

FACE

THE VOLKSWAGEN GROUP MAGAZINE

THE CHANGE



2018

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Volkswagen



Audi



SEAT



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Commercial
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THE KEY TO MOBILITY

The Volkswagen Group 2018: From people. For people.

E-mobility, autonomous driving, mobility as a service – the entire automotive industry is facing enormous challenges. With our “TOGETHER – Strategy 2025” program for the future, we have come up with convincing answers: we are making the Volkswagen Group more open and efficient, more innovative and customer-centric. The figures show we are on the right track. The Volkswagen Group delivered more vehicles in 2017 than ever before. And we are making rapid progress with “Roadmap E” – the most comprehensive electrification initiative in our industry.

Notwithstanding these successes, it is also clear that realigning a company like Volkswagen takes time. It takes patience and stamina on the part of all involved. And we must learn to live with setbacks along the way. We will not allow ourselves to be discouraged by them. We will continue to devote all our energy to making the Volkswagen Group a leading provider of sustainable mobility.

The magazine section of the Volkswagen Group Annual Report 2017 also reflects this spirit of change. The magazine has a new face – or to be more precise, many faces. Transparency and integrity, a team spirit and a zest for innovation are core values in our company, values that are lived and shaped by our employees day in, day out. Their opinion counts – irrespective of hierarchy or field of expertise. That is why we asked colleagues from different continents and departments to share their views on important mobility issues with us for this magazine. Their statements and portraits are both the leitmotif of this issue, and a symbol of our sense of a new beginning. Jennifer Wittmann and Servet Çelik feature on the cover pages. Wittmann is an Executive Assistant at MOIA in Berlin, Çelik is an Enterprise Architect at Volkswagen IT Sales & Marketing in Wolfsburg.

“Face the change” is the motto of the 2018 magazine. It is a twofold motto. On the one hand, it expresses our firm resolve to tackle change together. And on the other, it reminds us that good, genuine, sustainable change always comes from people, for people. We hope you find this magazine enjoyable and informative.



THE WIND OF CHANGE IS A PRETTY POWERFUL MOTOR, ISN'T IT?

Courtney Cox

UX Motion Designer, Electronics Research Lab,
Volkswagen Group of America, Belmont

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Go Electric

EVs are the best option for everyone.

Especially if they have green license plates.

Xiaohang Yin

Head of Digitalization & Connectivity,
Audi China, R&D, Beijing

About half a million electric vehicles are already being sold in China. Why? Because buying an EV is a lucrative alternative. In many big cities, EV owners are issued with their green license plates straight away. For other owners, it takes years.



“The thirst for innovation is stronger than ever.”

The auto industry is facing the biggest transformation in its history. Ulrich Eichhorn and Henning Kagermann discuss the most pressing issues.

Text: Jochen Förster, Tom Levine | **Photos:** Holger Talinski

Where are e-mobility and CNG drives headed? How will today's automakers become the mobility services providers of tomorrow? Will we still own cars ten years from now? And what can the Volkswagen Group learn from the software industry? When it comes to the top issues impacting future mobility, hardly anyone can match the expertise of the two gentlemen we are meeting this afternoon at DRIVE, the Volkswagen Group Forum in Berlin: Dr. Ulrich Eichhorn, Head of Research and Development at the Volkswagen Group, and Prof. Henning Kagermann, President of the Deutsche Akademie der Technikwissenschaften (National Academy of Science and Engineering (acatech)) and a leading thinker on mobility issues. They know each other from many expert discussions. They both hold science PhDs – one of them in mechanical engineering, the other in physics. And both value a frank and open exchange.

Mr. Eichhorn, people have been predicting the beginning of the electric era for years, but so far e-mobility still hasn't become a mass market anywhere, not even in its heartland of China. When will this change?

EICHORN My estimate is 2020. By then battery production will have become so cost-efficient that we will be able to offer EVs at affordable prices, and we will have a meaningful charging structure by then, too. In other words, the EVs we will be putting on sale from 2020 will have a range of up to 600 kilometers, and get an 80 percent charge in 15 to 20 minutes. And they will cost about the same as conventional drives. That does away with the three main reasons why customers are reluctant to buy electric: high price, low range and inadequate charging facilities.

When it comes to EV numbers, Norway and China are way ahead of the U.S. or Germany. What can we learn from these trailblazers?

KAGERMANN Market support from the governments in these countries is far more extensive.



To steer or not to steer? Ulrich Eichhorn (right) shows Henning Kagermann that self-driving can be fun, too.



Should the Volkswagen Group produce its own battery cells? The experts can't quite agree.

“We'll soon be able to produce synthetic natural gas from sustainable sources. So CNG vehicles will be carbon neutral.”

Dr. Ulrich Eichhorn, Head of Research and Development at the Volkswagen Group since 2016

In Norway, EV drivers are allowed to use bus lanes and they have free public parking in cities. China uses an even more powerful instrument – vehicle registration. If you buy a car with an internal combustion engine in Shanghai you can often wait years to get your license plates. But if you buy an EV, you get them straight away. There are good reasons why we don't use such methods. Nevertheless, things have changed quite a bit in Germany, too. Take the environmental incentive and the charging infrastructure program, for example. In global terms, though, other countries are much further ahead.

What is Volkswagen doing with regard to infrastructure?

EICHORN Together with other manufacturers we have founded a pan-European high-power charging network called IONITY to build a network of fast charging stations along motorways and major routes in Europe. We are doing something similar in America with Electrify America. We believe fast charging is essential for making e-mobility attractive for long journeys, too. There will be high-power charging stations at all motorway gas stations and service stations in Germany by 2020. We will be providing many of them.

Let's talk about range. Surely anyone who wants to become a leading e-mobility services provider must have their own battery production?

KAGERMANN In my view, the complete battery technology, in particular the battery cells, is the core competence. The battery is the critical factor for quality, costs, and performance. In the future, it will be just as crucial as the engine is today. It's encouraging to see that Volkswagen is already producing battery packs in Salzgitter. If we look at battery cell production, on the other hand, we see a different picture. And yet this is a strategic factor.

EICHHORN We have already been running a battery lab for decades – although we haven't yet started mass production. Battery packs are undoubtedly an integral part of an EV. We produce them ourselves, for instance in Brunswick, or purchase them from suppliers. In-depth expertise about battery cells is a must. As a car manufacturer we need to understand how battery cells behave in the vehicle, even at a temperature of minus 15° Celsius. On the other hand, going into mass production is first and foremost a question of cost-effectiveness.

The Volkswagen Group is not currently focusing exclusively on e-mobility, but rather on a drivetrain mix which also includes Euro 6 diesel engines and CNG powertrains. Is that half-hearted or clever?

EICHHORN Above all, it is realistic and caters for the fact that, today, vehicles with internal combustion engines are genuine all-rounders. For buses and trucks, diesel is not only the most efficient solution, it's also the cleanest – particularly for long-haul journeys. And as far as cars are concerned, our present-generation EA 288 TDI engines rank among the cleanest there are. We have got the upper hand when it comes to pollutant emissions – and it's important to remember that the diesel engine has significant benefits as regards CO₂. The reason we are backing CNG is that we will soon be able to produce synthetic natural gas from sustainable sources. Audi operates a plant near Cloppenburg that converts wind power into synthetic methane. That makes CNG vehicles carbon neutral. I believe that in the foreseeable future we will have a drivetrain mix where electric drives take the place of the internal combustion engine. By 2025, one-quarter of the



Learning from IT: Ex-SAP executive Henning Kagermann (left) believes software firms have the edge when it comes to teamwork.

vehicles we sell will be pure electric models. And this also means that, by that time, we need a solid infrastructure to be able to produce 2.5 million vehicles.

Obviously, drivetrains are important. But don't car manufacturers also need to step on the gas when it comes to connectivity? There's a software update for cell phones every few weeks.

EICHHORN We can only follow that approach to a certain extent. Let's say a cell phone has just been updated and then some of the features no longer function properly or the phone simply switches off. That's nothing like as dangerous as it would be if the same thing were to happen in a car. When it comes to testing and validation, we are talking about a totally different scale.

To what extent is connectivity redefining the mobility sector?

KAGERMANN The challenge isn't so much creating a link between the car and the internet. That's easy. In my view, it is mobility platforms that



Driverless driving: For Henning Kagermann, one benefit will be improving everyday life for the elderly, the blind, and people with disabilities.

will play a central role in the future. They are the thing that will radically change the market. Platform operators may possibly become the strongest competitors for car makers. For me, one big advantage for the manufacturers is autonomous driving. When it comes to self-driving, customers are more likely to trust Volkswagen than start-ups.

EICHHORN Over the next few years, three technological innovations – e-mobility, connectivity and autonomous driving – will merge with two social trends: urbanization and sustainability. That brings our customers a totally new experience on three levels: mobility as a service in an autonomous electric car. We tested that with Sedric back in 2016, and demonstrated how well it works. At the moment, we are conducting intensive research into the easiest way for customers to book cars like Sedric and integrate them in their everyday mobility.

How can an automobile brand stay relevant in such a service market?

EICHHORN If the Volkswagen Group operates its own ride services then the quality of our vehicles is a decisive factor – design, engineering, ride comfort. As is service, in every respect: availability, cleanliness, billing system, assistance systems. And another factor will be: how well does autonomous driving function? In short, as the Volkswagen Group, we will then be judged by far more performance criteria than we are today.

So far Volkswagen has had a strong bias on engineering. Does the Group need to be more IT-driven?

KAGERMANN I think that is a challenge for the entire automotive sector. Agile working and “disruptive-creative innovation cycles” have been common practice in the software industry for a long time. In other words, the entire system is challenged every few months; you need to adjust your leadership structures and retrain your developers in new methods. In addition, software firms have always had a strong focus on innovation partnerships. The auto industry can learn quite a lot in these areas.

So for car manufacturers, that means much closer cooperation among Research, Design and IT in the future?

EICHHORN The Group strategy is called “TOGETHER 2025” and not “TOGETHER 2020” for a reason. We can’t switch to new mindsets and ways of working overnight. Even so, there is already much closer R&D cooperation among the brands today than there was a few years ago. And we introduced a new function in 2017 with the heads of the series groups who are responsible for all aspects of the vehicles in one series, as well as moving forward with integrated work processes.

At what levels do you see the Volkswagen Group well equipped for the electric era?

EICHHORN We have a high-quality, broad-based, global portfolio. On top of that, we have developed a previously unknown drive for reform in recent years. The diesel crisis was a wake-up call for the future viability of the Group. It was serious and shocking, but the call came at the right time. Three years ago, we certainly would not have been showcasing a vehicle like Sedric at a motor show, or setting up MOIA, or forging cooperations with start-ups like Aurora. Today, the thirst for

innovation, the intense desire to explore new terrain, is stronger than ever in the Group.

We have talked a lot about connectivity and mobility services. But are we maybe forgetting rural areas? After all, the majority of car buyers today do not live in inner cities.

EICHHORN If I don't live in Berlin or Los Angeles, but in a much more remote region, I would be wasting my time trying to contact a mobility services provider. But Sedric could be deployed in rural regions, too, for example to collect customers after a visit to the pub. One thing is certain: private vehicles will still be a necessity in the future. And there will still be auto fans who just enjoy

getting their hands on the steering wheel. Multi-optionality will be the catchword for mobile life.

KAGERMANN I believe autonomous driving will be an enormous chance to revive rural regions. Vehicles such as Sedric give mobile access to remote areas that cannot be reached by bus or train. And for some target groups, this means greater mobile freedom and quality of life – for the elderly, the blind, and people with disabilities, to name just a few. Not to mention more freedom for everyone and less stress, for instance on journeys in heavy traffic. Some models already offer enormous assistance today. In this sense, autonomous driving really is a wonderful thing.



Ulrich Eichhorn was born in Obernburg am Main in 1961. He holds a PhD in mechanical engineering.



Henning Kagermann was born in Brunswick in 1947. He holds a PhD in physics.

“Agile working has been common practice in the software industry for a long time.”

Prof. Henning Kagermann has served as Chair of the German National Platform for Electric Mobility since 2010



Discussion with drive: The experts and their interviewers Jochen Förster and Tom Levine (right) at DRIVE. Volkswagen Group Forum in Berlin.

Roadmap E: full of energy!

The Volkswagen Group is gathering speed as it heads towards the age of e-mobility. What can we expect? Here are seven recent milestones.

Text: Joachim Hentschel

Anyone who has already sat in an e-Golf¹ or e-up!², an A3 e-tron³ or Passat GTE⁴ and experienced the acceleration, the silent ride, and the ease of use will happily confirm that e-mobility really is quite something – and it's happening right now. The transition from internal combustion engines to electric powertrains is often talked about as if it were an abstract principle, a topic for forecasts and visions. For Volkswagen Group brands and their customers, though, electric drives have been the real thing for quite some time now. Go electric? Let's go!

Several all-electric cars and plug-in hybrids are already on sale, and many more developments are in the pipeline. CEO Matthias Müller presented "Roadmap E," the most comprehensive electrification initiative in the global automotive industry, in fall of 2017. By 2030 at the latest, Volkswagen Group brands will be offering at least one all-electric or hybrid version of their entire portfolio, comprising some 300 different models. Setting itself such a deadline is an unusual step in the automotive industry – and above all one that testifies to just how seriously the Group is taking e-mobility. "We are reinventing the car," Matthias Müller says. "To achieve this, we are making targeted investments to provide the necessary funds from our own resources."

**€50
billion**

and more is the sum the Group will be investing in battery cell procurement over the coming years.

The Volkswagen brand, for example, is currently developing the Modular Electrification Toolkit (MEB). This is a vehicle architecture optimized for e-mobility, which will serve as the basis for all future electric vehicles in the volume segment. Audi and Porsche are collaborating on the Premium Platform Electric (PPE) for the premium segment. In addition, the Group is researching battery potentials, getting production ready for manufacturing electric vehicles – and taking responsibility for the customer experience in



2



Volkswagen I.D. family

The project: It all began in 2016 with the all-electric I.D. concept car for the compact class (left). This was followed by the I.D. BUZZ electric van (center) and the I.D. CROZZ electric SUV (right). The trio was then showcased as a model family at the Los Angeles Auto Show in winter 2017. The family is designed for a range of between 500 (I.D. CROZZ) and 600 kilometers (I.D., I.D. BUZZ). The first model in this family, the compact-class I.D., is scheduled to go into production at the Zwickau plant in Saxony, Germany, at the end of 2019.

The mission: Volume models like the Golf or Bulli have cult status – the electric chapter of the Volkswagen legend begins now.



1

MOIA ride pooling

The project: The first vehicle from MOIA, Volkswagen AG's new mobility services company, is a fully-electric six-seater. It is part of a comprehensive ecosystem for ride pooling to be rolled out in Hamburg at the end of 2018. Like taxi sharing, rides can be booked via an app. An algorithm groups together passengers with similar destinations.

The mission: Clever e-concepts make urban transport cleaner and more relaxed.

80

new electric and plug-in hybrid models from the Group will be on sale by 2025.

charging and the charging infrastructure. One goal of the IONITY joint venture, launched in cooperation with other automotive manufacturers, in November 2017 is to expand the vitally important network of fast charging stations along major routes across Europe.

But what does all this mean for the immediate future? What concrete ideas and models from the Group and its brands are already driving Roadmap E forward? Here are seven current examples.

3



Porsche Mission E

The project: Fans caught a glimpse of the first test mule at the Nürburgring in October 2017. The all-electric four-door sports sedan (shown here as a concept study) offers the driving pleasure and dynamics that have made Porsche a legendary brand. The Mission E is designed for a driving range of 500 kilometers. It is expected to go into production late 2019 at the brand's main plant in Zuffenhausen, which is being expanded specifically for the purpose.

The mission: This model from Porsche underscores just how sporty, fast, and luxuriously stylish e-mobility can be.

MAN eTGM

The project: Silent and emission-free distribution transport will revolutionize logistics. MAN has debuted the eTGM, a fully electric truck, with practical trials starting in 2018. Other key e-projects from Volkswagen Truck & Bus include the e-Delivery electric distribution truck from Volkswagen Caminhões e Ônibus, electric city buses from MAN and Scania, the Electric Road Truck from Scania, and the e-Crafter from Volkswagen Commercial Vehicles.

The mission: Electrification opens up new opportunities for freight transport – and the Volkswagen Truck & Bus brands have the solutions.

5



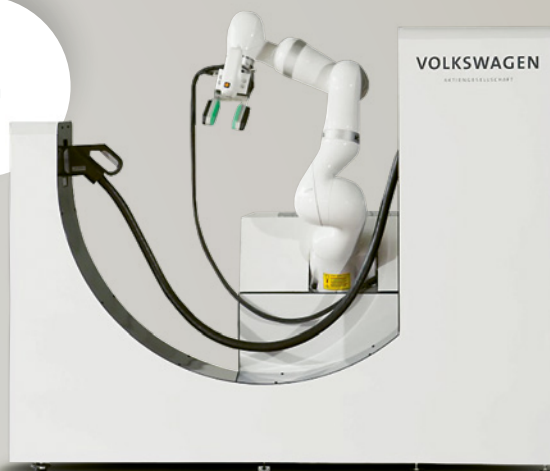
e-smartConnect quick-charging station

The project: One of the most frequently expressed reservations about e-mobility is the risk of not being able to find a charging station – or only finding the wrong kind – while traveling. Group Research is currently developing e-smartConnect, an automated e-filling station, in order to provide an optimal service in the future.

The connector and the vehicle are linked via a special cable arrangement and the use of a lightweight robot. Research on mobile charging robots is also underway.

The mission: Volkswagen is working on innovative projects that address the critical issues associated with the charging infrastructure.

4



6



Audi Brussels plant

The project: The Audi e-tron, the brand's first all-electric SUV model (shown here as a concept study) is to be produced at the Audi plant in Brussels, Belgium, from 2018. Work began in 2016 to transform the present factory, which has been producing the A1 family since 2010, into a model facility for the carbon-neutral production of electric vehicles. A1 output will be shifted to Martorell in Spain.

The mission: As e-mobility gathers momentum, Audi is investing wisely in innovative production technology.

ŠKODA VISION E

The project: The VISION E concept car from ŠKODA is a fully electric SUV coupe. The brand's emotionally designed first electric model has a range of 500 kilometers and also meets the Level 3 requirements for autonomous driving (Conditional Automation – the system monitors its performance limits and transfers to the driver when these limits are reached). A production version is in the pipeline for 2020.

The mission: SUVs are a great favorite with customers, and ŠKODA is proving that elegant and efficient electric versions are possible.

7



- 1 Volkswagen e-Golf: power consumption in kWh/100 km: combined 12.7; CO₂ emissions combined in g/km: 0; efficiency class: A+
- 2 Volkswagen e-up!: power consumption in kWh/100 km: combined 11.7; CO₂ emissions combined in g/km: 0; efficiency class: A+
- 3 Audi A3 e-tron: fuel consumption, l/100 km: combined 1.8 - 1.6 (petrol); Power consumption in kWh/100 km: combined 12.0 to 11.4; CO₂ emissions combined in g/km: 40 to 36; efficiency class: A+
- 4 Volkswagen Passat GTE: fuel consumption, l/100 km: combined 1.8 to 1.7; power consumption in kWh/100 km: combined 13.9 to 13.4; CO₂ emissions combined in g/km: 40 to 38; efficiency class: A+



Traffic in tomorrow's world.

