloys from different manufacturing routes. At the end of the project, the results from quasi-static, isothermal and, in some cases, anisothermal fatigue tests on these materials will be made available for immediate use.

I have always been a **technology enthusiast**

»It makes me very happy, of course, that my dedication and hard work are being recognised.«

Marco Günther's fascination with technology began at an early age. Cars always played a part, starting with a go-kart; later, he was allowed to drive the car into the garage with his father. In conversation, Günther recalls a presentation in Year 10: »I'd given a talk on engines – why cylinders are arranged in a row, why in a V-shape, how power can be increased, things like that. **I found powertrain and drive systems very interesting even back then, and by the time I reached upper school at the latest, it was clear that I wanted to study something technical.«** In his spare time, sport plays a central role alongside his affinity for technology. Günther played football in the top youth leagues and is a keen winter sports enthusiast.

He is studying mechanical engineering, specialising in internal combustion engines, motivated by a desire to ›become highly proficient in this field‹. The more he learns about the technology during his studies, the greater his fascination becomes. During an internship at BMW in Munich, Marco Günther benefits greatly from experienced engineers and gains insights into series production development. He stayed at BMW for his final-year project, and his desire to pursue a PhD grew even stronger: »I also saw it as a personal challenge and wanted to delve really deeply into a subject. A PhD would certainly be helpful for a potential career in industry,« explains Günther.

APL PROF DR ING MARCO GÜNTHER

graduated with a degree in mechanical engineering, specialising in internal combustion engines, from RWTH Aachen University in 2010. In 2015, he obtained his PhD from the current Chair of Thermodynamics of Mobile Energy Conversion Systems at RWTH Aachen University on ›Pre-ignition and glow-ignition of gasoline fuels containing bio-components‹.

From 2010 to 2014, Günther worked as a research assistant at the aforementioned chair before being appointed Senior Engineer in 2014. In this role, he is responsible for research and teaching. His research interests range from thermodynamics, combustion process development and optical diagnostics to topics in fuel cell and battery development.

In April 2025, Günther was awarded the title of extraordinary professor in recognition of his achievements in teaching. His commitment to academic education and his research work contribute significantly to the further development of the department.

Furthermore, Günther has been a member of the management board of Aldenhoven Testing Center GmbH since mid-2014, where he works alongside his colleagues to drive forward the development of this highly innovative test facility.

But in 2010, in the aftermath of the major financial crisis, industrial PhDs were few and far between. Günther made a conscious decision to pursue a PhD at university: »The combination of research, teaching and the continued exchange of knowledge in a university environment has always inspired and motivated me deeply, and thanks to RWTH Aachen University's close ties to industry, the learning and working experience is very hands-on,« says Günther.

In 2014, he became a senior engineer at the Chair of Thermodynamics of Mobile Energy Conversion Systems (tme), followed by his PhD in 2015; at the same time, as part of the management team at the Aldenhoven Testing Centre (ATC), he was gaining the skills needed for a career move that was unthinkable at the time. Gaining in-depth insights into financial and legal matters as well as corporate management, plus additional responsibility for staff – Marco Günther enjoys being a manager, yet: »I'm torn between two passions. On the one hand, I like practical work; I want to teach, conduct research and analyse results; on the other hand, I believe I'm quite good at pulling the strings and keeping an overview.«

He realised he enjoyed imparting knowledge whilst teaching during his PhD. But would he still, in good conscience, advise young people today to study mechanical engineering with a focus on internal combustion engines? »Yes, because internal combustion engines will remain in various applications even after 2035, for example in ships or stationary applications such as combined heat and power plants. Moreover, degree programmes are changing; they are becoming more interdisciplinary and incorporating other power and drive systems.« In this context, Günther regrets that discussions about powertrains are not always conducted in an open and fair manner; that the combustion engine is often portrayed in a worse light than it deserves.

» If fair competition shows that a particular technology performs better in certain applications, we should accept that. «

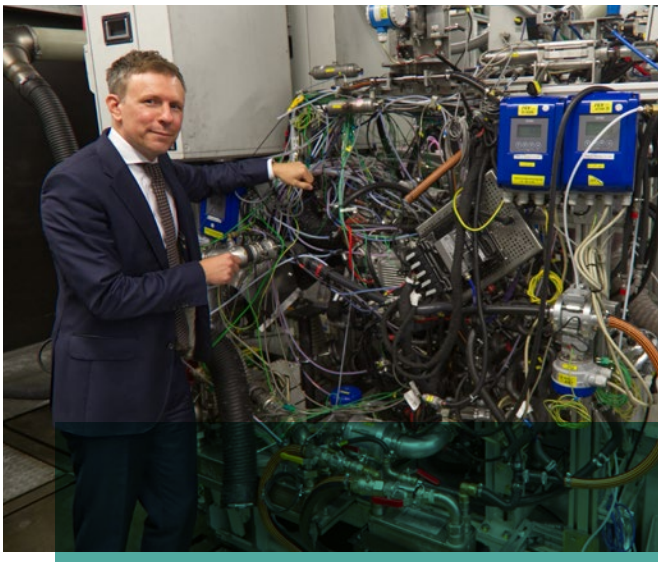
APL PROF DR MARCO GÜNTHER

Today's diversity of powertrains is evident on a walk through the ›hallowed halls‹ of the tme; the soundproof doors of the 19 test cell chambers stand open, as the annual maintenance day for the technical facilities is due. Electric powertrains are installed in several chambers, as well as fuel cells and a large single-cylinder engine with a two-litre displacement, on which ammonia combustion is being investigated. In the software laboratory, Günther explains that a PhD student is investigating the influence of AI on the data input for engine control units. Final results are still pending, but it is already clear that AI can help achieve results more efficiently. Electric powertrains, fuel cells, artificial intelligence – times and powertrain systems are changing. The one thing that doesn't change is the partnership with the FVV.

During his PhD, Günther was heavily involved with the FVV; the research centre was submitting proposals for new project ideas, and as a research assistant he provided support, for example by drafting project applications. At conferences, he made contacts and expanded his network; in the working groups, he was sometimes ›put through his paces‹, as he puts it: »There were 30 people sitting there, some of whom had been doing this for decades, asking questions that we hadn't even considered in the project yet. You learn that you have to look at and understand things in a very broad context, and that was my ambition, too.« These discussions, some of them critical, had

a profound influence and helped with his personal development, even though – or perhaps precisely because – there were situations where it ›really became a lot to handle‹.

Günther misses this intensive exchange today; sometimes there are ten people in the working group on site, where there used to be 30. »But the exchange is important, and the input from the project user committee was and always is a great asset to pre-competitive research. Unfortunately, this intensive exchange is lost somewhat in the digital formats,« says Günther. Yet the FVV is doing ›a really good job‹, and it would be nice to integrate more OEMs and suppliers as a regular feature again. Experts from electric motor development or battery research could also strengthen the OEM presence through the diversity and breadth of the topics. »Pre-competitive research was and remains the USP; all the major OEMs were there, a topic was presented, and 30 people discussed it,« says Günther. »That is a valuable asset and should be preserved.« Students also benefit from the FVV; the projects provide a solid foundation for PhD and master's theses.



The Chair of Thermodynamics of Mobile Energy Conversion Systems (tme) of RWTH Aachen University conducts research into all aspects of mobile propulsion systems: The focus is on the internal combustion engine, fuel cells and battery-electric propulsion, always closely linked to the further development of intelligent test methods and calibration.

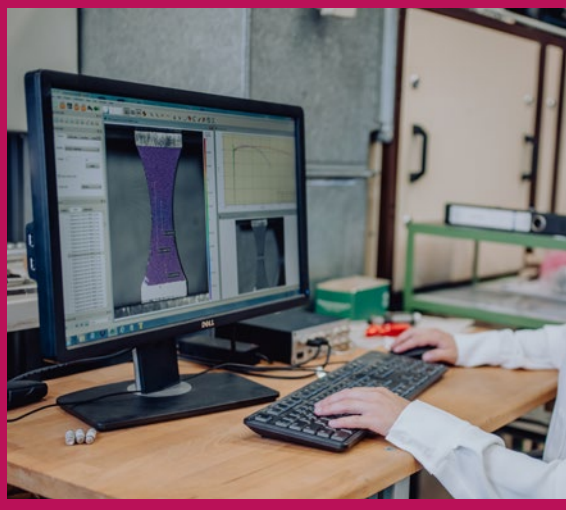
How teaching is changing and moving with the times is illustrated by the following: not only is the range of lectures in the field of mobile propulsion systems being steadily expanded, but courses are becoming increasingly digital. For example, this winter semester saw the launch of the first fully digital master's programme at RWTH Aachen University – with all lectures, tutorials and even exams taking place online. »This allows students to organise their own study schedules. However, the drawback is that the live experience in the lecture is missing, and I can no longer tell whether I'm managing to inspire and motivate the students. Nothing can replace the personal interaction found in small classes,« explains Günther.

The word ›passion‹ comes up frequently in conversation; his fascination with technology is still evident, and there is no other way to explain why he spends such long hours at the department every day. He does not simply want to fulfil his duties, but to offer his students attractive opportunities and to train excellent engineers. In early June 2025, Dr Marco Günther was appointed extraordinary professor – this award recognises his many years of dedication to teaching and research.

As for what the future holds, he is open to surprises, though he admits that jobs in industry are not unattractive either; he could certainly see himself getting excited about bringing a car into series production at an OEM or seeing a project through over the long term. »I have been a technology enthusiast from day one, and always will be.« It's true, you can see the passion written all over his face. //

Taking an **active role** in shaping change

Copper, copper alloys and their joints play a crucial role in the performance of electric powertrains, both in development and production. What is missing, however, is design methods for joints. Professor **Anna Trauth** is conducting research into this topic in an FVV project at TU Darmstadt.



Her path appears to have been set early: »We have always joked that the first thing I learned as a child was how a car engine works,« says Anna Trauth. She spent time building model planes with her father, and had a keen interest in technology from a young age. At school, she excelled in science subjects. She thought about studying physics, but was not sure what a career as a physicist looked like. She finally opted to study Sports Engineering at TU Chemnitz, as the combination of sport and technology suited her interests better.

What has followed is an impressive scientific career with a clear guiding principle: her interest in materials. »It started during my bachelor's degree, when I first heard about polymer-based fibre composites. They are used in sports equipment, for example. I found it fascinating that it is possible to ›design‹ materials specifically to create certain properties and to bring different worlds together,« says Anna Trauth.

To open up more options for her future career, she studied for a bachelor's degree in mechanical engineering at the same time. This was more of a pragmatic choice, as she did not see herself as a conventional mechanical engineer. Nevertheless, she still went on to study for a master's in mechanical engineering at the renowned Karlsruhe Institute of Technology (KIT). She spent part of her master's programme studying in France, where she was in good company: »At KIT I was often the only woman in my lectures; in France it was much more balanced.«

In her second year she took on a teaching role and learned that her strengths lie in research and scientific work. She became a research associate at KIT's Institute for Applied Materials and conducted research as a visiting scholar in the Department of Mechanical, Automotive & Materials Engineering at the University of Windsor in Ontario, Canada. With her master's degree in hand, moving into industry was never an option. Instead, she went on to complete her PhD at KIT in 2018 – a doctorate that opened new doors.

Dr Trauth spent five years as Group Leader at the Chair of Hybrid Materials, Institute of Materials Resource Management (MRM), Augsburg University. In 2022, she took on an interim professorship there, before being appointed to a full professorship at TU Darmstadt in 2024. From building model aeroplanes to becoming a professor in her mid-30s – it could have gone worse.

Lack of design methods for copper

Professor Trauth has taken on scientific leadership of two FVV projects, including a project on the ›Fatigue design concept of copper weldments‹ → FVV project number 1533, which has received three-quarters of a million euros in funding from the German Federal Ministry of Economic Affairs and Energy. Although the material plays a key role in new powertrain concepts and the mobility transition, few design methods are currently available. »Normally, engineers have a set of guidelines to determine which calculations they need to carry out to ensure the safety of a welded connection or joint. For copper, such design methods do not exist or are very limited, and for the corresponding joints, they do not exist at all,« explains Professor Trauth, outlining the need for research. Yet these methods are needed as part of the design process, she says, in order to enable standardised, user-independent approaches.

