THE FUCHS GROUP MAGAZINE

New Thinking

LUBRICANTS.
TECHNOLOGY.
PEOPLE.

FUCHS

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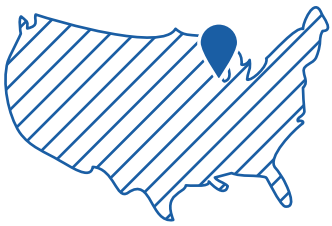
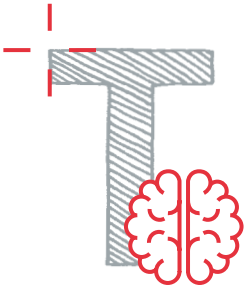
LUBRICANTS. TECHNOLOGY. PEOPLE.

LUBRICANTS.





TECHNOLOGY.

PEOPLE.

» **FUCHS PETROLUB is an agile, globally networked company that has lived through ever-changing times since it was founded almost 90 years ago.** We create value for our customers, partners and employees with our globally defined brand and our promise of 'technology that pays back.' Our ongoing growth, new technologies, the increasing complexity of the global markets and the **EVER MORE STRINGENT REQUIREMENTS OF CUSTOMERS** 6 make our business more dynamic. We meet this challenge with passion and see it as an opportunity.

We have already made some fundamental changes. And in the future, we will continue to define standards as well as standardized processes and work on new developments in the fields of **DIGITALIZATION** 20 and **E-MOBILITY** 16 – all this while increasing the agility of our company. With our thirst for **INNOVATION** 12 and the dynamism and specialist expertise of our internationally networked **TEAMS** 30, FUCHS will continue to enjoy profitable growth so that we can maintain our leading international position well into the future. «

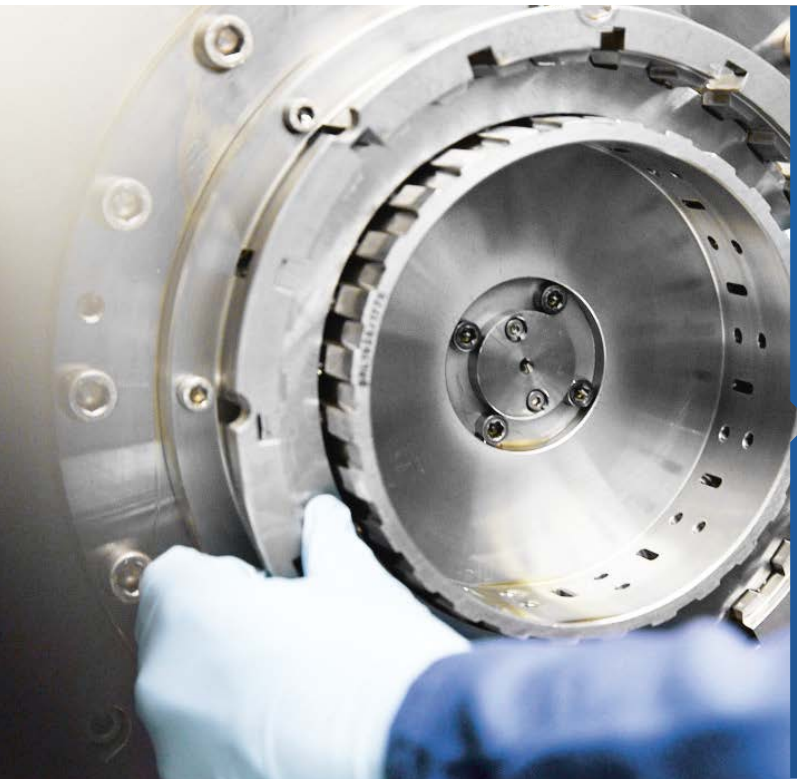
STEFAN FUCHS | CHAIRMAN OF THE EXECUTIVE BOARD

BUSINESS MODEL

LUBRICANTS.TECHNOLOGY.PEOPLE. Our company rests on these three pillars for over 85 years. As a mission statement, they are the basis for our daily activity around the world and simultaneously the core of the FUCHS brand.

LUBRICANTS. 100 % focus

Worldwide, FUCHS focuses 100% on the development, manufacturing, distribution and sale of high-quality lubricants and related specialties for nearly all applications and industries. With over 10,000 products, we offer our customers a full portfolio of lubricants that complies with exacting national and international standards.



TECHNOLOGY.
Holistic solutions

Technologically advanced, process-oriented, and holistic lubricant solutions are a key success factor for FUCHS. Our worldwide network of experts meets customer requirements on a global scale by quickly and efficiently networking fields of special expertise. We strive to be the technology and innovation leader in important business areas. Our approach focuses on effectiveness and efficiency, safety and reliability and the sustainability of lubricants along the process and value chain with regard to supplier, raw materials, production, and the end product.

PEOPLE.
Personal commitment

More than 5,000 highly qualified and specialized employees worldwide are committed to FUCHS. Our global team regards itself as a well-coordinated unit, whose personal commitment continues to write new chapters in our company's success story. Intensive dialog with our customers and partners and trusting and fair collaboration enable us to always find the optimum, tailor-made lubricant solution to meet the individual requirements of our customers.

GLOBAL PROXIMITY

With its new facility for specialty greases in Harvey, Chicago, FUCHS has built a state-of-the-art grease factory in North America. The new plant is an important element of the company's global 3-continent (3C) strategy and part of the growth initiative, for which the Group is planning a total investment of around € 300 million by 2018.

By Silke Wernet

It is presumably the largest internal, transnational joint venture in FUCHS' history and a prime example of international cooperation: the specialty grease factory in Harvey, USA, which was built over 3,200 square meters for around € 24 million and has been supplying North American customers since 2017. A large team of colleagues from Germany and the USA were involved in an intense professional cooperation lasting several months to bring this project to fruition. The plant, which is located in the south of Chicago and equipped with state-of-the-art technology, is part of the Group's investment initiative: FUCHS is planning to deliberately channel around € 300 million by 2018 into developing existing and building new facilities in the world's high-growth regions. More to the point, the plant is an important element of the lubricant manufacturer's global 3C strategy.

CHICAGO – New Plant for Specialty Greases:

400
employees

This is the total number of staff that FUCHS employs at the US location of Harvey in the south of Chicago.

3,200m²

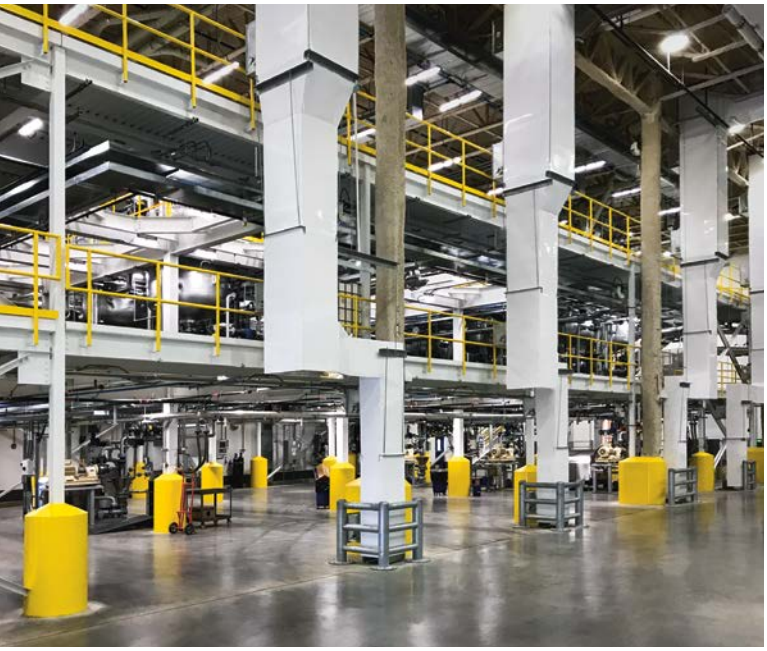
This is the floor space of the plant. It will cater to the automotive, heavy duty, construction, railway and off-road markets in North America.

~€24 million

This is the amount that has been invested in the grease plant, which is equipped with state-of-the-art technology.

30
specialty greases

This is the basis the plant started with when it commenced operations in 2017.



In 2017, the production of high-quality specialty greases for North American customers began in the new facilities in Chicago.

As part of this commitment, FUCHS is standardizing the production process for OEM specialty greases in Europe, America and Asia with the same production facilities, similar raw materials, an identical quality control process and laboratory equipment. This principle means that in the future, for example, automotive manufacturers with production facilities spread all over the world will have the assurance that the greases they use on all three continents are of a consistently high quality and composition. "For these customers in particular, what we have to offer is especially attractive. A definite unique selling point of our company," emphasizes the Director OEM FUCHS LUBRICANTS CO., who is in charge of the OEM business in the North America region. "Equally exceptional is the large internal network we have been building since the new plant was in the development phase," continues the OEM Director. "On a production level, this is an unbelievably big step for FUCHS, that has made a massive contribution to the success of the overall project."

Intense cooperation between colleagues

The training of employees for the factory in Harvey was also a success. Half the workforce is made up of experienced skilled workers, who had already worked at FUCHS production facilities in the USA previously. Most of them were then trained in Germany. "The core team completed a training program at the headquarters in Mannheim to improve its understanding of our company and corporate culture," explains the Director of Operations. "The employees also spent three weeks at our grease factory in Kiel where they learned about work organization and processes." In turn, specialists from Kiel and Mannheim flew across the pond to play a hands-on role in the start-up phase of the plant in the USA. Even now, almost one year later, colleagues from the two

Cutting-edge technology for the Chinese growth market: The new FUCHS LUBRICANTS plant in Wujiang, a Suzhou district in the province of Jiangsu, China, is expected to go into operation in 2019. Around 100 employees will be working here in production, storage, maintenance, IT, administration and other areas. The latest technologies and special measures to protect the environment and optimize processes at this factory, not far from Shanghai, will make it one of the most modern lubrication production facilities in China. We spoke with QingPing Zhu, Managing Director at FUCHS LUBRICANTS (CHINA) LTD.

Mr. Zhu, the budget for the new plant in Wujiang is roughly € 36 million. What is the capacity of the new plant?
This factory will have eight highly automated filling lines, 31 blenders and 55 tanks with a capacity of between 60 and 500 m^3 on 80,000 m^2 floor space. In Phase I, its nominal production capacity will be around 100,000 tons per year – almost twice as much as our plant in Shanghai. The automatic high bay warehouse will have a capacity of around 11,000 pallets.

This factory will be one of the most modern lubricant production facilities in China. What exactly will it produce in the future?
We will produce a wide range of products, including automotive lubricants for OEM customers and retailers. In the industrial sector, our portfolio includes metal working fluids, corrosion preventatives, quenching oils and products for lubricant management services. To increase production efficiency, the new plant will be designed based on an "intelligent plant" concept. This means greater and more flexible production due to more automation, more effective material flows and optimized management processes in order to meet customer requirements even better than before. We will also work with an automated storage and retrieval system (ASRS). We will be one of the first lubricant manufacturers to use this extremely efficient storage technology in China.

Some of FUCHS' most important Chinese customers are based in the Jiangsu region. And business is still growing in your country …
Absolutely. China is the largest automobile manufacturing country in the world and has the second-largest number of vehicles on the road. China is also a leader in the growing electric vehicle industry and in other industrial markets, such as wind energy, steel, cement and coal mining. At FUCHS, we have been increasingly expanding our business from year to year as part of this rapid development. Over time, customer requirements have become more demanding – for example, with regard to supply chain and production management. Our new sophisticated plant in Wujiang is another important step towards increasing our competitiveness in China. This will allow us to continue improving the quality of our products, our services and ultimately our position as a leading lubricant manufacturer in a dynamic market while being in close contact with our local customers.