How will people get from A to B in the future? The Futures of Mobility project developed scenarios for 2030+.

Text: Jana Galinowski | **Illustrations:** Hannes Geipel

Vehicles that take you direct to the 30th floor. Automated deliveries direct to your doorstep whenever suits you best. Passenger drones that fly round traffic jams. That could be the future shape of mobility in metropolitan cities. Everyday life for people living in a megacity is very different from

daily life in a sparsely populated rural area. That is why demands on mobility also vary so much. The Volkswagen Group has developed several scenarios for the year of 2030+. "With Futures of Mobility, we offer a tangible vision of the lives that our customer will lead in various regions of the world in the future," says Dr. Daniel Kauer, Head of Product and Platform Strategy at the



“Our worlds of the future don’t focus on specific vehicle innovations. Rather, they concern the wishes and desires of people.”

Dr. Daniel Kauer

Head of Product and Platform Strategy,
Volkswagen Group



“The scenarios of the worlds of the future will be developed further and refined.”

Dr. Axel Heinrich

Head of Group Research,
Volkswagen Group

Volkswagen Group. San Francisco, Beijing, Mumbai and eastern Saxony serve as representative examples for many other regions on the planet.

No blanket solution

Numerous trends and factors were examined under the project led by Dr. Michael Müller and Bitu Daryan. One such factor is urbanization. In 2050, around 80 percent of the world’s population will live in metropolitan areas – double the present figure. The impact of urbanization on traffic will be felt in both urban areas and rural regions. The economic and political framework, cultural trends, environmental aspects and innovative strength also play a role. “That means each type of city needs its own mobility solution,” explains Dr. Axel Heinrich, Head of Group Research at Volkswagen. Beijing, for example, will produce significant amounts of vertical growth, which is why vertical transportation is more important there. In contrast, San Francisco could give priority to adaptive vehicles – in other words, vehicles

that modify themselves to a user’s needs and can become mobile offices or living rooms. In rural areas like eastern Saxony, shared mobility concepts could feature more prominently.

Out of the lab and onto the road

Group Future Heads, a network of some 200 experts from different fields and regions, bundles the expertise and knowledge in the project. The company is expanding its portfolio based on Futures of Mobility. Describing the approach, Kauer says, “Product, service and business models will no longer be segregated from one another. Instead they will be developed into a holistic mobility solution for our customers.” And the future is already defining the work of the Volkswagen Group. “We are already experiencing and shaping the change in many areas,” says Heinrich. “I’m talking about things like new drive technologies, new mobility services, or autonomous driving.”

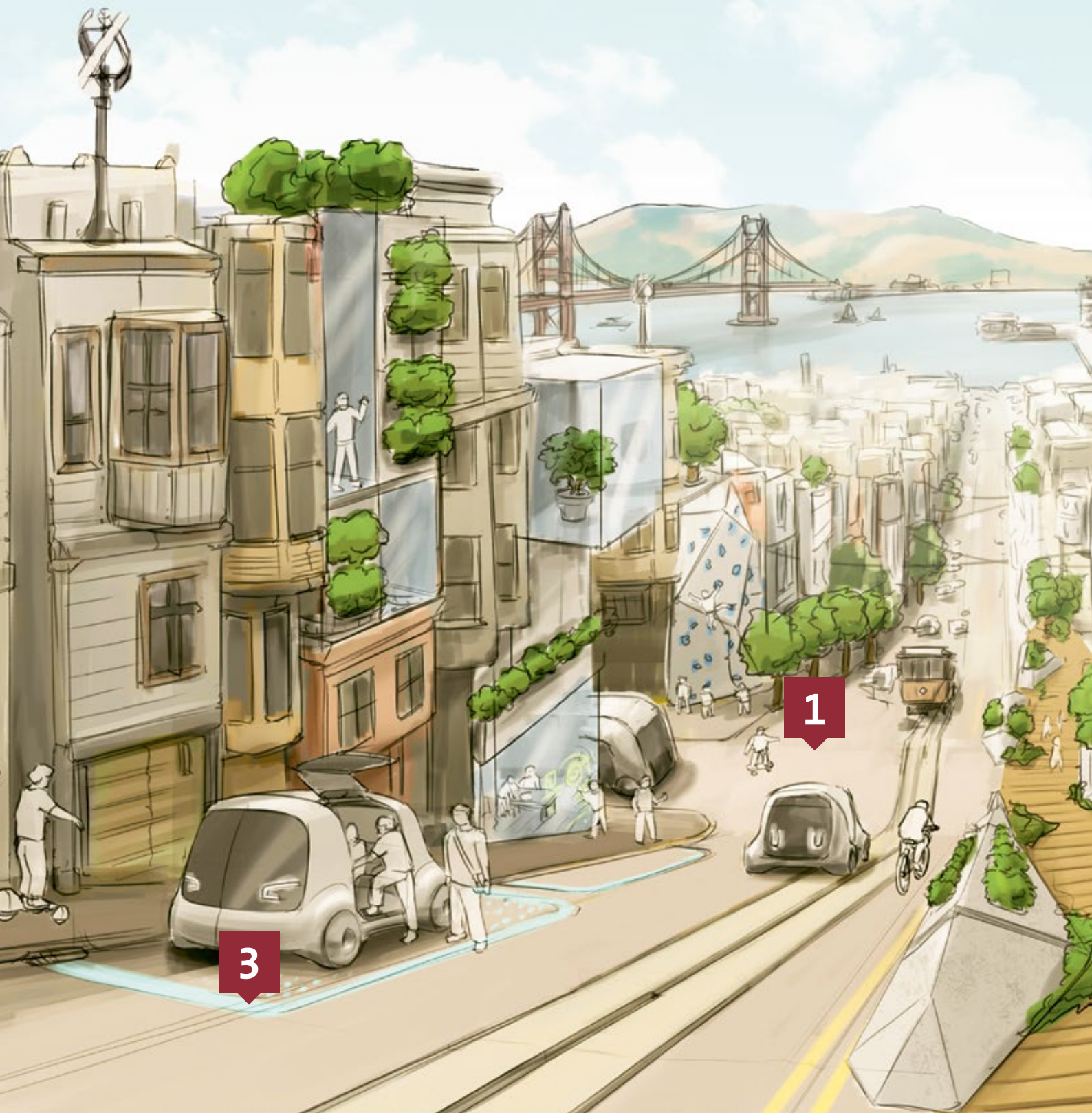


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SAN FRANCISCO: West Coast trailblazer

Hardly any other place has defined the digital transformation like San Francisco. Nearby Silicon Valley is one of the most important IT and high-tech locations in the world. On the other hand, the city needs to overcome major challenges such as the risk of earthquakes and the threat of water shortages. Housing is becoming increasingly scarce. For these reasons, the city needs an infrastructure that enables mobility and is environmentally efficient.



San Francisco 2017 – 2030+

Economy: The region's economy is booming and will continue to grow. The number of jobs is forecast to increase from 600,740 (2013) to just short of 707,000 in 2030. At the same time, social imbalances could be exacerbated. San Francisco already has the highest poverty rate in the region.

Mobility: Housing space is becoming ever more scarce and rents are getting ever more expensive, particularly in the city. As a result, more and more people will have to move to outlying areas and commute downtown. San Francisco wants to make its streets safer: traffic fatalities are to be totally eliminated by 2024 (Vision Zero).

Innovation: With Silicon Valley nearby, people in San Francisco are very open to future technologies. The city will continue to rank among the leading innovation economies in the future. The city's trailblazing role will be strengthened by planned infrastructure investments of some \$10.1 billion by 2030.

Environment: There is a keen interest in sustainability and the city has set itself ambitious targets: the goal is to have 100 percent renewable electricity supply community wide by 2030. Moreover, there is to be zero waste by 2020. Today, the recycling rate is already 80 percent.

On the streets of the future

1

Adaptive vehicles

The car as a place to live and work – on the move. In the future, cars can be individually configured and adapted to suit specific needs. As an open-air office, for instance: the car becomes both a workplace and a means of transport. It is fully connected and equipped with sensors, among other things. That means it can even turn itself into a camera or a scanner, for example to make 3-D recordings for virtual reality videos.

2

Smart bicycles

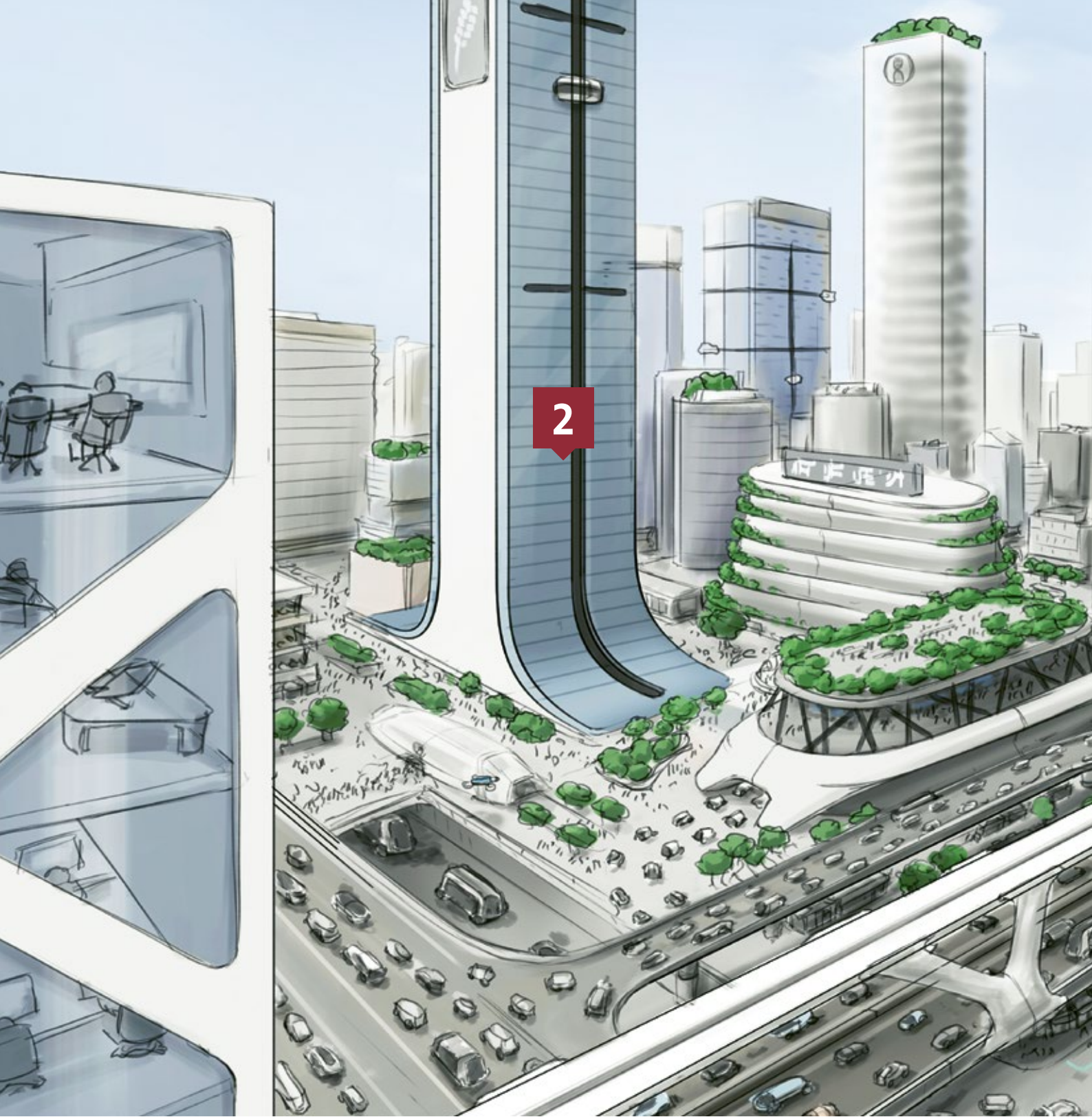
Equipped with navigation system, GPS, and sensors, bicycles become another part of the digital infrastructure. So the interaction between the different forms of transport – cars, autonomous shuttles and bicycles – is stress-free. Eliminating parking space means greater freedom for cyclists, too. Moreover, the extra bicycle lanes ensure greater safety.

3

Wireless charging stations

E-mobility will become standard. Charging stations throughout the city will make it easy to fuel up – minus the tangled mess of cables. In the future, there will be special loading plates for wireless charging at parking spaces, for example. An EV parked on one of these spaces is automatically charged.

2



BEIJING: Efficient hypercity

It's a megacity between traditional and modern: society is shaped by the political framework, but prosperity and education lay the foundation for a growing middle class, and individuality and sustainability are gaining in importance. As a result, demands on infrastructure, mobility, and safety are increasing. Moreover, the Beijing metropolitan region is to become the urban development model for the China of the future.

On the streets of the future

1

High-speed lines

Given the high population density, efficient mobility is particularly difficult. One solution is dedicated lanes for autonomous vehicles, where they can travel faster and more safely than on roads with mixed traffic.

2

Vertical mobility concepts

Anyone who likes to travel in comfort can enjoy “first-class mobility” in luxuriously equipped vehicles, where business professionals, for example, can relax or work during the journey. In the future, these vehicles will dock onto skyscrapers and deliver their passengers to the right floor.

3

Passenger drones

Despite smart traffic concepts, there will still be congestion on Beijing's streets. The fastest way to travel will be by air. The first passenger drones will take Beijingers to their destinations. Quadcopters will be fitted with cabins that can comfortably transport one or two passengers.



Beijing 2017 – 2030+

Economy: Beijing is an ever-growing, attractive industrial location. China plans to strengthen its technology industry and industrial production over the coming ten years. Some 70 percent of industrial robots, for example, are to be manufactured domestically.

Mobility: By 2030, some 130 million people will be living in the Beijing metropolitan area — about 30 million more than today. That means an immense increase in traffic flows. High-speed trains will enable efficient transport. Today, China's bullet train rail network is already longer than the European network. A further 7,000 kilometers are to be added by 2020. In addition, the government is planning to build 23 new subway lines by 2030.

Innovation: Beijingers are known to have a high affinity for new technologies. Not only that, but the region is also the most important player in the gigantic market for data collection and analysis. Furthermore, the government encourages forward-looking technologies and innovations to locate in the region.

Environment: Smog is a big problem in Beijing. Decisive action is being taken against air pollution in preparation for the 2022 Winter Olympics. Political restrictions such as e-mobility incentives and banning certain car models have already significantly improved air quality and the quality of life.

MUMBAI: On the road to the modern world

To an outsider, the scene is one of chaos. With a population of around 18 million, Mumbai has the world's highest population density. The modern metropolis is a magnet for international professionals and young, highly educated Indians. The population of Mumbai Metropolitan Region is likely to reach 33 million by 2030. Rapid growth is exacerbating the social and infrastructure problems – first and foremost as regards housing, which is already in short supply. The state government is aiming for a slum-free Mumbai by 2022.

Mumbai 2017 – 2030+

Economy: The young population and ever more skilled specialists make Mumbai a favorite location for the digital industry and the financial sector. There will be significant economic growth. By 2025 Mumbai will rank among the world's richest cities.

Mobility: As a result of the growing economic strength, more people will be able to afford a car of their own. By 2025, the number of cars in Mumbai will rise to about 40 – 45 per 1,000 inhabitants, compared with only 20 today. The transport system is already overloaded and the situation will get worse.

Innovation: Mumbai is a city of contrasts. On the one hand, Mumbai residents love high-tech and enjoy trying out new technologies. On the other, society is still shaped by traditional ways of thinking and working.

Environment: The quality of life in Mumbai is suffering. This is due to the critical state of the environment in terms of emissions, air and water quality, and hygiene. The Indian government is taking the first steps and has pledged to reduce emissions by 35 percent by 2030.



On the streets of the future

1

Shared mobility concepts

Digitalization will make more efficient use of the existing infrastructure in Mumbai. Shared mobility concepts, for example, will ease the strain on mobility. People can select and share different models from a vehicle fleet to suit the specific occasion.

2

Bus rapid transportation

For getting to your destination quickly and easily despite the immense commuter traffic, Mumbai will have exclusive lanes for innovative rapid buses.

Thanks to their own infrastructure, these buses take their passengers to their destinations faster and more reliably.

3

3

e-mobility zones

The widespread use of electric vehicles helps to improve air quality. That is why creating emission-free areas in the city is one element of the sustainable urban planning concept.

The only vehicles allowed to travel in these areas are electrically powered. Anyone who does not own an EV can book an e-shuttle using the MOIA app.



EASTERN SAXONY:

Bridging the distance

Picturesque landscapes, but not many people – Saxony is already clearly feeling the effects of demographic change. Some local communities will have lost almost one-quarter of their inhabitants by 2030. Young people in particular are moving to cities, and by 2030 the average age in Saxony will be about 48. Rural life does have its advantages, though. Everyone knows everyone else, people help each other and engage with their communities.

Eastern Saxony 2017 – 2030+

Economy: Agriculture will remain a key sector, but tourism also generates revenues and jobs. However, given the demographic trend, pensions will be the most important source of income. At the same time, eastern Saxony could see the creation of social innovations such as community services and local exchange concepts.

Mobility: Because of the sparse population, infrastructure is expensive and expansion

is stagnating. That is true for broadband coverage as much as for energy, goods and services, schools, and physicians. Without a car, is it hardly possible to cope with everyday life in the region. Given the aging population and general budget restrictions, that could become a problem.

Innovation: There is still no reliable, area-wide broadband coverage. However, there are plans to invest €160 million in expanding

the broadband network. New living environments such as multigenerational homes are already being tested in the region.

Environment: Country air is healthy – above all tourists from the cities appreciate that. Consequently, sustainability and nature conservation are an issue in the region. Local production of energy from renewable sources will spread. And the majority of new vehicles will have an electric drive.





On the streets of the future

1

Delivery networks

People usually have to travel quite a distance to supermarkets, bakeries, or drugstores. That is why networked delivery systems are important. For example, mobile convenience stores could deliver basic groceries directly to the door. Thanks to community platforms, neighbors could run errands when they drive to town.