PROF DR ING ANNA TRAUTH
is Professor of Materials Mechanics at TU Darmstadt. Following studies at TU Chemnitz, the Karlsruhe Institute of Technology (KIT) and the École nationale supérieure d'Arts et Métiers (Arts et Métiers ParisTech) in Paris, she completed her PhD at KIT's Institute for Applied Materials in 2018, in the field of hybrid fibre-reinforced plastic composites for structural applications. Anna Trauth then worked as Group Leader for Materials and Mechanics at the Institute of Materials Resource Management at Augsburg University. In 2024, she accepted a professorship at TU Darmstadt, where she and her working group have researched innovative solutions for value-preserving materials and processes ever since. Her scientific work focuses particularly on multi-scale characterisation and modelling of the damage and fatigue behaviour of materials and structures. Through her research, she creates links between fundamental questions in materials mechanics and application-orientated approaches, thus contributing to the development of durable, high-performance and resource-efficient materials solutions.

Widespread interest across industries

Why doesn't this data exist? Copper is not a conventional engineering material and, especially when it comes to the fatigue strength examined in the project, very little data is available. In addition, investigating the service life is a very complex and time-consuming task. It is therefore no wonder that there is so much interest in the data across industries, and that the project meetings always include people from a very wide range of disciplines, says Trauth: »It is great that FVV brings so many players to the table. A research association is probably the only way to achieve that.«

In the project, the researchers hope to shorten the conventional route with its numerous lab tests by identifying models and working with simulations. According to Trauth, what makes the project fascinating is that it focuses on a concept that can be easily applied in practice. The researchers have now »understood what matters and what information we need. The second step will now be to combine the methods and design processes.« The automotive industry will not be the only sector to benefit from the results, says the professor. »One of the main goals, and the standard we have set ourselves, is scalability and transferability. This is why we are focusing so much on materials.« The data could then be used in the development of wind turbines, battery technology and power electronics, for example.

The researchers are also using data-driven intelligence in the project. Professor Trauth says that many of her colleagues at TU Darmstadt make extensive use of these approaches and artificial intelligence in technical fields, both in research and teaching, in order to solve specific technical challenges or conduct calculations. She welcomes the technology as a valuable aid in day-to-day work, but also argues for critical scrutiny: »How does responsibility work? Who ultimately says that the calculation is correct and the component will hold? We cannot ask a computer to do this we always need people to check the results. Unfortunately, I see time and again with students that this does not always happen.« Raising awareness of the technology's limits is a major challenge, she says. It is also important to incorporate the latest research into teaching.

When it comes to the question of whether she could choose between research and teaching, her ambivalence is clear: »That's difficult. I hope I never have to choose between the two. But I deliberately chose the academic route back then to focus more on research,« says Trauth. Although she enjoys both, each side also has aspects that »can sometimes be annoying.« Perhaps that is all part of playing an active role in shaping change. The professor wants to play her part in ensuring that things move »in a good direction« in future, not only in terms of technology, but also in society and teaching. Not least for her family, with whom she loves to spend what little free time she has – outside in nature, being active, ideally in the mountains. Ultimately, it's all about guiding energy in the right direction. //

1533 // Fatigue design concept of copper weldments (FATWELDCO)

The electric powertrain is hugely important in developing and producing the vehicles of the future. Copper and copper alloys play a major role here, for both performance and cost efficiency. In contrast to steels or aluminium alloys, there is currently almost no published data on the fatigue behaviour or design methods for copper joints. Because there is no recognised design concept, the only way to validate safety-relevant welded copper elements is to conduct fatigue strength tests. However, this is extremely time-consuming and costly, putting it out of reach for component and parts suppliers (tier 2 and 3 suppliers, largely SMEs).

Drawing on scientific findings, the project results and their transfer outputs are implemented in a pragmatic form suited to SMEs and prepared for immediate use in practice.

This includes the following aspects:

- Recommendations for material selection for welded copper joints
- Phenomenological design concept
- FEM modelling with standard FE software
- Provision of the required model and material parameters
- Simple assessment options for new designs or new welded joints

The research bodies involved have been working on topics relating to joining technology and fatigue strength for many years and have clear areas of specialisation that complement one another perfectly. A comprehensive concept for transfer to SMEs has been developed.

Who is driving our future?

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CHIBA UNIVERSITY

DECHEMA FORSCHUNGSINSTITUT Stiftung bürgerlichen Rechts

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Fraunhofer ISIT

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Fraunhofer IWU

Fraunhofer IZM

HOCHSCHULE COBURG

HOCHSCHULE | TAC COBURG

KOMPETENZZENTRUM tribologie MANNHEIM

LHM Laserinstitut Hochschule Mittweida

HM Hochschule München University of Applied Sciences

IUAS Institute for Unmanned Aerial Systems

IVESK Institut für verlässliche Embedded Systems und Kommunikationselektronik

HOCHSCHULE OFFENBURG

Abgaszentrum Karlsruhe

DVGW

IPEK

KIT Karlsruher Institut für Technologie

IFKM

ITS

King Abdullah University of Science and Technology

ITT

TVT

iPeG Institut für Produktentwicklung & Gerätebau

Institut für Turbomaschinen und Fluid-Dynamik

MPA life cycle material engineering.

THE OHIO STATE UNIVERSITY

OTTO VON GUERICKE UNIVERSITÄT MAGDEBURG EIT

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RUHR UNIVERSITÄT BOCHUM

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IKDG RWTH AACHEN UNIVERSITY

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IST RWTH AACHEN UNIVERSITY

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IEH

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FVV ANNUAL REPORT

2025/2026

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NETWORK

TRANSFER

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Science for a moving society

+ Industrial Collective Research (IGF) has a particular commitment to the **transfer of knowledge and technologies**.

+ Networked actions between manufacturers and suppliers, developers and scientists, leading industrial engineers, renowned researchers and excellent young talents promote mutual understanding. This is very important to us. Contrary to purely project-related cooperation, Industrial Collective Research is geared towards lasting relations among all partners.

+ At the **FVV Transfer + Networking Events** in the autumn and spring, some 250 experts get together regularly to easily gather information about the research programme of the FVV and to discuss further research needs. Many also benefit from the knowledge transfer at the **expert conferences of our cooperation partners**.

Ideas sometimes need time and a prolific place to grow. Here at FVV you will find both.

Please save the dates of the forthcoming FVV conferences:

Spring 2027: 7 to 9 April

Autumn 2027: 22 to 24 September

See you in Bonn next year!

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Science for a moving society

FVV Publications

The FVV as a transfer platform provides continued exchange between science, industry and society with reports from the project world, transfer + networking events and a newsletter.

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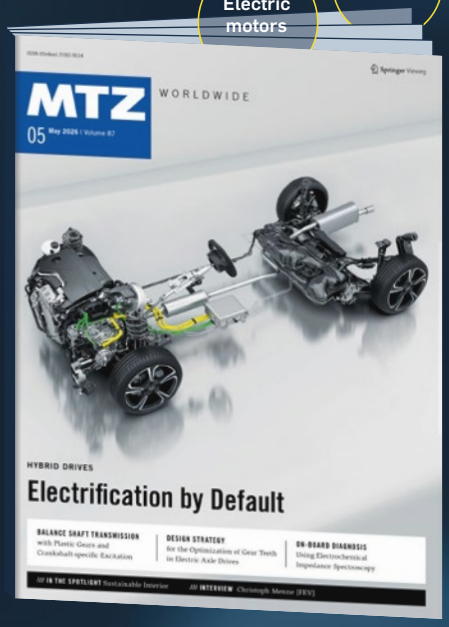

MTZ Articles

MTZ is the international technical-scientific trade magazine for engineers in powertrain development with a special focus on the development of electrified and internal combustion engine powertrains. In addition, it also reports on classic topics such as friction, turbocharging or charge cycle and valve control.

www.springerfachmedien-wiesbaden.de/en | MTZ

Car-to-X C_2X

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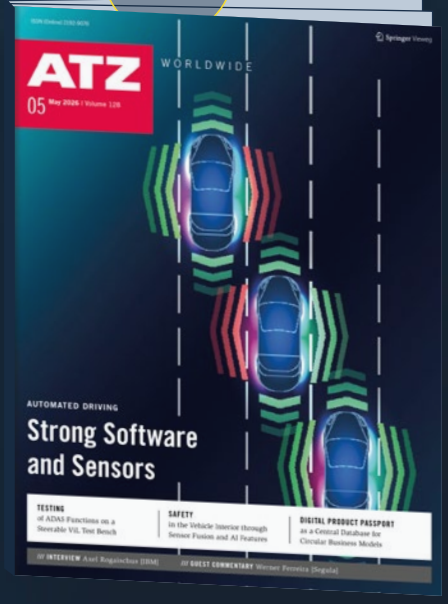

ATZ Articles

ATZ is the must-read international technology magazine for decision-makers in the automotive industry. For more than 120 years, it has been presenting forward-looking technology solutions in automotive research and the latest information for the daily work of engineers on the entire vehicle - chassis or bodyshell, lighting technology or air conditioning.

www.springerfachmedien-wiesbaden.de/en | ATZ

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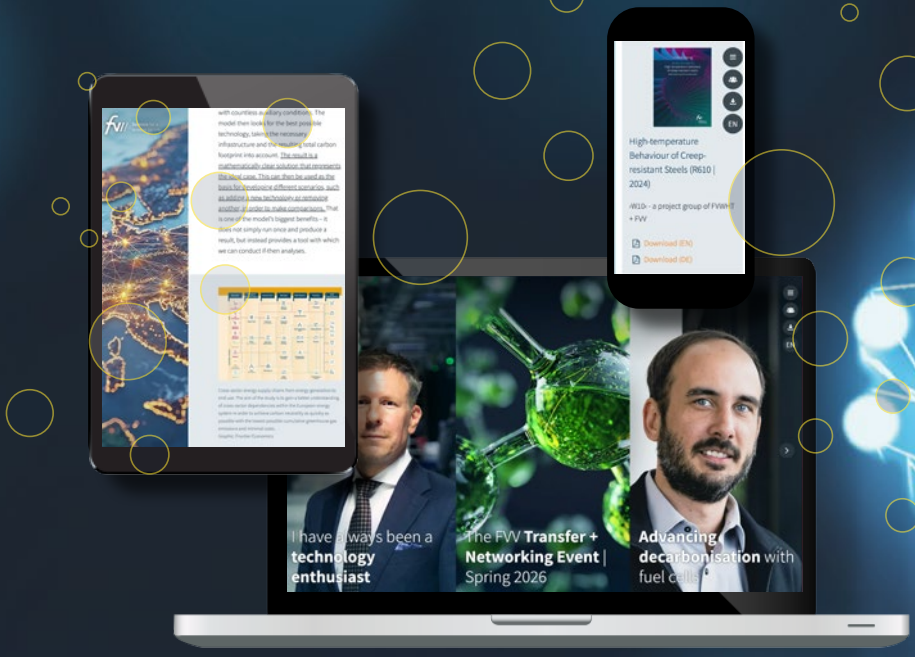

Science

The FVV Website informs about research findings on important technological challenges and identifies future research needs. Discover the work of scientists and engineers who are researching the best available technologies of the future together with us!

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For members and friends of the FVV we issue an electronic newsletter. It informs you regularly about news from our innovation network and interesting facts about Industrial Collective Research (IGF) as well as technology funding and promotion. Sign up now! The subscription is free and can be stopped at any time.