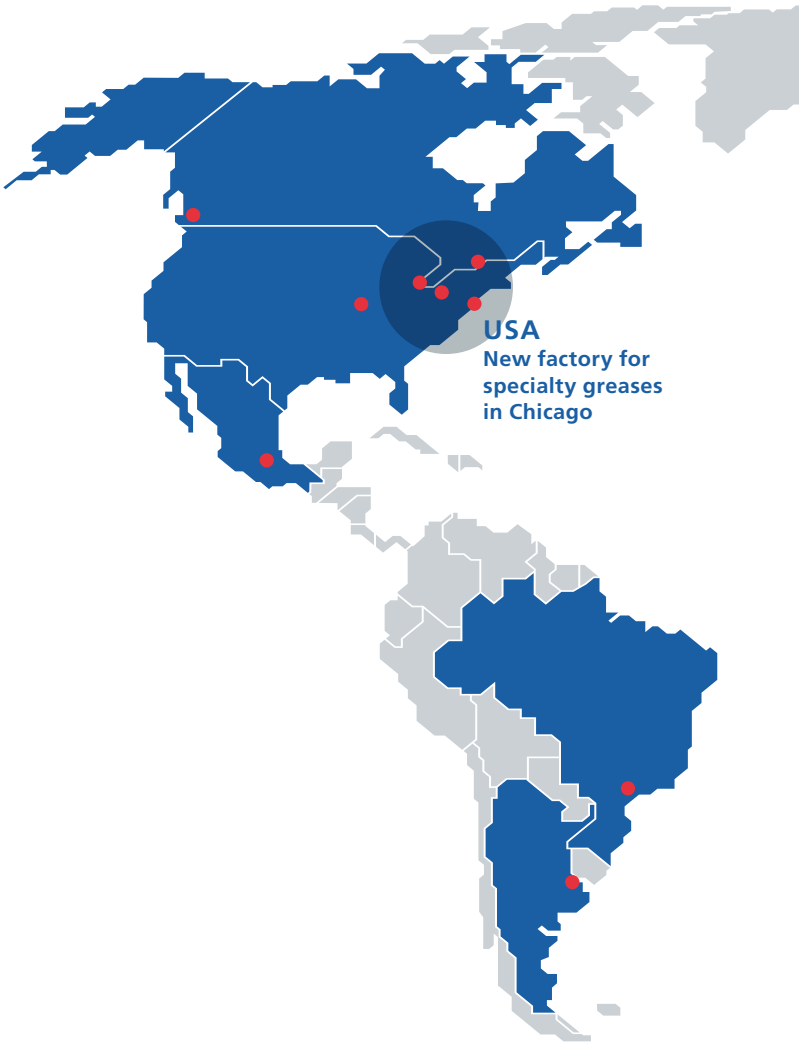
This interview was held by Silke Wernet

» Lubricants are definitively one of the most important industrial products in the Chinese growth market. In this environment, we are a flexible and reliable partner for our customers. «

QINGPING ZHU | MANAGING DIRECTOR
AT FUCHS LUBRICANTS (CHINA) LTD.

Close to the customer all over the world

Our company can be found wherever our more than 100,000 customers need us – in over 45 countries around the globe. We have local bases with our 58 operating companies and 33 plants. And, as part of its growth initiative, FUCHS is continuing to invest in building new locations and expanding existing locations worldwide. At the same time, our employees work closely with their international colleagues. This connected, extraordinary know-how and our employees form the basis of our success.



countries continue to have a close working relationship. There are still close channels of communication when it comes to technical issues. "It is a truly excellent example of transnational cooperation that also extends beyond individual departments. I've never experienced something quite like it before," says the Director of Operations with admiration. Born in Kiel, he has been working at the specialty grease factory in his hometown for a number of years, most recently as head of the "technical departments."

Highly automated equipment

The facility at his new workplace in Harvey commenced the test phase in spring 2017 with around 30 specialty greases for the automotive, heavy duty, construction, railway and off-road markets in North America. Full production is underway since 2018. An IT system controls the addition of raw materials to the high-quality specialty greases that are produced at the new facility. Most of the systems are automated and the facility is fitted with high-tech equipment. This makes overdosing or underdosing practically impossible. Nevertheless, should an error occur in the production process, it is identified and reported immediately. The highly automated systems also document each individual phase of the production process – generating a level of transparency that is of paramount importance to customers.

Tailor-made solutions

But the new plant offers many more advantages: Whereas up to now FUCHS has mainly produced these high-quality greases for OEM customers in Kiel, the company is now able to produce them faster in the USA and potentially in Yingkou, China, and supply them more flexibly to North America and the Asia-Pacific, Africa region. In addition to product quality, these other important aspects are required to meet ever-growing industry demands even more effectively.

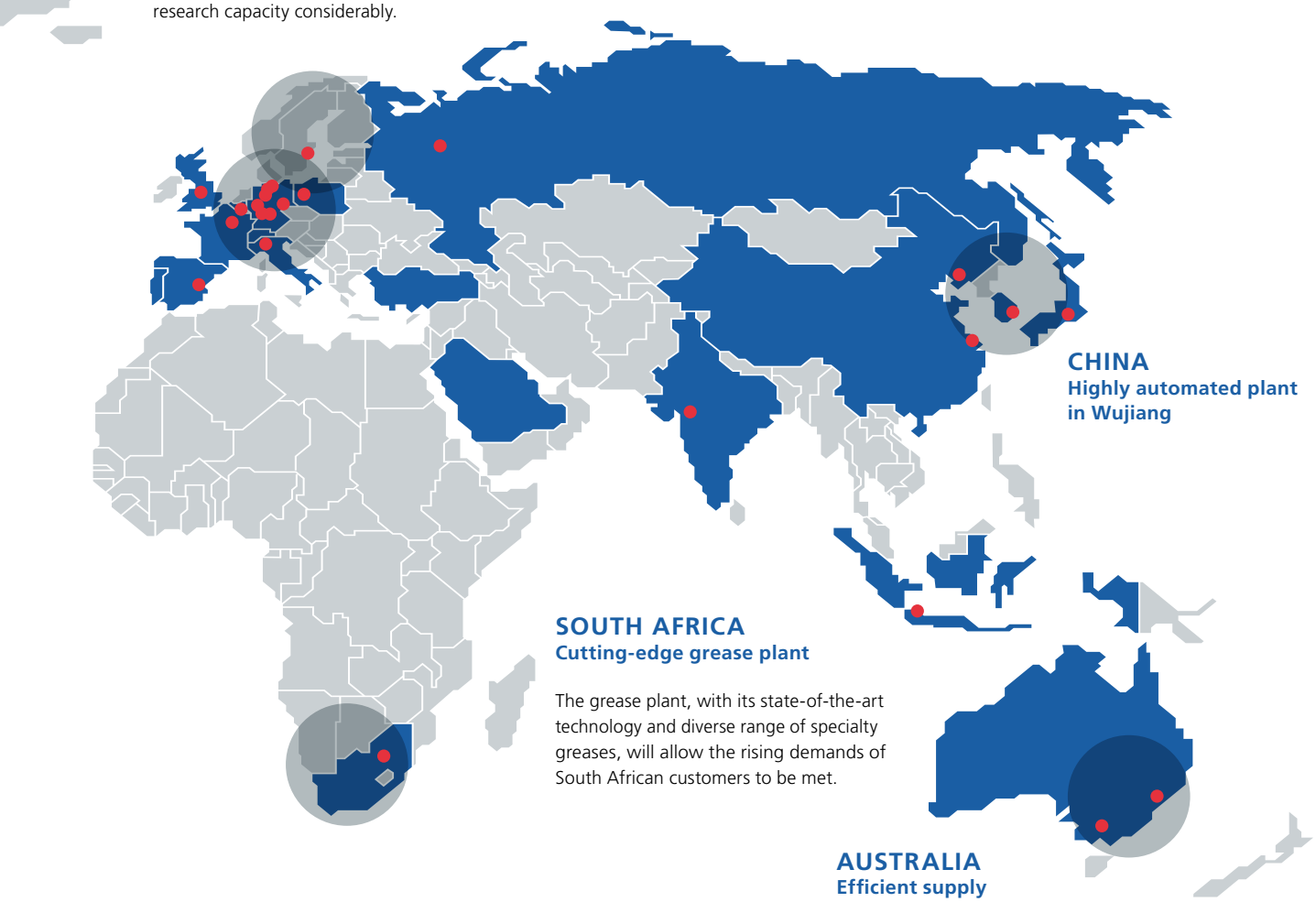
As well as the production facility, a new warehouse is also optimizing logistics in Harvey. A laboratory with highly specialized testing equipment has been built for research and development (R&D). Some of the greases produced are customized developments. "Before we manufacture tailor-made products like these, we get a team of key account managers, product managers and R&D specialists together and visit the customer's local premises. We work together on-site to formulate the best individual solution," says the OEM Director, describing the close cooperation with the customer and the unique opportunities that this produces in terms of lubricant development.

GERMANY
Expansion of laboratory and storage capacities

We are expanding laboratory, storage and office capacities at our two locations. The new test facility in Mannheim has increased research capacity considerably.

SWEDEN
Construction of a new plant

The planned factory will replace the rented plant in a few years' time.



CHINA
Highly automated plant in Wujiang

SOUTH AFRICA
Cutting-edge grease plant

The grease plant, with its state-of-the-art technology and diverse range of specialty greases, will allow the rising demands of South African customers to be met.

AUSTRALIA
Efficient supply

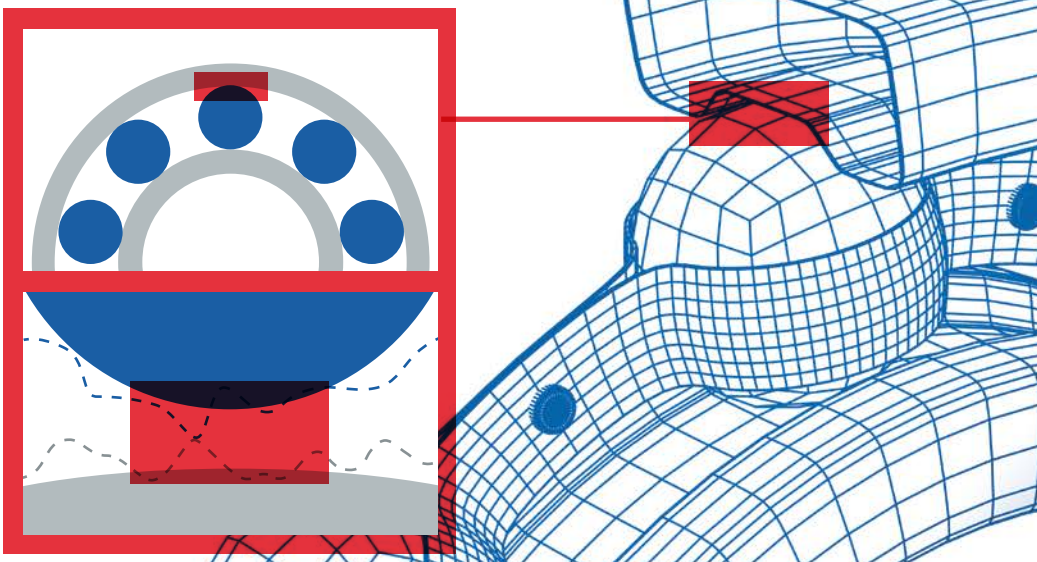
The Beresfield (Newcastle) plant focuses on the requirements of the Australian market and ensures that our local customers are supplied efficiently.

Potential in the US market

The grease factory in the south of Chicago is FUCHS' second facility for lubricating greases in the USA in addition to the one in Kansas City. High-volume greases for a range of applications, including the steel industry and food lubricants, are produced in Missouri. Both colleagues in Harvey still see enormous potential for their company on the US market: "In the USA, FUCHS has so far been identified almost exclu-sively as an oil supplier. Now with our diverse and superior-quality range of specialty greases we have the opportunity to change this perception, which will allow us to reach completely new target groups." Even the increased significance of electric mobility, with the increased use of premium greases in electric cars, is expected to open up new growth prospects for FUCHS in North America. "With our highly advanced technology, we will soon be able to offer our customers a great deal in this area as well," the two men agree. "We are very well prepared." ■

The complex world of friction

Where the naked eye sees smooth surfaces touching, high magnification shows multiple complicated relationships, awareness of which is needed in order to understand the friction process and lubricant performance.



THE DIGITALIZED LUBRICANT

Experience and qualitative understanding are good but it is even better to complement it with valid quantitative forecasts. Therefore, FUCHS is concentrating on simulation and sensor: methods that have the potential to significantly simplify the development process and status monitoring of lubricants.

By Ulrich Pontes

Imagine a vast, mountainous landscape, over which a second, upside-down mountainous landscape is scraping. Here, only the tallest heights come into contact with each other, while large distances dominate elsewhere. Here, peaks remain stuck together, become wedged together and deform, break apart where possible before it continues abruptly. Here, the upper landscape slides a bit higher in order to speed crashing into the depths if mountains and valleys fit together somewhat better.

And so it continues dramatically, when two seemingly smooth objects rub together. Even reflective metal surfaces are strewn with microscopically small rough spots and become a kind of mountainous landscape with sufficiently sharp magnification. Therefore, in roller and plain bearings, gears and other tribological systems, the selective and short-term conditions can be much more extreme than the macroscopic view – with a massive impact on the lubrication.

