

factor<sup>y</sup>

Magazin für nachhaltiges Wirtschaften



Topic

# MOBILITY

Looking Forward to 2035 Decarbonization by 2030 Cities are Using the Urban Space The Domino Effect: the Mobility Transition as the Engine for the 'Great Transformation' Make the Transition! Good Traffic Flow is Pure (Eco-)Routine From the Automotive Industry to the Mobility Industry Renewal of Entrepreneurial Mobility Make Automotive Industry Great Again?

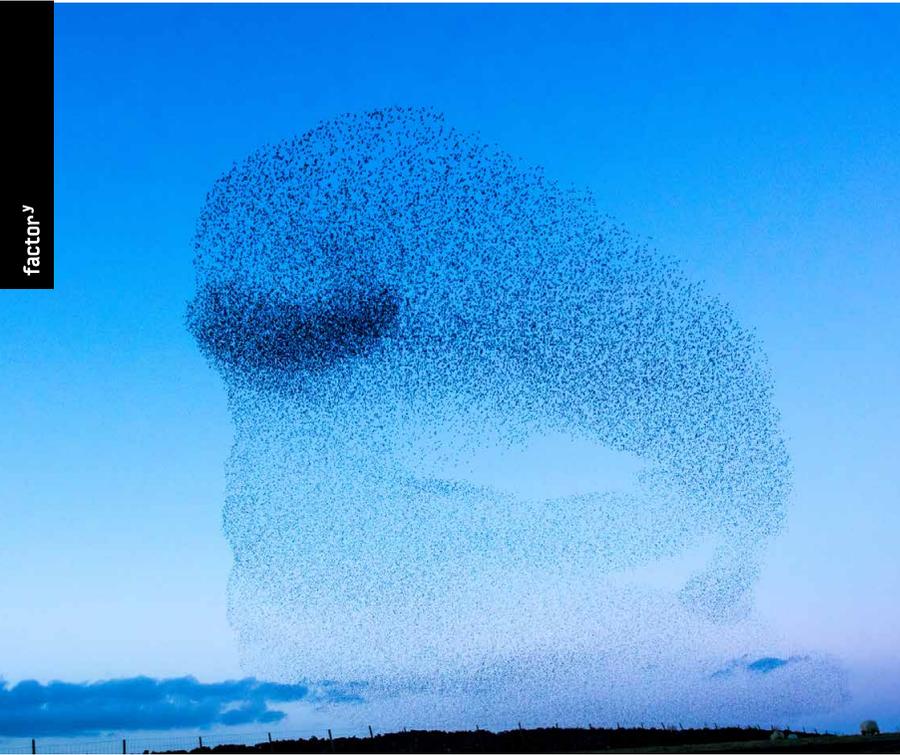
# Looking Forward to 2035

Isn't mobility in Germany just great nowadays? While it was formerly a tricky matter to have meetings regularly with your co-workers, I can now travel to the country's furthest corners with an autonomous bus — and return even late at night. Depending on the weather and the amount of time I have, I can also choose to use the e-bike sharing system. In a pinch I can take an e-convertible. And thanks to maintenance by Audi, Benz and co., everything is in excellent condition.

EV charging stations are almost everywhere and the batteries can also be quickly changed. However, depending on your mood, the best part is to be driven around while reading a book or chatting. The public transportation system is well connected and perfectly coordinated, even the spoiled Swiss praise us. There is almost no wait and if there were, then there is good relief, because everything proceeds nearly too smoothly.

Only few vehicles still exist and these are less than a quarter of the five million that existed in 2019. The air in the cities is clean. Instead of traffic noise you can hear the birds singing in fruit trees at the curb of single-lane ring roads, which function as shady bikeways, and former parking lots are now green parks.

On the last mile to the customer, the suppliers distribute their products on freight bikes. Electric trucks supply the urban logistics hubs. Overall, the distance between producer and consumer is shorter nowadays, because local production has been increasing. We move fast, thanks to streetcars, buses, and bicycles. As mentioned, the transportation system goes as far as the periphery, bike sharing systems are everywhere, and many of us walk more often. ►



The freeways are mainly used for long-distance travel and 80 percent of them are electrified through overhead contact lines, which power electric trucks. Then the trucks drive the remaining distance fueled by ecofriendly synthetic fuels. Almost half of the goods are transported by means of an expanded rail transport system and waterways. Most of us prefer to use the train or an electric bus. In the countryside, cars which are electrically powered are usually used.

Only 43 percent actually own an e-car. It does not longer serve to enhance one's prestige. The 'electric smile', which appears on your face the first time you drive an e-car, is a common experience. The electric engine's acceleration mesmerizes everyone. We get our speed rush at events like the Formula E, eSports, and in bike parks. Roaring engines are frowned upon and electric ones are a must-have.

Mobility in 2035 — no longer a necessity, but wellness, fitness, and even entertainment are. The days of traffic jams, searching for parking lots,

and train cancellations are over. The number of accidents has decreased by 80 percent. The transport sector achieved its climate goals, advanced the electrification and the energy transition, shut down the last coal-fired power plants, and in place of former brown coal districts, battery factories and research centers were established. The German automotive industry

builds almost exclusively e-cars as well as practices mobility services and with that it makes sales worldwide. Transformation is a German word now. How did all of this happen, what only a few dared to believe in 2019? You will find the prescriptions in this issue of *Factory*. We wish you pleasant reading.

Ralf Bindel and the *Factory* team

© istockphoto.com / mikedabell



# Content

- 2 Looking Forward to 2035
- 9 Decarbonization by 2030
- 16 Cities Use the Space
- 23 The Domino Effect: the Mobility Transition as an Engine for the 'Great Transformation'
- 28 Do the Transition!
- 37 Good traffic is all about eco-routine.
- 44 From the Automotive Industry to the Mobility Industry.
- 50 A new Perspective on Entrepreneurial Mobility
- 58 Can we make the automotive industry great again?
- 65 factor' is the magazine for sustainable management



36

© istockphoto.com/ aapsky



16



28

© www.xcyc.de/



49

© istockphoto.com/ AndreyPopov

© istockphoto.com/ domin\_domin

9





decarbonization,  
 car driving, e-mobility,  
 energy transition, climate goals, automotive  
 industry, **transport transition**, transport service,  
 greenhouse gas, CO<sub>2</sub>, **walking** alternative drivetrains, The  
 Intergovernmental Panel on Climate Change, power mix, total mileage, new  
 registrations, solar and wind power, **driving**, life cycle assessment, combustion  
 engine, battery production, energy storage, stability of power grids, **swimming**,  
 commuter car, ridesharing, **autonomous driving**, EV charging station, electric  
 buses, **local public transport**, mobility gap, digitalization, **vicinity**, mobile storage  
 power plants, decentralized energy generation, peer-to-peer, city congestion charge, bicycle  
 highway, **free local transport**, driving ban, threshold, nitrogen oxides, air pollution,  
 transport policy, **fast**, diesel emission scandal, livability, risk of accidents, **speeding**, noise  
 pollution, school run, **free space**, grassy areas, **quality of urban life**, speed limit,  
**remote**, **bike sharing systems**, car sharing, minibuses, **hiking**, special treatment  
 for official vehicles, Great Transformation, mobility transition, **key industry**,  
 alternative concepts of mobility, **freight bikes**, route to/from work, route  
 planning, congestion length, **eco-routine**, sufficient mobility, **far**, freeways,  
**slow**, land consumption, road construction, airfields, subventions, Blue  
 Badge, mobility industry, **stroll**, employment, vehicle fleet mileage,  
 supplier, business travel, vehicle fleet, CMM, Corporate  
 Mobility Management, **technological  
 leadership**, megacities