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LOCATION (HEADQUARTERS)	RTD PERFORMERS	REPRESENTATIVE (HEAD OF RESEARCH)
Magdeburg	**Otto von Guericke University Magdeburg OVGU** Mechanical Engineering Institute of Mechanics IFME Technical Dynamics	Prof Dr Jens Strackeljan
Magdeburg	**Otto von Guericke University Magdeburg OVGU** Mechanical Engineering Institute of Machine Design IMK Machine Elements and Tribology MET	Prof Dr Dirk Bartel
Magdeburg	**Otto von Guericke University Magdeburg OVGU** Mechanical Engineering Institute of Mobile Systems IMS Energy Conversion Systems for Mobile Applications	Prof Dr Hermann Rottengruber
Magdeburg	**Otto von Guericke University Magdeburg OVGU** Mechanical Engineering Institute of Materials, Technologies and Mechanics IWTM	Prof Dr Elmar Woschke
Magdeburg	**Otto von Guericke University Magdeburg OVGU** University Hospital Magdeburg Experimental Audiology EXA	Prof Dr Jesko L. Verhey
Mannheim	**Mannheim University of Applied Sciences** Tribology Competence Center KTM	Dr Markus Grebe
Mittweida	**Mittweida University of Applied Sciences** Engineering Sciences / Physics and Laser Technology Laser Production Technology / High-performance Engineering LHM	Prof Dr Udo Löschner
Munich	**Fraunhofer-Gesellschaft eV** Fraunhofer Institute for Electronic Microsystems and Solid State Technologies EMFT	Prof Dr Amelie Hagelauer Prof Dr Christoph Kutter
Munich	**Hochschule München – University of Applied Sciences** Institute for Mobility and Life in Motion IMM	Prof Dr Stefan Sentpali
Munich	**Hochschule München – University of Applied Sciences** Institute for Sustainable Energy Systems ISES	Prof Dr Herbert Palm
Munich	**Technical University of Munich TUM** School of Engineering and Design Sustainable Mobile Powertrains NMA	Prof Malte Jaensch
Munich / Garching	**Technical University of Munich TUM** School of Engineering and Design Turbomachinery and Flight Propulsion LTF	Prof Dr Volker Gümmer

	LOCATION (HEADQUARTERS)	RTD PERFORMERS	REPRESENTATIVE (HEAD OF RESEARCH)
	Munich / Garching	**Technical University of Munich TUM** School of Engineering and Design Vibroacoustics of Vehicles and Machines VIB	Prof Dr Steffen Marburg
	Munich / Garching	**Technical University of Munich TUM** School of Engineering and Design Machine Elements / Gear Research Center FZG	Prof Dr Karsten Stahl
	Munich / Garching	**Technical University of Munich TUM** School of Engineering and Design Thermodynamics	Prof Dr Dongsheng Wen
	Munich / Garching	**Technical University of Munich TUM** School of Engineering and Design Thermo-Fluid Dynamics TFD	Prof Dr Wolfgang Polifke
	Munich / Garching	**Technical University of Munich TUM** School of Engineering and Design Materials Science LWW	Prof Dr Jan Torgersen
N	Nuremberg	**Technische Hochschule Nürnberg Georg Simon Ohm** Power Electronic Systems ELSYS	Prof Dr Ivana Mladenovic
	Nuremberg	**Technische Hochschule Nürnberg Georg Simon Ohm** Mechanical Engineering and Building Services Engineering Institute for Automotive Engineering IFZN	Prof Dr Christina Singer
O	Oberpfaffenhofen	**DLR German Aero Space Center eV** Institute of Atmospheric Physics PA Atmospheric Trace Species ATS	Dr Anke Roiger Dr Friedemann Reum
	Offenburg	**Offenburg University of Applied Sciences** Electrical Engineering, Medical Engineering and Computer Science EMI Radar and High-Frequency Technologies Institute of Unmanned Aerial Systems IUAS	Prof Dr Marlene Harter
	Offenburg	**Offenburg University of Applied Sciences** Mechanical and Process Engineering M+V Institute of Reliable Embedded Systems and Communication Electronics ivESK	Prof Dr Axel Sikora
	Offenburg	**Offenburg University of Applied Sciences** Mechanical and Process Engineering M+V Mechanics and Materials	Prof Dr Thomas Seifert
	Orléans (FR)	**University of Orléans** PRISME Laboratory	Prof Dr Christine Mounaïm-Rousselle

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	LOCATION (HEADQUARTERS)	RTD PERFORMERS	REPRESENTATIVE (HEAD OF RESEARCH)
P	Paderborn	**Fraunhofer-Gesellschaft eV** Fraunhofer Institute for Mechatronic Systems Design IEM	Prof Dr Ansgar Trächtler
	Pfinztal	**Fraunhofer-Gesellschaft eV** Fraunhofer Institute for Chemical Technology ICT	Prof Dr Frank Henning
	Pfinztal	**Fraunhofer-Gesellschaft eV** Fraunhofer Institute for Chemical Technology ICT Polymer / Environmental Engineering	Rainer Schweppe
R	Rostock	**University of Rostock** Mechanical Engineering and Marine Technologies Piston Machines and Internal Combustion Engines LKV	Prof Dr Bert Buchholz
	Rostock	**University of Rostock** Mechanical Engineering and Marine Technologies Fluid Mechanics LSM	Prof Dr Sven Grundmann
	Rostock	**University of Rostock** Mechanical Engineering and Marine Technologies Technical Thermodynamics LTT	Prof Dr Karsten Müller
S	Schaffhausen (CH)	**ESU-services Ltd.**	Dr Niels Jungbluth
	Stockholm (SE)	**KTH Royal Institute of Technology**	Prof Ulf Olofsson
	Stuttgart	**DLR German Aero Space Center eV** Institute of Engineering Thermodynamics TT	Prof Dr André Thess
	Stuttgart	**Hahn-Schickard-Gesellschaft** **für angewandte Forschung eV**	Prof Dr André Zimmermann
	Stuttgart	**University of Stuttgart** Computer Science and Electrical Engineering Institute of Power Transmission and High Voltage Technology IEH	Prof Dr Stefan Tenbohlen
	Stuttgart	**University of Stuttgart** Engineering Design, Production Engineering and Automotive Engineering Institute of Automotive Engineering IFS Automotive Powertrain Systems	Prof Dr André Casal Kulzer
	Stuttgart	**University of Stuttgart** Engineering Design, Production Engineering and Automotive Engineering Institute of Automotive Engineering IFS Automotive Mechatronics	Prof Dr Hans-Christian Reuss
	Stuttgart	**University of Stuttgart** Energy-, Process- and Bio-Engineering Institute for Building Energetics, Thermotechnology and Energy Storage IGTE	Prof Dr Konstantinos Stergiaropoulos Prof Dr André Thess

	LOCATION (HEADQUARTERS)	RTD PERFORMERS	REPRESENTATIVE (HEAD OF RESEARCH)
	Stuttgart	**University of Stuttgart** Energy-, Process- and Bio-Engineering Institute for Building Energetics, Thermotechnology and Energy Storage IGTE Energy Storage	Prof Dr K. Andreas Friedrich
	Stuttgart	**University of Stuttgart** Aerospace Engineering and Geodesy Institute of Aircraft Propulsion Systems ILA	Prof Dr Stephan Staudacher Prof Dr Malte Krack
	Stuttgart	**University of Stuttgart** Mechanical Engineering Institute of Machine Components IMA	Prof Dr Andreas Nicola
	Stuttgart	**University of Stuttgart** Energy-, Process- and Bio-Engineering Institute for Materials Testing, Materials Science and Strength of Materials IMWF	Prof Dr Stefan Weihe
	Stuttgart	**University of Stuttgart** Aerospace Engineering and Geodesy Institute of Aerospace Thermodynamics ITLR	Prof Dr Bernhard Weigand
	Stuttgart	**University of Stuttgart** Energy-, Process- and Bio-Engineering Institute of Thermal Turbomachinery and Machinery Laboratory ITSM	Prof Dr Damian Vogt
	Stuttgart	**University of Stuttgart** Engineering Design, Production Engineering and Automotive Engineering Institute for System Dynamics ISYS	Prof Dr Dr Oliver Sawodny
T	Thuwal (SA)	**King Abdullah University of Science and Technology KAUST** Physical Science and Engineering Division PSE	Prof Mani Sarathy
	Tokyo (JP)	**University of Tokyo**	Dr Yudai Yamasaki
	Trier	**Trier University of Applied Sciences** Department of Engineering Interdisciplinary Engineering Sciences	Prof Dr Christian Kontermann
	Turin (IT)	**Politecnico di Torino POLITO** Center for Automotive Research and Sustainable Mobility CARS	Prof Federico Millo
U	Ulm	**Center for Solar Energy and Hydrogen Research ZSW SdbR** Fuel Cell Stack Technology	Dr Joachim Scholta

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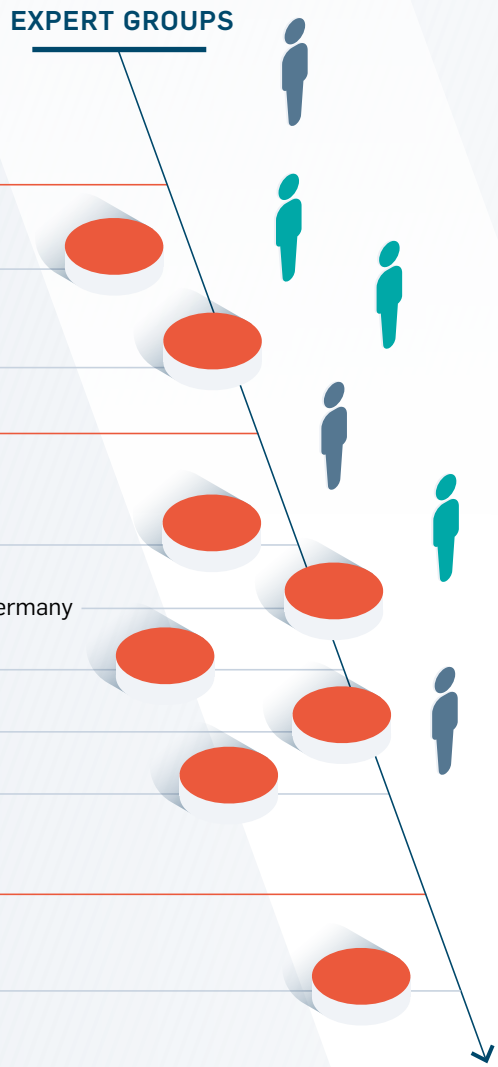
	LOCATION (HEADQUARTERS)	RTD PERFORMERS	REPRESENTATIVE (HEAD OF RESEARCH)
V	Valencia (ES)	**Universitat Politècnica de València** Thermal Engines and Machines Combustion Engines CMT	Prof Dr Jesús Benajes
	Villigen (CH)	**Paul Scherrer Institut PSI** Center for Energy and Environmental Sciences CEE Laboratory for Sustainable Energy Carriers and Processes LEP	Prof Dr Oliver Kröcher
W	Weimar	**Materials Research and Testing Institute at the Bauhaus-Universität Weimar MFPA** Institute of Structural Mechanics ISM Structural Analysis and Component Strength	Prof Dr Carsten Könke
	Weimar	**Materials Research and Testing Institute at the Bauhaus-Universität Weimar MFPA** Materials, Processes & Component Development	Prof Dr Carsten Könke
	Vienna (AT)	**Technical University of Vienna TU Wien** Mechanical and Industrial Engineering Institute of Powertrains and Automotive Technology IFA	Prof Dr Bernhard Geringer
	Windisch (CH)	**FHNW University of Applied Sciences and Arts Northwestern Switzerland** School of Engineering Institute of Thermal and Fluid Engineering ITFE	Prof Dr Kai Herrmann
	Wuppertal	**University of Wuppertal** School of Mechanical Engineering and Safety Engineering Institute of Particle Technology IPT	Prof Dr Eberhard Schmidt
Z	Zurich (CH)	**Swiss Federal Institute of Technology ETH Zurich** Mechanical and Process Engineering MAVT Institute of Energy and Process Engineering IEPE Aerothermochemistry and Combustion Systems Laboratory LAV	Prof Dr Konstantinos Boulouchos Prof Dr Nicolas Noiray
	Zurich (CH)	**Swiss Federal Institute of Technology ETH Zurich** Mechanical and Process Engineering MAVT Institute of Energy and Process Engineering IEPE Combustion and Acoustics for Power and Propulsion Systems CAPS	Prof Dr Nicolas Noiray
	Zurich (CH)	**Swiss Federal Institute of Technology ETH Zurich** Mechanical and Process Engineering MAVT Institute for Dynamic Systems and Control IDSC	Prof Dr Christopher Onder

Scientific coordination

Together we develop ideas for the future. Experts from member companies meet in the groups to identify common research needs and design projects accordingly. The Scientific Advisory Committee of the FVV appoints chairpersons for each group to lead the scientific work.



SYSTEM

Energy Infrastructure and Storage

Hans-Jürgen Hitz, Robert Bosch

Sustainable Powertrain Systems

Thorsten Oberpenning, Rolls-Royce Power Systems

SUBSYSTEMS

Energy Conversion Systems

→ **Engines** | Dr Christian Weiskirch, TRATON R&D Germany

→ **Electric Motors** | Dirk Weberskirch (acting), TRATON R&D Germany

→ **Fuel Cells** | NN

→ **Turbo Machines** | Heinz Knittel, MTU Aero Engines

→ **Zero-impact Emissions** | Dr Frank Bunar, IAV

COMPONENTS

Materials Science and Recycling

Dr Dieter Eppinger, SEG Automotive Germany

See also:
»Make it new – Science for a moving society« (ToR)
→ www.fvv-net.de/en

THEMIS Database

Members of the FVV innovation network can find a list of all planned and ongoing projects in the FVV research programme and dates for the discussion groups, workshops and project user committees in THEMIS.