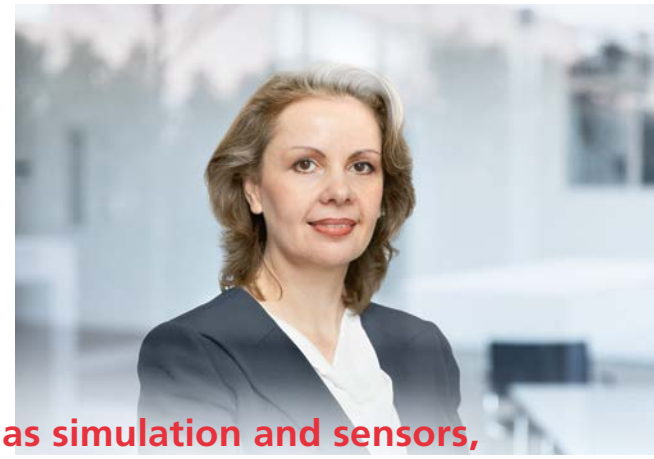
"In a manner of speaking, the lubricant 'sees' the extreme conditions in the rough spots, the high pressures and the changing gaps. And it does not see the contact area and the reaction force that we can see from outside," explains Dr. Christine Fuchs, Vice President Global Research & Development at FUCHS. Therefore, in order to understand the performance of tribological systems and the lubricants used in them, you need to know these details. "However, it's practically impossible to recognize them using metrology. This means that we need to calculate them."

Moving tests to the virtual world

For this reason, there is an important area called "simulation and calculation" in FUCHS' research and development department. However, using simulation calculations to find out the conditions and wear that a lubricant experiences in a given application is just the first step for experts in this field. If the simulation of mechanical parts succeeds – and existing, highly specialized expert tools make this possible – then it stands to reason that lubricants can also be integrated into the calculation model in order to be able to predict the behavior of the entire system. "In the end, our goal

"Our goal is to make lubricant 'talk' and draw specific recommendations for action from that. There is a vast amount of added value in this."

DR. MATTHIAS MARQUART | MANAGING DIRECTOR OF INOVIGA GMBH



"With tools such as simulation and sensors, digitalization helps us to quickly develop just the right products for our customers and offer even more comprehensive services."

DR. CHRISTINE FUCHS | VICE PRESIDENT GLOBAL RESEARCH & DEVELOPMENT AT FUCHS PETROLUB SE

is to make the product development process faster and more efficient by moving at least part of the experiments and tests to the virtual world of simulations," explains Christine Fuchs.

The perfect simulation is a virtual copy that behaves exactly like the real system. However, in the case of lubricants with the behavior described, this kind of "digital twin" is difficult to achieve, as the head of the simulation and calculation department explains: "In reality, there are always also chemical aspects to add to the mechanical and physical, e.g. surface effects." As a result, he and his colleagues are already wrestling with the next big challenge – combining chemical and mechanical simulation. If the merger of these two worlds is achieved one day, it will be possible to shorten the development process again.

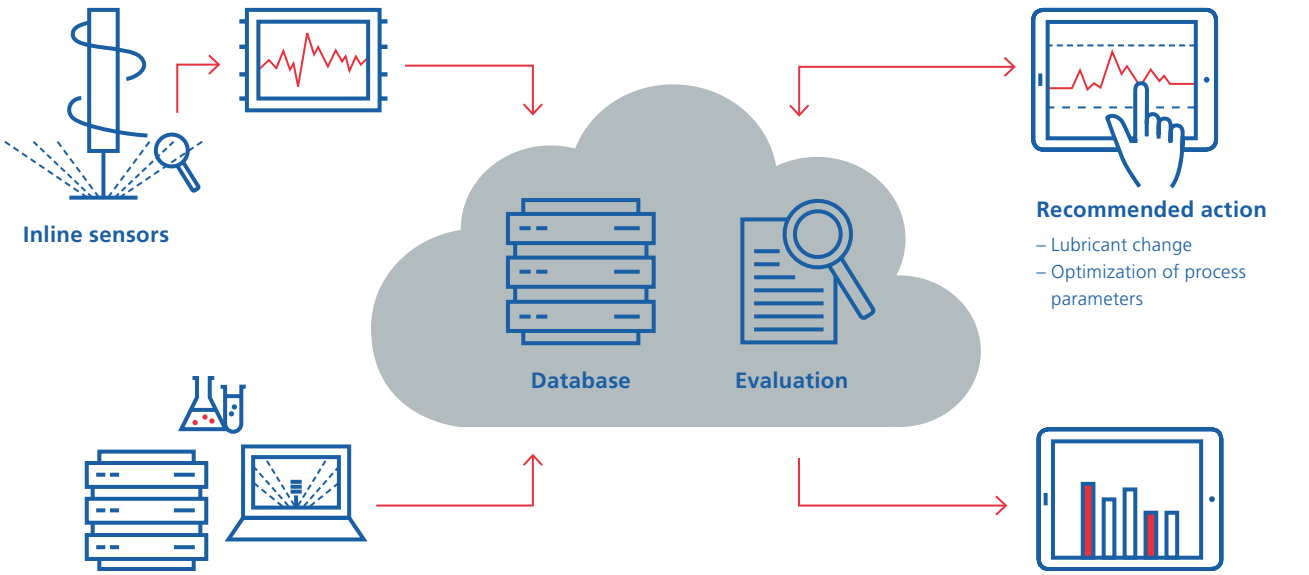
Getting the lubricant to "talk"

With the topic of simulation, it is a matter of a digital tool for the lubricant's path to application, so another focus of research at FUCHS deals with another path for lubricant in application. The key words are sensors and networking. "Digitalization is leading us to the Internet of Things or, to put it simply, in the future everything will 'speak' with everything else. This means that we need to ensure that lubricant can join in," says an engineer who focuses on sensors at inoviga, a FUCHS subsidiary (see p. 20).

Of course, the "talking lubricant" will not formulate words and sentences but rather provide information about its present condition. "Our goal is to continuously recognize relevant status parameters in order to recognize impending problems early on

The networked lubricant

If lubricants are made to 'talk' in the respective application by inline sensors with cloud connection, it could have many advantages. However, the step from pure data to informative analysis or recommended actions remains certainly challenging.



and to be able to address them," says inoviga Managing Director, Dr. Matthias Marquart. A decline in certain parameters could be the signal to replace part of the lubricant as soon as possible – and an intelligent overall system could even lead the way in this process and, for example, order the required lubricant, temporarily reduce machine performance as a precautionary measure or similar.

In real time instead of by mail

This would be a major advancement for those responsible for maintenance. At the moment, they generally need to manually draw samples of lubricant at certain intervals, send these for analysis by mail and interpret the lab results a few days later in order to determine whether action is required. In the future, sensors could directly determine the condition of the lubricant in the machine, transfer the performance data online into a central computer, which can assess it in real time. This entire process would need just a few moments.

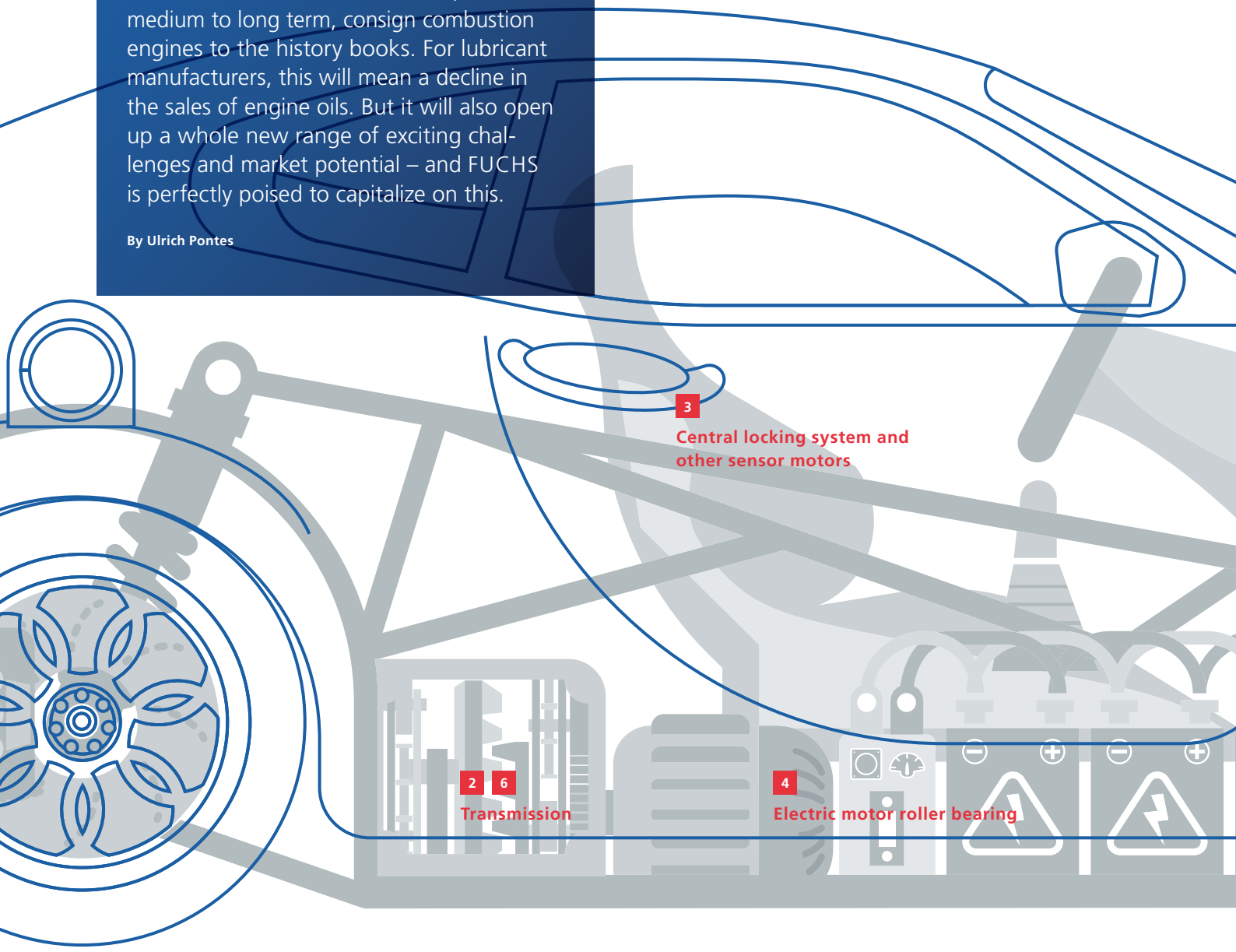
However, sensor experts at FUCHS still have a number of challenges to solve until then. For example, suitable products are still to be extensively tested in the context of relevant applications. "But the sensor is, for us, mainly just a part of a complex system," says the inoviga engineer. Development work is still necessary to get from bare test results to relevant added value. According to experts, the biggest challenge is waiting when data arrives in the analysis computer: to draw specific recommended actions from it. ■

THE FUTURE'S ELECTRIC

Electric drives are becoming increasingly common on our roads and could, over the medium to long term, consign combustion engines to the history books. For lubricant manufacturers, this will mean a decline in the sales of engine oils. But it will also open up a whole new range of exciting challenges and market potential – and FUCHS is perfectly poised to capitalize on this.