2

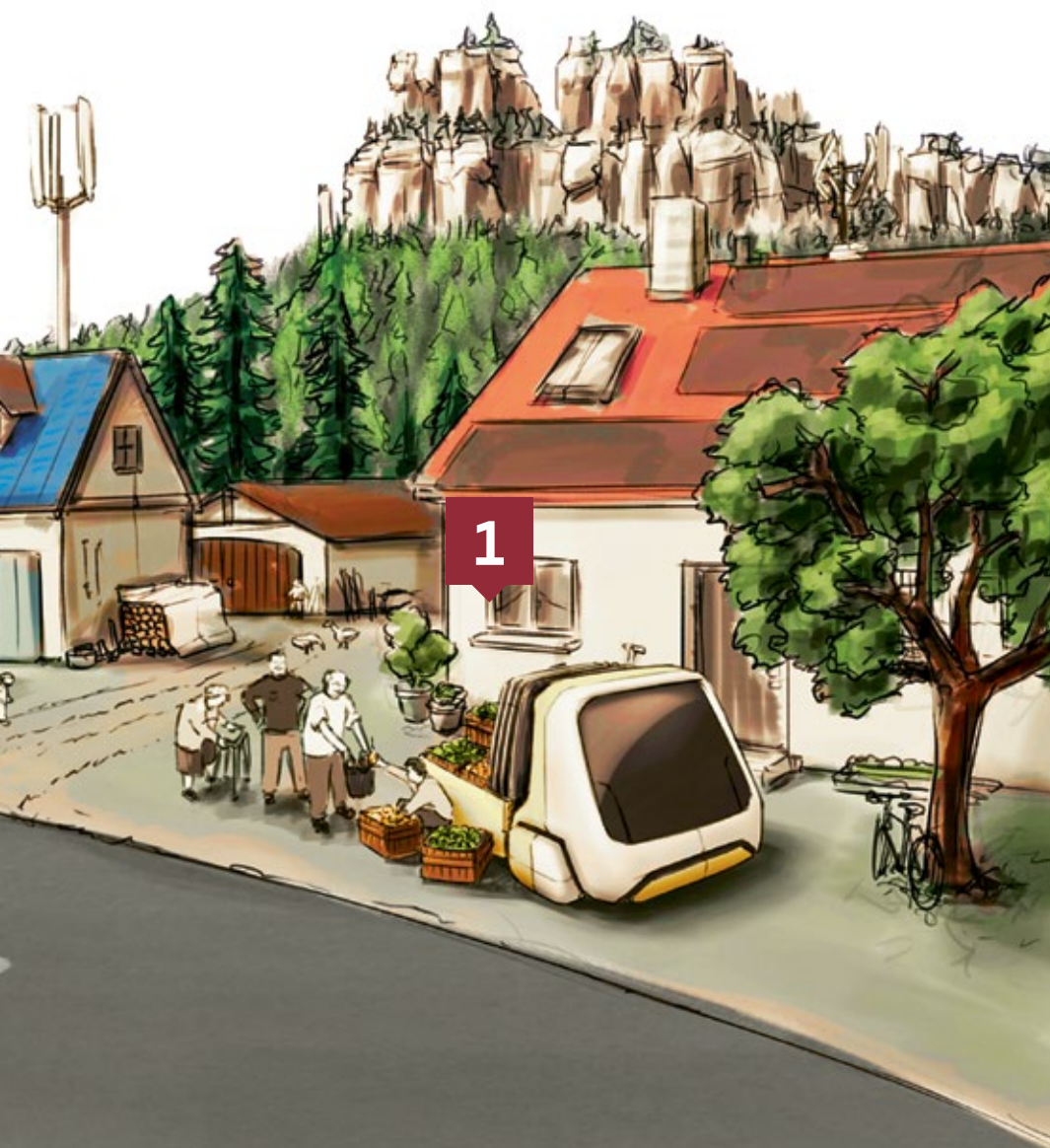
Shared mobility

In rural areas, having your own car will always be important. Nevertheless, there will also be car-sharing concepts such as peer-to-peer platforms that function like ride-pooling centers. Or autonomous shuttles that collect passengers direct from their doorsteps.

3

Temporary infrastructures

In 2030, area-wide broadband coverage will still not have materialized. That is why temporary digital infrastructures will be set up – in the air. Drones with integrated radio units will provide highly efficient data lines.



Smart city concepts

All over the world, the Volkswagen Group is working on services and solutions for intelligent mobility. These activities include the following three research and pilot projects.

SEAT Metropolis: Lab Barcelona

SEAT and the city of Barcelona wish to support innovation and sustainable mobility. The company is one of the initiators of CARNET. Other participants in this research and innovation network are Volkswagen Group Research and UPC (Polytechnical University of Catalonia). The lab has already presented concrete solutions such as the “About it” navigation app.

Intelligent solutions for China

The requirements for smart mobility are growing in China’s urban areas. The Volkswagen Group is working on concepts for the smart city of the future with partners, such as Tongji University in Shanghai and further cities in China.

Smart City Dresden 2025+

Dresden is to become a model city for smart traffic concepts. That is why Volkswagen Saxony and the state capital have formed a partnership. Their aim is to introduce new solutions and services, such as the UMA Navigation app for smartphones that continually checks the current traffic situation to recommend the ideal route and provides information on parking availability.

Connect with Consumers

Our cars are our smartphones.

They let us communicate
directly with customers.

Vânia Chicarolli

Body Shop production worker,
Volkswagen do Brasil, Anchieta

Networking gives car manufacturers new opportunities for service and interaction. Customers can chat with them on Twitter or Facebook via consoles. In Brazil, roughly three quarters of adults actively use social networks.





Kristina Martin
delivers the
Bentley direct to
the customer.

Today a Bentayga, tomorrow a Continental GT.

Bentley on Demand offers a luxury mobility solution for customers. The Bentley of their choice is delivered to their door – thanks to concierges such as Kristina Martin.

Text: Lukas Hermsmeier | Photos: Kelly Serfoss

A sunny Monday morning in Long Beach. In a large hall about 30 kilometers from downtown Los Angeles, a Bentayga¹, a Mulsanne² and a Continental GT³ are lined up next to each other. So much Bentley luxury in one place. Mechanics and valeting staff are bustling about. The air smells of cleaning products. Every now and then one of the mighty engines gives a roar. In the thick of it all is Kristina Martin, one of the few not wearing overalls, but instead dressed in blazer, jeans and high heels. She walks past the highly polished luxury cars and heads straight for the office.

The 25-year-old is a concierge with the new Bentley on Demand service. Her working day already started two hours ago with an email from the Bentley office: a customer has reserved a vehicle for that morning at short notice.

Bespoke service

All the information about the reservation is waiting for Kristina in the office. Apart from the customer's name, the delivery time, and the location, this also includes special requests. Just about every customer has some special wishes. "It could be a lactose-free coffee. Or we could be asked not to ring the bell when we deliver the Bentley," Kristina says. For her, each reservation is different. She prepares carefully for each individ-

ual customer, from the beverage of choice, ready and waiting when the car is handed over, to the optimal seat position or the pre-programmed radio stations. Because customers make their reservations via the Bentley Network app, all the preferences are saved. "One of my regular customers appreciates a bottle of mineral water in the car. But she doesn't need to request that every time she uses the service. The information is automatically included in the reservation and we take care of it," Kristina explains. It is this bespoke service, combined with digital comfort, that makes Bentley on Demand so exceptional.



Service 24/7: Customers communicate with the concierges via the Bentley Network app.

“Possessing a Bentley is much more than just owning a car – it is an all-encompassing experience of luxury.”

Kristina Martin, concierge with Bentley on Demand



Car lover Kristina Martin looks forward to every journey in a Bentley. She delivers or collects a car from a customer almost every day.

Perfect organization

At 10 a.m., the final preparations are underway. Kristina's customer this morning has chosen a silver Bentayga. Two of the valeting staff clean and polish the car before Kristina inspects the Bentley together with a mechanic. Tank: full. Paintwork: glossy. Tire pressure, windshield washer fluid, oil level: all perfect. “Cars have always been part of my life, they're in my blood,” she says. She grew up in Detroit, the “Motor City,” spent hours and hours in her father's body shop, and worked for a car dealer once she graduated from high school. That stands her in good stead today. Detailed questions from customers do not put her off her stride. Neither does the final check in the workshop.

Forty-five minutes to go before the Bentayga is scheduled for delivery. Kristina uses the app to send the customer a reminder that the car will be delivered to his door at 11 a.m. Now comes the best moment for her: she settles in behind the steering wheel, drives out of the garage and makes a quick stop at a café to buy two cappuccinos – one for the customer and one for herself. Then she takes the highway that follows the Pacific coastline, heading for the picturesque Palos Verdes Peninsula in Los Angeles County.

Luxurious mobility

Bentley on Demand was launched as a pilot scheme in Los Angeles, New York, and Dallas in May 2017. Other cities in the United States and abroad are to follow soon. There are also plans to expand the connectivity features. Bentley on Demand already offers owners of these luxury cars a unique service: they can select a vehicle via the Bentley Network app and drive it for several days. The perfect solution for people who would like to try out a different model – or for Bentley drivers who do not want to forego the Bentley experience while on vacation or traveling on business. The concierges always deliver the car to the customer's preferred location – their home, a hotel, or a café. And they collect the car at the preferred location, too.

It's 11 a.m. sharp and Kristina has drawn up in front of a yellow house. The 30-minute drive was too short – for her anyway. But she has arrived exactly on time and that is the most important thing. Taking the cappuccino with her, she rings the doorbell, and a gentleman in his mid-thirties opens the door. A quick greeting, a little small talk. Kristina would like to know why the customer has chosen a Bentayga. He explains that he already owns a Bentley sedan, a 2013 Flying Spur⁴, and found out about the new Bentayga from the Bentley app. He has never sat in an SUV from Bentley before, so he wanted to try one out. The two make their way to the car.

“I don't have to explain the car's features very often, because the customer is already familiar with Bentleys,” Kristina says, and demonstrates some features of the new Bentayga, such as Apple CarPlay and the head-up display, that maximize driving pleasure. The brief introduction completed, Kristina hands over her business card – just in case there are any questions or emergencies – and takes a taxi back to the office. The customer has reserved the Bentayga for three days, and Kristina will be back again after that. What happens in the

Connect with Consumers



meantime? “Sometimes customers contact me. They usually have specific questions about the car. They might want to know how the seat massage system works,” she explains. The concierge and the customer communicate via the Bentley Network app. “Other customers let me know they would like to keep the Bentley for an extra day.” And of course she does her best to accommodate special requests. “One customer wanted to let his brother drive. I soon sorted out the formalities.”

When Kristina gets back to the hall in Long Beach, she meets Barrett, one of the other concierges, who is just about to set off. There is a Continental GT to collect at 2:30 p.m. in West Hollywood. Barrett has scheduled an hour to get there. “L.A. and the traffic, better safe than sorry,” he says. The two have known each other for years, and both worked at the same motor shows. “We were really pleased when Bentley asked us both whether we would like to take on jobs as concierges,



A Bentley instead of a rental car: Bentley offers customers a personalized mobility solution with the new service.

es, because it meant we could finally start working together,” Kristina recalls.

Sometimes there are three customers a day. Sometimes there is only one. Like today. Kristina pops into the office and then gets into a taxi. She always keeps an eye on her business cell phone. Maybe the Bentayga driver will want to know how the seat massage system works.

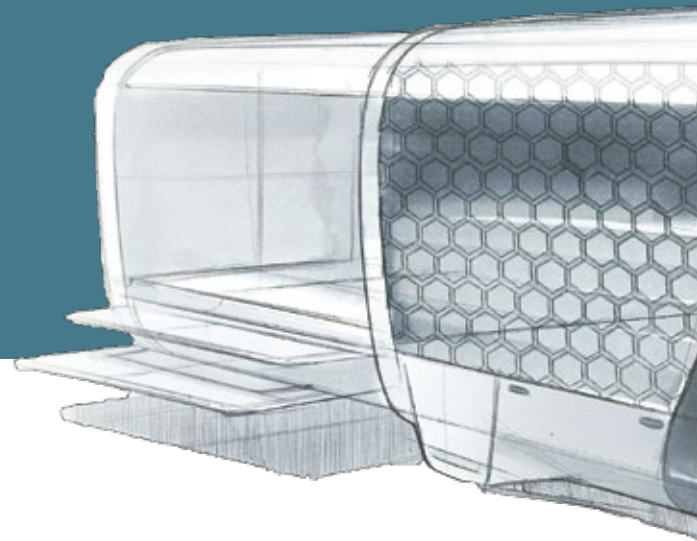
1 Bentley Bentayga: fuel consumption, l/100 km: combined 13.1; CO₂ emissions combined in g/km: 296; efficiency class: F

2 Bentley Mulsanne: fuel consumption, l/100 km: combined 16.9; CO₂ emissions combined in g/km: 393; efficiency class: G

3 Bentley Continental GT: fuel consumption, l/100 km: combined 14.5; CO₂ emissions combined in g/km: 338; efficiency class: G

4 Bentley 2013 Flying Spur: fuel consumption, l/100 km: combined 14.7; CO₂ emissions combined in g/km: 343; efficiency class: G

“The car will soon be our second home.”



Tomorrow's mobility brings the promise of unimagined possibilities for car interior design. Michael Mauer, head of Group Design at Volkswagen AG, explains the secret of this great new freedom – and shares some visions of the future.

Text: Michael Mauer

In the not too distant future, electric drives and highly intelligent driver assistance systems will be organizing driving, navigation, and even optimal traffic flows for us. This will not only make traveling greener, less stressful and more safe. It is also, for us designers, nothing short of truly revolutionary. So far, we have had to work within the boundaries of technology. Now, we are being given a technology that opens up entirely new possibilities.

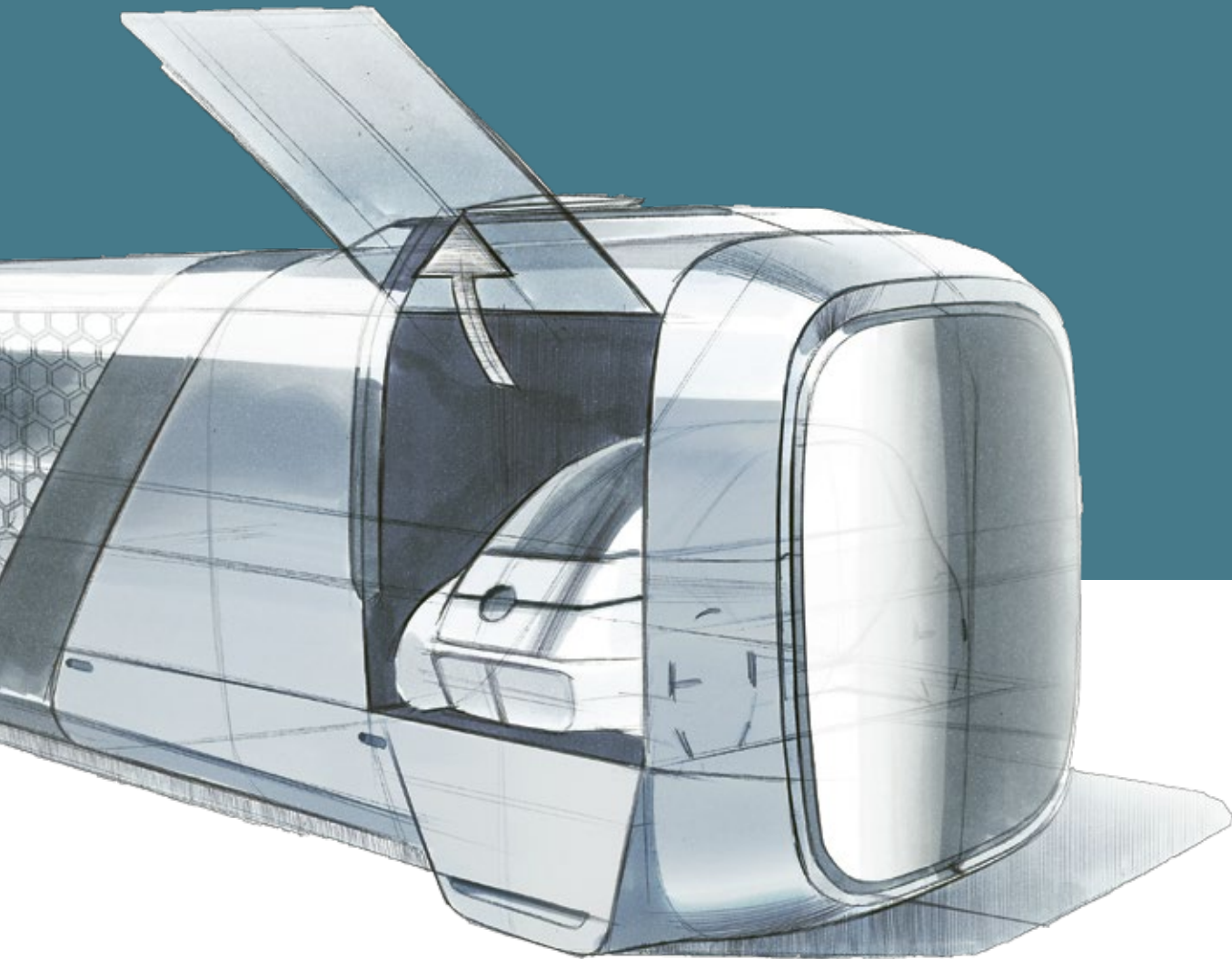
Until now, the car interior has largely been determined by exterior design. But all of a sudden,

it is being turned into a more or less blank canvas. And that also means that, in the future, we can design cars from the inside out.

The Volkswagen Group is working on this future with tremendous energy and enthusiasm. Group Design is one driving force. We will be making full and very creative use of this technology and all its possibilities. The streetscape of the future will be even more diverse. More colorful. More emotional.

But why not see for yourself? I have selected some of our latest designs, and I would like to describe these to you in this chapter.

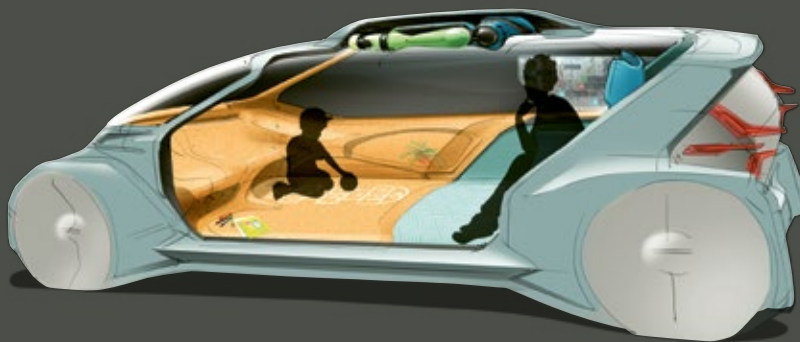
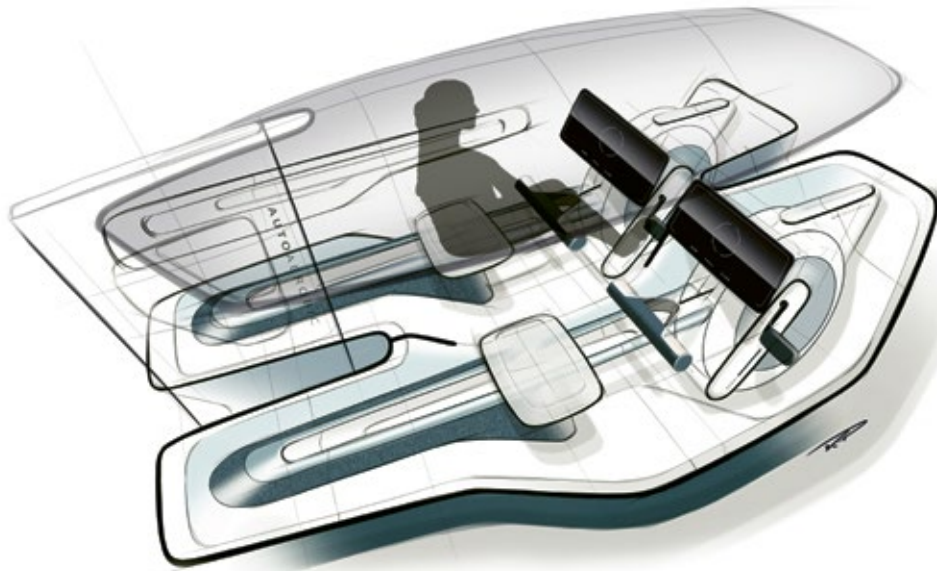
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Michael Mauer, 55, studied car design at Pforzheim University of Applied Sciences from 1982 to 1986. Following posts at Mercedes-Benz and Saab, he was appointed Chief Designer at Porsche AG in 2004. He became Head of Group Design at Volkswagen AG at the end of 2015.