Project list

Status: 01.05.2026

Research programme

Status: always up-to-date

Meeting dates

Status: always up-to-date

Energy Infrastructure and Storage

SYSTEM

Research priorities

Interaction of energy sources and system components,
energy infrastructure and external storage

→ Chemical energy carriers and alternative fuels beyond application
→ Standardisation → Life cycle analyses

Terms of References (ToR)

+ General issues related to demand and availability of energy sources / carriers
+ Production, quality, distribution and availability of hydrogen, electricity-based and alternative fuels
+ Standardisation topics on future energy carriers and related issues such as infrastructure and storage
+ Life cycle assessment (LCA)
+ Development of collaboration projects with other institutions to serve the interests of FVV members (e. g. workshop with the fuel / energy industry, ...)

Research projects

COORDINATING **Hans-Jürgen Hitz, Robert Bosch**
PROJECT MANAGEMENT **Ralf Thee, FVV**

NO.	TITLE // FUNDING ORGANISATION // DURATION	PROJECT COORDINATOR
	Planned projects	
M0125	**Carbon Capture Study for CHP Systems (CCS-CHP)**	**Klaus Meyer,** KKF2consult
M4225	**Initialization of Macroecomonic CCUS Assessment**	**Klaus Meyer,** KKF2consult
	Ongoing projects	
1526	**GHG-neutral European Energy System** // FVV-EM // 01-07-2024 – 31-03-2026	**Simon Hettig,** Rolls-Royce Power Systems AG **Hans-Jürgen Hitz,** Robert Bosch GmbH

Sustainable Powertrain Systems

SYSTEM

Research priorities

Road / rail vehicles: classic powertrains (ICEV), hybrid / electrified powertrains (PHEV, BEV, FCEV), aircraft engines, marine propulsion, mobile machinery, power systems

→ Energy storage within the application → System efficiency → Air pollution, global warming, noise, sound, radiation → E-machine combined with battery

Terms of References (ToR)

+ Questions on energy storage in the aforementioned applications
+ System efficiency of energy conversion processes e. g. charging, system control / regulation, sensor technologies, ...
+ Thermal management
+ Zero-impact emissions, greenhouse gas emissions (e. g. CO_2), noise, sound, electromagnetic compatibility (EMC)
+ E-machine combined with battery / ICE [interface to E-MOTIVE platform]
+ Impact of legal, social and political requirements onto powertrain systems, circularity
+ Development / engineering of tools for i. e. the system architecture and interaction of powertrain assemblies

Research projects

COORDINATING **Thorsten Oberpenning, Rolls-Royce Power Systems**
PROJECT MANAGEMENT **Ralf Thee, FVV**

Planned projects

NO.	TITLE // FUNDING ORGANISATION // DURATION	PROJECT COORDINATOR
M3719	**Transfer Path Analysis by Means of Deep Learning (TPAbyDL)** // BMWE/IGF	**Dr Tim Kamper-Schley,** HEAD acoustics GmbH
M1823	**E-Motor Inverter for NVH and Efficiency (EMUNE)** // BMWE/IGF	**Hans Johannesson,** Aurobay Sweden AB
M2224	**Onboard Hydrogen Compression**	**Philipp Rolke,** IAV GmbH
M3324	**NVH of Pipes, Hoses and Cables (LOBSTER)** // BMWE/IGF	**Dr Jan Herrmann,** Robert Bosch GmbH
M1225	**AI-supported Validation and Verification**	**Dr Sven Cortes,** Rolls-Royce Power Systems AG
M1425	**NVH-behaviour of Fuel Cell Vehicles II (FCEV-NVH-II)** // BMWE/IGF	**Dr Stefan Heuer,** TRATON R&D Germany GmbH

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Sustainable Powertrain Systems

NO.	TITLE // FUNDING ORGANISATION // DURATION	PROJECT COORDINATOR
M1525	**MO_2Fa** // BMWE/IGF	**Hans Johannesson,** Aurobay Sweden AB
M2225	**NVH Optimised Design of E-machine Types (NOVEM)** // BMWE/IGF	**Hans Johannesson,** Aurobay Sweden AB
M2625	**Data-Efficient AI for Metal Components**	**Edward Werninghaus,** Kolbenschmidt Pistons Management GmbH
M3425	**Hybrid Powertrains for Sustainable Fuels 2035 (HyFuel2035)** // FVV-EM // 01-07-2026 – 31-12-2027	**Prof Dr Karsten Wilbrand,** Shell Global Solutions (Deutschland) GmbH
M0326	**Particle Dampers (PREDAMP)** // BMWE/IGF	**Dr Stefan Heuer,** TRATON R&D Germany GmbH
M0526	**CONVHOY**	**Hans Johannesson,** Aurobay Sweden AB
M0626	**ThiNe**	**Hans Johannesson,** Aurobay Sweden AB
M1026	**Federated AI-Methods for AD/ADAS and Powertrain (AD/ADAS-2-PT)** // CORNET/BMWE/IGF	**Prof Dr Reza Rezaei,** IAV GmbH
M1126	**NVH-Simulation Axial Flux Machines**	**Bernd Müller,** Dr. Ing. h.c. F. Porsche AG
M1226	**Structure Project $HeCO_2$NeutralFuel**	**Marc Sens,** IAV GmbH **Dr Olaf Toedter,** KIT Campus Transfer GmbH

Ongoing projects

1472	**Hybrid Powertrains for Alternative Fuels** // BMWE/IGF // 01-04-2022 – 30-04-2026	**Christoph Thielen,** Rolls-Royce Solutions GmbH
1473	**Maneuvering with Hybrid Ships** // BMWE/IGF // 01-04-2022 – 30-11-2026	**Christoph Thielen,** Rolls-Royce Solutions GmbH
1488	**Real Driving Data for Automotive Application** // FVV-EM // 01-02-2023 – 31-12-2025	**Christopher Grießhaber,** SEG Automotive Germany GmbH **Stefan Gottlieb,** Robert Bosch GmbH
1503	**Predictive Powertrain Health Care** // FVV-EM // 01-11-2023 – 30-04-2026	**Dr Christian Jörg,** Astemo Europe GmbH
1507	**Light-duty CI-ICE 2027 (LDCI2027)** // FVV-EM, CORNET/BMWE/IGF // 01-09-2023 – 31-08-2026	**Dr Frank Bunar,** IAV GmbH
1513	**Robust NVH Design of EDUs** // FVV-EM // 01-01-2024 – 30-06-2026	**Hans Johannesson,** Aurobay Sweden AB
1527	**Transfer Virtual Validation from AD/ADAS to Powertrain** // FVV-EM // 01-09-2024 – 31-08-2026	**Prof Dr Reza Rezaei,** IAV GmbH

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Sustainable Powertrain Systems

NO.	TITLE // FUNDING ORGANISATION // DURATION	PROJECT COORDINATOR
1528	**Sustainable Mobile Propulsion 2035+** // FVV-EM // 01-10-2024 – 23-09-2026	**Marc Sens,** IAV GmbH
1537	**AI Integration in the Development Toolchain (AIDA)** // FVV-EM, CORNET/BMWE/IGF // 01-10-2024 – 31-03-2027	**Afanasie Vinogradov,** WinGD Ltd.
1539	**Lubrication Large Bore Engines III (LLBE3)** // BMWE/IGF, FVV-EM // 01-12-2024 – 31-07-2027	**Hans-Peter Böhm,** ELGAN Diamantwerkzeuge GmbH & Co. KG
1546	**NVH Optimization of BEV for EDU Excitations** // FVV-EM // 01-01-2025 – 31-12-2026	**Hans Johannesson,** Aurobay Sweden AB
1547	**MoNSy** // FVV-EM // 01-01-2025 – 31-12-2026	**Hans Johannesson,** Aurobay Sweden AB
1555	**ML/AI Support for NVH Engineering** // FVV-EM // 01-08-2025 – 31-07-2026	**Dr Michael Fischer,** Robert Bosch GmbH
1569	**Pass-by Noise Simulation II (SimVorbeifahrt II)** // BMWE/IGF // 01-11-2025 – 31-10-2027	**Dr Stefan Heuer,** TRATON R&D Germany GmbH
1576	**AI-Based Thermal Management (MATRICS)** // FVV-EM, CORNET/BMWE/IGF // 01-01-2026 – 31-12-2027	**Enrico Botter,** TOYOTA RACING GmbH

Completed projects

1494	**Condensate Formation in Exhaust Systems** // BMWE/IGF // 01-05-2023 – 31-08-2025	

Energy Conversion Systems // Engines

SUBSYSTEMS

Research priorities

Innovative and / or optimised energy conversion systems minimising environmental impact and maximising process efficiency and engine performance

→ **Engines**

Terms of References (ToR)

+ All conventional engine development topics
+ Optimisation and development of new energy conversion processes focusing on e. g. increasing process efficiency of future varieties of fuels (including use of hydrogen)
+ Reducing the environmental impact
+ Process-focused adaptation of related components and (sub-) assemblies
+ Effects of increasing electrification to the ›engine‹ subsystem and its aggregates
+ Digitalisation
+ Development and improvement of related development / engineering tools based on changing and adopting application / subsystem requirements

Research projects

COORDINATING **Dr Christian Weiskirch, TRATON R&D Germany**
PROJECT MANAGEMENT **Ralf Thee, FVV**

NO.	TITLE // FUNDING ORGANISATION // DURATION	PROJECT COORDINATOR
	Planned projects	
M2124	**AH_2CM Advanced Hydrogen Combustion Modeling** // FVV-EM, CORNET/BMWE/IGF	**Lorenz von Römer,** IAV GmbH
M2324	**Methanol Direct Injection in CI Engines (MALIBU)** // FVV-EM, CORNET/BMWE/IGF	**Dr Vladyslav Sazonov,** Woodward L'Orange GmbH
M2424	**MeOH Diesel – Stratified Injection**	**Prof Dr Thomas Garbe,** Volkswagen AG
M2524	**MeOH Diesel – Mono Fuel MeOH CI**	**Prof Dr Thomas Garbe,** Volkswagen AG
M2624	**MeOH Diesel – Non Fossil Fuel Blends and Additives**	**Prof Dr Thomas Garbe,** Volkswagen AG
M2724	**MeOH Diesel – Auxiliary Ignition with Glow/Spark Plug**	**Prof Dr Thomas Garbe,** Volkswagen AG

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Energy Conversion Systems // Engines

NO.	TITLE // FUNDING ORGANISATION // DURATION	PROJECT COORDINATOR
M0825	**Modelling of Pilot Injection (MPI)** // FVV-EM, CORNET/BMWE/IGF, FVV-EM // 01-07-2026 – 30-06-2028	**Eric Lauer,** Everllence SE
M0925	**Pre-Chamber Ignition: Optical and Numerical Exploration (PIONEER)** // CORNET/BMWE/IGF, FVV-EM	**Dr Marcus Becher,** Everllence SE
M1325	**Future Fuels in HD-PC Application (EKIM II)** // CORNET/BMWE/IGF	**Dr Jonas Villforth,** Dr. Ing. h.c. F. Porsche AG
M1825	**Multiple Spark Strategies for Alternative Fuels (MULTISPARK)** // BMWE/IGF	**Dr Christian Jörg,** Astemo Europe GmbH
M3225	**ITE50+ Ultra-lean Stratified Combustion)** // FVV-EM // 01-07-2026 – 30-06-2028	**Dr Jonas Villforth,** Dr. Ing. h.c. F. Porsche AG
M3925	**EGR for NOX and Backfire Mitigation (EGRONOMI)** // FVV-EM, CORNET/BMWE/IGF	**Dr Andreas Boemer,** DEUTZ AG
M4125	**Fundamentals of Ammonia Combustion**	**Christian Kunkel,** Everllence SE
M0726	**Emission Optimization for M-100 Cold Start**	**Prof Dr Thomas Garbe,** Volkswagen AG
M0826	**Improving Efficiency via Fuel & CCV Control**	**Dr Jonas Villforth,** Dr. Ing. h.c. F. Porsche AG
M1526	**Methodology for Premixed Gas Combustion**	**Dr Jonas Wärnberg,** Volvo Technology AB