By Ulrich Pontes

In 2016, the number of electric cars on the world's roads exceeded the two-million mark – and during the course of 2017 this number is likely to have increased by more than a million. These figures – which include not only purely battery-powered vehicles but also plug-in hybrids – show just how dynamic the market for electric cars has become. But as a proportion of the overall market, these figures are still very low – after all, around 100 million motor vehicles are produced every year. In some countries, however, electric cars do already enjoy a tangible market share – especially in Norway, where around 30 % of cars are



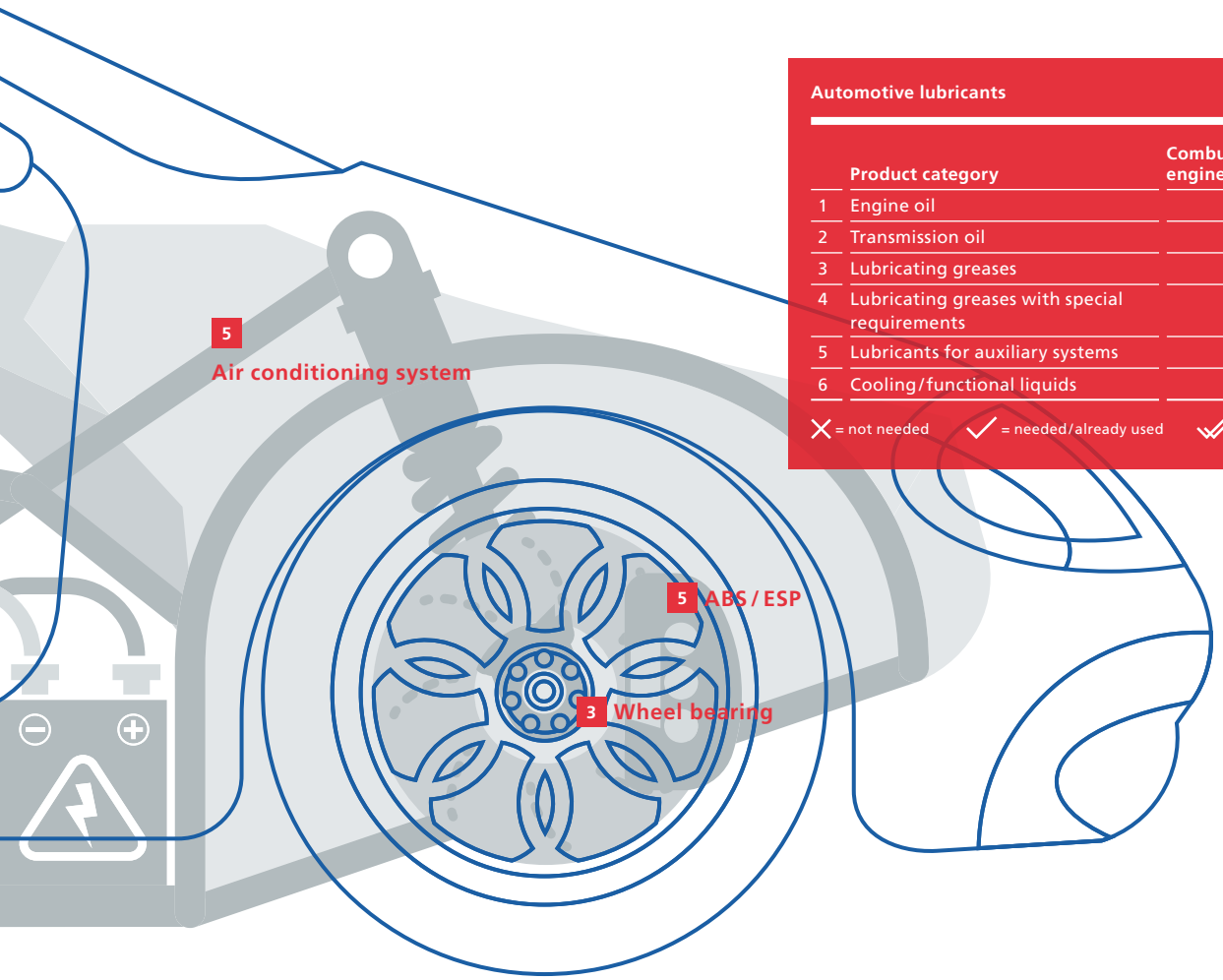
electric. For the automotive sector and associated industries, this development entails far-reaching changes – including for lubricant manufacturers. "Together with the automotive industry, we have to face new challenges and new questions," says the Head of Global Product Management Automotive at FUCHS.

One could assume that the expected decline in the number of combustion engines on the roads would be a cause for concern for the lubricants industry. After all, engine oil – the most widespread and highest-volume automotive lubricant – is not used in an electric motor. In fact, however, electromobility offers real potential – for FUCHS at least. Chief Technical Officer Dr. Lutz Lindemann (see the interview on page 19): "With electric drives comes a whole host of new requirements that will cause us to define new generations of lubricants."

New materials, higher speeds, electromagnetic fields

In response to this major, shared challenge, FUCHS is actively approaching its partners in the automotive industry and, through presentations at expert forums among other things, making it clear that the trend toward electric vehicle drives places numerous requirements on lubricants – these requirements will change the production process at first. Electric cars require new materials and production methods, in turn requiring new processing fluids. And then there's the powertrain: Electric cars, too, have transmission systems and, in many cases, clutches, although these operate at much higher speeds and with much higher efficiency requirements.

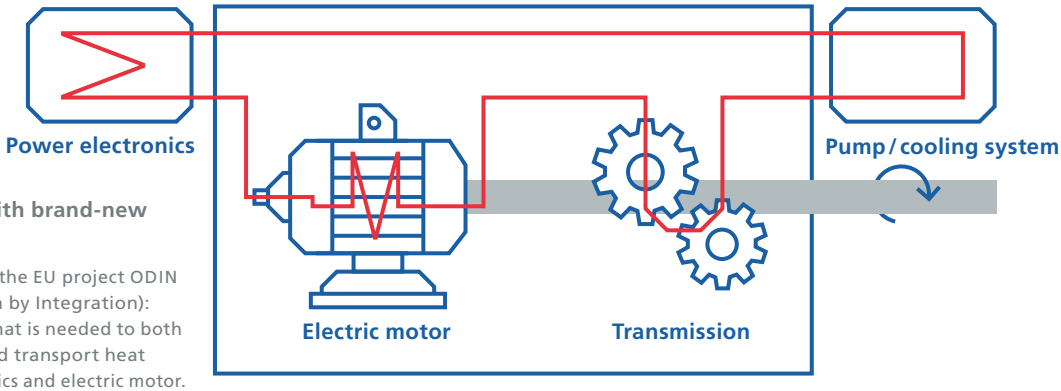
Another important area are the lubricating greases. Cars today contain around two-and-a-half kilograms of lubricating grease, applied in many different areas including in the engine, ancillary components and central locking system. In at least some of these



Automotive lubricants

	Product category	Combustion engine	All-electric drive
1	Engine oil	✓	✗
2	Transmission oil	✓	✓
3	Lubricating greases	✓	✓
4	Lubricating greases with special requirements	✗	✓
5	Lubricants for auxiliary systems	✓	✓✓
6	Cooling/functional liquids	✓	✓✓

✗ = not needed ✓ = needed/already used ✓✓ = increased need



Integrated powertrain with brand-new cooling / functional liquid

How the fluid circuit works in the EU project ODIN (Optimized electric Drivetrain by Integration): A single "e-engine oil" is all that is needed to both lubricate the transmission and transport heat away from the power electronics and electric motor. All of the components are accommodated within the same enclosure.

areas, the conditions in electric cars are much harsher. The greases have to be able to withstand higher temperatures and much higher rotational speeds. Additionally, they come into contact with a wide range of materials – from copper cables to special plastics – as well as with electronic modules and sensors, electrical currents and electromagnetic fields.

New additives, new measurement processes

It is precisely these electrical requirements that the FUCHS development team has been focusing on for some time now. "We had to come up with whole new ways of influencing – to a greater or lesser extent – the electrical properties of lubricants," says the head of predevelopment. Potential solutions include brand-new additives and appropriate measurement processes: "We already use rheological and tribological measurement methods in electrically charged environments in our laboratory." That said, FUCHS is well positioned because it already has a wealth of vital experience in the development of numerous detailed electrical solutions for cars: "Even cars equipped with combustion engines contain dozens of electric motors performing a wide range of tasks," says the divisional head. "The task now is 'only' to electrify the primary power train, although that is a bigger challenge than you might think."

Concerning this particular challenge, the industry is still very much in its early stages. "The layperson might think: 'Vacuum cleaners with electric motors have been around for a century now, so what's the problem?'" says the head of predevelopment. But the requirements are not remotely comparable: "Cars are much more dynamic in their operation." And he mentions another important aspect – energy efficiency: "In electric cars, reducing friction through the use of lubricants is fundamentally even more important than in cars with combustion engines. While the top development priority right now for combustion-engine cars is to cut CO_2 emissions, for electric cars it is to achieve ever-greater ranges. And achieving both of these goals also ultimately involves reducing friction."

> » It is part of our culture here at FUCHS to respond rapidly to new requirements. The trend toward electromobility is a fantastic opportunity for us to break new ground. «

On top of this are high expectations regarding performance, weight and, above all, cost. "A wide range of different approaches to develop partial or fully electric powertrains is currently being explored. Regardless of which approach wins out, they all have areas that urgently require optimization," says the expert from FUCHS. "This is why nobody yet knows which concept will perhaps become the established standard in 20 years."

Multi-functional e-engine oils

This period of transition is also a good time to explore new approaches. One of these is the idea of integrating the different components of an electric powertrain – power electronics, electric motor and transmission – in an enclosure that is as compact as possible to save weight and costs. It was with this objective in mind that the EU joint research project "Optimized electric Drivetrain by Integration" (ODIN) was launched in 2014 in collaboration with consortium partners such as Renault and Bosch. FUCHS contributed the idea of developing a suitable "e-engine oil" for a combined lubricant and cooling circuit – in other words, a cool-

» We have set up teams in Germany, China and the USA who focus on e-mobility, analyze customer requirements and convert these to suitable products. «

DR. LUTZ LINDEMANN | CHIEF TECHNICAL OFFICER

ing/functional liquid that simultaneously allows almost frictionless rotation of the transmission, transports the waste heat away from the electronics and the motor and can be pumped through the lines with as little energy expenditure as possible. "We developed a range of possible formulations and successfully created viable e-engine oils," says the head of predevelopment. The overall project thus achieved its aim: "We presented an exciting, almost fully developed alternative concept for an electric drive. We now have to wait and see whether and for what purpose carmakers will adopt it."

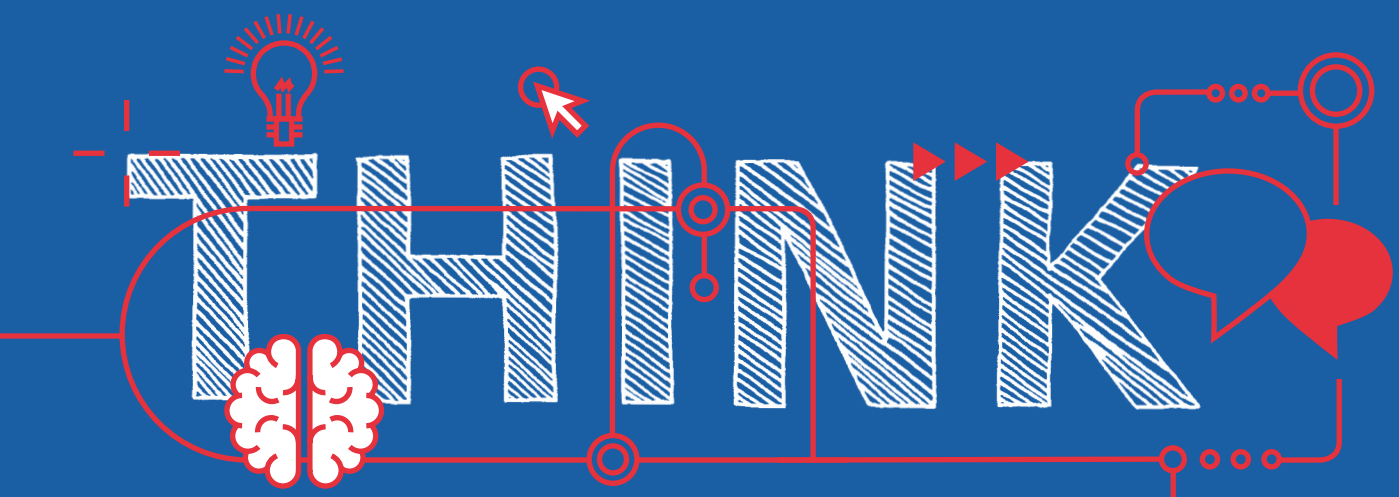
The optimum degree of integration, however, is just one of many concept-related questions to which there are still no sound answers: Is electricity the best and most sustainable energy source for cars, or are renewable fuels likely to constitute serious competition? Which of the numerous electric motor design principles is the most effective? Which speed range is the best? Is a transmission with a fixed gear ratio sufficient, or is gearshift capability a better idea?

For lubricant manufacturers, one virtue is most important: smoothness of running. And as the world's largest independent lubricant specialist with an extremely broad portfolio and almost unparalleled experience, FUCHS has exactly what it takes to respond flexibly to these future challenges. Or, as the automotive product manager puts it: "It is part of our culture here at FUCHS to respond rapidly to new requirements. The trend toward electromobility is a fantastic opportunity for us to break new ground and remain at the cutting edge of technological development." ■

Dr. Lindemann, since the diesel scandal, more and more people are predicting the demise of the combustion engine. What does this mean for FUCHS?
First, there's no need to be alarmist. It is indeed true that more and more cars, particularly in urban environments, will be equipped with electric motors. The conventional, combustion-powered drivetrain is still going to be with us for some time, however, in the form of hybrid drives, for example. Quantitative forecasts are difficult because there are too many unknowns, but it does seem conceivable to us that, by 2030, the global market share of electric cars could be as high as around 30%, with a significant proportion of this figure comprising hybrids as a form of transitional technology.