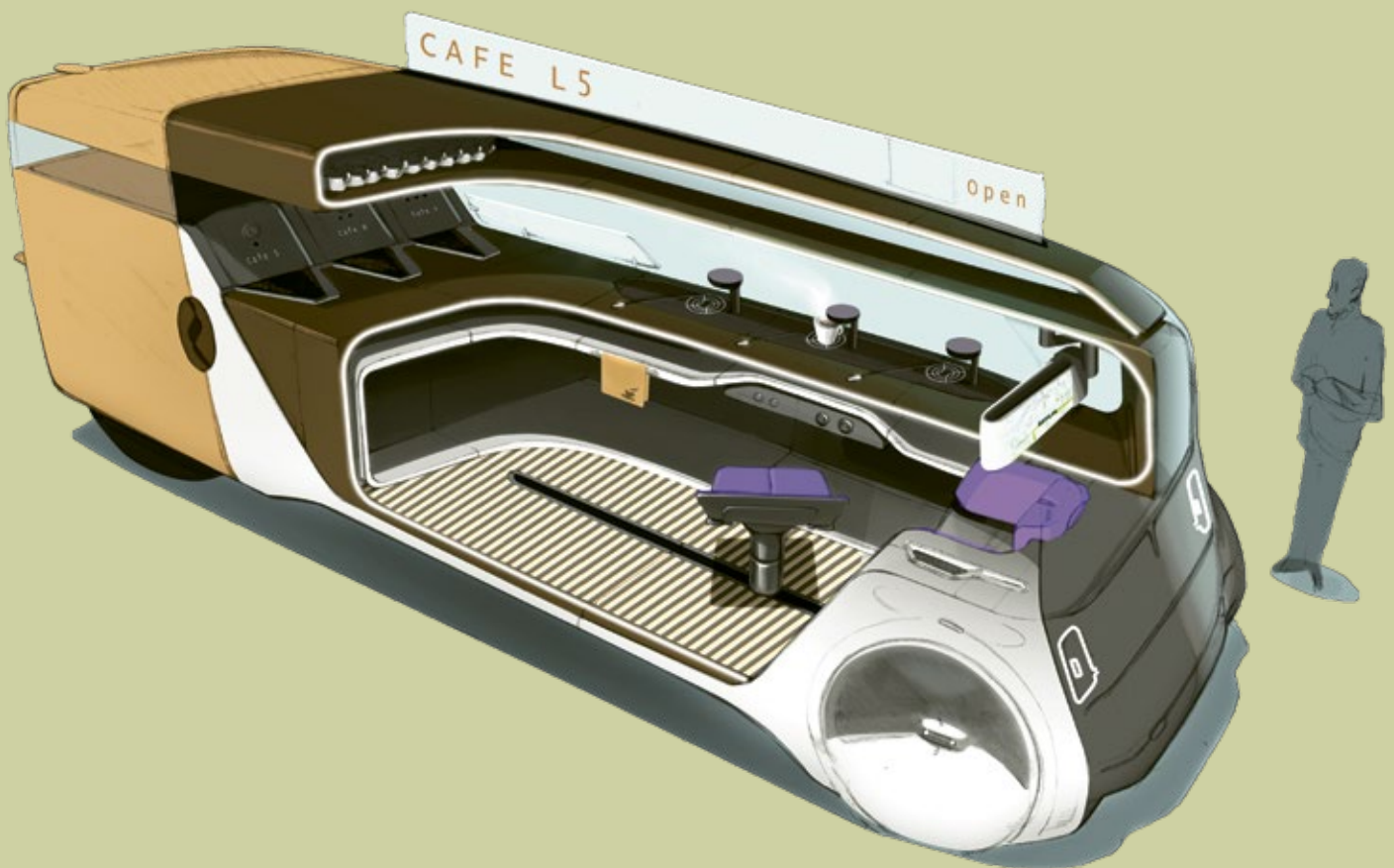
“In the near future, traveling will become incredibly relaxed. You board this campmobil in the evening, enjoy a meal together, get a good night’s rest, and are woken the next morning when you reach your destination, happy and relaxed in time for breakfast.”

“If you don’t need to concentrate on driving, you have so much more time for yourself. The driver becomes the passenger, the car becomes a second home. Or, as in this example, a workout area.”



“We’re giving a lot of thought to how a vehicle for young families might look in the future. For example, why shouldn’t a child sit in the front? That’s unthinkable today. In the box seat, in front of the parents, with the best view of what’s going on outside? That would be completely safe as the car would be self-driven, so there would be no risk of accident.”

Connect with Consumers

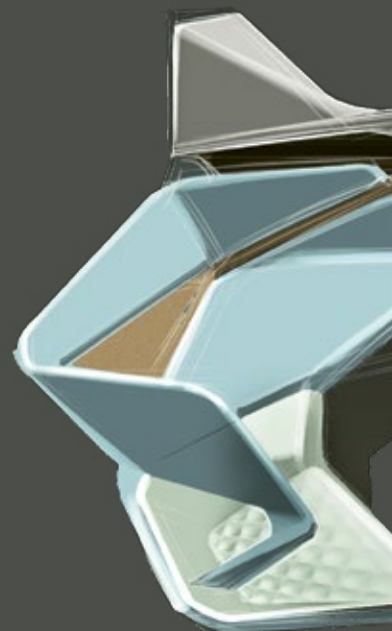


“If the engine and the transmission, the fuel tank and the exhaust system are superfluous, then we designers have unbelievable creative possibilities. Shared mobility brings unprecedented leisure potential, creating an entire universe of new ideas. Just imagine – you could decide on the spur of the moment to make your journey to the office in a Viennese café, a pizzeria or an Italian bar. That sounds a bit utopian, but will soon become part of everyday life.”

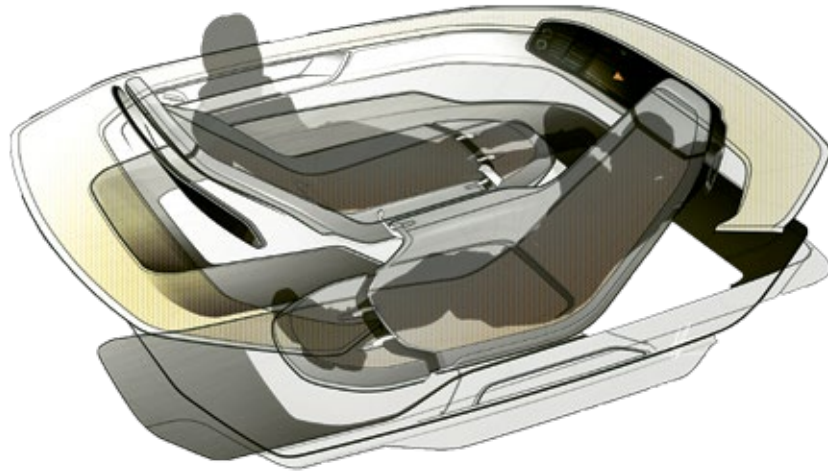
“The outer skin of the car of the future will be a 360° screen, ready for all kinds of adventure. When your child gets bored, the windows are transformed into an aquarium, or passing cars become lifelike dinosaurs – thanks to augmented reality.”



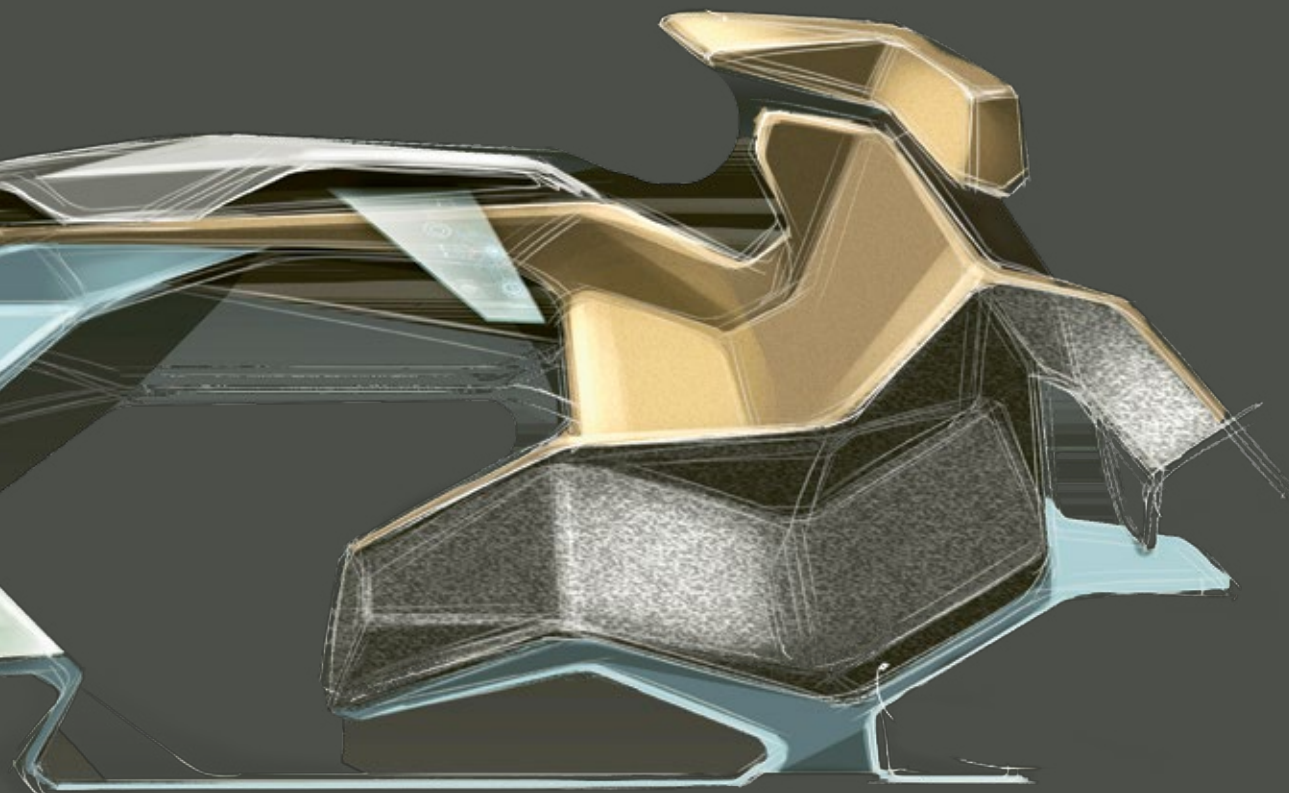
“When cars were first invented, each one was a unique specimen. And we’re heading back that way again now. For instance, we can customize seating to suit our specific requirements. Modular systems mean flexible seating design – depending on the number of passengers, the situation and personal preferences. All things considered, what is an electric car after all? Basically it’s a skateboard with a battery in the middle, a compact drive at the front, and four wheels at the sides. We can work with that, with a totally new sense of freedom.”



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“Up to now, safety criteria have restricted our creativity. Windscreen, a pillar, crumple zone, fixed seats, safety belts – all of that becomes obsolete in the future. Glass compartments then only need to provide protection against wind, rain, heat or cold. The seating positions enable eye contact with other passengers.”



A trunk full of new ideas.

The Volkswagen brand is building a big digital user platform. The We Deliver service is one element. We meet one of the testers.

Text: Joachim Hentschel | **Photos:** Georg Roske

It was worth it after all. Gufeng Zhou is pleased he braved the parking chaos in Berlin today. Just as well he left home a little earlier than usual this morning to find a good parking space for his Polo before starting work – his office is on the border between the Mitte and Friedrichshain districts, an area where parking spaces are in very short supply. The e-commerce firm that Gufeng works for has its headquarters there. And the email he has been expecting arrives at 11.45 a.m.: the parcel has been delivered.

“Yes! That will be the lamp.” Gufeng Zhou spotted the designer item from Sweden on Instagram at the end of last week and ordered it from an online retailer. Now, at last, it is waiting for him in the trunk of the Polo. The courier from the DHL Parcel service personally put it there, opening the trunk with the parcel scanner – and the help of a single-use access code that was issued by Volkswagen once Gufeng had notified the online retailer that the parcel should be delivered to the trunk of the car.

Where is this service from Volkswagen available? In spring 2018, the answer is nowhere – yet. However, the planned service, called We Deliver, has already passed the intensive practical test with

flying colors. Naturally, not everything is running smoothly yet. But the team at Volkswagen We, the brand’s digital mobility initiative, can work on the fine tuning using feedback from the 300 testers.

A cosmos of services and options

Gufeng Zhou, 33, is one of the people who have trialed We Deliver for four weeks – he was given a Polo to use for the test period. The service is one element in the Volkswagen We digital ecosystem, which will also include many other features. Going forward, Volkswagen AG will be organizing many of its mobility services in similar platforms. As digital ecosystems. As a cosmos of services, preference settings, sharing options, and much more.

To make a long story short, we will soon be logging into an account with the Volkswagen Group brands, just like we do now with Google or an Apple ID. The crucial factor will be designing these platforms to be as practical, intuitive, user-friendly, and connectable as possible. According to a forecast from the consulting firm McKinsey, global revenues from digital mobility services



More than 800 people applied to test We Deliver. Gufeng Zhou, 33, is one of the successful candidates.



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Orders for delivery to the car trunk are placed with the online retailer. The participating cooperation partners list We Deliver as a delivery option.

Volkswagen

Volkswagen We is the name of the platform that includes individual services such as We Deliver or the We Park app. This means that Volkswagen always has its eye on the big picture when it comes to digital services.

All services are designed to meet specific customer needs, but at the same time they are also part of an interactive network. Today, mobile connectivity not only links the driver and car with the Internet, it also connects drivers and cars with one another. The Volkswagen We modules will deliver on that, too – at the latest by the time the Volkswagen ID is launched. The Volkswagen We universe will also

encompass the service packages offered by Volkswagen Car-Net: Security & Service (automatic emergency call), Guide & Inform (traffic info), e-Remote (real-time info for e-models and hybrids) and App-Connect (smartphone integration).

Next steps for Volkswagen We: We Deliver will undergo trials in more cities in 2018. In the near future, We Park is to be rolled out across Europe and also made available for parking garages. In addition, the VW Connect vehicle data app, currently available in Spain for example, is also to be launched in other countries. The new cosmos is filling up nicely.



The delivery message is transmitted via email. The moment of truth arrives when Gufeng opens the trunk.

could reach US\$1.5 trillion by 2030, one-quarter of all automotive revenues. The quality of the platforms will decide who comes out on top in attracting and keeping customers in this gigantic market.

Tomorrow's ideal customer

The big players in Silicon Valley, too, are using this trend to set themselves apart from the rest. At the end of the day, it is not necessarily the biggest that wins, but the player that can provide the best customer experience. Jeff Bezos, CEO of Amazon, once said, "If you only take your lead from your competitors, then you are condemned to playing the waiting game. On the other hand, if you focus 100 percent on customers you can always be the pioneer." What Volkswagen We is currently developing is already shaping up to be a visionary and eminently practical solution.

"I'm very willing to download apps if I think a digital trend is a good idea," Gufeng Zhou says. "But I don't go along with every marketing gag." Gufeng, who was born in China, came to Germany in his early twenties, and has been living in Berlin since 2009. Today, he works as a data analytics manager in e-commerce.

He has always been an early adopter. He built his first computer as a 13-year-old student in



Gufeng Zhou can use the Polo equipped with We Deliver technology for four weeks. His girlfriend Dijana (right) also thinks the service is useful.

China. Today, Gufeng makes use of all the mobile services he considers meaningful – from digital wallets to education apps. He doesn't own a car, but uses car sharing up to three times a week. He has an account with sharing services for e-scooters and bikes, and is a real virtuoso when it comes to combining public transport, cars and two-wheelers. If you were to paint a picture of the ideal customer based on everything that has been written about urban mobility – Gufeng Zhou would be the perfect fit.

Meanwhile, it is afternoon in Berlin. Gufeng has quickly changed into his sports outfit at the office. Before he drives home, he wants to go for a jog along the bank of the River Spree. There are plenty of public parking options near Moltkebrücke. "That's good for me in two ways, because it also means that the courier is able to deliver the parcel," he says as he steers the Polo through the city.



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“Flexibility is the most
important thing for us.
It’s how we can optimize
our daily lives.”



“We’d even be willing to pay 50 cents more if the parcel was delivered straight to the car.” Dijana and Gufeng think the idea behind We Deliver is very convenient and practical.



The reason for that is because he is going to a birthday party at the weekend with his girlfriend Dijana. The birthday present is a special pair of sneakers. And Gufeng has arranged for them to be delivered to the trunk of the car – to the parking space near the Spree where the Polo can be found most afternoons. The trunk delivery service specifies a 300-meter radius for the car’s location to make sure the courier can deliver the parcel. “For

me, this is the typical use case,” Gufeng says before he puts his headphones on. “I can go for a jog instead of queuing up at the post office.”

One piece in the We universe

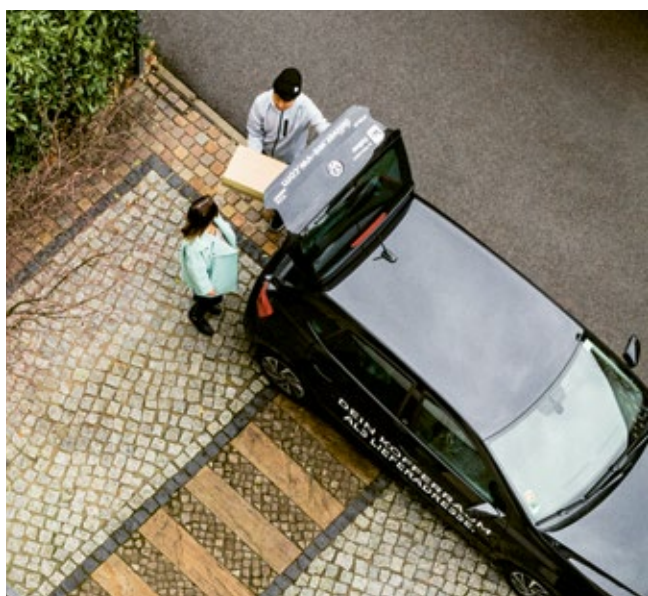
There are plenty of situations in which this kind of delivery service can help solve problems. And it is important to remember that car trunk delivery is only one of many pieces in the jigsaw that makes up the Volkswagen We universe. We Park pays for your parking ticket by app, VW Connect sends easy-to-read vehicle data to your smartphone, the Car-Net services provide real-time information and navigation – the list goes on.

We Deliver is symptomatic of the vision for a Group-wide ecosystem for two reasons. First, it features one variety of what is known as the digital key. If the parcel courier can be authorized to open the trunk – then a friend or partner could also be sent the authorization to use the car without the added complication of handing over the key. People who do not own a car themselves could also be issued with a Volkswagen user ID. That opens up entirely new answers to the question: How does the industry define its customers?