Ongoing projects

1491	**H_2-DeNOX-Model** // FVV-EM, BMWE/IGF // 01-07-2023 – 31-05-2026	**Dr Jelto Frerichs,** IAV GmbH
1495	**PCTM: Potential SI Pre-Chamber Thermal Management** // CORNET/BMWE/IGF, FVV-EM // 01-05-2023 – 31-10-2026	**Paul-Benjamin Reinicke,** IAV GmbH
1501	**Test Method Fuel Quality** // FVV-EM // 01-08-2023 – 31-08-2026	**Ingo Helms,** Volkswagen AG
1502	**Investigation of Wall Heat Transfer in H_2 Engines** // FVV-EM // 01-01-2024 – 31-12-2026	**Claus Wundling,** Bosch Engineering GmbH
1522	**Influence of Methanol Fuels on Tribology** // BMWE/IGF // 01-04-2024 – 31-01-2027	**Prof Dr Thomas Garbe,** Volkswagen AG
1540	**Pre-Chamber Combustion System with Alternative Fuels (SACI II)** // FVV-EM, CORNET/BMWE/IGF // 01-12-2024 – 31-08-2028	**Dr Jonas Villforth,** Dr. Ing. h.c. F. Porsche AG
1541	**H_2-PFIDI** // FVV-EM, CORNET/BMWE/IGF // 01-12-2024 – 30-11-2026	**Dr David Lejsek,** Robert Bosch GmbH
1542	**H_2-HPDI-Jet** // FVV-EM, CORNET/BMWE/IGF // 01-12-2024 – 30-06-2027	**Lukas Moslener,** IAV GmbH
1553	**Advanced MeOH-CI** // FVV-EM // 01-07-2025 – 31-07-2026	**Prof Dr Thomas Garbe,** Volkswagen AG **Michael Rieß,** IAV GmbH

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Energy Conversion Systems // Engines

NO.	TITLE // FUNDING ORGANISATION // DURATION	PROJECT COORDINATOR
1564	**Alcohol Fuels in Marine Combustion Engines (AlcoFuels)** // CORNET/BMWE/IGF // 01-07-2025 – 31-12-2027	**Dr Johann Wloka,** Everllence SE
1574	**Oil Flow Measurement H_2-ICE (HyLiner)** // CORNET/BMWE/IGF // 01-01-2026 – 31-12-2027	**Dr Marcus Gohl,** APL Automobil-Prüftechnik Landau GmbH **Koji Tokunari,** NPR-RIKEN CORPORATION
1578	**PC Ignition and Combustion Characterization** // FVV-EM, DFG // 01-04-2026 – 31-03-2028	**Dr Jonas Villforth,** Dr. Ing. h.c. F. Porsche AG

Completed projects

1476	**Preferential Evaporation of Alternative Fuel Mixtures** // BMWE/IGF // 01-05-2022 – 30-04-2025	**Dr Jonas Villforth,** Dr. Ing. h.c. F. Porsche AG
1478	**EKIM Engine Knock Model for Future Fuels** // CORNET/BMWE/IGF, FVV-EM // 01-05-2022 – 31-05-2025	**Dr Jonas Villforth,** Dr. Ing. h.c. F. Porsche AG
1481	**CO2 Reduction by Shorter Burn Duration** // FVV-EM // 01-10-2022 – 30-06-2025	**Dr Sascha Schönfeld,** FEV Europe GmbH
1492	**Cold Start Optimisation for M-100 Methanol Engine** // BMWE/IGF, FVV-EM // 01-04-2023 – 31-12-2025	**Prof Dr Thomas Garbe,** Volkswagen AG
1493	**Power Density Increase of Hydrogen CI Engines** // BMWE/IGF // 01-05-2023 – 31-07-2025	**Dr Christian Schnapp,** WinGD Ltd.
1515	**Methanol Compatibility** // FVV-EM, FVV-EM // 01-02-2024 – 31-05-2025	**Dr Johann Wloka,** Everllence SE
1525	**Wall Heat Transfer in H_2 Engines (WHTforH$_2$)** // FVV-EM, CORNET/BMWE/IGF // 01-06-2024 – 31-05-2026	**Enrico Botter,** TOYOTA RACING GmbH

Energy Conversion Systems // Electric Motors

SUBSYSTEMS

Research priorities

Innovative and / or optimised energy conversion systems minimising environmental impact and maximising process efficiency and engine performance

→ **Electric Motors** [in cooperation with E-MOTIVE/FVA]

Terms of References (ToR)

+ Improvement of electrical motor properties in mobile applications
+ Electrical energy storage systems (battery)
+ Power electronics of the electrical motor and electrical energy storage system
+ Application-focused adaptation of related components and (sub-) assemblies
+ Development and improvement of related development tools e. g. simulation tools, measurement and testing methods

Research projects

COORDINATING **Dirk Weberskirch, TRATON R&D Germany**
PROJECT MANAGEMENT **Jana Müller, FVV**

NO.	TITLE // FUNDING ORGANISATION // DURATION	PROJECT COORDINATOR
	Planned projects	
M2024	**BEV Cell Degradation in Parallel Configurations (BEVCeDeg)** // CORNET/BMWE/IGF, FVV-EM	**Dr Alexander Fandakov,** IAV GmbH
M3224	**Conductivity Testing of Battery Coolants (CoolBat)** // BMWE/IGF // 01-06-2026 – 31-05-2028	**Dr Michael Harenbrock,** MANN+HUMMEL GmbH
M0426	**Leakage Field Measurement based E-Machine Control**	**Nico Remus,** IAV GmbH
M0926	**Bearing-Aware Control of Electric Machines** // FVV-EM	**Dr Christian Jörg,** Astemo Europe GmbH

Energy Conversion Systems // Fuel Cells

SUBSYSTEMS

Research priorities

Innovative and / or optimised energy conversion systems minimising environmental impact and maximising process efficiency and engine performance

→ **Fuel Cells** [interface to E-MOTIVE platform]

Terms of References (ToR)

+ All conventional fuel cells development topics
+ Air and hydrogen system path, media conditioning and purification
+ Thermal management of the fuel cell stack
+ Optimisation of fuel cell specific components and (sub-) assemblies e. g. ion exchanger, compressors, ...
+ Research on materials at fuel cell specific conditions and effects, e. g. on bipolar plates, membranes, sealings concerning stack performance, loading characteristics, ageing (durability, degradation), humidification, ...
+ Stack performance / efficiency improvements e. g. performance effects of component and assembly tolerances
+ Safety requirements and definitions
+ Development of defined evaluation methods towards industry standards (generic, ›best practice‹)
+ Technology comparison PEM, High-temperature PEM, SOFC
+ Development and improvement of fuel cell specific development tools e. g. simulation tools, measurement methods (e. g. impedance analysis)

Research projects

COORDINATING **N.N.**
PROJECT MANAGEMENT **Jana Müller, FVV**

NO.	TITLE // FUNDING ORGANISATION // DURATION	PROJECT COORDINATOR
	Planned projects	
M3323	**Degradation Effects and ASTs for LT-PEM (CAUSAL)** // BMWE/IGF // 01-06-2026 – 31-05-2028	**Monika Derflinger,** Ford-Werke GmbH **Janis Kelsch,** IAV GmbH
M3623	**PEM-EL-DegrAST**	**Stefan Neugebauer,** IAV GmbH
M0725	**Electrolysis Technology Comparison** // FVV-EM // 01-07-2026 – 28-02-2027	**Dr Michael Becker,** Pierburg GmbH, Rheinmetall AG

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Energy Conversion Systems // Fuel Cells

NO.	TITLE // FUNDING ORGANISATION // DURATION	PROJECT COORDINATOR
M2825	**Model-based Assessment of Porous PE-xC Structures (MAPPS)**	**Christian Altenhofen,** Gamma Technologies GmbH
M2925	**Fuel Cell System & Components Interactio**	**Dr Markus Auer,** MAHLE International GmbH
M3025	**H_2 Fuel Cells with Bio-based Membrane Materials**	**Artur Pöppel,** Honda R&D Europe (Deutschland) GmbH
M3325	**Scenarios for Fuel Cell Applications**	**Dr Jochen Hammer,** Purem by Eberspächer GmbH
M3725	**EIS-DRT Analysis for Diagnosis of PEMFC Stacks (EIS-DRT-DynamicFC)**	**Tassilo Pflanz,** MAN Truck & Bus SE
M3825	**Evaluation Methods for Reference FC Environment**	**Monika Derflinger,** Ford-Werke GmbH
M4025	**Model-based Operational Optimization of FC-systems**	**Dr Sören Tinz,** FEV Europe GmbH
M1326	**Influence FC Parameter on Key System Performance**	**Monika Derflinger,** Ford-Werke GmbH

Ongoing projects

1524	**PEMPAR** // BMWE/IGF // 01-05-2024 – 30-04-2027	**Ralf Rauschen,** FEV Europe GmbH
1532	**Reference System with Generic FC Stack** // FVV-EM // 01-01-2025 – 31-12-2026	**Dirk Weberskirch,** TRATON R&D Germany GmbH
1556	**Chemical stability of FC MEAs** // FVV-EM // 01-08-2025 – 31-07-2027	**Dr Michael Harenbrock,** MANN+HUMMEL GmbH
1595	**Fuel Cell Model Tool** // FVV-EM // 01-09-2026 – 31-08-2028	**Remy Fontaine,** Opel Automobile GmbH

Completed projects

1455	**CFD Simulation of Droplet Separators** // FVV-EM // 01-06-2022 – 31-05-2025	**Dr Michael Harenbrock,** MANN+HUMMEL GmbH
1471	**Cooling Fuel Cells II** // BMWE/IGF // 01-04-2022 – 30-06-2025	**Dr. Markus Kaiser,** nexiss GmbH
1477	**Lifetime Simulation of Ion Exchange Filters** // BMWE/IGF // 01-06-2022 – 31-05-2025	**Dr Michael Harenbrock,** MANN+HUMMEL GmbH
1511	**Impedance Analysis for Fuel Cells** // FVV-EM // 01-01-2024 – 30-06-2025	**Tassilo Pflanz,** MAN Truck & Bus SE **Dr Volker Formanski,** BMW Group

Energy Conversion Systems // Turbo Machines

SUBSYSTEMS

Research priorities

Innovative and / or optimised energy conversion systems minimising environmental impact and maximising process efficiency and engine performance

→ **Turbo Machines**

Terms of References (ToR)

+ All conventional turbomachinery development topics
+ Optimisation of aerodynamics
+ Optimisation of turbomachinery specific components and (sub-) assemblies
+ Research on materials of turbomachinery specific conditions and effects; e. g. high-temperature, loading characteristics, ageing, resonances, use of hydrogen
+ Development and improvement of turbomachinery specific development tools

Research projects

COORDINATING **Heinz Knittel, MTU Aero Engines**
PROJECT MANAGEMENT **Dirk Bösel, FVV**

NO.	TITLE // FUNDING ORGANISATION // DURATION	PROJECT COORDINATOR
	Planned projects	
T0421	**Time Dependent Crack Closure** // DFG, FVV-EM	**Henning Almstedt,** Siemens Energy Global GmbH & Co. KG
T0722	**Blade Forces and System Damping II (NextGenTurbo)** // FVV-EM, BMWE/PtJ // 01-06-2026 – 31-05-2029	**Dr Thomas Hildebrandt,** CFDYNAMIX
T1022	**BiDiKo 3** // BMWE/PtJ, FVV-EM // 01-07-2026 – 31-05-2029	**Dr Andreas Hartung,** MTU Aero Engines AG
T1223	**Laser Measurement in High Temperature Flows** // FVV-EM, BMWE/PtJ	**Dr Andreas Zeisberger,** MTU Aero Engines AG
T1523	**Constraint Model for Engineering Applications (ConMAp)** // BMWE/IGF	**Dr Christian Amann,** Siemens Energy Global GmbH & Co. KG
T0224	**Centrifugal Compressor LES (RADLES)** // BMWE/IGF	**Dr Thomas Hildebrandt,** CFDYNAMIX
T0524	**Hot Gas Ingestion into Wheel Cavities II (HeRaFlex)** // BMWE/PtJ, FVV-EM	**Dr Stephan Stotz,** MTU Aero Engines AG

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Energy Conversion Systems // Turbo Machines

NO.	TITLE // FUNDING ORGANISATION // DURATION	PROJECT COORDINATOR
T0125	**GetMatData** // BMWE/IGF	**Dr Yevgen Kostenko,** Siemens Energy Global GmbH & Co. KG
T0225	**Industrial Centrifugal Compressors: Test Case I (IRV-OpenTC)**	**Dr Matthias Schleer,** Howden Turbo GmbH
T0325	**Centrifugal Compressor: Holistic Stator Optimization** // FVV-EM, BMWE/PtJ	**Thomas Ceyrowsky,** Everllence SE
T0625	**Fill Factor Influence II**	**Dr Christoph Weißbacher,** Gleitlagertechnik Weißbacher GmbH
T0725	**OOI for Thermoacoustic Systems**	**Dr Claus Lahiri,** Rolls-Royce Deutschland Ltd & Co KG
T0825	**MikroPost**	**Dr Dirk Kulawinski,** Siemens Energy AG
T1025	**LES for a Low-pressure Turbine Stage (LESINA)** // BMWE/IGF	**Dr Thomas Hildebrandt,** CFDYNAMIX
T1125	**Turbulent Prandtl Number in Cooling Flows (COOLPRANDTL)** // BMWE/IGF	**Dr Georg Scheuerer,** ISimQ GmbH
T0126	**Anisothermal Probabilistic Lifetime Assessment**	**Dr Christian Amann,** Siemens Energy Global GmbH & Co. KG