# 1000

**The external expenses related to traffic amount to EUR 1,000bn in the European Union.** The costs include the expenses related to accidents, the environment (almost 50 percent) as well as congestion (EUR 250 billion), excluding infrastructure. More than three quarters of the costs are caused by road traffic. The external costs of one kilometer per person or per ton are the lowest via bus or rail. [zukunft-mobilitaet.de](http://zukunft-mobilitaet.de), Externe Kosten Verkehr (external costs of traffic) EU28 2016, 17 December 2018

# 70

**It is the fossil fuels that comprise the highest percentage of imported raw materials with 70 percent in Germany** one fifth is petroleum. It is mainly used by the transport sector. German industry is the world's fifth largest consumer of metallic raw materials and at the same time depends almost 100 percent on imports. The automobile manufacturers need iron, steel, aluminum, copper, tin, platinum and other metals in large quantities that are mostly imported from the global south. Mining causes severe consequences for humans and nature. Twenty-six percent of the steel used in Germany is consumed by the automotive industry, as well as seven percent of the zinc and ten percent of the copper. German Federal Institute for Geosciences and Natural Resources (BGR), Rohstoffsituation 2016, Weniger Autos, mehr globale Gerechtigkeit, Brot für die Welt (bread for the world), Misereor, PowerShift 2018

# 76

**Three quarters of EU freight transport is on the streets.** In 2010, about 76 percent of the freight transport in the EU traveled on the roads, 17 percent on rails and 7 percent on inland waterway vessels. German Federal Statistical Office, Verkehr auf einen Blick, 2013

# 18

**The transport sector causes 18 percent of Germany's greenhouse gas emissions:** Road, rail, barge and air traffic pollute the air and the climate with carbon dioxide, methane, nitrous oxide, sulfur dioxide, nitrogen oxide, carbon monoxide, volatile organic compounds, and fine particles. The emission trend is almost completely defined by road traffic, which represents about 95 percent of traffic emissions. Since 2013, emissions have been increasing by 2 percent annually. The transport sector is thus the only one in which emissions have not declined. It is certain that without a traffic and energy transition, the climate protection goals will not be met. German Federal Ministry of the Environment, Nature Conservation and Nuclear Safety (BMU), [Umweltbundesamt.de](http://Umweltbundesamt.de), 2018

# 3,180

**In 2017, 3,180 people died in traffic.** This is the lowest rate in more than 60 years. Every day, the police records 7,200 road accidents, approximately 1,100 injured people and about 9 fatalities. The goal is to decrease the rate of road fatalities by 40 percent by 2020, compared to 2011. It has decreased by 20.7 percent so far. In 90 percent of the cases, the cause of the accident is human error. The German Federal Highway Research Institute estimated the costs to the national economy caused by traffic accidents in Germany at EUR 31bn in 2009. This is more than one percent of the gross domestic product. German Federal Statistical Office, 2018

# 95

**The EU fleet-wide average emission of new passenger cars will be limited to no more than 95 grams of carbon dioxide per kilometer starting in 2021.** The European average is currently 118 grams. About one quarter of the European Union's greenhouse gases are caused by traffic. Cars and trucks emit the greatest percentage. By 2030 the EU will have reduced the emission threshold by 37.5 percent to 60 grams per kilometer and intends to lower the threshold by at least 15 percent by 2025. If the percentage of electric cars is not increased to one third of the overall production, the manufacturers won't achieve these limits. [sueddeutsche.de](http://sueddeutsche.de), Schärfere CO<sub>2</sub>-Grenzwerte für Autos (strict CO<sub>2</sub> thresholds for cars), 17 December 2018

# 60

**The construction of an electric car produces about 60 percent more CO<sub>2</sub> emissions compared to a conventional gasoline-powered car.** As for resources, it even uses about 80 percent more. It depends on the type, but at 35 percent of ecologically generated electricity (2018), the eco balance of the electric car between 30,000 and 150,000 kilometers is better than that of a gasoline car. Currently, only 25 percent of the cars that are taken off the road per year in Germany are also recycled. Therefore, a higher rate would improve the ecological and social balance sheet. At [emob-kostenrechner.oeko.de](http://emob-kostenrechner.oeko.de), you can compare the eco balance sheet of electric cars with conventional cars. [wz.de](http://wz.de), Warum das Elektroauto die Ökobilanz verbessert, 21 September 2017; [spektrum.de](http://spektrum.de), Wie ist die Umweltbilanz von Elektroautos, 4 November 2017

# 30

**Thirty million people worldwide died in car accidents before 2015.** By 2035, 60 million will have died due to global motorization, according to estimates by the World Health Organization and World Bank. No other technology has caused so many deaths, not even all the wars put together. Only tobacco production causes a comparable number of casualties. Klaus Gietinger, 99 Crashes, 2014

# 16,500

**In 2014, one ton of lithium cost around USD 5,000. The price rose to USD 16,500 in 2018.** Cobalt cost USD 80,500 per ton in 2018, but its price doubled within one year. These metals are essential for e-mobility. Meanwhile, the small-scale prospectors who mine most of the cobalt in the Democratic Republic of the Congo (DRC) do not benefit from the price increase. Still, 20 million Congolese live off small-scale mining. Experts recommend developing the craft sector and building smelt facilities and factories for battery cells in the DRC instead of imposing restrictions on small-scale prospectors. Der kongolesische Moment, Südlink 185, September 2018

# 120

**At a speed limit of 120 kilometers per hour, CO<sub>2</sub> emissions on freeways could soon be decreased at low cost by 9 percent.** This would reduce the impact of CO<sub>2</sub> on the climate by three million tons per year. Automobile manufacturers could save resources by focusing on engine power and drive types and thus build vehicles lighter and more efficiently. Almost 60 percent of all accidents causing personal injuries involve cars in the highest maximum speed class (according to the registration documents) above 120 kilometers per hour. German Environment Agency (UBA), Tempolimit, 2012; German Federal Ministry of Transport and Digital Infrastructure (BMVI), Verkehr in Zahlen, 2018; ZEIT.de, Scheuer hält Tempolimit für falsch, 19 December 2018

# 6,000

**At 38 percent, the largest source of nitrogen oxide emissions in Germany is road traffic. According to the German Federal Environment Agency, a total of 6,000 premature deaths were caused by road traffic in 2014.** Diesel vehicles emit about 67 percent of direct NO<sub>2</sub> emissions in municipalities. In the course of the diesel emissions scandal in 2015, it became known that the actual emissions of numerous car models exceed the figures determined on the test rig because cleaning devices were shut down via software during the process. For example, the figures for VW automobiles were 40 times higher. German Federal Environment Agency (UBA) 2016, 2018

# 600

**A VW beetle constructed in 1948 weighed 600 kilograms.** Today, an average new car weighs 1,500 kilograms, and an SUV over two tons. Raw material and energy consumption rise proportionally to the increase in weight. One of five registered cars in Germany is now an SUV, an off-road vehicle or a van. In 2017, more SUVs than small cars were registered for the first time, accounting for 22.5 percent. In fact, the two percent-increase in CO<sub>2</sub> emissions each year is primarily attributed to SUVs and off-road vehicles. German Federal Motor Transport Authority 2018, German Federal Statistical Office 2016, Mobilität in Deutschland 2018