This, too, will see shifts in the market.
As far as the global market for lubricants is concerned, we are indeed expecting to see a marginal decrease in the overall volume. But why only marginal? There are a number of reasons for this: The only liquid that is not required in all-electric cars is the engine oil – all-electric cars still have transmission systems, regardless of contradictory rumors. But, as I said, the demand for engine oil will fall only gradually. And what makes electric cars so exciting is the fact that they will result in a whole new demand for lubricants.

How can FUCHS leverage this potential?
Our comprehensive product range and our experience in developing just the right solutions quickly and flexibly mean that we are perfectly poised to capitalize on this. Our development team has spent a long time expanding our arsenal of solutions aimed at meeting whole new requirements. And we have set up teams in the technology-driven markets of Germany, China and the USA who focus on e-mobility, analyze customer requirements and convert these to suitable products.



Digitalization and networking are key topics for FUCHS, as they are almost everywhere in the industry. Our approach focuses on much more than just efficient communication. Business should be more transparent, data treasures should be extracted, making entirely new business models possible. The epicenter of these developments is the newly established inoviga GmbH.

By Ulrich Pontes

Anyone going there, where FUCHS is bundling its interests in things related to digitalization, moves to a place far away from production facilities, tanks and chimneys. This path leads to the Lindenhof district of Mannheim, close to the city, to the Mafinex campus for high-tech startups. Approximately 60 new companies are based in the modern, segmented office building: software developers, internet startups, highly specialized engineering service providers – including of course inoviga GmbH, the newest subsidiary of the FUCHS family.

"We are developing concepts so that FUCHS – in light of the disruptive changes caused by digitalization – can continue its success story and make use of its strengths in new ways," says inoviga Managing Director Dr. Matthias Marquart. To be really independent of established routines, a decision was made to set up a new company. Intentionally the site was located apart from the FUCHS headquarters to make clear that it serves all Group companies equally as a think tank: "The digitalized world knows no borders in the traditional sense," emphasizes Marquart. "Therefore, it's important to us to take various local needs and cultural characteristics into consideration."

Of course, a small innovation developer operating outside existing structures cannot cover all aspects that come with the mega-topic of digitalization. FUCHS is further developing its digital infrastructure at all levels. The expanded intranet and new, cloud-based office and communication solutions simplify global open communication, an element of the DNA at FUCHS. Other global IT projects relate to customer management and personnel management. Modifications to the central ERP systems ensure that the company is prepared for future requirements and possible new business models.

In turn, what such requirements and business models might look like is one of the issues which Matthias Marquart and his colleagues deal with. Other key areas for the four-person team are e-commerce, big data – i. e. the question of how process and market data can be leveraged – and the Internet of Things. "In this broad field, it is a case of identifying issues with which we can generate added value for FUCHS,"

explains Marquart. inoviga is generally responsible only for conceptual questions and interlinking networks: "We transfer results into the organization. However, the respective FUCHS companies are responsible for the operational implementation."

However, being well connected in the Group is important not only for implementation, but also for identifying topics. This is the reason that Marquart was on the road for months, presenting inoviga in countless meetings together with his first colleague. With success: FUCHS employees now come up regularly with ideas, their own projects and findings. "When a colleague in the USA hears a report about a startup or an app in the car and thinks that this is exciting for FUCHS, then he or she sends me a brief message with the link afterwards."

The inoviga Managing Director is more reserved when talking about specific projects. He is happy to outline just rough scenarios: "In a world of Facebook and Amazon, users want their questions answered and products delivered with one click." However, creating a corresponding global online platform for an organization that is strictly subdivided into regional responsibilities, business and product segments, is a major challenge.

Scenario number two toys with the idea of offering a specific function as a service in the future instead of the lubricant product. "For example, if we want to guarantee a certain running time for machines, we need more than just sensors to monitor the condition of the lubricant," explains Marquart. "The system should also respond automatically, for example to order replacements." This is a comprehensive integration task that also includes production planning, logistics, warehousing and accounting. What is clear is that a holistic plan such as this to restructure the business is, for the time being, still just a dream of the future. However, since inoviga's establishment, it has at least been clarified who is responsible for making it reality. ■

inoviga GmbH

was established as a wholly owned subsidiary of FUCHS PETROLUB SE at the end of 2016. The name highlights the objective and the mandate, which is extensive and not limited to specific markets: inoviga is derived from the word "novigo", which means "innovation" in Esperanto, a language spoken all over the world.

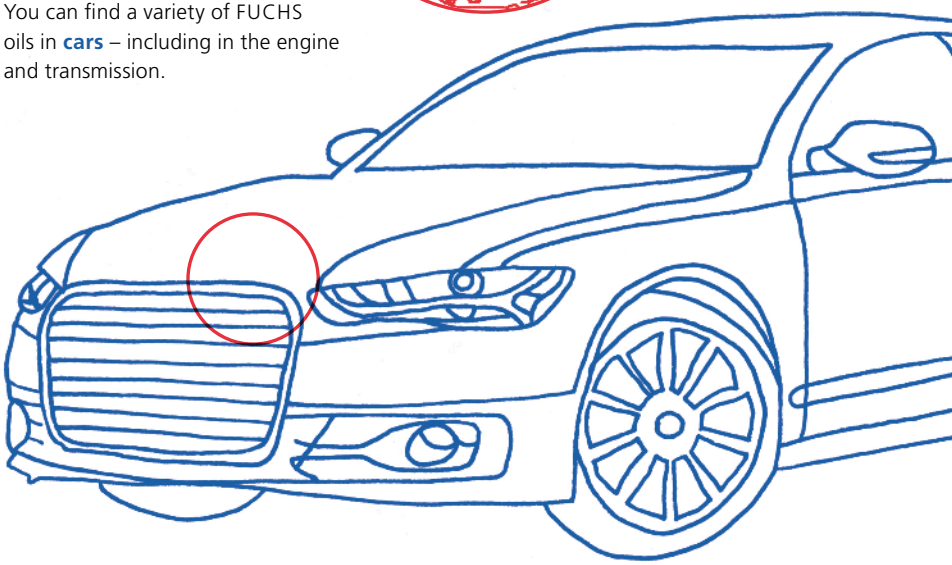
The inoviga team

currently comprises four employees. Its diversity reflects the broad spectrum of topics inoviga deals with. Managing Director Dr. Matthias Marquart is a qualified mechanical engineer and has been working with a variety of digitalization topics at FUCHS for many years. The team also includes an economist with experience in innovation projects, an engineer specializing in microtechnology and sensors and an experienced FUCHS global key account manager from the USA.

SERVICES

In the services product category, FUCHS offers analytical services, coating services, chemical process management (CPM), maintenance monitoring, customized development, special services for food processing (LCCP) and special services for open gears as well as technical advice.

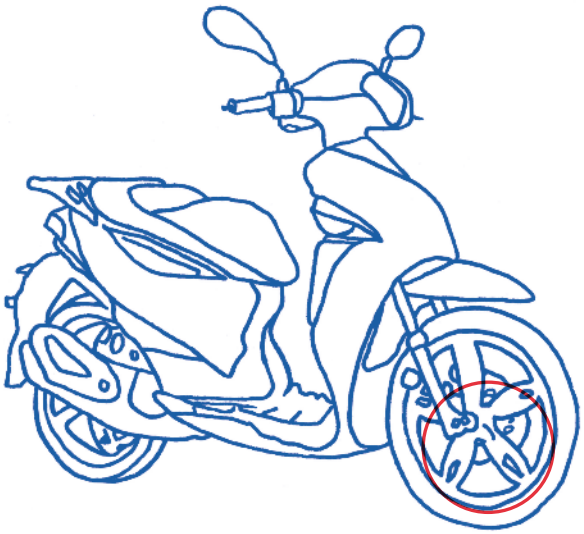
You can find a variety of FUCHS oils in **cars** – including in the engine and transmission.



FUCHS, YOUR EVERYDAY COMPANION

Whether in the sausage slicer or the refrigerated section, the vacuum cleaner or the washing machine, FUCHS lubricants can be found in many everyday items. We provide customized products for hundreds of applications in six product categories. See where you can find us as you go about your day – some things might surprise you!

By Silke Wernet

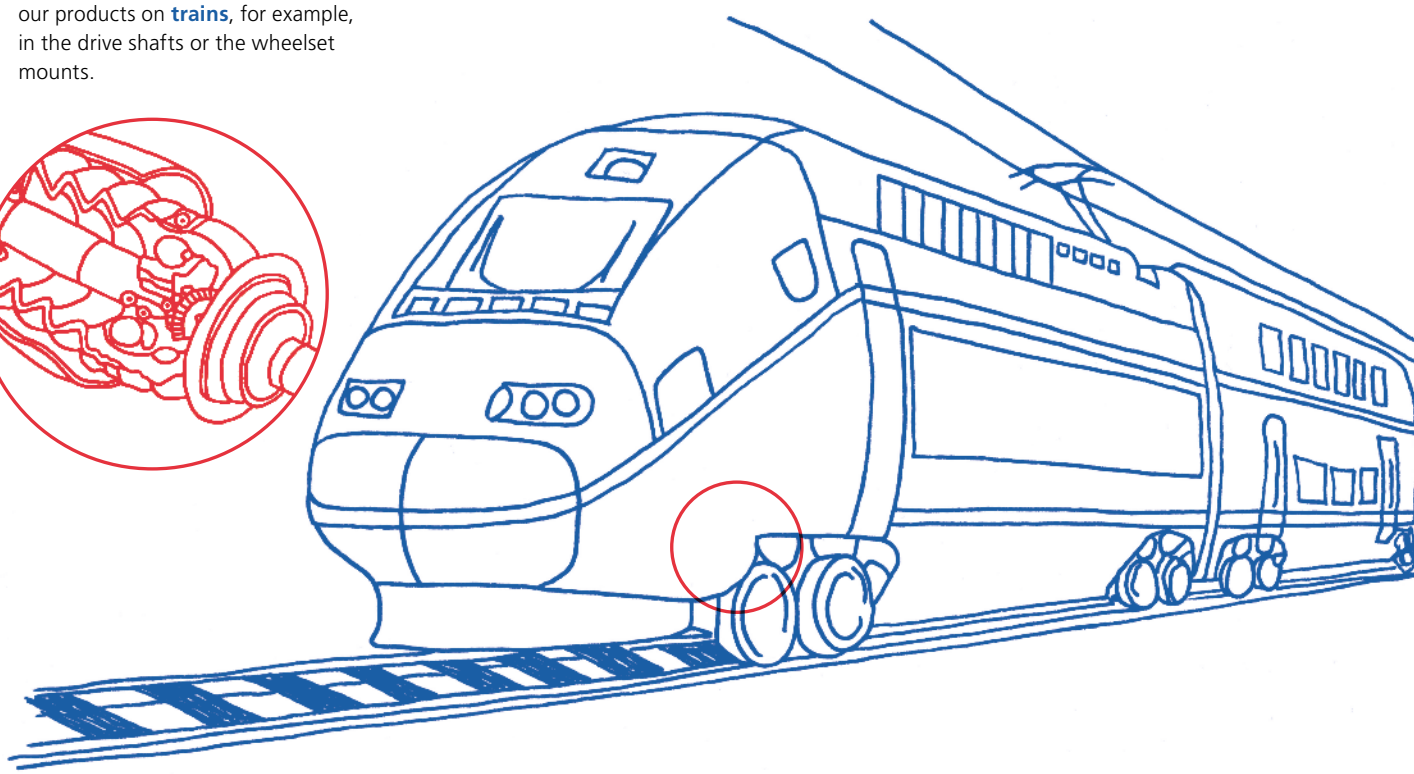


Various oils and operating fluids are also required for **scooters**. In addition to engine and gear oils, FUCHS also supplies brake fluids and radiator antifreeze.