Ongoing Projects

1439	**Fuel Cell Compressor Design** // BMWE/IGF, FVV-EM // 01-03-2021 – 31-08-2025	**Dr Thomas Hildebrandt,** CFDYNAMIX
1447	**Flexible HP-Turbines** // DFG, FVV-EM // 15-06-2021 – 30-11-2024	**Christoph Lyko,** Rolls-Royce Deutschland Ltd & Co KG
1458	**Creep-fatigue Crack Behavior of Welded Joints II** // AVIF // 01-01-2022 – 31-12-2025	**Dr Shilun Sheng,** Siemens Energy Global GmbH & Co. KG
1467	**Hot Gas Ingestion into Wheel Cavities** // BMWE/IGF // 01-01-2022 – 31-10-2025	**Dr Stephan Stotz,** MTU Aero Engines AG
1496	**Casing Treatment Centrifugal Compressor** // FVV-EM, BMWE/PtJ // 01-07-2023 – 30-06-2027	**Dr Matthias Schleer,** Howden Turbo GmbH
1498	**Dynamic of Jet Flames under Elevated Pressure (DIVA)** // FVV-EM, BMWE/PtJ // 01-01-2023 – 31-12-2026	**Dr Lukasz Panek,** Siemens Energy Global GmbH & Co. KG
1505	**Crack Behaviour Multiaxial HAT (ARIMA II)** // BMWE/IGF // 01-08-2023 – 31-01-2027	**Julian von Lautz,** MTU Aero Engines AG
1506	**Open Test Case Turbine Cooling** // BMWE/PtJ, FVV-EM // 01-08-2023 – 30-04-2026	**Dr Georg Scheuerer,** ISimQ GmbH
1508	**Suction Sided Noise Emission of Radial Compressors** // BMWE/IGF // 01-10-2023 – 31-03-2026	**Vera van Dinther,** Everllence SE **Nicolai Ehlenbeck,** Everllence SE
1512	**Robust Fracture Deformation Characteristics II** // AVIF // 01-01-2024 – 31-12-2026	**Dr Torsten-Ulf Kern,** Siemens Energy Global GmbH & Co. KG

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Energy Conversion Systems // Turbo Machines

NO.	TITLE // FUNDING ORGANISATION // DURATION	PROJECT COORDINATOR
1518	**Integrated Creep-fatigue Assessment** // BMWE/IGF // 01-03-2024 – 31-08-2027	**Dr Martin Reigl,** GE Vernova
1519	**Influence of Water Vapour on TBC** // FVV-EM, DFG // 15-05-2024 – 14-05-2027	**Dr Susanne Schrüfer,** Rolls-Royce Deutschland Ltd & Co KG
1520	**HT-Threshold Calculation Methods II** // BMWE/IGF // 01-04-2024 – 30-09-2026	**Julian von Lautz,** MTU Aero Engines AG
1521	**Simulation-Crack Behaviour Coarse Grain II** // BMWE/IGF // 01-04-2024 – 30-09-2027	**Markus Fried,** MTU Aero Engines AG
1529	**Flexible HP Turbines II (Project completion)** // FVV-EM // 01-12-2024 – 31-12-2026	**Christoph Lyko,** Rolls-Royce Deutschland Ltd & Co KG
1534	**Efficient H_2-HT-Test** // FVV-EM, BMWE/IGF // 01-09-2024 – 31-08-2027	**Dominique Kießlich,** Rolls-Royce Deutschland Ltd & Co KG
1536	**Effect of H_2 Combustion on Capability of TBCs** // FVV-EM, BMWE/PtJ // 01-08-2024 – 31-07-2027	**Dr Arturo Flores Renteria,** Siemens Energy Global GmbH & Co. KG
1543	**LPBF Notch Embrittlement Creep Fatigue** // BMWE/IGF // 01-01-2025 – 31-12-2027	**Dr Jochen Tenkamp,** Everllence SE
1548	**ComDynA: Sensitivities and Probabilistic** // FVV-EM, BMWE/PtJ // 01-07-2024 – 30-06-2027	**Dr Lukas Bruder,** MTU Aero Engines AG
1549	**TMCF Cracking Behaviour of Component-like Samples** // AVIF // 01-07-2024 – 30-06-2027	**Dr Shilun Sheng,** Siemens Energy Global GmbH & Co. KG
1550	**Artificial Intelligence based Contact Identification and Mistuning Analysis (AICIM)** // BMWE/PtJ, FVV-EM // 01-08-2025 – 31-10-2027	**Dr Andreas Hartung,** MTU Aero Engines AG
1554	**Hydrogen Flame Flashback (flasHH)** // BMWE/PtJ, FVV-EM // 01-08-2025 – 31-07-2028	**Dr Lukasz Panek,** Siemens Energy Global GmbH & Co. KG
1557	**LPBF Thin Walledness** // BMWE/IGF // 01-07-2025 – 30-06-2028	**Dr Christoph Haberland,** Siemens Energy Global GmbH & Co. KG
1560	**Fitness of 2618A for H_2 Energy Conversion Systems (AluFit-H_2)** // BMWE/IGF // 01-07-2025 – 31-12-2027	**Santiago Uhlenbrock,** Everllence SE
1561	**Intentional Mistuning II (IM II)** // BMWE/IGF // 01-07-2025 – 31-12-2027	**Thomas Winter,** Everllence SE
1562	**TMF Crack Path Calculation II (TMF-CrackPath-II)** // BMWE/IGF // 01-07-2025 – 30-06-2028	**Dr Andreas Koch,** Rolls-Royce Solutions GmbH
1566	**Damage Mechanisms of Brazed High-temperature Alloys** // FVV-EM, DFG // 01-01-2026 – 31-12-2028	**Oliver Munz,** MTU Aero Engines AG
1570	**Centrifugal Compressor: Reynolds and Gap Variation (RSV)** // BMWE/IGF // 01-12-2025 – 31-05-2028	**Dr Matthias Schleer,** Howden Turbo GmbH
1579	**Cyclic Relaxation (ZyRV)** // BMWE/IGF // 01-04-2026 – 31-03-2029	**Dr Martin Reigl,** GE Vernova

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Energy Conversion Systems // Turbo Machines

NO.	TITLE // FUNDING ORGANISATION // DURATION	PROJECT COORDINATOR
1581	**Development of AI Methods for HCF Analysis (KIAS)** // BMWE/IGF // 01-05-2026 – 30-04-2029	**Sebastian Spengler,** Everllence SE
1582	**Accelerated Creep Modelling** // AVIF // 01-01-2026 – 31-12-2028	**Dr Torsten-Ulf Kern,** Siemens Energy Global GmbH & Co. KG
1583	**PrEdictive frictioN Damping by topOgraphy Resolving Simulation and texturE design (ENDORSE)** // BMWE/PtJ, FVV-EM // 01-07-2026 – 31-05-2029	**Dr Andreas Hartung,** MTU Aero Engines AG

Abgeschlossene Projekte

1458	**Creep-fatigue Crack Behavior of Welded Joints II** // AVIF // 01-01-2022 – 31-12-2025	**Dr Shilun Sheng,** Siemens Energy Global GmbH & Co. KG
1462	**Optimization with Frequency Domain Based Methods** // BMWE/PtJ, FVV-EM // 01-04-2022 – 30-09-2025	**Dr Stephan Behre,** MTU Aero Engines AG
1465	**Cooling Flow Measurements Using MRI** // BMWE/IGF // 01-07-2022 – 31-05-2025	**Dr Robert Krewinkel,** Everllence SE
1467	**Hot Gas Ingestion into Wheel Cavities** // BMWE/IGF // 01-01-2022 – 31-10-2025	**Dr Stephan Stotz,** MTU Aero Engines AG
1485	**Inverse Dynamic Analysis** // FVV-EM, DFG // 01-01-2023 – 30-06-2025	**Dr Andreas Hartung,** MTU Aero Engines AG
1504	**Prediction of Gas Turbine Emissions II** // DFG, FVV-EM // 01-08-2023 – 31-07-2025	**Dr Ruud L.G.M. Eggels,** Rolls-Royce Deutschland Ltd & Co KG

Energy Conversion Systems // Turbo Machines // Plain Bearings

SUBSYSTEMS

Research priorities

Innovative and / or optimised energy conversion systems minimising environmental impact and maximising process efficiency and engine performance

→ **Turbo Machines // Plain Bearings** [in cooperation with FVA]

NO.	TITLE // FUNDING ORGANISATION // DURATION	PROJECT COORDINATOR
	Planned projects	
T0525	**Tilting Pad Bearing Elastokinetics II (ElKisegMo)** // BMWE/IGF	**Dr Tobias Wiedemann,** Everllence SE
	Ongoing projects	
1510	**Improved Axial Plain Bearing Modelling** // FVA-EM, DFG, FVV-EM, FVV-EM // 01-01-2024 – 31-12-2026	**Michael Bottenschein,** Voith Hydro Holding GmbH & Co. KG
1538	**Air Bearings in Charging Systems (LuLaSys)** // BMWE/IGF // 01-12-2024 – 31-05-2027	**Dr Oliver Alber,** Everllence SE
1592	**Monitoring Methods for Plain Bearings – Enabling** // FVV-EM // 01-06-2026 – 30-11-2026	**Dr. Ion Palamarciuc,** Daido Industrial Bearings Europe Ltd.
4444	**Roadmap AK Plain Bearings**	**Dr Petra Wiersch,** Flender GmbH **Klaus Steff,** Siemens Energy Global GmbH & Co. KG
	Completed projects	
1469	**Tilting Pad Bearing Elastokinetics** // BMWE/IGF // 01-07-2022 – 30-06-2025	**Dr Tobias Wiedemann,** Everllence SE

Energy Conversion Systems // Zero-impact Emissions

SUBSYSTEMS

Research priorities

Innovative and / or optimised energy conversion systems minimising environmental impact and maximising process efficiency and engine performance

→ **Zero-impact Emissions**

Terms of References (ToR)

+ Exhaust aftertreatment concepts, systems and components
+ Alternative aftertreatment system technologies and approaches
+ Effects of the use of alternative fuels and operating liquids
+ Interactions of exhaust components, primary and secondary exhaust species
+ Non-exhaust emission evaluation of all mobile applications (incl. electrified), e. g. brake dust, tyre abrasion, ...
+ Interaction emission and immission / air quality
+ Carbon capture approaches and technologies
+ Development and improvement of related development tools, e. g. simulation tools, measurement and evaluation methods

Research projects

COORDINATING **Dr. Frank Bunar, IAV**
PROJECT MANAGEMENT **Max Decker, FVV**

NO.	TITLE // FUNDING ORGANISATION // DURATION	PROJECT COORDINATOR
	Planned projects	
M2123	**Modelling of Vehicle Induced Emissions (MoVIE)** // BMWE/IGF	**Dr Frank Bunar,** IAV GmbH
M0724	**Memory Effect of Lambda Switching (TWC Lambda-Memory)** // CORNET/BMWE/IGF	**Mats Laurell,** Aurobay Sweden AB
M3024	**PtX-Ex-Condensates – Exhaust gas condensation from PtX fuels** // BMWE/IGF	**Dr Andreas Jäger,** IAVF Antriebstechnik GmbH
M0325	**Validated CO_2 Capture Models (VALCO$_2$)** // FVV-EM // 01-09-2026 – 31-08-2028	**Dr Panagiotis Grigoriadis,** IAV GmbH
M2525	**Exhaust Analytics for Low GHG Impact Fuels II (EXHALE)** // FVV-EM // 01-07-2026 – 30-06-2027	**Klaus Rusch,** Rolls-Royce Solutions GmbH

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Energy Conversion Systems // Zero-impact Emissions

NO.	TITLE // FUNDING ORGANISATION // DURATION	PROJECT COORDINATOR
M3125	**Pre-turbo Oxidation (PreTurbo)** // BMWE/IGF	**Klaus Rusch,** Rolls-Royce Solutions GmbH
M1426	**Experimentally Validated Models for Mobile CCS (EVM-MCCS)** // CORNET/BMWE/IGF	**Dr Panagiotis Grigoriadis,** IAV GmbH