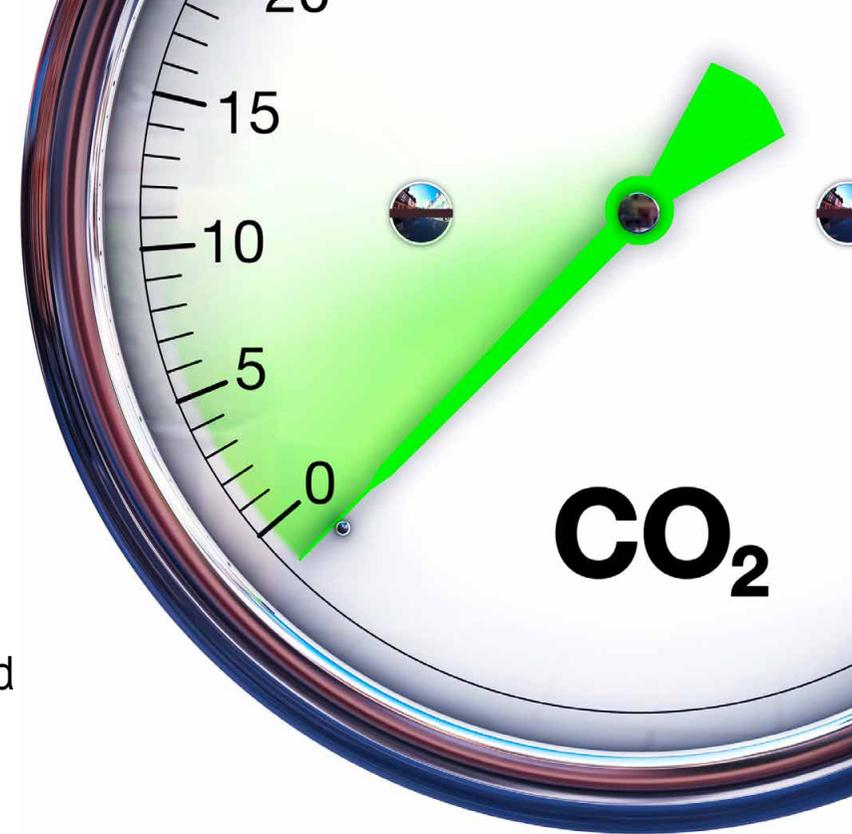
“I had the idea  
while I was riding my bike.”

Albert Einstein (1879–1955), Swiss-German physicist and Nobel laureate, talking about the theory of relativity.

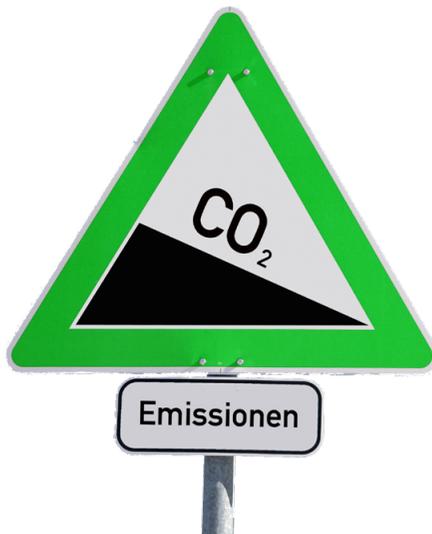
# Decarbonization by 2030

Renewable mobility, a combination of e-mobility and energy transition, is considered the crucial key to achieving a real emissions turn, and with that the agreed climate goals. Nevertheless, the turn is affecting major corporations in the automotive, oil and construction industry. The mobility industry is now on the verge of upheaval. But it is not only ambitious climate goals that call for action. It is the economic success of renewable energies worldwide that, in combination with digitalization, is changing the predictions and shifting decarbonization by 2030 into the realm of possibility. This is already shown by current applications.

By Christiane Schulzki-Haddouti. Translated by Alexandra Bartelt & Denis Francis



In the German transport transition, the focus was on on-board efficiency measures for a long time. But because of the increasing traffic capacity and increased motorization, emissions were slightly higher in 2016 than in the base year 1990. The transport sector, alongside industrial production, are the only ones in which greenhouse gas emissions continued to increase in 2017. In 2018, the German Advisory Council on the Environment, which advises the Federal Government, came to the conclusion that a switchover to alternative drives has to be made as soon as possible. Complete decarbonization, a greenhouse gas-free



© istockphoto.com/ hfoxfoto

Germany, is now in the focus of the efforts. The target for this is still the year 2050. According to the latest report by the Intergovernmental Panel on Climate Change, it is clear that the deadline has to be moved forward as far as possible. Some consider a target of 2030 to be possible.

At the moment, e-mobility is seen to be a great harbinger of hope. It is not yet really clean. During the production of electric cars, considerable amounts of greenhouse gases are emitted into the atmosphere. To even out the carbon dioxide released during battery manufacturing and the electricity needed for operation with today's power mix, electric cars would need a total mileage of around 150,000 kilometers. The balance is only improved when the production is gradually changed to clean electricity. It will look even better if vehicles get their electricity directly from solar and wind power.

Many countries such as Norway, India or China push for an exit from combustion engines by stating a concrete end date for new vehicle registrations such as the year 2035 or

quotas for e-vehicles. Still, economic decisions seem to be more important than political choices. This is why the current dynamic cost reduction of renewable energies could prove to be an important driver of the development. In 2014, Stanford professor and Silicon Valley entrepreneur Tony Seba pointed out that the efficiency of photovoltaics (PV) is developing exponentially just as the Internet did in the past. He expects that the worldwide energy demand can be covered by solar power in 2030. From a German point of view, Seba's prognosis does not seem to be very realistic. But according to a report by the World Economic Forum, solar and wind power cost the same as energy sources coal and natural gas in 30 countries in 2017.

Seba expects that the costs for e-vehicles will decrease as fast as those of solar panels. The costs for photovoltaics have decreased by 22 percent for every doubling of industry capacity because of a learning curve of 22 percent. The disruption will be reached when the monthly costs for an e-car are close to those of a vehicle

with an internal combustion engine. The costs of batteries are not pivotal, because similar to the competition between the smartphone and the landline, an e-car is not a replacement for a conventional vehicle. The electric motor is more energy-efficient, the charging cheaper and the maintenance easier. E-cars can also be used for energy storage and therefore contribute to the stabilization of the power supply system.

## Fewer Vehicles Because of Digitalization

Tony Seba is not the only one who is of this opinion. Karl-Thomas Neumann, former head of the Adam Opel AG until 2017, who today works for the Californian e-vehicle start-up *EVelozcity*, agrees with Seba. In the *Handelsblatt*, a German newspaper for business and economic issues, he said recently. “In reality, this is all disruptive and in the end it will completely destroy the existing industry.” He therefore recommends that large companies invest in the new business with adaptable start-ups. *EVelozcity* want to roll out their first electric vehicle in 2021 and they set their hopes on commuter cars, ridesharing and delivery vehicles to reach their goal. Rather than having

range as the distinguishing feature, it is actually having a price of less than USD 50.000 that is important. This is made possible with components from the US and China.

The market is therefore shaken up from the top. Today, Tesla dominates the US-American market in the price segment of high-quality limousines, and the segments in the lower price range will follow. This development is followed with a sharp eye at the stock exchange. Already in 2017, Tesla was rated higher than the traditional US car manufacturers General Motors and Ford. It looks similar for companies like Alphabet or Mobike that pin their hopes on digitalization in mobility. Studies of the Wuppertal Institute such as the one regarding the transport transition 2035 expect that the transport sector could get by with only one tenth of the number of today’s cars, if the possibilities of digitalization of autonomous driving and ridesharing are used consistently.