AUTOMOTIVE LUBRICANTS

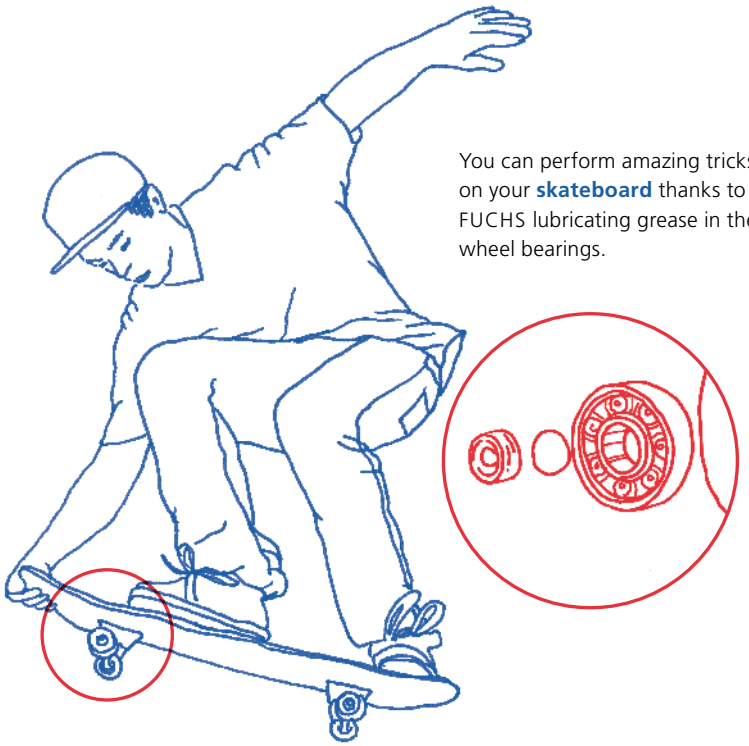
Our products in the automotive sector include lubricants and operating fluids such as engine oils, gear oils, central hydraulic oils, greases, shock absorber fluids, biodegradable lubricants as well as brake fluids and radiator antifreeze.

You will also come across many of our products on **trains**, for example, in the drive shafts or the wheelset mounts.

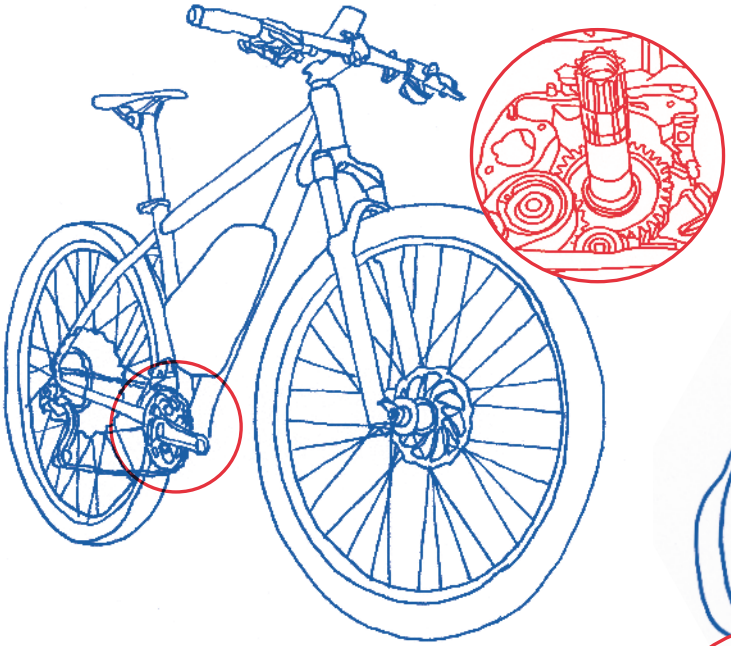


LUBRICATING GREASES

The FUCHS range of lubricating greases includes multi-purpose/ longlife greases, greases for plain and roller bearings, wheel bearing greases, gear box, food grade greases, greases for extreme temperatures, greases for rail vehicles, greases for machine tools, biodegradable greases, greases for central lubricating systems, assembly pastes and greases in spray cans.

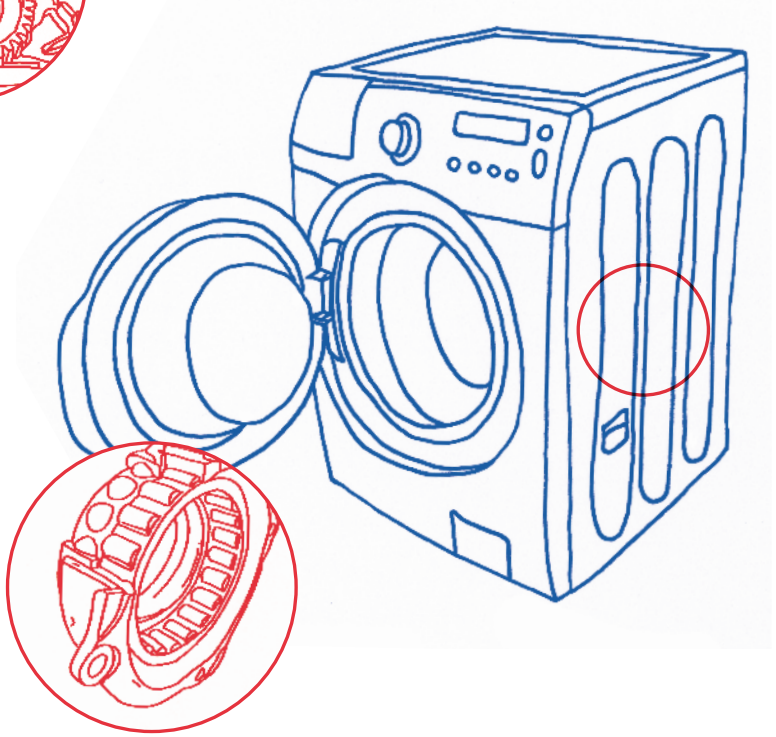


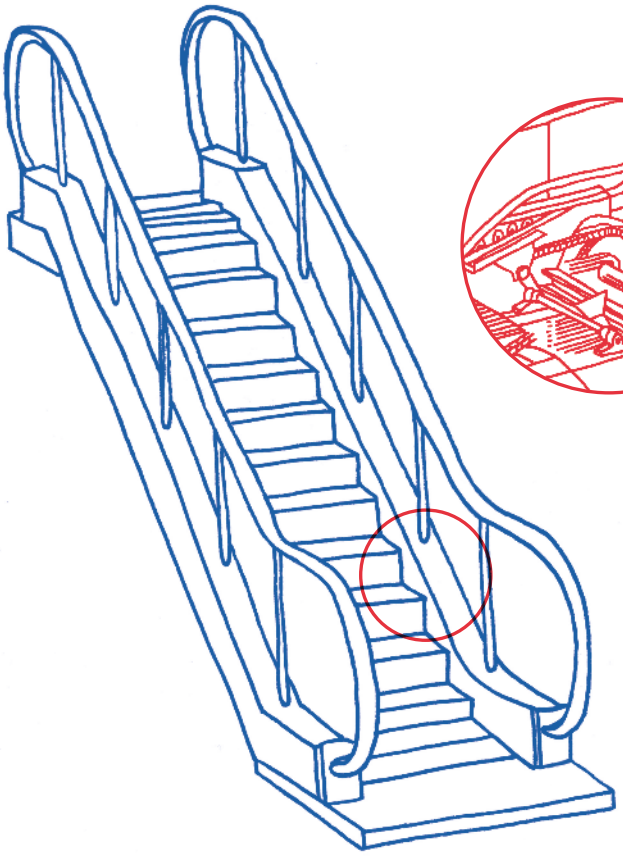
You can perform amazing tricks on your **skateboard** thanks to FUCHS lubricating grease in the wheel bearings.

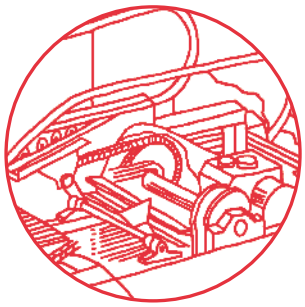


We also ensure that you can get around quickly and smoothly thanks to our greases for gearwheels in the electric motor of your **e-bike**.

For clean trousers and T-shirts your **washing machine** has to function perfectly. This is ensured by our lubricating greases in the roller bearing of the drum and the shock absorber, which dampens vibrations caused by unbalance during the spinning process.





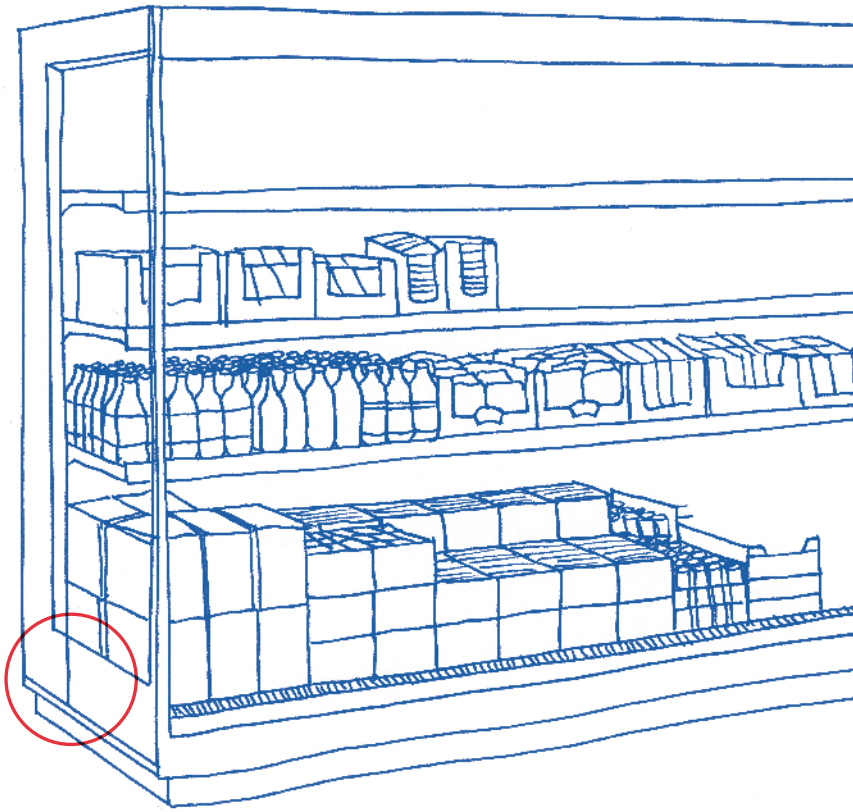


Escalator drive systems run smoothly thanks to gear oils from FUCHS. Furthermore, our products can be used for circulating tracks.

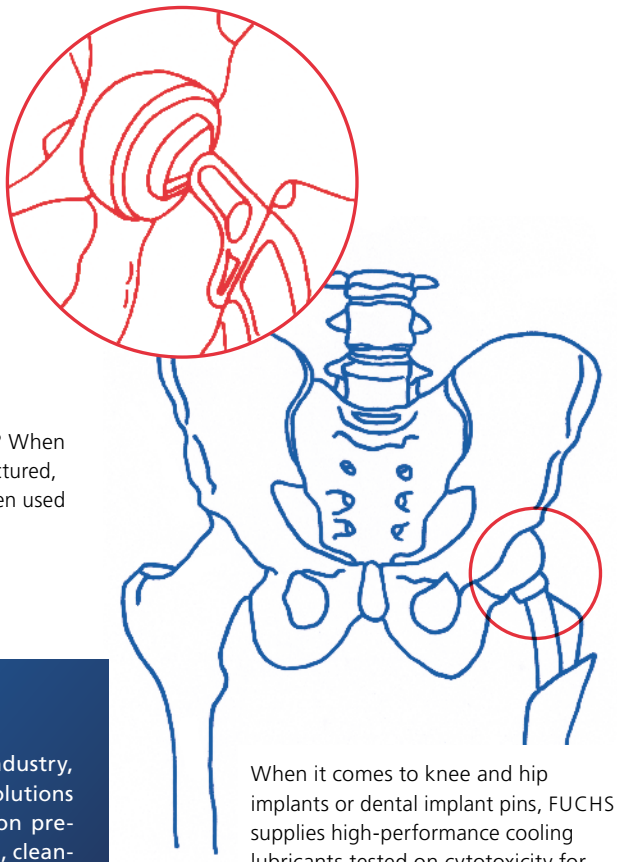
For the industrial sector, we produce rapidly biodegradable lubricants, greases, gear oils, slideway oils, adhesive lubricants, heat transfer oils, hydraulic oils, refrigeration oils, compressor oils, machine oils, textile machine oils, transformer oils, turbine oils and cylinder oils.

INDUSTRIAL LUBRICANTS

Would you ever have guessed that our refrigeration oils can sometimes be found in the refrigeration compressors in the **refrigerated section** of your supermarket?