Ongoing projects

1475	**H_2-DeNO$_x$ II** // BMWE/IGF // 01-02-2022 – 31-03-2026	**Dr Frank Bunar,** IAV GmbH
1523	**Requirements Measurement of On-road Brake Emission** // FVV-EM // 01-07-2024 – 31-12-2026	**Dr Eike Stitterich,** Hengst SE
1531	**N_2O Exhaust Gas Treatment in Ammonia Engines II** // FVV-EM // 01-07-2024 – 30-06-2026	**Dr Daniel Peitz,** Hug Engineering AG
1535	**TWC Deterioration** // BMWE/IGF // 01-09-2024 – 30-11-2027	**Ryo Nagai,** SUBARU Corporation
1545	**Formation of Particles with UWS Injection II** // FVV-EM // 01-01-2025 – 31-12-2026	**Manuel Werner,** Purem GmbH
1558	**Clarification and Modeling (sDPF)** // BMWE/IGF // 01-07-2025 – 31-12-2027	**Dr Marcus Gohl,** APL Automobil-Prüftechnik Landau GmbH
1563	**Oxygen Storage II - Aging** // FVV-EM, BMWE/IGF // 01-07-2025 – 30-06-2027	**Jeremias Bickel,** Robert Bosch GmbH
1567	**Ash Structure under Influence of Condensation Water (AEK)** // BMWE/IGF // 01-11-2025 – 31-01-2028	**Dr Michael Fischer,** 40 Yo ICE – 40 Years on ICE
1568	**SCR Aging** // BMWE/IGF, FVV-EM // 01-11-2025 – 30-04-2028	**Dr Frank Bunar,** IAV GmbH
1571	**Greenhouse Gas Effect of a H_2-based Economy (SAGEHYBE)** // FVV-EM // 01-01-2026 – 31-12-2026	**Dr Markus Glöckle,** Robert Bosch GmbH **Dr Frank Bunar,** IAV GmbH **Dr Dieter Rothe,** TRATON R&D Germany GmbH
1572	**FaconSCR Model II** // BMWE/IGF // 01-12-2025 – 31-05-2028	**Dr David Beichel,** CERAM Austria GmbH
1573	**HT-H_2-DeNO$_x$ II** // BMWE/IGF // 01-12-2025 – 31-05-2028	**Dr Frank Bunar,** IAV GmbH
1575	**Minimizing PGM in TWC** // FVV-EM // 1-04-2026 – 31-03-2028	**Hiroyuki Minokoshi,** SUBARU Corporation
1577	**EEfficient Aftertreatment for Methanol Engines (ENAM)** // BMWE/IGF // 01-02-2026 – 31-07-2028	**Prof. Dr Thomas Garbe,** Volkswagen AG
1580	**Cold Start HC and CO Simulations for (Low) GHG Engine (CoCO-HC-lowGHG)** // FVV-EM, BMWE/IGF // 01-04-2026 – 31-03-2028	**Mats Laurell,** Aurobay Sweden AB

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Energy Conversion Systems // Zero-impact Emissions

NO.	TITLE // FUNDING ORGANISATION // DURATION	PROJECT COORDINATOR
	Completed projects	
1499	**Modelling Approaches of Vehicle Induced PN/PM and Emission Reduction Strategies** // FVV-EM // 01-07-2023 – 30-06-2025	**Dr Frank Bunar,** IAV GmbH
1517	**Assessment of Vehicle Particle Emissions** // FVV-EM // 01-03-2024 – 30-04-2025	**Dr Volker Ricken,** Robert Bosch GmbH

Materials Science and Recycling

COMPONENTS

Research priorities

All conventional topics on materials research in connection with new energy sources, production methods and recycled materials

→ Strength → Tribology → Recycling

Terms of References (ToR)

+ Tribology, strength, fatigue models and improvements
+ Properties, strength and fatigue characteristics of materials for electric powertrains (e. g. copper)
+ Durability and robustness of electrically isolating materials (e. g. aspect of partial discharge, ...)
+ Impacts and interactions on components and (sub-) assemblies caused by novel energy types (e. g. hydrogen, e-fuels, methanol, ...)
+ Components made by additive manufacturing, their properties and related method approaches
+ Material properties impact of recycled materials
+ Energy footprint of components and assemblies depending on material and manufacturing process, circularity
+ Development and improvement of group related development tools e. g. simulation tools, measurement and evaluation methods

Research projects

COORDINATING **Dr Dieter Eppinger, SEG Automotive Germany**
PROJECT MANAGEMENT **Max Decker, FVV**

NO.	TITLE // FUNDING ORGANISATION // DURATION	PROJECT COORDINATOR
	Planned projects	
M3123	**HowToSurvivePD Lifetime Model Winding Insulation II (HowToSurvivePD)** // BMWE/IGF	**Dr Zeljana Beslic,** SEG Automotive Germany GmbH
M3423	**Lifetime Modelling for Hybrid Plastic Parts (Overmould-LT)** // BMWE/IGF	**Stephan Noack,** SEG Automotive Germany GmbH
M3124	**InWoWi – Investigation of Insulation Aging for Motor Windings** // BMWE/IGF	**Dr Dieter Eppinger,** SEG Automotive Germany GmbH

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Materials Science and Recycling

NO.	TITLE // FUNDING ORGANISATION // DURATION	PROJECT COORDINATOR
M1625	**FC Air Supply Coolant Based Lubrication**	**Dr Frank Schmitt,** BorgWarner Systems Engineering GmbH
M2425	**Component Dimensioning in Hydrogen Environment II (ComDimH_2)** // BMWE/IGF	**Dr Stefan Averbeck,** Everllence SE
M2725	**Recycling of Rare Earth Magnets for E-motors – Short Loop** // FVV-EM	**Dr Marcel Dürl,** SEG Automotive Germany GmbH
M3525	**Material Compatibility in EV Coolants**	**Dr Kilian Köbschall,** MTU Aero Engines AG
M3625	**Advanced Flow-induced Degradation Study**	**Dr Kilian Köbschall,** MTU Aero Engines AG
M0226	**Li ion Battery Recycling Technology Study**	**Dr Michael Harenbrock,** MANN+HUMMEL GmbH
M1626	**Recycling of Rare Earth Magnets for E-motors – Long Loop** // BMWE/IGF	**Dr Marcel Dürl,** SEG Automotive Germany GmbH

Ongoing projects

1530	**Basic Components for H_2 Combustion Engines** // FVV-EM // 01-09-2024 – 30-11-2026	**Dr Daniel Hrdina,** MAHLE International GmbH
1533	**Fatigue Design Concept of Welded Copper (FATWELDCO)** // BMWE/IGF // 01-09-2024 – 28-02-2027	**Micha Haußmann,** SEG Automotive Germany GmbH
1544	**H_2T-ICE Tribosystems** // BMWE/IGF // 01-01-2025 – 30-06-2027	**Dr Heiko Haase,** Rolls-Royce Solutions GmbH
1551	**H_2 Piston Bore Interface** // FVV-EM // 01-09-2025 – 31-01-2027	**Dr Mirko Plettenberg,** AVL List GmbH
1552	**Substitute Gas for Pure H_2** // FVV-EM // 01-07-2025 – 31-05-2026	**Martin Frey,** Robert Bosch GmbH
1559	**Corrosion Loads due to new Drive Concepts (KorrEA)** // BMWE/IGF // 01-07-2025 – 31-12-2027	**Regina Franke-Hörth,** SEG Automotive Germany GmbH
1565	**TMF-H_2 Cast Iron** // FVV-EM // 01-08-2025 – 30-06-2026	**Dr Andreas Koch,** Rolls-Royce Solutions GmbH

Completed projects

1487	**Additively Manufactured High-pressure Components** // BMWE/IGF // 01-12-2022 – 30-11-2025	**Stefan Zimmermann,** Woodward L'Orange GmbH

Research support

Sponsors

Innovative and sustainable research cooperations need a stable funding framework. Our projects are financed by contributions from member companies, co-operations and from public research funding. We would like to thank all our research partners for their fantastic support over many years:

DFG

German Research Foundation / Deutsche Forschungsgemeinschaft e.V.

www.dfg.de/en

AVIF

German Steel Application Research Foundation / Forschungsvereinigung der Arbeitsgemeinschaft der Eisen und Metall verarbeitenden Industrie e.V.

www.avif-forschung.de

CORNET

COllective Research NETworking

www.cornet.online

BMWE

Projects were/are supported by the Federal Ministry for Economic Affairs and Energy (BMWE) on the basis of a decision by the German Bundestag.

www.bundeswirtschaftsministerium.de

IGF

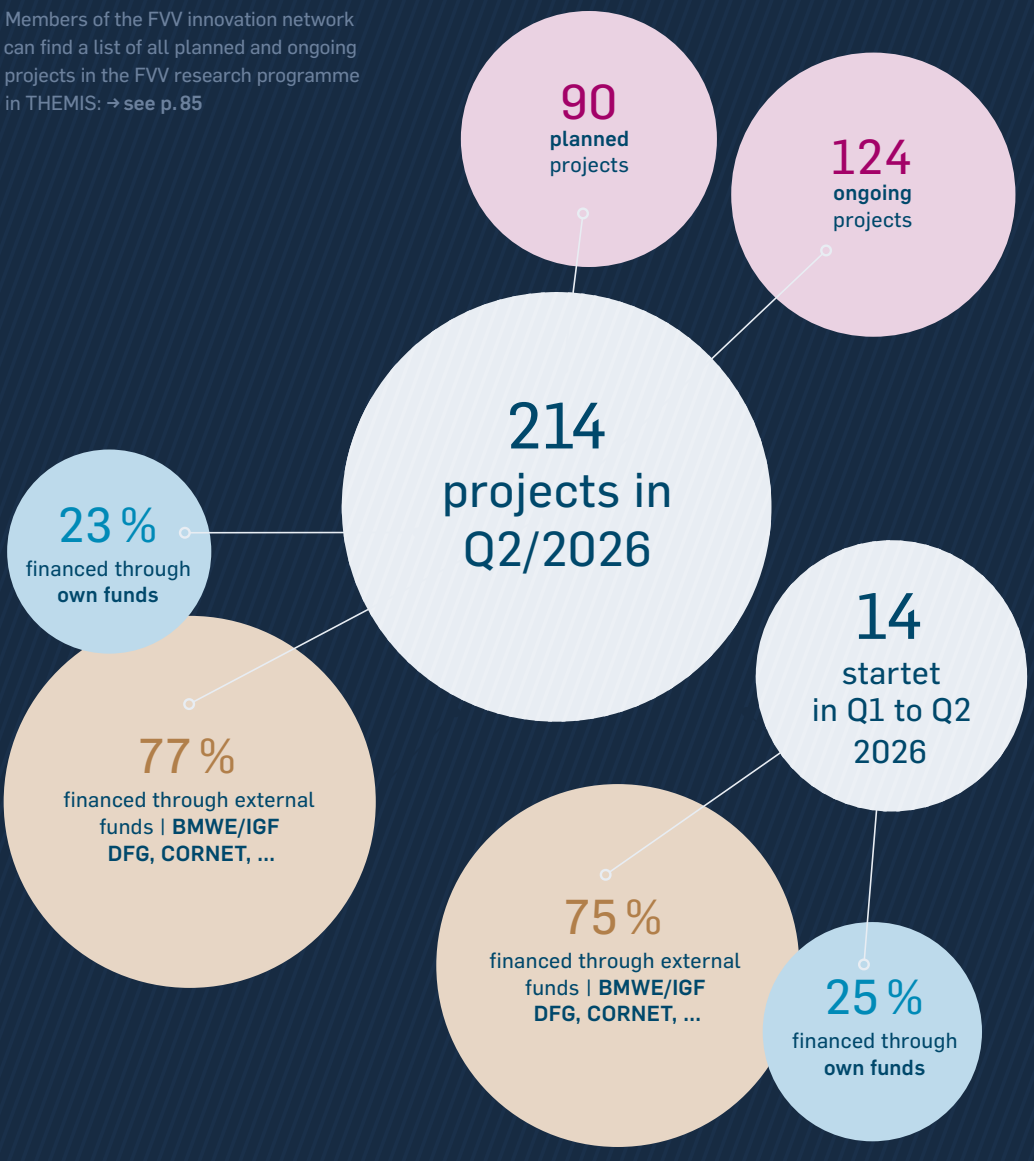
Industrial Collective Research (Industrielle Gemeinschaftsforschung IGF) is a successful Europe-wide, open-topic and pre-competitive funding programme of the Federal Ministry for Economic Affairs and Energy (BMWE) that provides small and medium-sized enterprises (SMEs) with easy access to practice-oriented research and the latest research results. In the IGF, companies or associations, research organisations and research & technology (RTD) performers determine the research needs and research topics of their industry collectively. The supervision of the research projects by the companies guarantees the practical relevance of the research work. The results of IGF projects are public and are available to all interested companies on equal terms. In this way, the IGF strengthens the competitiveness of SMEs in Germany and thus makes a significant contribution to Germany's innovation sovereignty.