California is far away. But there are also considerable changes in Germany, although on a small scale — in a vast and windswept area in Northern



Germany. The region of Northern Friesland is currently a pioneer in the expansion of charging stations and the number of vehicle registrations of e-cars in Germany. In the Friesian municipality of Sprakebüll for example, there are 20 registered e-cars for every 240 inhabitants. The inhabitants of Sprakebüll did not accept having their wind turbines switched off when the electrical grid was in overload, so they looked for alternative possibilities to use the generated power. Sprakebüll claims to have the highest density of e-cars per person in Germany. If the entire country functioned as this municipality does, there would already be seven million e-vehicles.

In a blog entry, the small municipality celebrated itself as an e-mobile village and the inhabitants founded an association of the same name. The association provides its members with e-carsharing for an hourly charge with the so-called ‘Dörpsmobil’, which is charged at its own carport. This development is being promoted by the Andresen family. “We wanted to use our own electricity

and not petrol from the station”, say Hans-Christian Andresen and his son Christian, who serve as CEOs for the communal citizen-owned wind farm. But the inhabitants of *Sprakebüll* are not yet satisfied with their achievement. In the future, they want to supply agricultural vehicles with fuel generated from the electricity from the citizen-owned wind farm.

Also in Northern Friesland, there are currently tests with three autonomous e-buses to try out public transport ‘on demand’. After the tests on the site of the GreenTEC Campus in Enge-Sande, the buses are supposed to be used in commuter transport in Northern Friesland and in tourist traffic on the island of Sylt. The passengers are supposed to call for assistance using an app and the new bus service will thus be able to close mobility gaps in rural areas. Besides the *SVG* and *Autokraft* bus companies, many specialized companies as well as Christian-Albrechts University in Kiel are working on the North Frisian bus project.

Digitalization with its advantages for networking is the game changer in



*The municipality of Sprakebüll presents itself as the place with the largest e-car density in Germany.*

the transport transition. It allows the use of decentralized structures efficiently with relatively little effort and expense. In regard to the resilience of networks, a decentralized management is crucial, which means e-cars play a new role as mobile batteries. As early as 2013, a report by the California supervisory authority for public utilities came to the conclusion that owners of e-cars could be paid up to USD 100 a month if they provided electricity to stabilize the power supply system.

## Mobile storage power plants

At the moment, however, the public debate on the expansion of e-mobility is still dominated by the question of what happens when the many new e-vehicles charge every evening, causing overloaded power lines at the municipal utilities. This question focuses on a centralized provision of energy — but not on decentralized power generation, which would already be possible on site with today's state-of-the-art technology. It is a little reminiscent of the discussion in the late 1990s, when it was suspected that the livestreaming of voice messages and moving images would completely overload the internet. Shortly thereafter, companies like *Skype* launched successful voice and video services using peer-to-peer technologies.

E-cars and computer junctions could play a similar role in a peer-to-peer structure and store energy when there is a surplus of sun and wind energy production in order to be able to release it in a controlled manner in the event of bottlenecks. A current project in rural *Allgäu* (part of the

alpine region in Bavaria) shows that this works. Together with the *Research Centre for Energy Economics* in Munich, the Augsburg utility company LEW has set up a project at the Buchloe train junction, where many commuters board trains to Augsburg or Munich. All 14 research participants were provided with an e-car, which they were to connect to the electric vehicle charging stations, also called EV charging stations, at the train station every evening. They were then supposed to indicate the time at which they will arrive at the EV charging stations on the following day. The charging schedules for the car batteries were calculated on the basis of the data and forecasts for insolation. As a result, the vehicles were able to absorb 40 percent more of the local green electricity and avoid peak loads in the grid.

Often technical rules still interfere with the integration of e-mobility

into the grid. For example in Hagen, in October 2018, *Nissan* and *The Mobility House* (the EV charging station manager) started their vehicle-to-grid-project. Only after years of preparatory work was it possible to meet the regulatory requirements for the so-called primary reserves of power plants. Now connected e-vehicles automatically register with the energy center in Hagen as a control power system and are integrated as such into the power supply system. In this way, they can contribute to the stabilization of the power supply system and reduce the cost of expanding the grids and the need for fossil-fired control power systems. In Germany, this is regarded as the biggest problem which transport transition supporters criticize. Despite the long technical lead time, there are still no standardized adjustments to facilitate the integration of e-mobile storage power plants.



The founders of Ibitricity, a Berlin startup, have been working on the idea of bidirectional charging since 2008 — they also had to overcome countless regulatory hurdles. After years of collaborative research, pilot projects and field tests, they have been on the market since 2016 with a cable which can even be used for direct billing. It has been compliant with the calibration law since 2018. Since 2013, they have been represented in Berlin with their charging infrastructure on several street lights. However, the breakthrough came in 2017 with a major contract from the London municipal administration.

Speaking of regulations, it is especially mentioned when it comes to the question of why the development of e-mobility in Germany is lagging far behind expectations. It is the construction and property law, the charging across supplier boundaries, the calibration and measurement law and a resilient network expansion that hinder the expansion. If policy makers now want to speed up this process, they have to tackle all this and even more whole heartedly. If they force the energy and automotive industry onto a sustainable path, it will do them and society more than one favor. Otherwise the economic disruptions could be severe. ■

Christiane Schulzki-Haddouti is a freelance media and IT journalist who has been involved in different projects in the areas of foresight, innovation management and media development. She mainly writes for c't, a computer magazine, VDI-Nachrichten (a news portal for engineers), the Stuttgarter Zeitung (daily newspaper in Stuttgart) and also for online portals like Heise online (news on computers, IT, science and politics) and Golem (IT news). Together with Christopher Schrader and Alexander Mäder, she founded the KlimaSocial channel on the Riffreporter platform (an online platform publishing projects and research about coral reefs). The main question is: What is really driving climate protection forward — is it politics or are completely different factors involved?



“The number of cars registered in Germany must be dramatically reduced. Electric cars with battery storage are currently the best ecological option for replacing combustion engines, but they also consume finite raw materials in large quantities.”

Merle Groneweg, PowerShift (association for ecology and world economy), co-author of the study “Weniger Autos, mehr globale Gerechtigkeit (fewer cars for more global justice). Die Antriebstechnik allein macht noch keine Verkehrswende (drive technology on its own does not make a transport transition)” by PowerShift, Bread for the World and MISEROR, 2018

# Cities Use the Space

The strategies for changing cities range from a city congestion charge and free local transport to car-free days. Bicycle highways, streetcars and electric busses are also part of the strategy. Municipal administrations and urban economy can do a lot for the attractiveness of this range of options by creating their own transport transition, which is driven by the citizens.

By Thorsten Koska and Stephan Rammler.  
Translated by Julia Baur & Bianca Bauer.

Stuttgart, Berlin, Frankfurt, Cologne, Essen: In autumn of 2018, court judgments on driving bans in major German cities were issued almost weekly. For years now, the threshold limit values for nitrogen oxides have been radically exceeded. In order to put an end to this illegal situation, the Federal Administrative Court cleared the way in February 2018 for driving bans, which cities now have to implement gradually.

For years, politicians have turned a blind eye to the health-threatening air pollution caused by car traffic. For example, the Federal Government has shifted the responsibility for action onto the municipalities and blocked possible solutions — from a Blue Badge (a label for marking diesel vehicles) that is effective in the short term to the funds needed in the long term for better public transport. The municipalities have at best dared to make small changes to their transport policies— and hoped that newer vehicle technology would solve the problem on its own.