Who would have thought? When your **bathtub** was manufactured, our lubricants may have been used on the pressing tools.

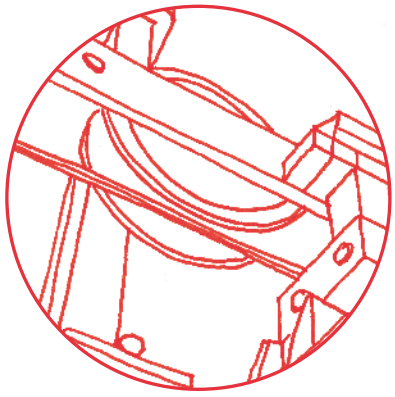


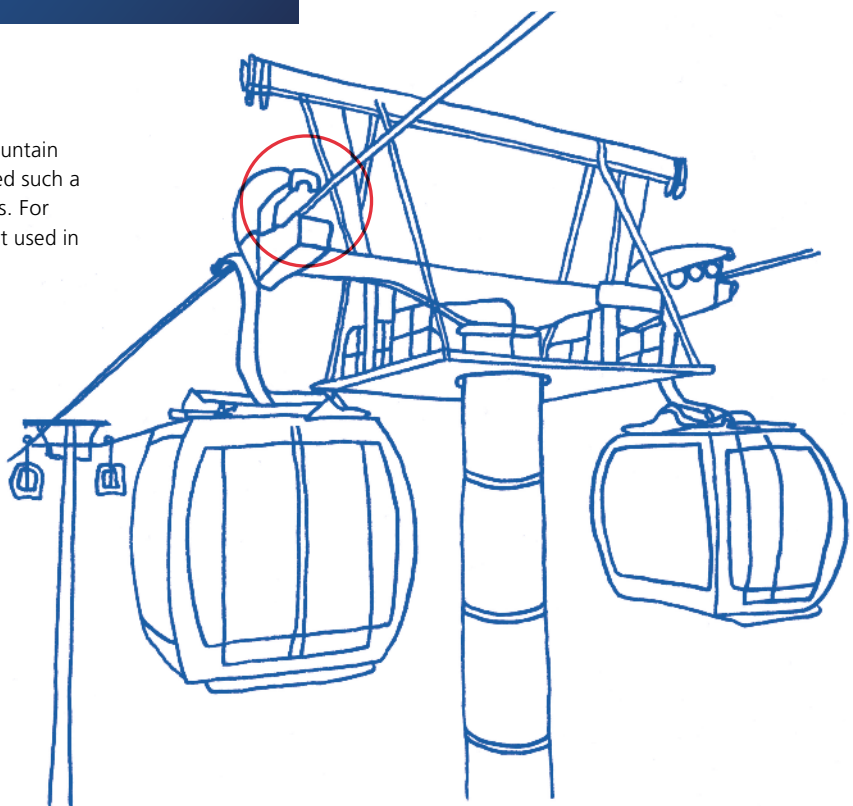
When it comes to knee and hip implants or dental implant pins, FUCHS supplies high-performance cooling lubricants tested on cytotoxicity for the **medical industry**.

METAL PROCESSING LUBRICANTS

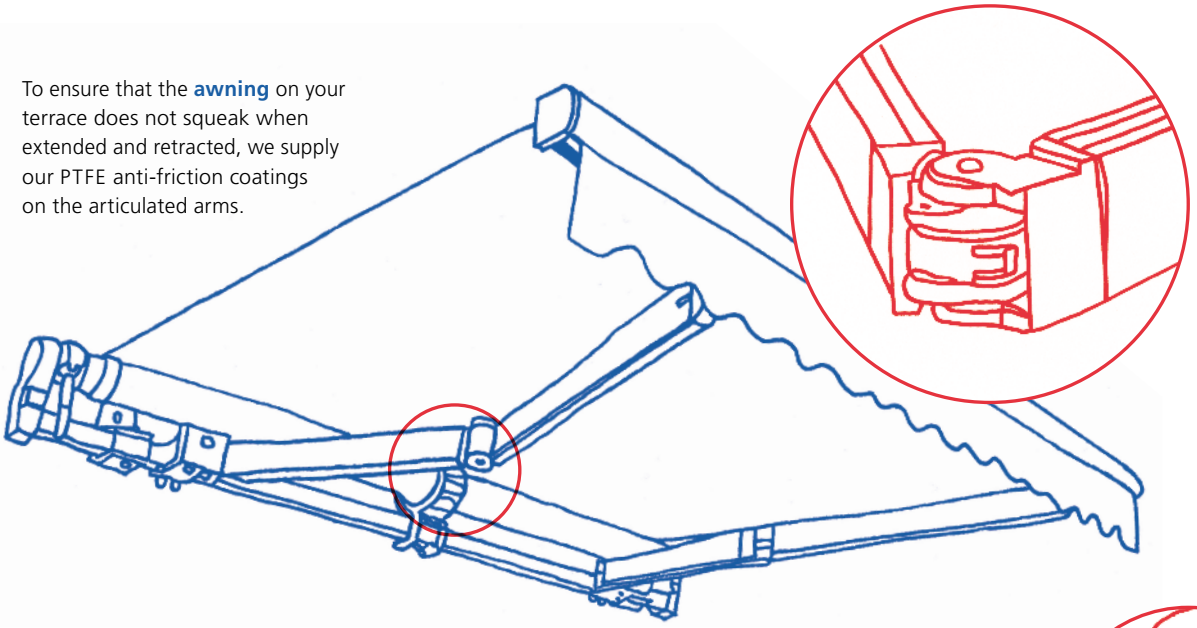
For the metal processing industry, FUCHS develops customized solutions for quenching fluids, corrosion preventives, minimum lubrication, cleaners, cutting and grinding and forming lubricants.

Anyone who has traveled up a mountain on a ski lift might not have enjoyed such a smooth trip without our products. For **cable cars**, we produce a lubricant used in the production of wire ropes.

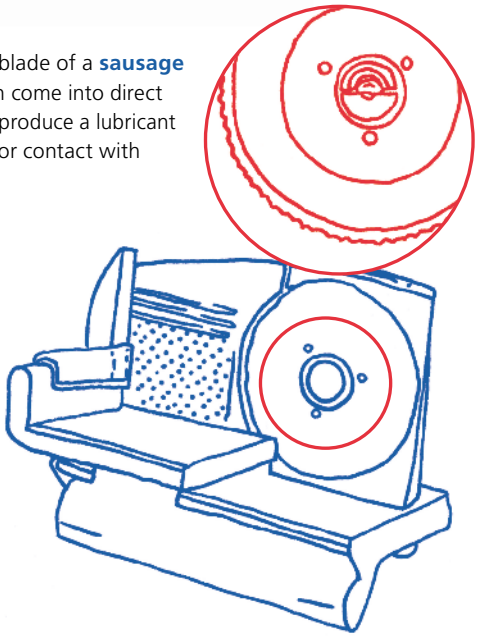


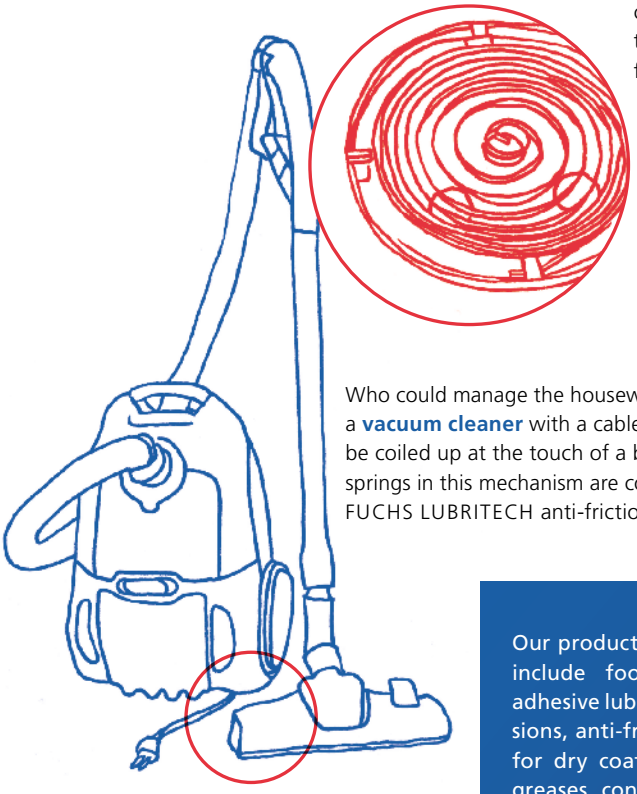


To ensure that the **awning** on your terrace does not squeak when extended and retracted, we supply our PTFE anti-friction coatings on the articulated arms.



Since lubricant on the blade of a **sausage slicer**, for example, can come into direct contact with food, we produce a lubricant that is specially tested for contact with foodstuffs.





Who could manage the housework without a **vacuum cleaner** with a cable that can be coiled up at the touch of a button? The springs in this mechanism are coated with FUCHS LUBRITECH anti-friction coating.

Our products for special applications include food-compliant lubricants, adhesive lubricants for open transmissions, anti-friction coatings and films for dry coating, pastes and special greases, concrete release agents and high-temperature chain oils as well as lubricants for the glass manufacturing process, hot forming, the wind energy sector and the sugar industry.

SPECIAL APPLICATION LUBRICANTS

HIGHLIGHTS

NEW COOLING LUBRICANTS PRESENTED AT EMO TRADE FAIR

The EMO is the world's largest machine tool trade fair. For six days, FUCHS SCHMIERSTOFFE GMBH presented its products, represented by employees from Germany, Spain, Italy, Poland, Russia, China and the USA. A highlight was the new synthetic, water-miscible cooling lubricants in the ECOCOOL S series. "One of their distinguishing features is their noteworthy efficiency," reports the Head of Marketing Services. "Thanks to their excellent lubricating properties, they achieve a high level of machining and cutting performance." Another highlight in Hanover was the announcement of the technology partnership with DMG MORI in Europe. DMG MORI AG, based in Bielefeld, manufactures metal machine tools (more information about the partnership on the following page).

TWO SUSTAINABILITY AWARDS RECEIVED

In 2017, two teams were delighted to be presented with the FUCHS Sustainability Award. The research and development/PM department of FUCHS SCHMIERSTOFFE GMBH received the award for the development of various "sustainable" industrial oil products. The Spanish/French research and development department took the victory with its project "The Next Serial Tree Planter."

The internal FUCHS Sustainability Award was introduced in 2016. Its goal is to further embed the issue in the Group. From now on, each of the winning projects will be presented during the annual FUCHS Global Sustainability Meeting.

RESEARCH AND DEVELOPMENT DEPARTMENT RELIES ON WORLDWIDE COLLABORATION

In November, 120 experts from research and development met at the international R&D meeting in Mannheim. The event mainly promotes cross-border networking. This worldwide collaboration is very important to FUCHS. Twice a year, experts from numerous labs come together to discuss the current research and product-related challenges in the industry. "The most important topics at the moment are new concepts for electromobility and lubricant solutions for Industry 4.0," reports Dr. Christine Fuchs, Vice President Global Research & Development. Important aspects of this are advancing digitalization and the accompanying methods, such as design of experiments. To do this, an IT tool is building up algorithms in databases. The objective of this efficient and resource-conserving methodology is to determine and statistically analyze the interdependency of different influencing factors in as few, systematically planned experiment designs as possible.

15 **FUCHS now has 15 Key Working Groups, with which the company is advancing research and development projects. Just over six years ago, the concept started with two groups and has been continuously expanded since then.**

TECHNOLOGY PARTNERS: DMG MORI AND FUCHS

With innovative product developments, together FUCHS and DMG MORI are setting standards for machine tool lubricants and have agreed a technology partnership. Other goals of this cooperation, from which customers and operators will benefit in particular, include the expansion of digitalization in production and condition monitoring for machines and equipment. "For the best possible level of productivity in intensive workpiece machining on machine tools, using the right lubricant is essential," says Christian Thönes, Chairman of the Executive Board at DMG MORI AG, one of the worldwide leaders in manufacturing machine tools, explaining the collaboration.

NEW PRODUCTS (NOT JUST) FOR E-MOBILITY

A number of product innovations are arising from FUCHS' hard work on development. This applies in particular to the electromobility sector – a focus of research at the company. "In e-mobility, gear oils and greases, for example, need to meet completely new requirements and also need to be compatible with materials different to those found in traditional vehicles," explains Dr. Christine Fuchs, Vice President Global Research & Development. The mobility department harbors major future potential for FUCHS. Therefore, it has its own Head of E-Mobility, who is in charge of looking after this topic, since November. However, FUCHS is also developing highly innovative new products for long-standing industries. For example, devices and fluids that prevent even the finest particles from reaching the atmosphere during the extraction process have been developed for the mining industry. This protects people and the environment from dust contamination.