Second, We Deliver demonstrates how cooperation can function. Six online retailers who use DHL as their carrier are participating in the field trials – that, too, is an important step toward the best user experience. However tough competition

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“A digital trend must make sense. I don’t go along with every marketing gag.”



on digital markets may be, no online customer is willing to accept product boundaries that are too rigid. The brands must be aware of who they are and what they are, but they also need to stay compatible with the outside world.

We Deliver passed the demanding beta test on this particular afternoon. The message that the courier had found the car and delivered the sneakers came while Gufeng was still jogging. “No matter how many times it works, it’s still exciting,” Gufeng says when he shows Dijana the parcel once he has arrived back home. “Flexibility is the most important thing for us. It’s how we can optimize our daily lives. That’s what makes digitalization so valuable.”

Reliable and close to people – that was part of Volkswagen’s DNA in the analog age, and will likely be the best possible motto in the digital ecosystem of the future, too.

 **MORE ABOUT THIS ONLINE:**
Our video at annualreport2017.volkswagenag.com

The big ecosystem

To take account of the transition in the automotive industry, all brands in the Volkswagen Group will sooner or later offer their customers platform solutions. Although the positioning will vary, all of these platforms will be based on the idea of an overarching system architecture. What features belong to an ecosystem?



User ID

The user ID is the log-in, the digital fingerprint, the unique code that gives a customer access to the ecosystem. And you do not need to buy a car from Volkswagen to be issued with a user ID. The goal for the future: an ID for every brand in the Group.



Digital key

Anyone with a user ID can use one – or several – digital key(s) via a smartphone. There are many situations where that not only comes in very handy, but also brings with it convenient additional functions. You want to lend your car to someone? You want the trunk to be opened to take delivery of something? Everything is possible – uncomplicated and mobile.



Vehicle settings

Personalization via user ID can turn a strange car into your own vehicle at the swipe of a smartphone. Infotainment system settings, seat position, heating and ambient lighting configurations – all just the way you like them in the other car thanks to the ecosystem.



Vehicle features

In the future it will also be possible to purchase and manage additional functions and special features for mobile use via the ecosystem accounts. That makes it easy to transfer certain assistance systems, infotainment content, and apps to other models in the Group portfolio.



Digital services

External ecosystem networking begins when external services become involved. The new Volkswagen We services are a good example. The We Park app is vehicle independent, We Deliver is an interface with cooperation partners. And the future has only just begun.

Act Sustainably

Today, companies must make the world a better place.

That's why responsibility plays
such a big role for us.

Nonkqubela Maliza

Director of Corporate & Government Affairs,
Volkswagen South Africa, Uitenhage

Equal rights, fighting poverty, nature conservation: in South Africa, the Volkswagen Group engages in social responsibility in many different ways. These activities include a monitoring system for greater equal opportunities at suppliers.



“Like playing chess at 200 kph.”

World champion Lucas di Grassi explains why Formula E is so fascinating. And why it is the racing sport of the future.

Text: Marin Majica, Lucas di Grassi

Conceived in 2012 and inaugurated in 2014, the FIA Formula E Championship quickly established itself in the racing world, revolutionizing motorsport.

Formula E is the world's first fully electric international street-racing series and consists of 12 ePrix competitions in 10 cities. It is currently broadcast in 117 countries, and is covered by international channels such as Fox Sports, Canal+, and Eurosport. Last season's final in downtown Montreal drew some 45,000 spectators. The races all take place on city-center circuits. For the fourth season, namely the 2017/2018 championship, Formula E is visiting Hong Kong, Marrakesh, Paris, New York City, Santiago, Rome, Berlin, Mexico City, and Zurich – bringing motorsport back to Switzerland for the

first time in 60 years. The 20 drivers (two per team) include many famous names such as Nick Heidfeld and Nelson Piquet Jr. And the number of participating teams and manufacturers is constantly growing – Porsche AG recently revealed its plans to enter Formula E from the 2019/20 season.

The Audi Sport ABT Schaeffler team has been a regular competitor in Formula E since the inaugural race in Beijing in 2014. The two drivers, Lucas Di Grassi and teammate Daniel Abt, have been on board since the first season, with both drivers taking multiple podium finishes. Di Grassi was not only the winner of the first ever Formula E race, he is also Formula E's reigning world champion, having clinched victory in the 2016/17 season. So who could better explain the astonishing success of this racing series than the champion himself?



Electrifying power duo:
Together with Daniel Abt
(right), Lucas di Grassi (left)
has been driving for Team
Audi Sport ABT Schaeffler
since 2014.



1

The driving

Formula E is very different from other racing series. First, we only drive on street circuits. They are much narrower than racing tracks so the drivers need total concentration. Then qualifying driving and race driving

are very different. In qualifying, you go as fast as possible, just as in any other race series. In the race itself, though, you only have a limited amount of energy. Strategically, that makes it very challenging. Another difference is that there is lots of overtaking during a race because the technological level of the cars is quite similar and, unlike in Formula One, any driver could overtake another competitor. That is why there's so much attacking driving. The circuits are much more complex than in Formula One, for example. And because there isn't really much risk of losing aerodynamic quality when you touch other cars, the drivers do it regularly during races, mostly at corners and turns. That means plenty of great action for spectators.



2

The tracks

It's amazing to race through the very heart of magnificent cities such as New York and Paris, Mexico City and Marrakesh. Hong Kong, for example, where this season began, is a very small urban circuit.

The total distance raced is only 80 kilometers. Of course, when I'm racing, I don't have time to appreciate my surroundings, but when I'm in the pit and I can take a closer look at the scenery, it's quite spectacular. We can race in city centers because the cars are so quiet. Electric cars are

mostly designed for urban environments, so it's the perfect technology for metropolitan races. That's why so many cities worldwide want to promote Formula E.

3

The rules

Formula E has some special rules. There's the FanBoost, for example, an online voting system where fans can choose to give their favorite driver extra power for the second race in the second car. That's a great opportunity for the fans to interact with the race, even if the boost doesn't make much difference to the outcome. It's your performance as a driver that counts, much more

Metropolitan role models: Clean, quiet racing cars like the Audi e-tron FE04 are welcome guests in megacities such as Hong Kong.

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4

The strategy

Because the amount of energy per race is limited, we have to shape our strategy according to our goals.

Let's say each battery has 28 kWh and you have to drive 28 laps. That means you can only use 1 kWh per lap on average. But how do you use this power? That's the tricky part. Where do you accelerate with maximum power, where do you ease up a little bit and save power? Where do you lift before a corner, how do you recuperate the energy when you brake? Sometimes

Up-and-coming star: Daniel Abt was the fastest driver at the season's opener in Hong Kong.

than the superior quality of your car. FIA made the regulations very strict so that the cars are very similar and every driver has an equal chance to win. The batteries, for example, are all the same. The team rules for developing aerodynamics and chassis are really tough. I'm in favor of that, even if it can have dramatic consequences for the drivers. My teammate Daniel Abt won the second race in Hong Kong and then was disqualified because there was a mistake with the car's technical passport. The mistake didn't give us any advantage, it was just an oversight on the part of the team. The same thing happened to me in seasons one and two, but that's how it is. It's part of racing. You just have to build your strategy on these regulations.





Strategic challenge: close teamwork with the data engineers is vital for Formula E drivers.

when you're fighting another driver it's better to save energy until your opponent hasn't got much energy left. Or the other way around – when you're defending you need to drive smart so that the guy can't overtake you. That's why I say it's like playing chess at 200 kph. We have a clear goal before the race, but we have to adapt fast while we're racing – depending on whether we're in a good or bad position, or how the pit stop worked out for us. You never become perfect at that, you're just learning all the time. Because it's game theory. It always depends on what the other drivers are doing. It's totally fascinating.



5

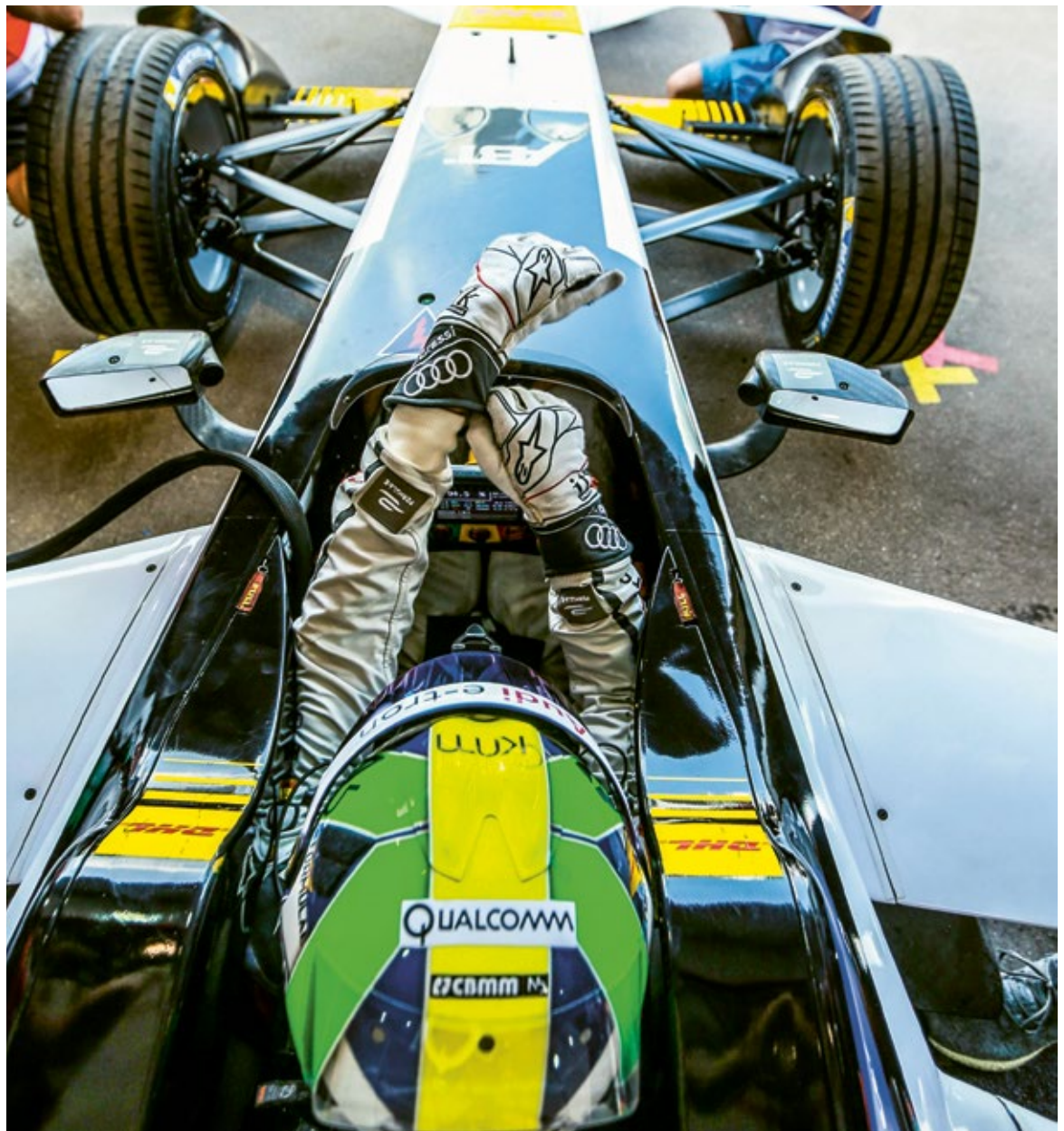
The fans

We race close to the spectators. That's a great way of demonstrating the advantages of e-mobility directly to the crowd. We take Formula E to the fans, they don't have to drive a couple of hours to get to the racing track. The fans are really excited about the new technology. We organize some events with them ahead of the race, such as driving with them in the simulator or saying hello during the driver parade. That's exciting. And I guess it's why people like Leonardo Di Caprio, Bar Refaeli and Adrien Brody come to the races.

The technology

Formula E is all about sustainability and high-tech. When I started out in Formula 3 back in 2004, I only had mechanical engineers – let's say, nine engineers and one data expert. It's completely the reverse now. We do all the digital race and structure analysis before the race, and then during the race itself we fine-tune the last 1 percent. The driver, the team, the hardware – in Formula E you have to get everything right.

And sometimes you need to get lucky in the right place at the right time. Things will get even more exciting as driverless cars advance and motorsport gives them a higher profile. In Hong Kong we put on a "Human versus Machine" race. You'll find the video on YouTube. A Formula E presenter drove five laps and then artificial intelligence tried to beat her. This time round, the human triumphed, but we're working on the software. Roborace will never replace motorsport, but it can become a great addition. Formula E is an ideal platform for promoting this new technology.



Total concentration: overtaking is very common in Formula E.

Close to the fans:
Formula E races
take place on city-center
circuits – for example,
near landmarks such
as the Central
District (right) and
the Observation
Wheel (left)
in Hong Kong.



7

The vision

The quicker we move towards e-mobility all over the world, the better for everyone. Electric racing has great potential in two areas. The first is improving e-technology. And the second is showcasing the fact that electric cars are fast and really cool to drive. This changes our perception of electric cars. It's not about us being the good guys and Formula One the bad ones because they are still driving combustion or hybrid engines. In racing, both will coexist for quite some time. But I'm very happy to be with Audi in Formula E. This is about promoting the technology for the future. The vision for the automotive industry is electric and autonomous cars.





The world champion

With six victories and 20 podium results, Lucas di Grassi, born in São Paulo in 1984, is one of the two most successful drivers in Formula E history. He began racing karts at the age of ten, then progressed to car racing in 2002, and entered the GP2 Series in 2006, winning four races. He spent a season in Formula One driving for Virgin Racing in 2010, and subsequently switched to the FIA World Endurance Championship for Audi Sport Team Joest. Di Grassi has raced in Formula E since 2014. He is of Italian descent, as his grandfather came from Apulia. He currently lives in Monaco with his wife, the designer Bianca Diniz Caloi. In September 2017, he became CEO of Roborace, a motorsport championship for driverless electric cars that race on the same circuits as Formula E.

FACE THE CHANGE

Act Sustainably

Dates and venues for the 12 races

In the 2017/18 season, Rome, Santiago de Chile, and Zurich are new among the city hosts.



R1	DEC 2, 2017 Hong Kong, HK	
R2	DEC 3, 2017 Hong Kong, HK	
R3	JAN 13, 2018 Marrakesh, MA	
R4	FEB 3, 2018 Santiago, CL	
R5	MAR 3, 2018 Mexico City, MX	
R6	MAR 17, 2018 Punta del Este, UY	
R7	APR 14, 2018 Rome, IT	
R8	APR 28, 2018 Paris, FR	
R9	MAY 19, 2018 Berlin, GER	
R10	JUN 10, 2018 Zurich, CH	
R11	JUL 14, 2018 New York City, US	
R12	JUL 15, 2018 New York City, US	

Vision Zero: Safety is digital

The Volkswagen Group wants to actively contribute to reducing the number of road traffic fatalities. But how? With clever assistance systems and connectivity.

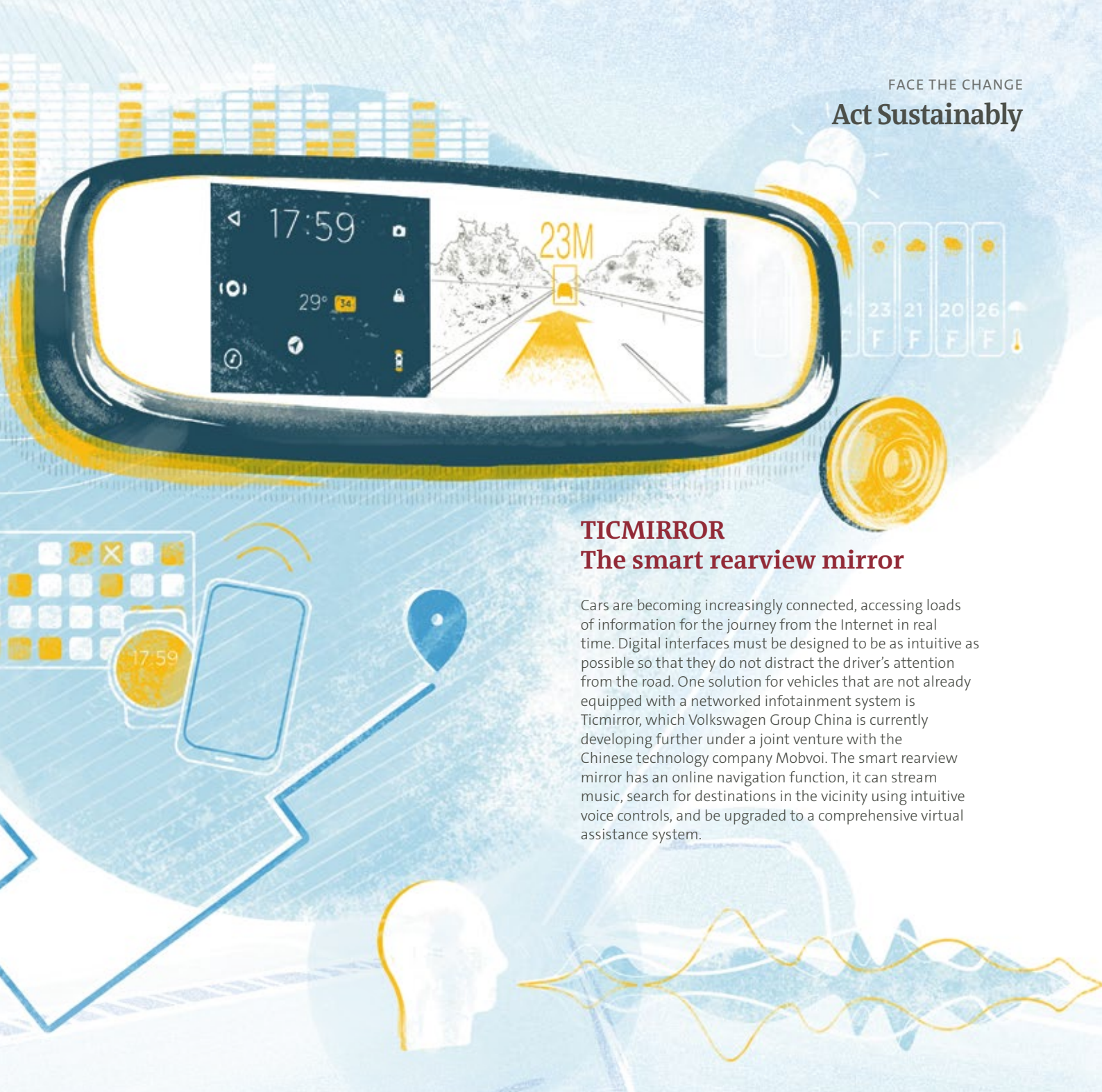
Text: Joachim Hentschel | **Illustrations:** C3 Visual Lab

The good news first: Europe's roads are getting safer and safer. Statisticians at the World Health Organization (WHO) came to that conclusion in their most recent Global Status Report on Road Safety, published in October 2015. The study shows that, in relative terms, the number of road traffic fatalities in European countries decreased by more than 55 percent between 2000 and 2015 ("relative" means that the figures have been adjusted to factor out the effects of the increase in vehicle numbers during the same period, making the result more informative).