And the automotive industry, which contributed to the problem with

its unlawfully high vehicle emissions, also continues to act as if it had nothing to do with the consequences. Instead, newly-sold cars are getting bigger, heavier and faster, while the number of vehicle registrations continues to rise. In the end, all of these players have shown at the diesel summits that they are not yet willing to take decisive action, but would rather limit themselves to symbolic policies.

Like under a magnifying glass, the current driving bans show the problems of urban traffic — and it is becoming clear that the pollution load is by far not the only challenge. The Federal Government states that in order for Germany to comply with the Paris climate goals, however, the CO<sub>2</sub> emissions from traffic must be reduced by at least 40 percent by 2030. But while emissions are decreasing in all other sectors, greenhouse gas emissions from traffic are rising.

## The Cost of City Traffic

Moreover, car traffic restricts the quality of life in cities and at the same time exacerbates the already growing social inequalities. Traffic noise makes living on main roads unattractive and unhealthy. Fast and dense traffic is dangerous — especially for the more vulnerable road users that do not travel by car. The high speed level as well as the lack of safe bike paths and sidewalks frighten off the cyclists and deprive the children of the ability to move freely around the city. It is because of these dangers that parents prefer to take their children to school by ‘parent taxi’, that is to say, by car. The lack of movement not only harms learning, but also makes it harder for children to participate independently in traffic later on.

Last but not least, car traffic takes up the spaces that cities are so urgently in need of. A stationary car occupies 12 square meters of public space that is provided almost free of charge; at a speed of 50 kilometers per hour, the car already takes up more than 100 square meters — space that is not available



for green areas, street cafes and playgrounds.

This list shows that it is not enough to replace the dirty combustion vehicles with electric cars, thus ensuring an 'energy transition in traffic'. Without a doubt, alternative drive systems can and must make a major contribution to reducing pollutants and CO<sub>2</sub> emissions in the future. But in order to free the cities from gridlock and create livable environments with democratic mobility, this is not enough. We need a new paradigm for urban mobility, a transport transition.

## The good life Is possible

An urban transport transition would increase the quality of life in the cities. Where cars still park today, green oases, street cafes and playgrounds can emerge tomorrow. There would be less noise and people of all ages could use the street space safely. Throughout the city, the speed limit would be 30 kilometers per hour. Instead of going by car, many more people would travel to work by other means



© istockphoto.com/ Nadezhda1906

of transportation. For instance, people could get to the train station using their own bike, take the city train from there and then, for the last kilometer, use one of the rental bikes that are to be found at every corner. The job ticket would be sponsored by the employer, making the changeover worthwhile for almost everyone. Another option could be the *Bürger ticket* (citizen ticket), a 'semester ticket for everyone'. In future, autonomously driving minibuses could pick up the passengers and carry them from door to door where the bus and train connections are poor. And if you want a car for a trip to the lake or to do the weekly shopping, you can use car sharing.

Germany's cities have a good chance of approaching such a transport transition and bring it to fruition, as they do not start from scratch, but have role models in many European cities who show how it can work.

There is *Copenhagen*, for example: The cityscape is dominated by cyclists and every third trip is taken by bike, as bike paths are wide, safe and the first to be cleared of snow, even before the streets. Moreover, cyclist get to enjoy the green wave at the traffic lights. Through ongoing encouragement and financial incentive, the former dominance in traffic of the car was reversed, and today even children and old people on bikes feel safe in the dense city traffic.

Then there is also *Vienna*, where one of the densest public transportation systems in Europe has been combined with an unrivalled low-cost ticket — for EUR 365 a year, i.e. one euro a day, citizens are mobile within the metropolis using public transport. This way, the share of public transport has doubled within 20 years.

And *London* avoided the gridlock by using a mixture of carrot and stick: A ►

dense network of bike rental stations as well as new bike paths made leaving the car behind more appealing. If you would still like to drive into the city by car, you have to pay a city congestion charge.

With a little imagination it is possible to envision how a transport transition is possible in German cities, too. The prerequisite for this is the consistent implementation of what has so far only functioned on a small scale. Mobile Internet allows for mobility to be organized as a service that is available from everywhere and on the go. Car sharing, rental bikes and on-demand driver services enable intermodal mobility, i.e. mobility that comprises various means of transportation. This eliminates one of the greatest emotional arguments in favor of the car — the freedom to decide yourself when and how to get from A to B can be experienced with a smartphone as a *Mobilitätsassistent* (mobility assistant) instead of with a car key in your hand. Mobility stations are enabling the switchover — with charging points of electric car-sharing vehicles, secure and weather-protected bicycle parking, parcel collection points and much more.

## Redistributing the space

To make this possible, cities have to set firm objectives — and then pursue them consistently. A bike path is only as secure as its weakest point, and if it ends abruptly at the road after 100 meters, many people prefer not to use their bike. And what use is there in a dense network of



streetcars and car-sharing vehicles in the city center when in the residential area on the outskirts only one bus stops per hour and no car-sharing options are available? Cities have to not only spend money, but also set conditions for new mobility providers, so that their innovative transportation concepts reach all citizens. If that is done successfully, current car companies also have the opportunity to secure their future as mobility service providers with new business models.

However, new and better offers of EcoMobility alone, which includes cycling, public transport, walking and car-sharing, are not enough. After many decades of car-friendly urban planning, preference given to cars in street space and financing of car traffic, today it is still very attractive to use a private car. Here again, urban policy must have the aim to use not only pull factors that increase attractiveness of EcoMobility but also — admittedly, unpleasant — push factors that decrease the attractiveness of using a car.

Some of these instruments are already in the cities' own hands. They



© istockphoto.com/mixetto

can redistribute street space, reduce traffic lanes for cars and allocate them for bicycle traffic. And they can make a charge for parking in order to achieve, at least to some degree, true-cost pricing in the highly subsidized public parking space. In doing so, good interaction between the different measures is important. If alternatives to cars are promoted and developed, it may be easier for road users to accept that parking spaces and traffic lanes are reduced and prices for parking are raised.

## Policy makers must emancipate themselves from the car

As important as these measures of municipalities in cooperation with new mobility providers are, the transport

transition cannot be successful without any help from federal policy making, as many of the privileges of car traffic are established at the federal level. It starts with fiscal policy, as the special treatment for official vehicles makes it still possible to deduct vehicles that are highly motorized in an absurd way from taxes as operating materials, and as diesel fuel continues to be subsidized. And it is similar with regulatory law, where traffic regulations make it impossible to introduce a general speed limit of 30 kilometers per hour in cities and where the law on transportation of passengers hinders the implementation of innovative concepts of mobility that are a combination of busses, car-sharing and taxis. After all, it is the German Federal Government that constantly torpedoes stricter CO<sub>2</sub> limits for cars at the EU level — in an attempt to protect the automotive industry and with the effect of endangering its transformation and therefore its sustainability.

If the transport transition has so many advantages and offers prospects even for the automotive industry to renew itself — why has nothing been

done yet? First, policy makers are apparently afraid of drivers as voters who might perceive an eco-friendly transport policy as a threat. However, there are a number of reasons not to be afraid of that. In fact, people want livable cities, and where they witness the transport transition, like in Vienna, Copenhagen, Paris or London, they are satisfied with their local politicians.

Second, decades of support to the automotive industry have left behind corresponding structures, routines and ways of thinking in the administration, whether it be in planning agencies or ministries. In order to overcome them, it needs pressure from within and from outside. In 2017, Berlin citizens showed with the *Bicycle Referendum* how this is possible. With a bottom-up mobilization, they organized a citizens' initiative that demanded a radical transport transition. It was only after feeling this pressure that the city introduced the *Berlin Mobility Act* in mid-2018. The Act said that — for the first time in Germany — the priority given to EcoMobility over cars was not only described as a noble objective, but made legally binding.