2017

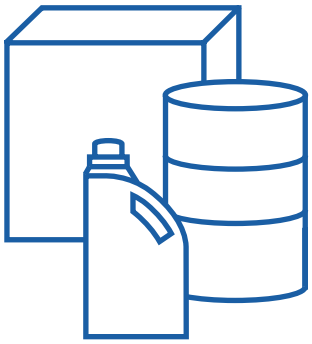
“We are proud to say that three generations of our family have worked here. Everything we have is linked to this company. You could say that our lives revolve around FUCHS.”

ISMAIL AKCESME (30) has been working at the large-scale filling station since 2011. He is a foreman and runs a team of roughly ten employees per shift.

FAMILY TIES

Whole families employed by the same company – this is not uncommon at FUCHS. Take the Akcesmes from Ludwigshafen, for example. Three generations of their family have worked for the lubricant manufacturer headquartered in Mannheim. This is a very special family history, and it all started back in 1965.

By Silke Wernet



Up to 400,000 liters

of oil and other lubricants pass through the large-scale filling station into a wide range of containers on a daily basis, and this number is on the rise.

When Ismail Akcesme came to Friesenheimer Straße in 1965, his German was still very poor. He had moved to Germany two years previously as a migrant worker from Turkey, first working in a mine in Dortmund, and then earning his living as a road worker in Karlsruhe. He was visiting his brother in Mannheim when he mustered up the courage to ask for work at the gates of the large company. At first without enjoying great success. He was just about to leave when suddenly a man addressed him. It was the plant manager, who offered Ismail Akcesme a job on the spot and invited him onto the plant premises. The migrant worker stayed with the company for many years (35 in total). In fact, he was one of the first Turkish people ever employed by FUCHS. This was also the beginning of a very special family history, because many years after him, more Akcesmes are joining the lubricant manufacturer's ranks in Mannheim, including his son Ekrem and grandson Ismail junior.

A stroke of luck for the family

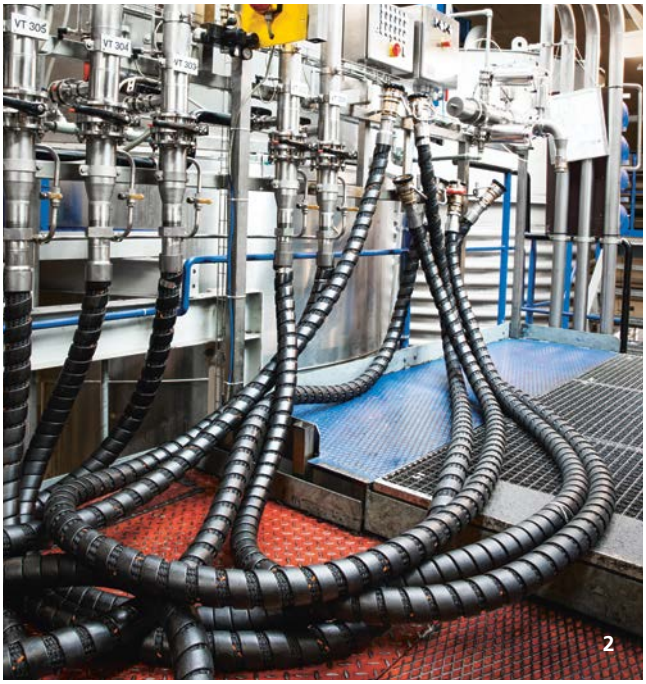
"For us, this history remains a great stroke of luck to this very day," says grandson Ismail, looking back. "That bit of fortune back there on the street has paved the professional careers of our whole family." The 30-year-old has worked since 2011 at FUCHS' large-scale filling station, where millions of liters of engine and hydraulic oils, industrial oils and all manner of specialty lubricants are collected into a wide range of containers every year. He had never worked with his grandfather and namesake – Ismail senior remained at the grease factory from the moment he was employed right up until 2000 – but he does work with his father Ekrem. If they meet in the factory these days, it'll be on the early shift. Ismail, who is a qualified refrigeration and air conditioning technician, works as a foreman. Ekrem Akcesme, who joined the large-scale filling department in 1984, is no longer able to work in shifts after suffering two serious heart attacks. He is now working in the office of the department.

Learning from "dinosaurs"

What is it like for junior and senior to work together? "Let me put it this way, you can learn a lot from the dinosaurs," says Ismail Akcesme, laughing and looking mischievously at his father, who has two other sons. Ismail is the oldest. "No, seriously. He used to be a foreman as well; I practically took over his whole team. His decades of experience have been invaluable to me." 53-year-old Ekrem Akcesme adds: "Of course I like to give him tips."

Everything has stayed within the Ludwigshafen family. In the past, it was sometimes the same when the working day was over. "My wife often had to forcefully put a stop to many of the conversations about the company around the dining table," recalls the father. But one thing was always clear to the Akcesmes: "Each of us always knew how much we owed to the company." Son Ismail, whose childhood was inevitably strongly influenced by FUCHS, emphasizes the point: "We are proud to say that three generations of our family have worked here. Everything we have is linked to this company. You could say that our lives revolve around FUCHS." In the past, people used to mock his father at school: "When I was a child, my German wasn't very good. When I told people that my dad worked for 'Öl-FUCHS', the other pupils didn't really understand what I meant and made fun of me," explains Akcesme, who moved with his mother to Germany in 1972 when he was eight years old. "But of course every person in the region knows this company."

1 // The father and the son: Ekrem (left) and Ismail Akcesme both work at FUCHS in the "large-scale filling" department. But they only work together during the early shift.
2 // Ismail Akcesme works as a foreman. He and his team operate 13 filling lines in alternate patterns.
3 // The third generation of the family: Grandfather Ismail senior also worked at FUCHS for 35 years.



1 // The different products make their way trough pipes from the tank farm and mixing plant to the main hall, where they are filled into containers such as drums.
2 // The latest filling technology makes it also possible to deal with the rapid increase of filling volumes.
3 // The containers are sealed before being shipped off on the conveyor belt to the high-bay warehouse.

"The effects of my illness are already limiting the activities I can do. FUCHS has been very accommodating as an employer. This should not be taken for granted."

EKREM AKCESME
After suffering two serious heart attacks, Ekrem Akcesme (53) is no longer able to do shift work. He worked for almost 35 years in the "large-scale filling" department.

3

“When I was a child, my German wasn’t very good. When I told people at school that my dad worked for ‘Öl-FUCHS’, the other pupils didn’t really understand what I meant and made fun of me. But of course every person in the region knows this company.“

EKREM AKCESME, WHO MOVED TO GERMANY IN 1972 WHEN HE WAS EIGHT YEARS OLD.

A special family-like environment

Ekrem Akcesme has gained a special appreciation for the strong family-like environment and the high level of responsibility that the family-run group demonstrates toward its employees, especially after his own period of illness, which continues to limit him to this day. “After this difficult time, I genuinely felt that I was in good hands,” recalls the qualified gas and water fitter. “FUCHS really has been very accommodating as an employer. This should not be taken for granted.” The Akcesmes discovered that these ties to the lubricant specialist extend beyond their immediate family circle and national borders when they visited Izmir, where the family has its roots. “We learned entirely by chance that my mother’s cousin works for OPET FUCHS,” says Ismail Akcesme. And the family’s ties to FUCHS could potentially become even greater, as his youngest brother, who still attends school, did an internship at Friesenheimer Straße – in the training workshop and laboratory.

Shifts around the clock

Foreman Ismail places special emphasis on instilling a family-like environment with his team at the large-scale filling station. In this respect, he is following his father’s advice: “I told him, don’t pass stress on to your people. Make sure there is a good working environment, even when things get hectic.” And things can sometimes get very stressful at the large-scale filling station, where staff work in three shifts around the clock, six days a week. There are up to ten employees per shift alternating between 13 filling lines. The different products make their way through pipes from the tank farm and mixing plant to the main hall, where they are filled into canisters and drums of varying sizes, not to mention into 1,000-liter containers. Afterwards, employees seal and label the containers before shipping them off on the conveyor belt to the high-bay warehouse.

Control: three-person principle

Back in the 1980s, filling amounts ranged between 60,000 and 80,000 liters a day. Now, the department works with volumes of up to 400,000 liters a day – and this number is rising. One employee alone fills between 40 and 60 containers per shift on average. Every movement, every fill has to be perfect. If mistakes occur, customers may even receive the wrong oil. But Ismail Akcesme can rest assured: “Our error rate is practically zero. Taking into account the filler, foreman and quality controller, our checks are carried out at the very least in accordance with the two-person principle, and mostly in accordance with the three-person principle.” He also knows that there is a state-of-the-art laboratory analyzing all his filling operations, which will identify even the tiniest of mistakes. Over all these years, Ismail Akcesme has learned a great deal from his father, who in turn learned from his father, Ismail senior, who once plucked up the courage to ask for work in broken German in Friesenheimer Straße. A stroke of luck for the entire Akcesme family – and for FUCHS. ■

FACTS AND FIGURES

Brief profile

Holding company: FUCHS PETROLUB SE, headquartered in Mannheim, Germany. World's largest independent lubricant manufacturer with more than 100,000 customers, including automotive suppliers, OEMs, and companies from the mechanical engineering, metalworking, mining, aerospace, power generation, transport, agriculture and forestry industries.

Founded: 1931

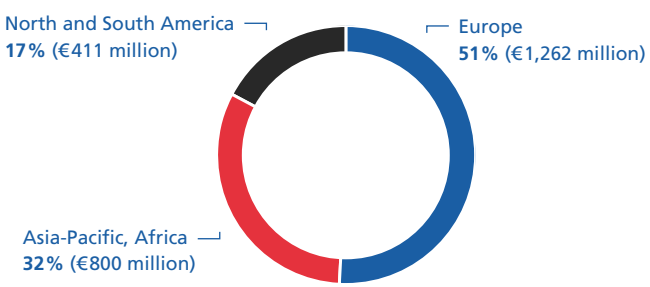
Employees: More than 5,000, of which more than 400 in research and development (R&D)

Locations: 58 operating companies and 33 production plants in over 45 countries

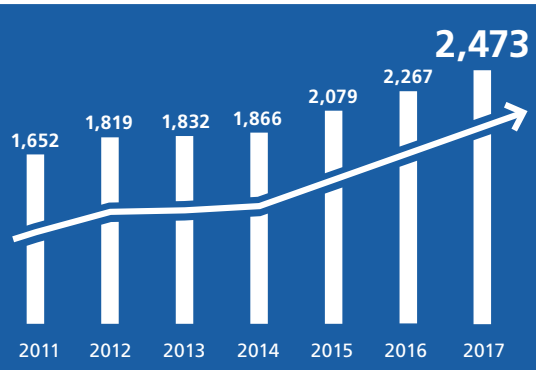
Products: A full range of more than 10,000 lubricants and related specialties for hundreds of applications in the key automotive, industrial, metalworking, special applications, lubricating greases and services categories.

FUCHS lubricants meet the highest quality standards and stand for performance and sustainability, safety and reliability, efficiency and cost savings.

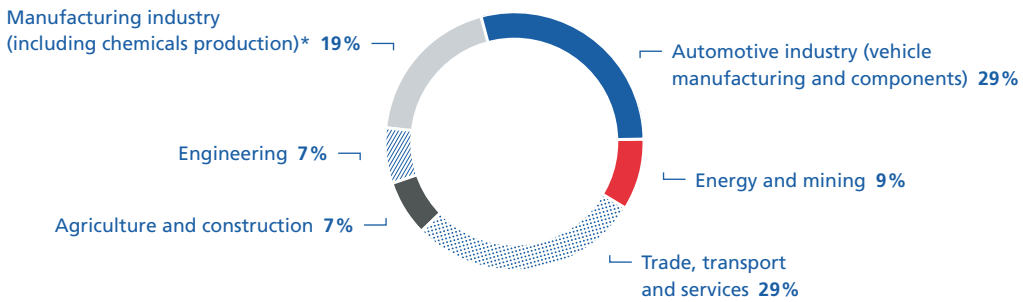
Sales revenues by customer location in 2017



Group sales revenues up €206 million in 2017



Breakdown of group sales revenues by customer sector 2017



* Manufacturing industry = producer goods, capital goods, consumer goods.

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