One reason for such a significant improvement in safety in many areas is stricter laws and intensified traffic checks, plus optimal infrastructure. Another is new assistance systems and further progress in automotive technology that makes protection for drivers, passengers and pedestrians ever more reliable.

The other, not-so-good news holds a challenge for the automotive industry. Despite all the progress, about 1.3 million road traffic fatalities per year worldwide is still far too many. Human behavior in road traffic will never be perfect,

that's for certain. But if carmakers were to be even more consistent in equipping their vehicles with digital safety systems and networked features, if they were to design displays and other infotainment sources to distract the driver as little as possible from what is happening on the road – then the number of accidents would fall even further in the future. And those accidents that are unavoidable would have less serious outcomes.



TICMIRROR **The smart rearview mirror**

Cars are becoming increasingly connected, accessing loads of information for the journey from the Internet in real time. Digital interfaces must be designed to be as intuitive as possible so that they do not distract the driver's attention from the road. One solution for vehicles that are not already equipped with a networked infotainment system is Ticmirror, which Volkswagen Group China is currently developing further under a joint venture with the Chinese technology company Mobvoi. The smart rearview mirror has an online navigation function, it can stream music, search for destinations in the vicinity using intuitive voice controls, and be upgraded to a comprehensive virtual assistance system.

That is why Volkswagen Group Research has embraced the goals of the "Vision Zero" international initiative. Zero stands for no fatalities, the ultimate goal. In this particular case, the zero means that, in the long term, vehicles from Volkswagen Group brands will no longer be involved in any accidents resulting in death or serious injury.

For Vision Zero, then, the further development of self-driving functions is particularly promising – because if cars are capable of driving and braking autonomously, and can communicate with one another, then the mistakes that people make when driving will become less and less

relevant. It will still take some time to arrive at that stage, but the technology is making rapid progress.

How are products and services from Group brands driving Vision Zero forward? The four highlights outlined in this chapter represent different approaches: improved user interfaces, real-time customer service, advanced assistance systems, and autonomous functions. Vision Zero is getting closer – step by step.

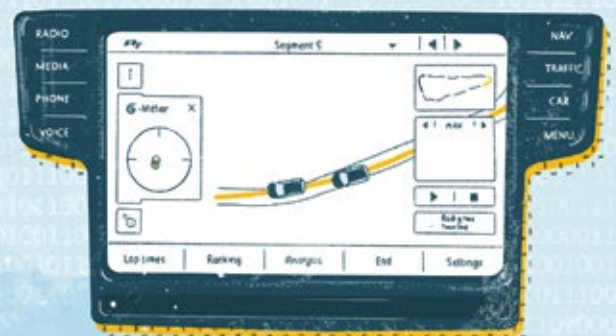
SCANIA PLATOONING Stop-and-go 4.0

Truck convoys in stop-and-go mode – the perfect situation for autonomous driving technology. This is the starting-point for a platooning project at Scania. The world's first full-scale autonomous truck platooning technology has been in trial operation since 2017. Once the trials have been completed, convoys of four trucks will transport containers between port terminals – for example, at the Port of Singapore. Only the lead truck has a driver, while the following three are driven autonomously. The project also aims to fully automate the processes for the precise docking and unloading of cargo. That not only enhances productivity, but also contributes to increased road safety.



RACE TRAINER The digital racing driver instructor

A lucky few have already been able to test this assistant at the Ehra-Lessien proving ground in Lower Saxony. The Race Trainer, a Group research project, is a visionary assistant that gives an insight into the interaction between autonomous driving, augmented reality, and road safety. With the help of steering and braking aids, acoustic assistance, and racing lines superimposed on the circuit in front of the vehicle, the system tells drivers when to brake on a specific section, how to accelerate, and the best way to take a corner. The findings from the research project will be used in the next generation of assistance systems, turning them into modern-day guardian angels.



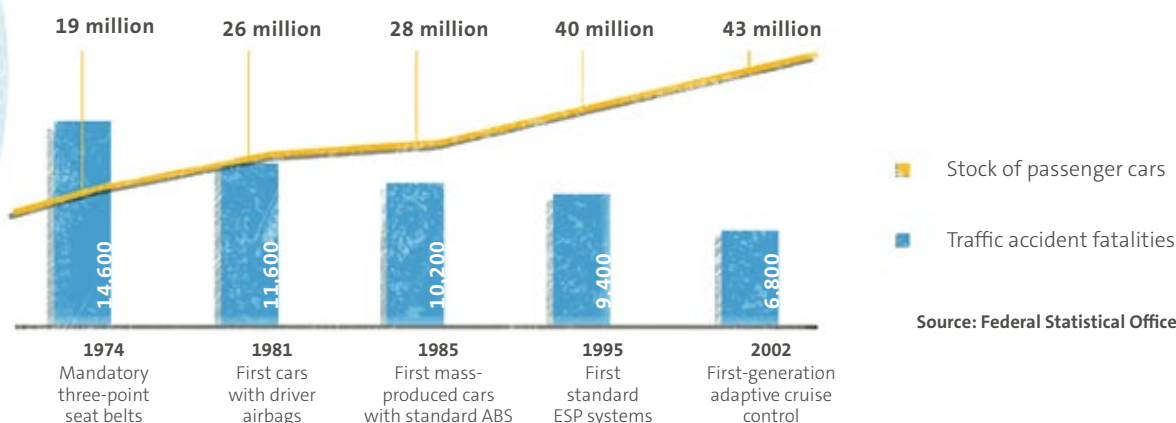


BUGATTI TELEMETRY The real-time technical service

Bugatti customers have been enjoying this service since 2004, when a data transmission and analysis system that monitors the technical status of each individual Bugatti from the company's headquarters in Molsheim 24/7 was introduced for the Veyron 16.4. Since the launch of the new Chiron¹ in 2017, the data is even transmitted on a real-time basis. If unusual signals are received from a vehicle, Bugatti customer service receives a message and can immediately respond. The premium service used to be available for Formula 1 or DTM racing cars only, but now it also provides Bugatti drivers with optimal safety.

Lifesavers on the move

Germany: this is how assistance systems have helped reduce the number of traffic fatalities since the 1970s.



1 Bugatti Chiron: fuel consumption, l/100 km: combined 22.5; CO₂ emissions combined in g/km: 516; efficiency class: G



Fun-loving pioneers (from left):
Oshi, Vuvu and Bubbles

Love life.

They are groundBREAKERS – pioneers and role models who want more out of life than poverty, crime, and resignation. They prove that is possible – both in their community and throughout South Africa.

Text: Marin Majica | Photos: Jonas Nefzger



Drug prevention with music: groundBREAKER Vuvu during a presentation in a church in KwaNobuhle.

The karate trainer stands sweating in front of the picture of Jesus that someone has painted on a sheet and hung on the wall, watching as Vuvu calls the kids to gather round. Vuvu is 23 years old, and her full name is Vuyokazi Noyo. But to her friends and the kids who form a circle round the young woman in this church on the hill above the South African township of KwaNobuhle, she is simply Vuvu. She is getting ready to talk to the kids about drug prevention. But Vuvu's presentation technique bears as much resemblance to a dry educational lecture as this simple room with its wooden walls, corrugated roof and strip lights where karate training has just finished does to the traditional image of a church.

Vuvu claps her hands. She gesticulates, sings with the kids. Her sentences are a mixture of English words and the isiXhosa language with

its click consonants. She talks about "Flakka," the horror drug which can lead to violent aggression and is widespread among South Africa's poorest in particular. It is an everyday reality in this district where many of the houses are simple brick buildings or huts. Vuvu mimes an addict staggering about, and urges the openmouthed kids to be careful. Then she plays some techno music and everyone dances, even the karate trainer. The children crowd round Vuvu, she says her good-byes and promises to come back soon.

"Has this work changed me?" Vuvu laughs at the question. "You have no idea what I used to be like. I've learned so much about myself here. I have never been shy, but I wasn't able to build up real relationships with people."

Vuvu has left the church and is now sitting in a bright room at the loveLife Centre in KwaNobuhle. The modern, purpose-built youth center opened in 2012, cost about €2 million, and is located in



“Define your life, don’t let it be defined for you. Life always has something better in store for you.”

Ayanda Sali alias Einstein,
groundBREAKER



Everyone at the loveLife Centre calls Thobeka Mzuzu Szyre (left) “Sista T.” She talks to kids and adolescents about sexual education and health, and prescribes contraceptives.

the heart of the township where 99 percent of the population is black. It belongs to the city of Uitenhage (pronounced “yoo-tin-haig”). The center has seminar rooms, workstations, a snooker room, a radio studio and a health clinic with a counselling service, open WiFi, and a large sports arena in the inner courtyard. Vuvu comes here every day. This is the place that changed her life and where, day after day, she changes the lives of so many other people – sometimes just a little bit, sometimes in a big way.

Vuvu and her two friends nicknamed Bubbles and Oshi are groundBREAKERS. They are pioneers. Young people who are building a future for themselves in surroundings where the prospects

for many are not bright. And they are showing others how to build their futures, too.

Young people apply to join the program, and if they are accepted they are awarded a one-year scholarship. They work in the center financed by the Volkswagen Community Trust. The groundBREAKERS talk to the children and adolescents about contraception and health, about vocational training and family planning, they give courses and organize sports sessions. “loveLife is fun, entertainment, education, everything”, Vuvu explains. Oshi and Bubbles nod in agreement. For them, this is the ideal preparation for their working lives and brings the chance of a good education.

The Volkswagen logo on the outside of the building and on the partition walls inside indicates how closely the Group engages with the center and its work. This is not marketing, this is a deep commitment. The Volkswagen plant is the largest private-sector employer in Eastern Cape.

Thema Maseti (right) is responsible for a total of four loveLife Centres and is always ready to listen.



Programming with Einstein: Ayanda Sali (right) teaches children how to use a computer.

The province on the Indian Ocean coast has a twinning partnership with the German State of Lower Saxony, the home of Volkswagen. Some 1.2 million people live in Nelson Mandela Bay Metropolitan Municipality, which not only includes Uitenhage, but also the nearby coastal hub of Port Elizabeth. Like the rest of South Africa, unemployment, corruption, and, more recently, a renewed increase in HIV infection rates, are part of everyday life. Many have a distrust of politics, and there is great frustration. A great deal of progress has been made since apartheid ended in 1994, but much still remains to be done. That is why the work at the loveLife Centre is so important, not just for the district and the city, but much further afield as well. There are loveLife Centres all over the country, but according to Nonkqubela Maliza, Director of Corporate & Government Affairs at Volkswagen South Africa, this one is something special.



“It’s this center’s leadership that makes it so exceptional,” Ms. Maliza says on a visit to the center. “The change theory behind loveLife is that you must love your own life, that you must master your own destiny, if you want to bring about change. So the change you are seeking must begin within yourself. Then you can take it into your community.”



“I always say to the kids: Never forget where you come from. And always remember where you are headed.”

Vuyokazi Noyo alias Vuvu, groundBREAKER



Vuvu plans to study social work at Nelson Mandela University in Port Elizabeth when she has completed her year as a ground-BREAKER.

The training currently in progress at the sports arena illustrates what this means in real life. Kids, adolescents and adults have met up for a joint fitness session in the inner courtyard. They jump up and down to music, do some shadow boxing, shout encouragement to one another. The youngest are three or four years old, the oldest are the grandmothers who brought their charges along.

Medals and small prizes are distributed at the end of the session. “Looking after your health is very important,” Themba Maseti tells the children, using the microphone for maximum effect. Then the 41-year-old program manager – the face and driving force behind this center and three others – hands the mike back to the DJ. Bubbles and Oshi invite the kids to dance on the small stage, and a few of the boys perform some impressive dance moves. It’s all part of an ordinary morning in the loveLife Centre. “This isn’t a job, it’s a vocation,” Themba says. He is proud that several former groundBREAKERS now have good jobs, one has even made it as a breakfast television presenter. “That’s the very best example of what loveLife is all about.”

Energy and joie de vivre are sometimes not easy to find outside the center. Stray dogs roam the streets of KwaNobuhl, cows and pigs run free. A red and white circus tent has been erected in front of one house. Is there a celebration?

“There was a funeral yesterday,” says Vuvu, who lives nearby with her mother and brother. Their house stands high up on the slope where

the tarmac road becomes a sandy path. It overlooks hills, other houses and huts, interspersed with wasteland where plastic trash blown in by the coastal winds flutters. “Nice view”, the visitor says to Vuvu’s brother. “Really?” is his skeptical response.

The groundBREAKERS from the township all come from very different backgrounds. Oshi, whose full name is Owethu Danster, went to a

private school and is now studying at Nelson Mandela University in Port Elizabeth. That is what Babalwa Majola, known as Bubbles because of her vivacious temperament and unruly hair, also intends to do. As a groundBREAKER, she works in a clinic as a health counsellor, gaining her first valuable practical insights. “My mom has always done everything she can to help me get on in life,” Bubbles says. “And we never went to bed hungry.” The kitchen in her mother’s house is a cozy room with an enormous stove. In the next room, her brother is cutting the hair of some other kids; the annex doubles as his salon and bedroom. Every morning, Bubbles’ mother still cooks food, fills two insulated boxes, and takes her cooking to the factories in Uitenhage to sell to the workers. Bubbles has a photo on her mobile phone showing her mother setting off in the mornings with the boxes on a trolley. “I quite literally owe who I am to those boxes.” Bubbles wants to say a big thank you to her mother when she has graduated. “We’re going to have an enormous party, mom, with masses of food.”

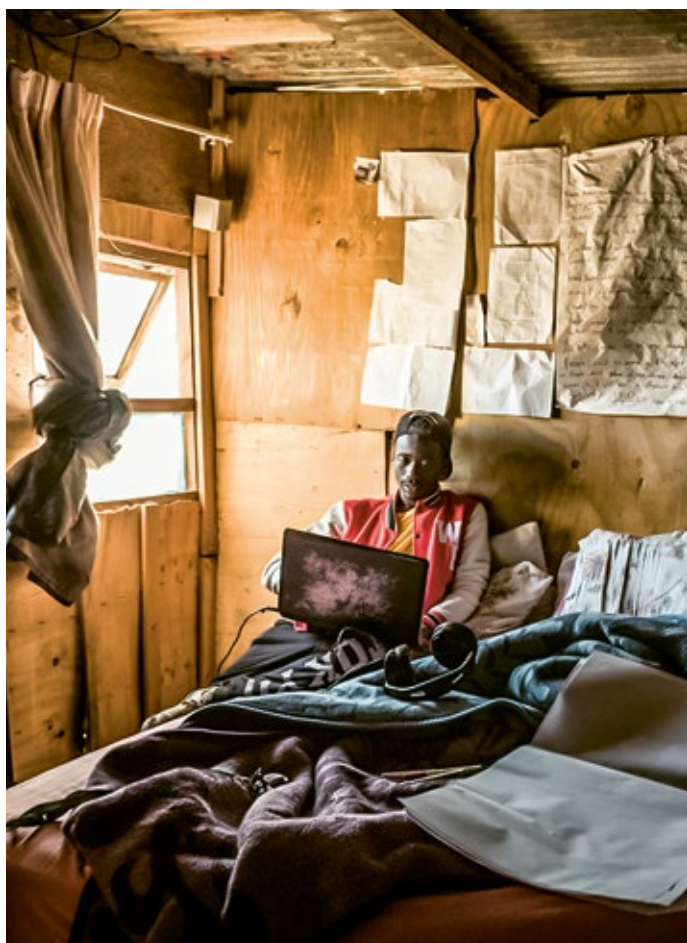
The parents of groundBREAKER Ayanda Sali, 24, have also tried to give him as much support as possible. Ayanda, aka Einstein because of his love of math and IT, lives with his parents and two younger brothers on the outskirts of the township. The garden of his house is carefully looked after. Einstein’s father Amos grows pumpkins and strawberries, spinach and carrots there to feed the family. “They do great work,” his father says, referring to his son and the other groundBREAKERS.

Einstein’s room is at the back of the house, a wooden shack right next to the henhouse. Inside, there is just enough space for a bed, a television set and an ancient cassette recorder, which he uses as a speaker for the computer. The wall is covered with handwritten notes, one of which says: “The only limit is the one that exists in your mind.”

Einstein’s mind is not familiar with many limits. He has plenty of ideas – for example, he wants to write a program to create an app for a 3-D model of your body to try out new clothes or make up, which you can then order direct. “Who enjoys queuing up in a shop?” Unfortunately, his computer is on its last legs, so it is difficult for him to continue writing the code for the app. There are more limits in the real world than there are in his mind. He had a study bursary for university, but that meant getting up at three in the

“My mom has always done everything she can to help me get on in life. We never went to bed hungry.”

Babalwa Majola alias Bubbles, groundBREAKER



Plenty of ideas and plans for the future: Einstein in his room behind his parents’ house.



Bubbles works in a clinic and has learnt a great deal about diabetes, HIV, and pregnancy tests. She wants to begin studying soon.

morning to walk to the station. And making the same journey back home every evening. Somewhere along the line he just couldn't take it any longer.

Give up? No way! At the loveLife Centre he teaches children and adolescents how to use a computer. He also visits schools and communities to talk about how to lead a healthy and self-determined life. What drives him? "The idea that I can change the world." With anyone else, that could sound like an empty phrase. Not with Einstein, though. He believes it. And he believes he has the strength to start something big. To be a groundBREAKER.



MORE ABOUT THIS ONLINE:
Our videos and our photo gallery at
annualreport2017.volkswagenag.com

Volkswagen South Africa

Volkswagen South Africa's Uitenhage plant is the oldest Volkswagen plant outside Germany. The first Beetle in South Africa was assembled there in 1951. Today, the plant has a workforce of 3,900.

The road to the KwaNobuhle township passes the plant and a large compound where thousands of vehicle are stored, waiting to be delivered. From 2018, the plant will manufacture 150,000 vehicles a year. Two models are built here: the New Volkswagen Polo and the Volkswagen Polo Viva (bestselling model in sub-Saharan Africa).

One striking feature of the urban landscape is the large number of Golf I. This model was built in South Africa up to 2009 and is very popular among car owners, including tuning fans who spray them in the colors of the rainbow and fit alloy wheels and other extras.

Explore new ways

The best ideas are created together.

We believe in team spirit and self-initiative.

Krishna Bhojkar

Head of Manufacturing Engineering,
Volkswagen India, Pune

Volkswagen India produced 150,000 vehicles in 2017. A new work culture is vital for continued growth in this boom market. Volkswagen AG is establishing agile team structures and creative labs all over the world.



Never forget the users.

Just outside Berlin, some 100 digital experts and designers are researching the mobility solutions of tomorrow. But above all, they are trying out a pioneering new form of collaboration. We paid them a visit.

Text: Jochen Förster | **Photos:** Georg Roske

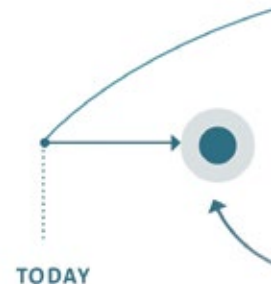


In the beginning, there was just a name: USP, the acronym for Urban Shared Pod. That was the goal – to develop a mobile structure that people could share and that was unlike anything ever seen before. The rest was TBD – to be discussed. The first thing the members of “Team USP” did was to make a list. With questions such as, does our pod solve people’s problems? Or, is our pod fun? Does it make everyday life easier for users? Does it inspire them?