Even though policy makers are not taking action yet — or maybe for this very reason —, a bottom-up transport transition is possible, if citizens take matters into their own hands. ■

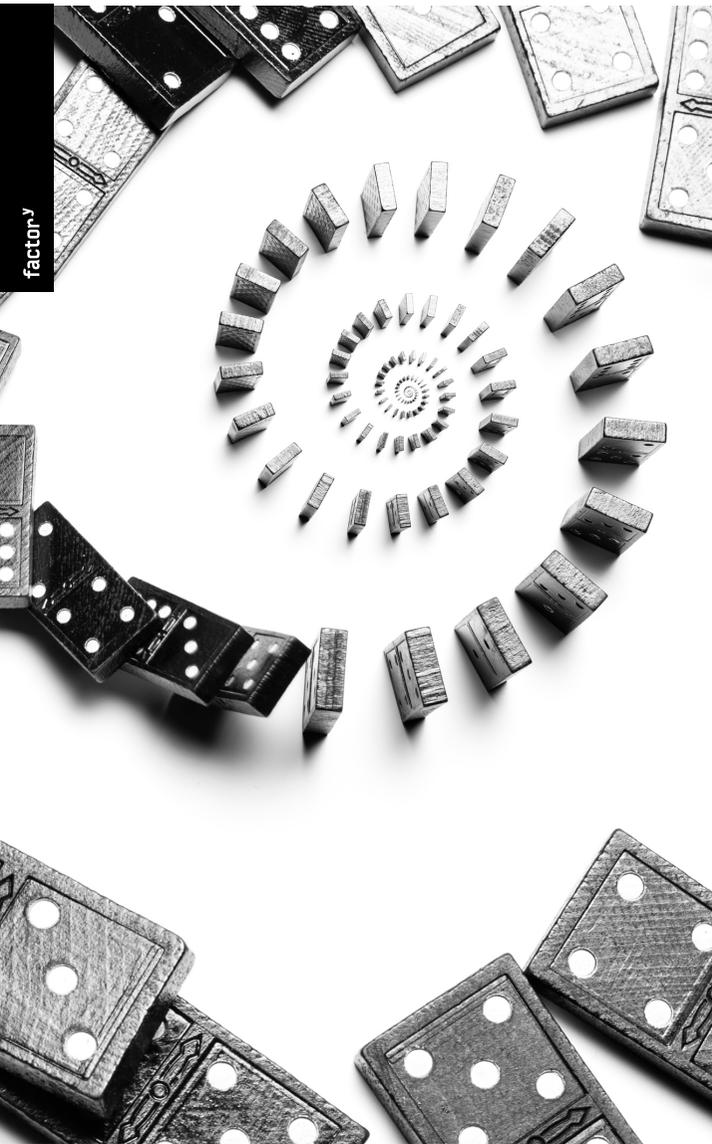


© istockphoto.com/ oneinchpunch

Thorsten Koska is a political scientist and sociologist and works as a project leader in the area of energy, transport and climate policy at Wuppertal Institute. Stephan Rammler is the founding director of the Institute for Transportation Design (ITD) and professor for Transportation Design & Social Sciences at the University of Fine Arts in Braunschweig. Since October 2018, he has been the director of the Institute for Future Studies and Technology Assessment (IZT) in Berlin. The second edition of his book *VolK ohne Wagen* (a people without cars) was published in 2017 by Fischer Publishing House. In 2018, oekom Publishing House issued *Der blinde Fleck der Digitalisierung: Wie sich Nachhaltigkeit und digitale Transformation in Einklang bringen lassen* (the blind spot of digitalization: how sustainability and the digital transformation can be reconciled), which he had written together with Felix Sühlmann-Faul.

**“A fundamental right to park  
is not compatible  
with the mobility transition  
in our cities.”**

Christian Hochfeld, director of Agora Verkehrswende (Agora Transport Transition), September 2018



# The Domino Effect: the Mobility Transition as an Engine for the ‘Great Transformation’

In a number of ways, the change of today’s car-dependent society is like a domino for a ‘Great Transformation’. There is hardly any field that is as intensively linked to the other key ‘transitions’ to a sustainable society, and there is no other field with such a close connection with the specific functionalities of the current economy. Therefore, ‘future literacy’ in the area of mobility goes far beyond the transport sector.

By Uwe Scheidewind.

Translated by Kevin Bongard & Kevin Beckmann.

The term *great transformation* that was introduced in the eponymous flagship report of the *German Advisory Council on Global Change* (WBGU 2011) describes the comprehensive technological, economical, political and cultural transformation of modern societies towards a sustainable development.

In the course of this, the Great Transformation is taking place as a process of closely interconnected transitions (see fig. 1): These range from a fundamental energy and resource transition to the development of new consumption patterns and models of wealth. They take concrete form in a comprehensive transformation of our cities (urban transition), industrial production (industrial transition) or nutrition habits and food production (nutrition transition).

At that point the mobility transition plays a key role. The transport sector alone consumes almost 30 percent of the required delivered energy in Germany. The resource challenges of the automobile production and automobile use take on a new dimension with the transition to electric engines. And today nothing stands more for prosperity and consumption transition than mobility in cities, where heavily developed bike, foot and local public transport are the new symbols of high urban livability, as such cities as Copenhagen or Groningen show. Therefore, the urban and industrial transition are not only taking place especially in the German mobility sector but also in Copenhagen and Groningen. The mobility and transport transition is a central domino for all further transitions of the Great Transformation.

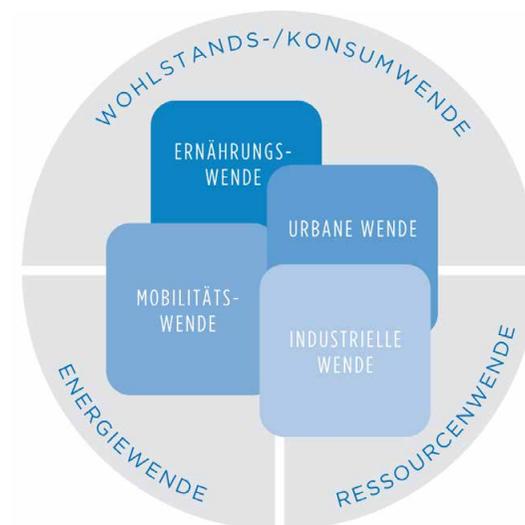


Fig. 1: Embedding the Mobility Transition in the Transitions of a Great Transformation (Source: *Zukunftskunst, Schneidewind/Wuppertal Institute* (2018), p. 170)

DYNAMIK	AUSPRÄGUNG IM FELD DER MOBILITÄT
Ökologische Landnahmen	<ul style="list-style-type: none"> <li>Verbrauch fossiler Energieträger</li> <li>Flächen-Inanspruchnahmen</li> <li>Dominanz der Automobilität im urbanen Raum</li> </ul>
Expansive Stabilisierung	<ul style="list-style-type: none"> <li>Logik der Automobilmassenproduktion (Weltmarken, einheitliche Plattformen) nur durch Größenwachstum zu stabilisieren</li> <li>Trend zu größeren Autos zur Stabilisierung von Gewinnmargen und zur Absicherung von Hochlohnstandorten</li> <li>Automobilindustrie »too big to fail«</li> </ul>
Kolonialisierung der Lebenswelt	<ul style="list-style-type: none"> <li>Mobilitätskultur als dominantes Kulturmoment</li> <li>Selbstinszenierung und Identifikation über das eigene Automobil</li> </ul>
Soziale Desintegration	<ul style="list-style-type: none"> <li>Wachsende soziale Ungleichheit und Risikoverteilung im Straßenverkehr</li> <li>Globale Restrukturierung der Automobilproduktion mit erheblichen sozialen Verwerfungen (z.B. Detroit/Michigan)</li> </ul>