www.igf-foerderung.de

Planned and ongoing projects

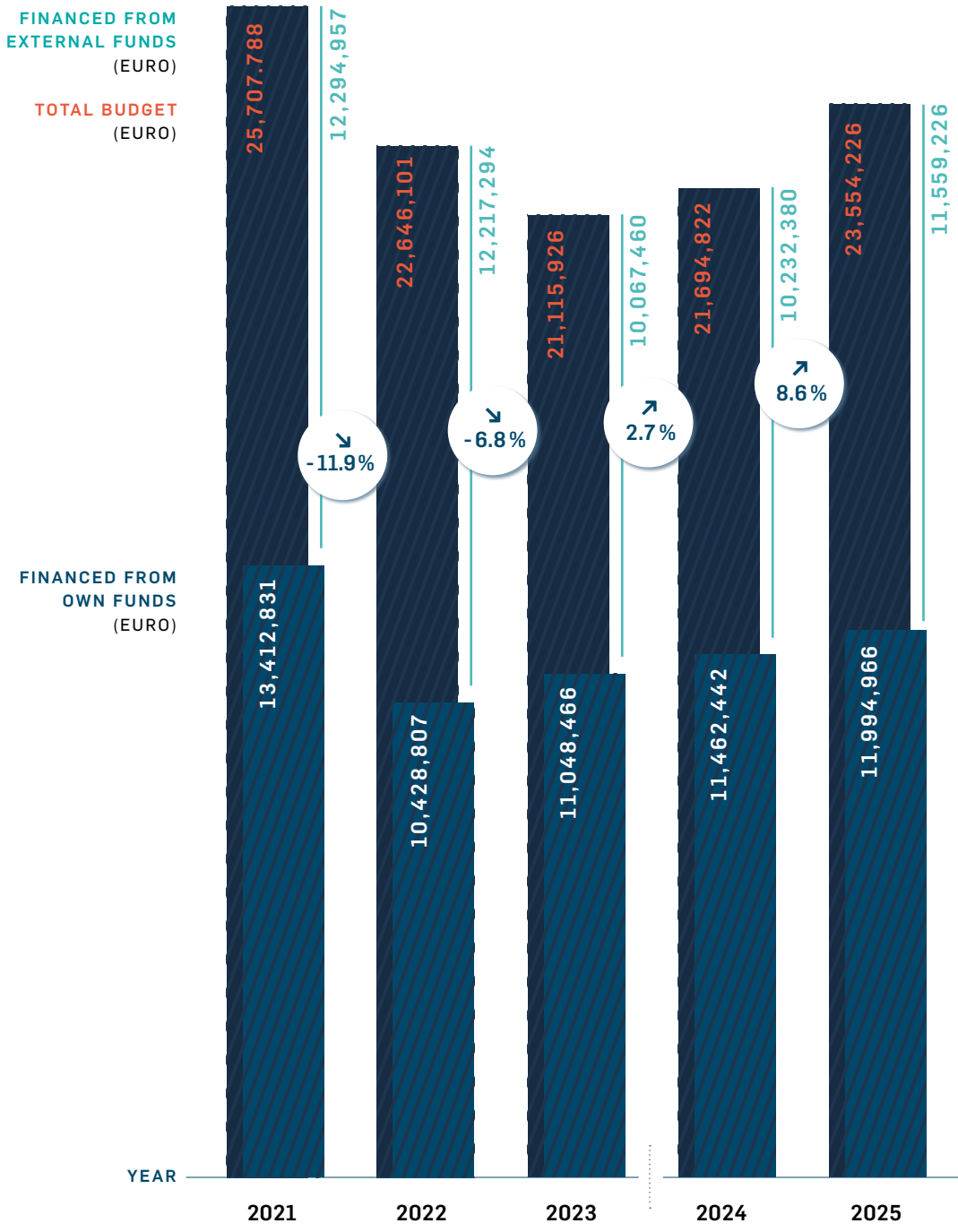
The pre-competitive project work of the FVV enables collaborative research to be performed on fundamental questions, thus allowing the ever stricter requirements regarding materials, energy efficiency and environmental friendliness to be met. In doing so, the FVV research programme also contributes to enhancing the competitiveness of its member companies.

Members of the FVV innovation network can find a list of all planned and ongoing projects in the FVV research programme in THEMIS: → **see p. 85**

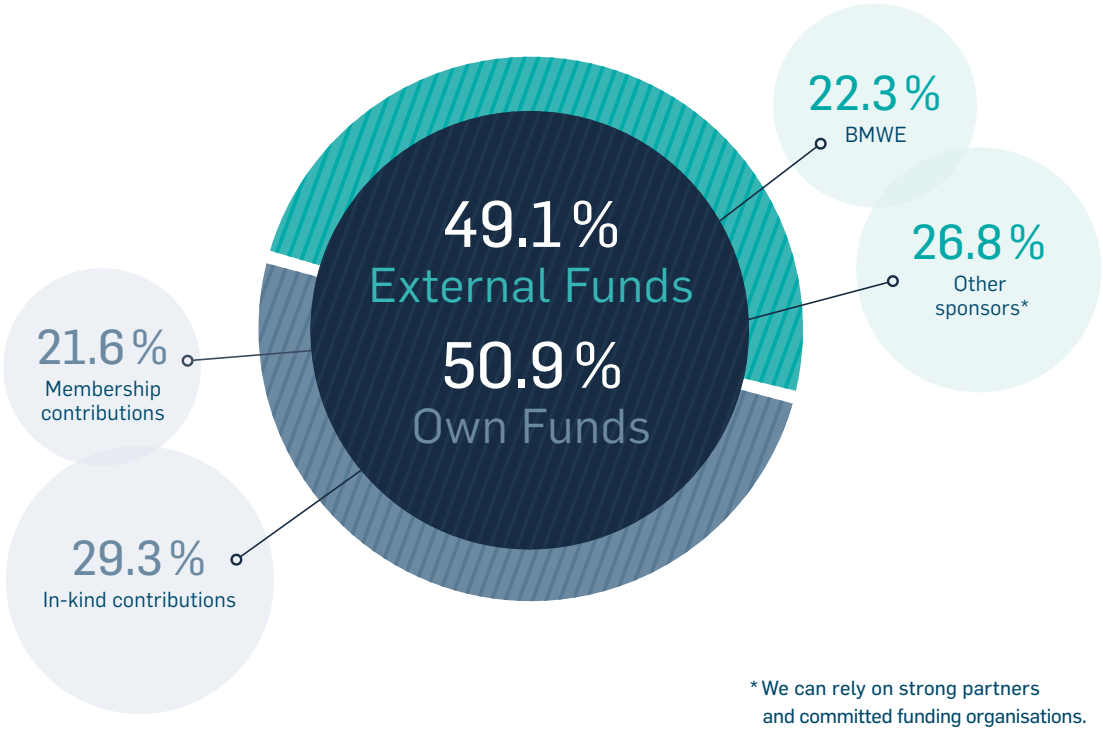


Research funding

Expenditure for research 2021–2025



Distribution of invested funds 2025



* We can rely on strong partners and committed funding organisations. For more information on our main sponsors, → see page 106

Year-Over-Year Analysis 2024 / 2025

	2024	2025	Change
MEMBERSHIP CONTRIBUTIONS	4,015,759	5,081,896	↗ +26.5%
IN-KIND CONTRIBUTIONS	7,446,683	6,913,070	↘ -7.2%
TOTAL OWN FUNDS	**11,462,442**	**11,994,966**	↗ +4.6%
BMWE	5,283,738	5,259,304	↘ −0.5%
OTHER SPONSORS	4,948,642	6,299,922	↗ +27.3%
TOTAL EXTERNAL FUNDS	**10,232,380**	**11,559,226**	↗ +13.0%

Research partners Energy conversion systems

Distribution of funds | External sponsors and FVV funds | (without Turbo Machines)

LOCATION	EUROS	PERCENT
Aachen	1,005,120	14.6 %
Stuttgart	955,289	13.9 %
Darmstadt	797,475	11.6 %
Karlsruhe	623,145	9.1 %
Braunschweig	544,846	7.9 %
Dresden	423,751	6.2 %
Hanover	305,044	4.4 %
Berlin	262,500	3.8 %
Freiberg	236,322	3.4 %
Hamburg	185,767	2.7 %
Bochum	108,955	1.6 %
Erlangen/Nuremberg	108,298	1.6 %
Esslingen	88,213	1.3 %
Weimar	82,370	1.2 %
Freiburg	68,310	1.0 %
Ostwestfalen-Lippe	57,845	0.8 %
Switzerland	293,587	4.3 %
Austria	258,101	3.6 %
Spain	243,923	3.4 %
Mexico	48,062	0.7 %
France	22,678	0.3 %
Others < 50,000 €	171,812	2.5 %
	6,872,492	

A detailed list of our research partners can be found at Page 66 to 83 and at ***→ www.fvv-net.de | Network | RTD Performers***


HAMBURG
BERLIN
HANOVER
BRAUN-
SCHWEIG
BMWE
OSTWESTFALEN-LIPPE
BOCHUM
WEIMAR
DRESDEN
AACHEN
RTD performers
that received funding
External and
own funds
FREIBERG
FRANKFURT
FVV
DARMSTADT
ERLANGEN-
NUREMBERG
ESSLINGEN
KARLSRUHE
STUTTGART
VIENNA
ORLÉANS
FREIBURG
GRAZ
DÜBENDORF
VILLIGEN
ZURICH
WINDISCH

Research partners Turbo Machines

Distribution of funds | External sponsors and FVV funds

LOCATION	EUROS	PERCENT
Darmstadt	759,838	38.9 %
Stuttgart	413,870	21.2 %
Aachen	410,556	21.0 %
Magdeburg	80,870	4.1 %
Berlin	74,028	3.8 %
Cottbus	64,026	3.3 %
München	44,978	2.3 %
Freiburg	27,498	1.4 %
Bremen	25,206	1.3 %
Dresden	13,714	0.7 %
Jülich	12,389	0.6 %
Clausthal	11,527	0.6 %
Bochum	8,962	0.6 %
Hannover	4,800	0.2 %
	1,952,253	

A detailed list of our research partners can be found at Page 66 to 83 and at ***→ www.fvv-net.de | Network | RTD Performers***


BREMEN
HANOVER
BERLIN
BMWE
MAGDEBURG
CLAUSTHAL
COTTBUS
BOCHUM
DRESDEN
JÜLICH
AACHEN
RTD performers
that received funding
External and
own funds
FRANKFURT
FVV
DARMSTADT
STUTTGART
FREIBURG
MUNICH

Annual statement of accounts

Balance sheet

	31.12.2024		31.12.2025	
ASSETS SIDE	EURO	EURO	EURO	EURO
A. Current assets				
I. Receivables and other assets				
01. Advance payments	821,093.81		692,716.92	
02. Other assets	36,090.60		71,992.36	
		857,184.41		764,709.28
II. Cash on hand and bank balances		6,902,999.41		7,220,50.08
B. Non-current assets				
I. Securities		1,091,398.03		927,669.11
		8,851,581.85		8,912,628.47
LIABILITIES SIDE	EURO	EURO	EURO	EURO
A. Amount carried forward for research activities				
01.a Own funds	6,876,440.50		6,975,507.57	
01.b Reserves of own funds	224,000.00		224,000.00	
02. External funds	-559,084.35		-1,263,02.38	
		6,541,356.15		5,936,205.19
B. Provisions				
01. Provisions for pensions and similar obligations	466,872.00		480,791.00	
02. Other provisions	161,568.24		0.00	
		628,440.24		480,791.00
C. Liabilities				
01. Liabilities to research institutes	1,637,114.61		2,455,680.80	
02. Other liabilities	44,670.85		39,951.48	
		1,681,785.46		2,495,632.28
		8,851,581.85		8,912,628.47

Audit

The auditing firm GGV GmbH, Frankfurt/M., has audited the annual financial statements 2025 of FVV eV and issued an unqualified audit opinion.

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→ www.fvv-net.de/en | Transfer | Download | Magazine

Science for a
moving society

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The FVV is globally networked to create science-based insights into forward technologies for climate neutrality and zero-impact emissions from sustainable energy conversion systems. As an industrial research association operating in the network of the Mechanical Engineering Research Federation (FKM) it publishes an **annual report** in which facts and figures on the activities and projects of the research association are presented briefly and transparently.

Industrial research associations are **central hubs for implementing pre-competitive Industrial Collective Research (IGF)**. For innovative small and medium-sized enterprises, they are strong and skilled partners and serve as transfer + networking platforms for science, industry and society.

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