Some one hundred designers and user experience experts, software developers and IT professionals are working on tomorrow’s mobility at the Volkswagen Group Future Center Europe, a glass and concrete building in a prime location in Potsdam, state capital of Brandenburg. One way or another, everyone in the automotive industry

seems to be doing that at the moment, but these particular colleagues can also claim another USP – their unique selling point. Their focus is not so much on developing new sales products, but rather on trying out new perspectives. “The very first question we ask is, what do users want?” Mark Bergold, Lead UX Design, says.

That might sound like stating the obvious, but it is a genuine first in the history of the tradition-rich Group. Until now, automobile production was usually dictated by technological innovations. The design and IT departments were given concrete tasks to complete. However, the digital age calls for a new work culture. The mission is to come up with swift and flexible solutions tailored to customer needs. To design digital offerings capable of learning and adapting. “Our aim is to



FACE THE CHANGE

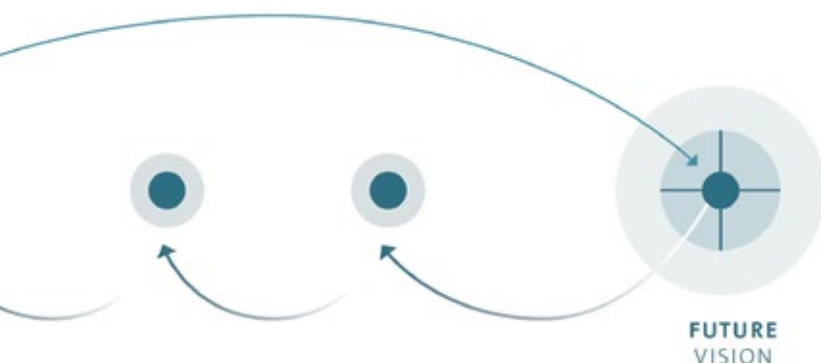
Explore New Ways



Asking questions,
developing ideas,
understanding customers:
Four of the ten members
of “Team USP” during a
normal day at the office.

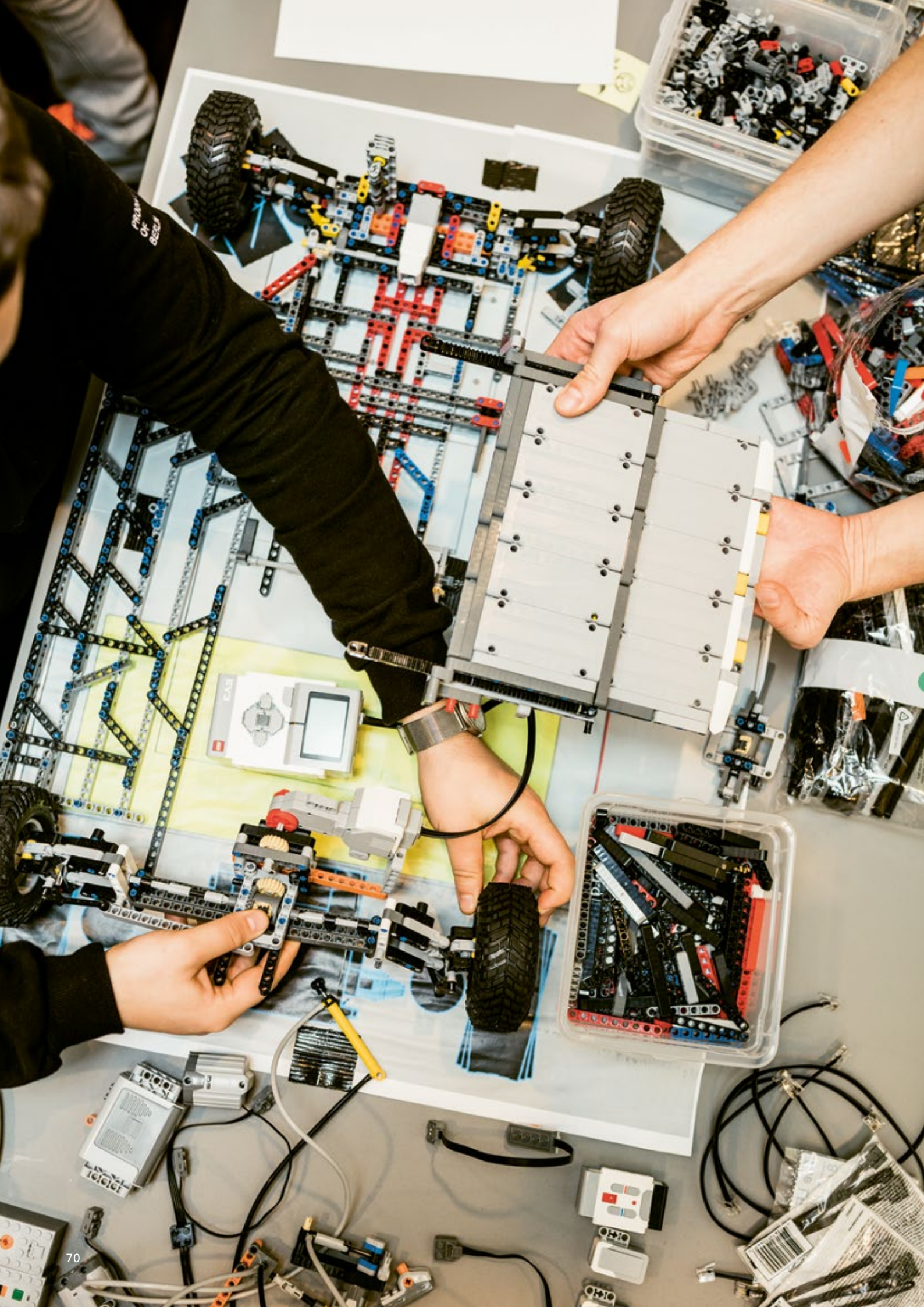
Take a great leap forward and then follow the trail back to the present:

Working sketch for Vehicle Design at the
Volkswagen Group Future Center Europe on the banks
of the Tiefer See lake in Potsdam.



solve more customer problems and execute fewer tasks. We work in agile interdisciplinary teams where the hierarchies are flat and there is no room for autocrats. And we take feedback from our users on board as early and as often as possible,” says Alisa Goikhman, UX Design Conceptor for smart interfaces. The trailblazers at the Future Center call this philosophy “human thinking.” There is only one focus: people. Their needs. Their well-being. And what Volkswagen can do to strengthen people’s confidence in new mobility solutions.

Team USP started with two four-week sprints at the end of 2016. Armed with their list of questions, the team members took to the streets and asked Berlin passers-by for answers. Then they got down to evaluating the responses: user journeys took shape in order to better understand



“We work in agile teams where there is no room for autocrats. And we get as much feedback as possible from our users.”

Alisa Goikhman, UX Design Conceptor

customer needs during the various stages of life. In the fourth week, the team built its first pod, complete with a wooden chassis and padded seats, in the workshop. “Here at the Future Center, we make most of our stuff ourselves,” says Exterior Designer Marian Hilgers. The center has experts on just about everything, everything is possible, and everything is in motion. At the Volkswagen Design Center Potsdam, the predecessor to the Future Center opened in 2016, demonstration studies had to be practically production-ready models. As far as the Urban Shared Pod is concerned, the provisional character typical of prototypes is the order of the day.

Team USP gets feedback from users at the end of every development step – initially as a digital experience with virtual reality headsets, and later “live” in the Wizard Bus, where testers can try out the USP complete with all services. The bus has a smart way of simulating autonomous driving. The passengers are unaware there is in fact a driver, because what they see is images of the view through the windscreen as taken by a camera and projected on a screen, creating a remarkably realistic sense of what autonomous driving is like.

It did not take the team long to agree on the mobility concept. “Ride hailing is a sharing concept that suits plenty of users,” says Inae Song, UX Design Conceptor. The USP is ordered by app, collects users at their pick-up point and lets them ride for as long as they want. During the ride, passengers can order food or “coffee to drive” for delivery to the USP, or they can book concert tickets via the screen. Or they can listen to their favorite kind of music – entertainment, karaoke or meditation.

On our visit, Team USP was in the middle of a sprint to optimize digital apps to suit user needs and develop intelligent payment models and

All their own work: the teams use Lego sets (left) or virtual reality rooms (below) to realize their projects.

networks. The project approach is iterative. Each result is continuously improved. “One of our advantages is that we are able to develop outside the series processes,” says Aaron Post, Interior Designer. “That gives us more flexibility. And possibly more open to unusual impulses.”

The Future Center mindset is evidently catching on. Other centers in Beijing and California have started working on a better understanding and evaluation of customer needs in the key markets of China and North America. And Future Center



“We are able to develop outside the series processes. That gives us more flexibility. And more openness to unusual impulses.”

Aaron Post, Interior Designer

experts have been criss-crossing markets and continents since 2016, organizing workshops that help others to experience and apply human thinking. Most of the feedback is positive, sometimes even surprising, and always fresh and enriching.

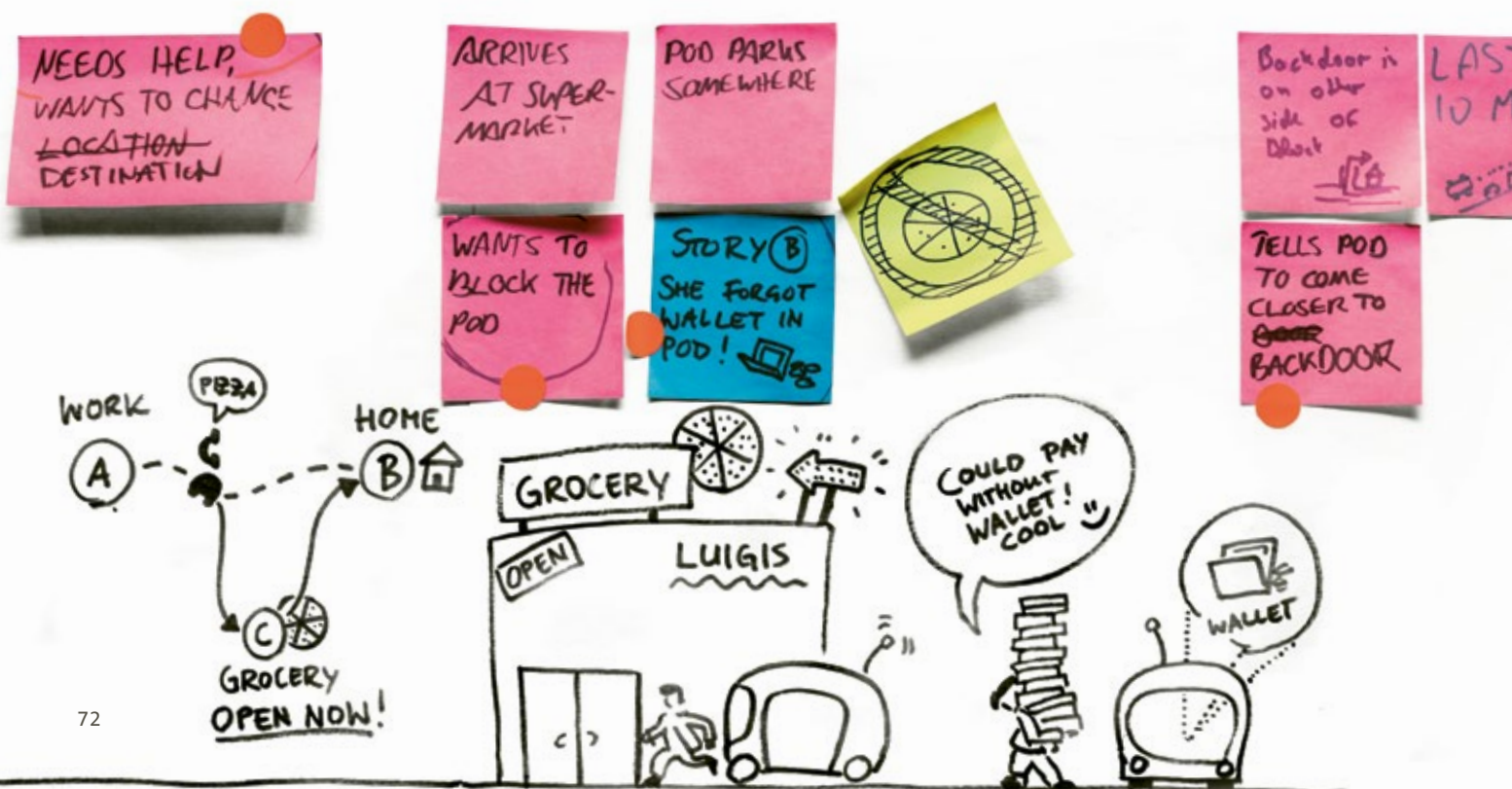
The Future Center also breaks new ground in its recruiting. The majority of employees come from international backgrounds, are highly trained and under 35. Only a few are classic automobile professionals, some do not even have a driver's license. What tempted them to come here? The close proximity to Berlin. The good team play lead by Nanna Nietiedt, Ulrike Müller, and Peter Wouda. A smart work-life balance. But above all, the exhilarating feeling that comes with playing a part in moving a global group forward.

User journey as a working basis: the mobility solutions must be designed to solve concrete everyday problems (below). Team USP and a model of the Urban Shared Pod (right).

And if their work culminates in a cutting-edge product – so much the better. Sedric, a self-driving car with no pedals or steering wheel that was developed in cooperation with Group Research, caused quite a stir at the motor shows in Geneva and Frankfurt in 2017. Users can summon the car at the touch of OneButton, a remote that is smaller than a car key.

Sedric has made people sit up and take notice of the Future Center – not just in the Group, but also across the automotive industry. Since then, hardly a week passes without people from various brands swapping knowledge and ideas about the future – the Potsdam way.

 **MORE ABOUT THIS ONLINE:**
Our video at annualreport2017.volkswagenag.com



FACE THE CHANGE
Explore New Ways



The fabric of the future.

Carbon fiber is ultra-light, yet extremely robust. And with production costs falling, it could play a key role in the electric vehicle era. Volkswagen Group engineers are carrying out pioneering work in this field.

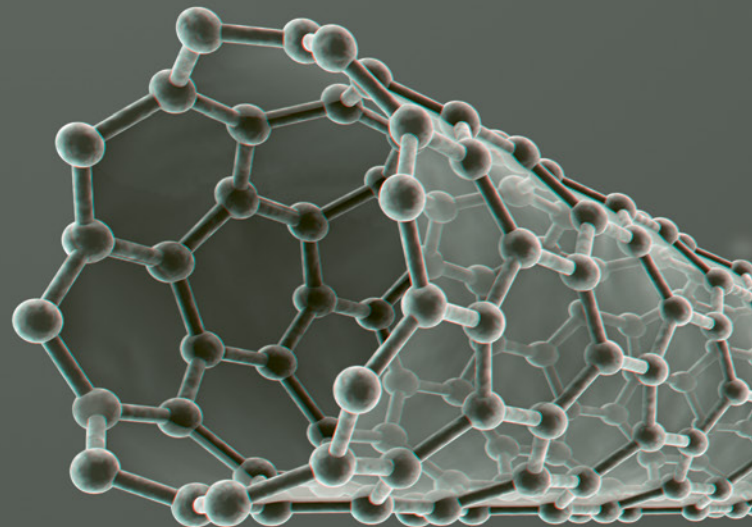
Text: André Boße | **Infographics:** C3 Visual Lab

The 42-centimeter coupling rod feels like a hollow tube: light as a feather, discreetly patterned and otherwise generally unprepossessing. If a traveling showman were to claim that this rod, which tips the scales at a mere 33 grams, could easily bear the weight of a mature dairy cow, the crowd would just laugh at him. But that scorn would very quickly turn into amazement, because the showman would be absolutely right. The carbon fiber rod is three times as strong as a steel profile of the same dimensions, but only one-quarter of the weight. And it is corrosion-resistant.

In the world of materials, carbon fiber – or carbon fiber reinforced polymer (CFRP), to give it its full name – is the one to beat. It outdoes all other materials in terms of its optimal strength-to-weight ratio, flexibility, and stability. That is mainly due to the carbon. No other element in the world has the same ability to form so many stable bonds with different elements – in nature's toolbox, carbon is as versatile as a Swiss Army knife. The fact that natural diamond – the hardest known material on Earth – is nothing other than crystalline carbon testifies to the enormous strength of this all-rounder. Carbon fiber is made from an organic polymer. This feedstock is heated to a high temperature to expel the non-carbon atoms in the form of various gases. This leaves fibers composed of chains of carbon

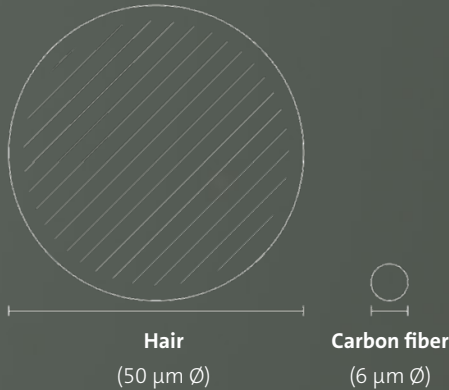
atoms, which are then embedded in a polymer matrix to create this unique material with properties far superior to those of other lightweight materials such as aluminum and titanium.

That is what makes carbon so interesting for materials research. However, quality of this caliber comes at a price. Even today, the development, planning and production of carbon fiber components is still very costly – which is the main reason why carbon fiber components are chiefly to be found in aircraft or golf clubs. In other words, where lightweight material and maximum robustness are essential. And, of course, in sports cars from the Volkswagen Group.



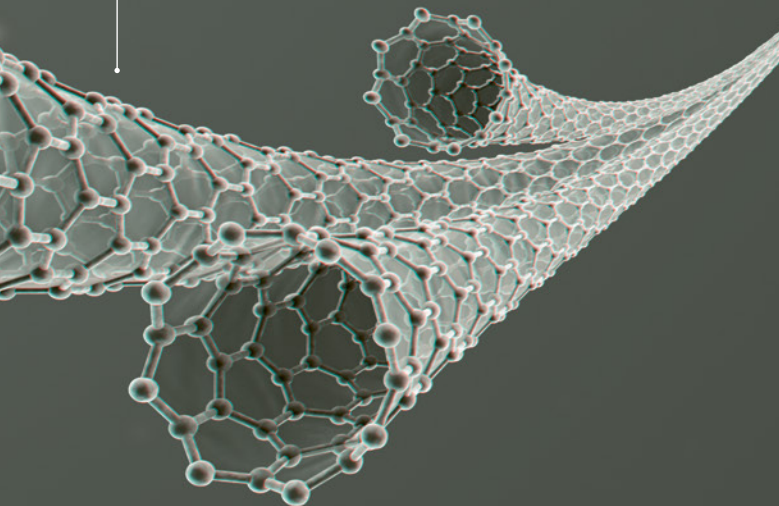
EIGHT TIMES THINNER THAN A HAIR

Carbon fibers combine enormous tensile strength (max. 6,600 MPa) with a very low weight (approx. 1.8g/cm³). For comparison: high-strength steel alloys have a tensile strength of only 1,300 MPa and a weight of 7.85g/cm³. The diameter of a single carbon fiber is only approx. 6µm – more than eight times thinner than a blonde hair (50µm).