Fig. 2: Dysfunctional Dynamics of the Modern Economic Order using the Example of the Automotive Industry (Source: *Zukunftskunst, Schneidewind/Wuppertal Institute* (2018), p. 91)

## The Automotive Industry as the Key Industry of Today's Economic System

In the case of mobility, it is also becoming clear how closely our modern car-dependent society is linked to the side effects of our modern economic order (see fig. 2): No other sector owes its current economic success to the extensive use of ecological resources without having to pay their 'real prices'. Few other industries are currently so aimed at growing in order to stabilize their successful model and have such an intense impact on the cultural code of modern affluent societies. And both the current organization of traffic — especially in cities — and the emerging structural change are associated with considerable social distortions.

A sustainable development of the mobility sector is therefore also a compass for a future-oriented development of our economy as a whole.

## The Art of the Automotive Transition

For the art of an 'automotive transition', politicians and companies must interact intelligently along four dimensions (see fig. 3). It is particularly the automobile manufacturers that need to assume a special role.

On the one hand, the massive disruptive potential of new technologies (such as electromobility, autonomous driving, digital networking) must be translated into business models that meet the requirements of sustainable development (see this *factory* p. 28 and 43). On the other hand, it is just



Fig. 3: Mobility Transformation and Entrepreneurial Future Literacy (Source: Zukunftskunst, Schneidewind/Wuppertal Institute (2018), p. 370)

as important for industry to take on a new regulatory and 'culture-shaping' co-responsibility. It is a question of political participation that is not limited to protecting the status quo for as long as possible. This has been the practice of the past decades and it is becoming an increasing threat to Germany as a business location. In China, but also in the USA, new alliances between policy-makers and the mobility industry have long been emerging, creating innovative boundary conditions for the industrial transition to new mobility.

It is also important to use the tremendous communicative power of the industry in a different way. Only if it is used for the positive communicative charging of new forms of mobility will industry live up to its responsibility for securing society's future.

## Make the Domino Fall in the Right Direction

The mobility transition is key for the Great Transformation. It is hoped that both the mobility industry and the policy-makers at local, regional and national level will use wise future literacy to make this domino fall in the right direction. ■

Prof. Dr. Uwe Schneidewind is President of the Wuppertal Institute and, among other things, a member of the German Advisory Council on Global Change, which advises the German Federal Government. His latest book was published in October 2018 and is called *Die Große Transformation. Eine Einführung in die Kunst gesellschaftlichen Wandels* (The great transformation. An introduction to the art of social change) at the Fischer-Verlag (German publishing house).



## Literature

- Schneidewind, U./Wuppertal Institute (2018): *Die Große Transformation. Eine Einführung in die Kunst gesellschaftlichen Wandels*. (The great transformation. An introduction to the art of social change). Fischer-Verlag, Frankfurt 2018.
- WBGU (Wissenschaftlicher Beirat der Bundesregierung Globale Umweltveränderungen: German Advisory Council on Global Change) (2011): *World in Transition: A Social Contract for Sustainability*. Berlin: German Advisory Council on Global Change, Berlin 2011.

**“The ever-increasing upgrade of cars is the result of a misguided competition for status symbols; success can only be expected if this competition is broken up or if the misguidance is corrected. This, in turn, would encourage, if not elicit, a surge in innovation.”**

Hans-Jochen Luhmann, in *Nicht das Ende der Dienstfahrten, aber das Ende ihrer Privilegierung tut Not* (Not the end of business journeys, but the end of their privileged status is a necessity), Wuppertal Institute, 2005



# Do the Transition!

While politicians and the automotive economy have only moved slowly so far, committed consumers and entrepreneurs could speed up the transport transition. One thing is for sure: Crowded streets and imminent driving bans have made alternative concepts of mobility increasingly attractive. The program offers vehicle fleets that are electrified by sun from company roofs as well as cargo bikes for families and has long since ceased to only be profitable thanks to funding.

By Kira Crome

People in Germany travel 3.2 billion kilometers a day on their journeys. Statistically speaking, each of us spends 3.1 times a day getting from A to B. This happens mostly by car. This is the result of the most recent mobility study in Germany commissioned by the Federal Ministry of Transport and Digital Infrastructure.<sup>1</sup> In German everyday life, mobility is a requirement. The downside is traffic that is getting more and more dense. More than 46 million cars registered in Germany were on the roads last year. Car drivers spend on average about 38 hours a year in traffic jams. The consequences are polluted air and traffic noise. In order to make mobility eco-friendlier in a sustainable way, it is necessary to break with established usage habits. Futurists believe that tomorrow's mobile society will not be dominated by maximum speed. "The decisive factor will be how — from a qualitative point of view — we best arrive at our destination,"

<sup>1</sup> Mobilität in Deutschland (mobility in germany). Infas (Institut für angewandte Sozialwissenschaft: Infas Institute for Applied Social Sciences) – Short report on behalf of the Federal Ministry of Transport and Digital Infrastructure, June 2018. The final extended version will be published at the end of the year.

says Mark Morrison of the *Frankfurter Zukunftsinstitut*.<sup>2</sup>

Already in the year 2035, the traffic in Germany could be climate neutral, as predicted in a scenario by the Wuppertal Institute — if the road users explore new avenues. But, "An electrification of the drive systems alone is not enough," warn the experts. The alternative to automobility is rather a mixture of different methods. The transport capacity would have to decrease significantly, the number of private cars would have to more than halve itself and be operated by renewable energies, only then would the climate neutral traffic balance succeed. Journeys would have to be transferred to eco-friendly means of transportation and the percentage of the use of bikes and local public transport would have to be more than doubled. Of course, a

<sup>2</sup> Mark Morrison, guest contribution in Die ZEIT (a weekly German newspaper), 17 November 2017, <http://www.zeit.de/mobilitaet/2017-11/zukunft-mobilitaet-entschleunigung-dekarbonisierung-vernetzung>



scenario like this is still pie in the sky. "But it clearly illustrates what extensive changes are necessary to abandon the currently entrenched habits," concludes the study.

## Success stories

The search for alternatives to the combustion engine powered with fossil fuels has long since begun. A lot of people rely on new ways that combine mobility and transport needs in various ways. One person who wants to sustainably push the decarbonization of the regional traffic forward is Roland Schüren. His bakery in Rhenish Hilden relies on an energy efficient baking process that is powered by solar energy, biomass and geothermal energy. Schüren, a master baker, is one of the first to shift his vehicle fleet to six electrically actuated vehicles and nine vehicles that are powered by natural gas. "Our drivers supply the bakery's 18 own branches and major clients with fresh baked goods several times a day — a lot of kilometers accumulate this way," says Schüren. ▶

He is convinced that mobility will only become sustainable when vehicles are supplied with renewable energies. Photovoltaic systems on the roofs of the bakery supply the bake-house with solar electricity in the early hours of the morning and charge the e-vans afterwards. The remaining electricity supplies a public charging station with 22 EV charging stations, the biggest in the region. "My aim is to operate our whole company CO<sub>2</sub>-neutrally through our own efforts," explains the baker, who also buys the raw materials mostly ecologically. His vision is that, by means of bidirectional charging technology, his vehicles should also serve as a power storage and consequently, become part of an independent local power supply system without straining external supply systems. In the spring of 2018, Schüren received the North Rhine-Westphalia Energy Efficiency Award for his manifold commitment to resource conservation.