TURNING ATOMS INTO FIBERS

Carbon fibers are produced by pyrolysis of an organic feedstock. This “precursor” is heated to a very high temperature and then drawn into long strands or fibers, stabilizing the atomic structure. The higher the temperature, the higher the share of carbon in the fibers. This share is usually between 96 and 98 mass percent.



Carbon fiber battery:
Lamborghini's Terzo
Millennio e-concept car.



To find out more about one of the Group's pioneers in carbon fiber research, we travel to Molsheim in Alsace, France. In this idyllic town with a population of just under 10,000, engineers and technicians from the Bugatti super sports car brand have been testing the use of carbon fiber components to meet the most demanding requirements since 2001. Almost the entire monocoque of the Chiron¹, Bugatti's latest model, is made of carbon fiber – like its predecessor, the Veyron. The same applies for the outer shell.

“We were the first to use tailored fiber placement ultra high-strength RTM components, ultra heat-resistant bismaleimide resins, and UMS carbon fibers in a production car,” explains Frank Götzke, Head of New Technologies, who is also responsible for manufacturing technology development at the brand. “Compared with conventional high-strength steel alloys, carbon fiber has an exceptional ratio of tensile strength and stiffness to density.”

The problem, though, is that carbon fiber only displays this strength and stiffness in the direction of the fibers, and only at a maximum temperature of 240°C. Interweaving the fibers and making them even more heat-resistant is complex, but possible. Several milestones in the history of carbon fiber at Bugatti are on display in Götzke's office. The carbon-ceramic brake discs for the Bugatti Veyron, for example, which were the largest of their kind in 2003, but only weighed half as much as their cast steel counterparts. Or the wiper arm in the new Chiron, which can easily withstand wind pressure even at a speed of 400 kph.

YARN

For further processing, different numbers of fibers are wound together to form different types of filament yarns. In the future, these yarns could also contain carbon nanotubes, tiny pipes with walls made of carbon atoms, to achieve an interlocking effect. Benefits would include significantly higher heat resistance (300°C compared to 240°C) of the carbon fiber components.

LAY-UP

Carbon fiber has a far higher strength and stiffness in the fiber direction than perpendicular to it. Depending on the component, layers of fibers are therefore arranged in different directions to achieve the desired strength and stiffness in all relevant load-bearing directions. This operation is usually performed by highly sophisticated weaving, braiding or winding machines.

Or carbon fibers reinforced with nanotubes and nanotube yarn, a research project in collaboration with the Leibniz Institute for Solid State and Materials Research in Dresden and the Bremen Fiber Institute. Other Group brands are also currently hard at work on ways to broaden the range of carbon fiber applications. According to Luciano De Oto, Head of the Advanced Composites Structures Development Center at Lamborghini, carbon fiber is today only slightly more expensive to produce than aluminum. The Audi subsidiary in Northern Italy has been one of the worldwide leaders in carbon fiber research since it started using the material on the Countach Quattrovalvole back in 1985. Today, the entire monocoque of the Aventador², for example, is made of carbon fiber – all built in-house. The complete body of the Centenario³ is, too, while the Sesto Elemento is almost entirely made of the material. Lamborghini processes about 400 tonnes of carbon fiber a year.

“Over the last five years we have developed technologies that enable us to produce ever larger quantities of increasingly complex parts. It won’t be long before we see carbon fiber being used not just in super sports cars,” De Oto says.

Take Ducati, for example. The Bologna-based motorcycle manufacturer, also a subsidiary of Audi AG, has been using carbon fiber for many years, and in a growing number of applications. Ducati began by producing carbon fiber fairings and guards, and for a good ten years now the motorcycle manufacturer has also been using the material for structural parts on its machines. This has a positive effect. The motorcycles weigh less, fuel consumption is reduced, and driving pleasure is intensified.

“Making lightweight construction cost-effective is a challenge,” says Simone Di Piazza, Head of Vehicle Design and R&D Services at Ducati. “The smart use of carbon fiber helps us to overcome these obstacles.” Carbon fiber could even play a key role for the automotive industry in the e-mobility era. Batteries are heavy, so the rest of the vehicle must be as light as possible to enable a long range.

Carbon fiber frame, swingarm and wheels: Ducati 1299 Superleggera.



Explore New Ways

MATRIX

Finally, the filament yarns are embedded in a polymer matrix, usually epoxy resin. This binds the fibers and fills the spaces, as well as preventing the fibers from buckling when exposed to load. To achieve this, the matrix must bond with the fibers.

INSTALLATION

The Volkswagen Group currently uses carbon fiber almost exclusively in super sports cars. Practically the entire monocoque of the Bugatti Chiron consists of carbon fiber components, and the material is also used for some parts of the powertrain and the outer shell (hood, fenders, roof, and so on). The characteristic fine-weave appearance of the exposed carbon fiber features only becomes visible close up.



“We will probably soon be seeing CFRP in the form of organic sheets and pultruded profiles in a Volkswagen e-Golf⁴ or other Group models,” Bugatti engineer Götzke says. For large components in particular – doors, roofs, hoods or battery boxes – carbon fiber could turn out to be a crucial factor in extending the all-important range of Volkswagen’s e-fleet without having any major impact on vehicle weight.

That is one of the reasons why brands such as Bugatti, Lamborghini, and Ducati are currently investing more know-how and financial resources than ever before in research cooperations – such as the collaboration between the University of Washington (Seattle), Lamborghini and Boeing at the Advanced Composite Structures Laboratory in Seattle. Or the cooperation between the Massachusetts Institute of Technology (MIT) and Lamborghini to create the visionary Terzo Millennio sports car. The chassis of this future concept has nanotubes sandwiched between carbon fiber layers to store electric energy. What’s more, a monitoring system has the ability to

detect even the tiniest cracks in the bodywork and initiate chemical repair processes.

Carbon fiber has always been ultralight and extremely robust, and now it is smart and can even function as a battery, too – so the material has a bright future in automobile construction. There is also a positive side effect, because other sectors also benefit from the knowledge of the Volkswagen R&D specialists. Take medical technology. For many years, Lamborghini has been giving several clinics in Northern Italy access to its know-how, helping to develop innovative prostheses and implants that are lighter, more compatible and more durable than those currently available. Most recently, Lamborghini announced it is collaborating with the Texas-based Houston Methodist Research Institute, while Bugatti is cooperating with Hannover Medical School. The common goal is to put carbon fiber and nanotechnology to use in biomedicine. Seen from a medium-term perspective, then, carbon fiber research will not only make cars lighter, but also make life easier for upper and lower limb amputees.

1 Bugatti Chiron: fuel consumption, l/100 km: combined 22.5; CO₂ emissions combined in g/km: 516; efficiency class: G

2 Lamborghini Aventador: fuel consumption, l/100 km: combined 16.9; CO₂ emissions combined in g/km: 394; efficiency class: G

3 Lamborghini Centenario: fuel consumption, l/100 km: combined 16.0; CO₂ emissions combined in g/km: 370; efficiency class: G

4 Volkswagen e-Golf: power consumption in kWh/100 km: combined: 12.7; CO₂ emissions combined in g/km: 0; efficiency class: A+

“Integrity is everyone’s business.”

What exactly do we mean by integrity? Why is it a fundamental component of our TOGETHER – Strategy 2025? And in what way do credibility and transparency help us to attract the best minds of tomorrow? An essay by Hiltrud Werner, member of the Board of Management for Integrity and Legal Affairs.

Text: Hiltrud Werner | Illustrations: Mario Wagner



Hiltrud Werner,

born in Bad Doberan, Germany, in 1966, is an economics graduate. She became Senior Vice President Corporate Audit at MAN SE in 2011, and was appointed Head of Group Auditing at Volkswagen AG in 2016. She has been member of the Board of Management for Integrity and Legal Affairs since February 1, 2017.

Never in its history has the Volkswagen Group been the focus of public criticism on the scale triggered by the diesel crisis. We are faced with two challenges simultaneously: we must permanently win back lost trust; and at the same time, we must take the radical transformation process in the Group

ushered in by the TOGETHER – Strategy 2025 decisively forward. Integrity plays a key role for both challenges. But what exactly do we mean by integrity? And why exactly is it so vitally important for TOGETHER – Strategy 2025?

The answer is: because integrity is everyone’s business and affects us all. In all brands, regions,





and Group divisions. At all levels in our company. For both colleagues and customers all over the world. Board decisions taken in any company can have far-reaching consequences, and in the event they prove wrong, can pose a direct threat to the company's survival. Indirectly, though, the success and continued existence of a company also depend on whether its employees base their conduct and thus their actions on their own conviction of "right" and "wrong." And finally, a company will only endure if its customers remain convinced that the products are morally acceptable and beneficial to the wider community. If a company and its employees merely restrict themselves to pursuing their own agenda, that eventually takes its toll on customer benefit – one might even say on customer trust.

Internal and external control or sanctioning systems, an effective compliance management system, and easily comprehensible guidelines that employees are familiar with are important. Even more important, though, is our self-perception of our day-to-day actions. Ultimately, it is employees themselves who know whether they have given their very best, or whether they have acted according to their conscience. Integrity is much more than just a word. Integrity does not depend on hierarchy levels. Integrity brings corporate values to life, it makes trustful collaboration possible, and it enables our managers at all levels to answer for their decisions

“Integrity brings corporate values to life.”

with a clear conscience. Responsibility practiced at individual level becomes vibrant, long-term responsibility for the company, for colleagues, for the company's customers, and for society.

Clearly, integrity can also make daily business more complicated, given that it could require passing up potential opportunities for income and profit that may be legal, but are no longer legitimate. The voluntary commitment given by a company to forgo certain profit opportunities for ethical reasons expresses a basic attitude. Integrity therefore demands steadfastness. But employees will only demonstrate this quality if they feel they will not suffer any disadvantage by so doing. This is why the conduct of the Board of Management is so crucial. The Board's words – and above all, its actions – must convey that it respects, expects, and encourages integrity. Personnel selection and development must reflect this, too. Only then is there a real likelihood that decisions taken by the company's middle and lower management will be driven by integrity.

However, even that is no guarantee. In the mid-1960s, Ernst-Wolfgang Böckenförde, the prominent philosopher of law, wrote, “The liberal secular state lives on premises that it cannot itself guarantee.” This dictum ultimately also holds true for companies, and has not lost its relevance to the present day. To use a word that has sadly gone out of fashion, companies today still depend on the quality of virtue in their employees – in the best sense of the word. And that is exactly what integrity means. Integrity imposes limits on business rationale, at least in the short and medium term. That is why our company's executive management has underscored the central role of integrity by firmly anchoring the mission to become a role model for the environment, safety, and integrity in the Volkswagen Group's TOGETHER – Strategy 2025.

One element of this mission is that our Group takes responsibility for the common good – in other words, that it assumes social responsibility. The crucial factor here is that this corporate social responsibility does not merely find expression in well-meaning but superficial gestures, but is practiced in harmony with our corporate strategy. Only then does CSR become credible

Explore New Ways

and effective, both internally and externally. And it should be noted that engaging for the common good may indeed also have a positive economic impact. I am firmly convinced that social and economic responsibility are not incompatible if they become a natural part of corporate culture. If a company's social engagement strengthens its reputation and makes it more attractive to customers, investors, and employees, as well as paving the way for new, forward-looking fields of business in an ecologically responsible society, then that is a welcome outcome, albeit not the sole purpose of social engagement.

There are occasions when it is difficult to make a distinction between the commercial and social motives behind the decision for or against a particular social project. In such instances, an outsider's perspective and advice can help. Volkswagen takes this very seriously and has already repeatedly sought advice from the highly competent international experts from politics, science, and research who make up the Sustainability Council.

An open attitude towards the opinions voiced by society, whether these are given by the Sustainability Council or the outcome of discussions with politicians and associations, can in fact encourage a company as a whole to act with integrity. A company's efforts will become even more credible in the eyes of the public if it is able to demonstrate transparency in the application of its principles, both internally and externally,



“Young talents have greater freedom to base their choice of company on non-economic criteria.”

and is even prepared to go against the short-term business rationale in specific instances.

And getting it right will also help us to succeed in the increasingly competitive recruitment markets. Where their skills are in demand, young talents have greater freedom to base their choice of company on non-economic criteria. For young people with a clear value system and a sense of social responsibility – in other words, who believe they act with integrity – one criterion for their choice of employer will be whether they perceive that company as advocating integrity and whether there is a high correlation between their personal values and those of the company. Unequivocal integrity therefore helps to secure tomorrow's manpower and business success. More generally, integrity helps a company to preserve its *raison d'être*, its “citizenship,” without which it could hardly exist in the long run, let alone flourish.

We believe that integrity helps to secure the future of a company. Volkswagen AG has recognized this and is acting accordingly. Compliance, culture, integrity – they form the basis for implementing our strategy and are thus the foundation of our corporate success.



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**WE USED
TO BE
COMPET-
ITORS.
NOW, THE
VOLKSWAGEN
BRANDS WORK
CLOSELY
TOGETHER AS
PARTNERS.**

Sven Bohnhorst
Engineer and test driver,
Bugatti, Molsheim



Key Figures

FISCAL YEAR 2017

VOLKSWAGEN GROUP

	2017	2016	%
Volume Data¹ in thousands			
Deliveries to customers (units)	10,741	10,297	+4.3
Vehicle sales (units)	10,777	10,391	+3.7
Production (units)	10,875	10,405	+4.5
Employees at Dec. 31	642.3	626.7	+2.5
Financial Data (IFRSs), € million			
Sales revenue	230,682	217,267	+6.2
Operating result before special items	17,041	14,623	+16.5
as a percentage of sales revenue	7.4	6.7	
Special items	-3,222	-7,520	-57.1
Operating result	13,818	7,103	+94.5
Operating return on sales (%)	6.0	3.3	
Earnings before tax	13,913	7,292	+90.8
Return on sales before tax (%)	6.0	3.4	
Earnings after tax	11,638	5,379	x
Automotive Division²			
Total research and development costs	13,135	13,672	-3.9
R&D ratio (%)	6.7	7.3	
Cash flows from operating activities	11,686	20,271	-42.4
Cash flows from investing activities attributable to operating activities ³	17,636	15,941	+10.6
of which: capex	12,631	12,795	-1.3
capex/sales revenue (%)	6.4	6.9	
Net cash flow	-5,950	4,330	x
Net liquidity at Dec. 31	22,378	27,180	-17.7
Return on investment (ROI) in %	12.1	8.2	
Financial Services Division			
Return on equity before tax ⁴ (%)	9.8	10.8	

VOLKSWAGEN AG

	2017	2016	%
Volume Data in thousands			
Employees at Dec. 31	117.4	113.9	+3.1
Financial Data (HGB), € million			
Sales	76,729	75,310	+1.9
Net income for the fiscal year	4,353	2,799	+55.5
Dividends (€)			
per ordinary share	3.90	2.00	
per preferred share	3.96	2.06	

1 Volume data including the unconsolidated Chinese joint ventures. These companies are accounted for using the equity method. 2016 deliveries updated to reflect subsequent statistical trends.

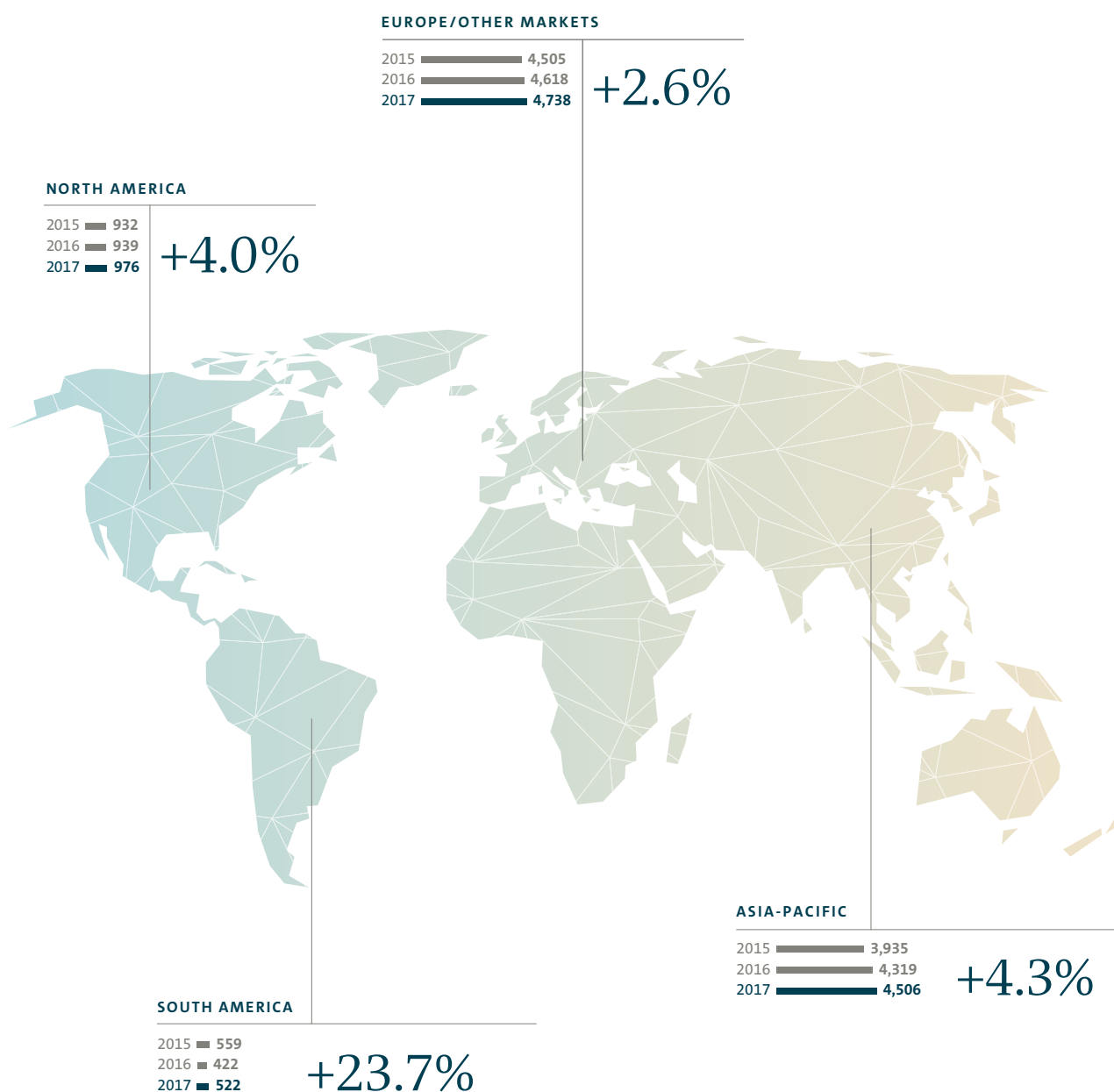
2 Including allocation of consolidation adjustments between the Automotive and Financial Services divisions.

3 Excluding acquisition and disposal of equity investments: €17,512 (€18,224) million.

4 Earnings before tax as a percentage of average equity.

Moving Globally

VOLKSWAGEN GROUP deliveries – in thousand units



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