In addition Schüren is considered a pioneer, who broke new ground with his rejection of diesel-powered transports. Together with his colleagues

all over Germany, he compiled detailed specifications for a cheap electrically powered commercial vehicle and asked automobile manufacturers for offers. A research initiative close to the market near the RWTH Aachen University got the job. Since then, Schüren is considered a sort of godfather of the transporter model 'Work', that *StreetScooter*, a Post subsidiary, now produces in series in Aachen. The *Deutsche Post DHL Group* (mail and logistics company) that wants to reduce all logistics emissions to zero by 2050, makes use of approximately 5,000 electric-StreetScooters. According to company data, the fleet economizes 16,000 tons of CO<sub>2</sub> every year.

## Clever route planning and an alternative

The commercial traffic on German roads alone constitutes a third of all vehicle journeys.<sup>3</sup> Still a lot of obstacles

<sup>3</sup> Kraftfahrzeugverkehr in Deutschland 2010 (KiD 2010) (motor vehicle traffic in Germany 2010) <https://www.bmvi.de/SharedDocs/DE/Artikel/G/kraftfahrzeugverkehr-in-deutschland-2010-kid-2010.html>, [https://www.bmvi.de/SharedDocs/DE/Anlage/VerkehrUndMobilitaet/kid-2010.pdf?\\_\\_blob=publicationFile](https://www.bmvi.de/SharedDocs/DE/Anlage/VerkehrUndMobilitaet/kid-2010.pdf?__blob=publicationFile)



© DLR

are in the way of the electrification of these transportation trips, deliveries and journeys of service providers in cities, agglomerations and rural regions with short range being the biggest hurdle. Baker Schüren, therefore, relies on route planning that is designed as intelligently as possible.

Dirk Schmidt found another solution for his business in Düsseldorf. Four years ago, the master carpenter started to use a cargo bike for the transports between his workshop and his customers. Shortly thereafter a second one followed. Last year alone, he and his employees rode the bikes 1,800 kilometers in the municipal area, reports Schmidt. The business does not ►

only save diesel costs but also avoids loss of time caused by congestion and looking for a parking lot. Another plus is the positive reaction of the customers and the public. Two years ago the City of Düsseldorf awarded the business with the Environmental Award for its commitment. Now Schmidt recruits imitators during information events organized by the Chamber of Skilled Crafts. “We see the bikes as an opportunity, but many people sadly still have a barrier in their minds and have difficulties with the concept of processing their orders with a cargo bike,” says the workman.

## Cargo Bikes for an Eco-Friendly Delivery Traffic

This attitude has to change. At the present time, the German Aerospace Center (DLR) provides 150 cargo bikes in 23 different model variants and five constructions nationwide. The bikes can carry almost 250 kilograms. Until mid-2019 workmen, businesses, service providers and public institutions are free to test drive and try out the cargo

bikes. Almost 350 companies have participated so far and almost 57,000 travelled kilometers have already been accumulated. The transportation researchers at the DLR see great potential for the strained traffic in the city. Every fourth journey within the context of urban commercial traffic could be undertaken with electronic cargo bikes instead of vehicles powered by combustion engines. As a result, 19 percent of the resulting mileage could be processed climate neutrally, showed the previous study ‘Ich ersetze ein Auto’ (I substitute a car) on the use of electronic cargo bikes by courier services.<sup>4</sup> For this to happen,

<sup>4</sup> [http://www.lastenradtest.de/wordpress/wp-content/uploads/2017/07/Ich-ersetze-ein-Auto\\_Schlussbericht.pdf](http://www.lastenradtest.de/wordpress/wp-content/uploads/2017/07/Ich-ersetze-ein-Auto_Schlussbericht.pdf)

rethinking and innovative approaches are needed, says DLR project leader Johannes Gruber and refers to a model used by the Swedish furniture chain Ikea. Customers of the city branch in Hamburg can have their purchases delivered to their home via electronic cargo bike or directly borrow a cargo bike at no charge.<sup>5</sup>

The idea to transfer short distance transports to eco-friendly alternatives is not new. In a lot of cities, cargo bikes are experiencing a revival. Whether as a carriage for children, a large shopping cart or a moving helper, nowadays

<sup>5</sup> [https://www.ikea.com/ms/de\\_DE/img/local\\_store\\_info/hamburg\\_altona/pdf\\_files/Service\\_Fahrradkurier\\_HH-Altona.pdf](https://www.ikea.com/ms/de_DE/img/local_store_info/hamburg_altona/pdf_files/Service_Fahrradkurier_HH-Altona.pdf); [https://www.ikea.com/ms/de\\_DE/img/local\\_store\\_info/hamburg\\_altona/pdf\\_files/Service\\_Leihfahrrad\\_HH-Altona\\_1406\\_Internet.pdf](https://www.ikea.com/ms/de_DE/img/local_store_info/hamburg_altona/pdf_files/Service_Leihfahrrad_HH-Altona_1406_Internet.pdf)



they belong to the street scene. Citizens' initiatives and neighborhood associations, following the notion of the common good, organize renting out cargo bikes — with or without electric assistance — for free. Meanwhile, Commons Cargobikes counts over 60 of these local offers nationwide. One of them is situated in Herten in the middle of the Ruhr area. Their 'Helara' can be booked online to carry heavy loads from A to B. The bikes are paid for with donations. What is special about this project? "Our e-cargo bike changes location every month and is always in a different part of the city," says project spokesman Klaus Droste, explaining the concept. "In this way, as many residents of Herten as possible can discover the alternative to the car." The balance sheet of the first summer season shows that the system, which was honored with the Herten Climate Award 2017, is well received. "In the first eight months, from March to October 2018, our cargo bike had an occupancy rate of 70 percent", says Droste.<sup>6</sup>

<sup>6</sup> Interview with Klaus Droste, spokesman of Helara, 6 November 2018

## Imitators wanted

In the meantime, the alternative energy subsidiary 'Donk-EE' in Cologne is setting up its first commercial e-cargo bike rental service. The cargo bikes are available at 50 locations in the municipal area. Bookings are simply made via app. Station partners ensure that the batteries are charged. The electrical support is expected to cover a distance of 75 kilometers.<sup>7</sup>

"Rental companies that offer cargo bikes can reduce the number of private car rides", says Sophia Becker of the Institute for Advanced Sustainability Studies (IASS) in Potsdam. She investigated the free cargo bike service in 44 German cities and speaks of a positive effect: "Forty-four percent of interviewed users rode a cargo bike for the first time and would have used a car for their transport route instead, had it not been for the alternative service on site." In addition, almost all users want to borrow the cargo bike again, and 35 percent even want to buy their own.

<sup>7</sup> Interview with Tim Loppe, spokesman of Donk-EE, 11 December 2017

"This shows that people are definitely breaking their habits and trying out new alternatives to cars," says Becker. The ecological effect is enormous. "On the day of the survey alone, 425 car rides with a total distance of 5,509 kilometers and thus about one ton (2,204 pounds) of CO<sub>2</sub> were able to be avoided."

Meanwhile, the German Federal Government, the federal states, and the cities have also realized the climate-protecting potential of cargo bikes. Companies, organizations, and municipalities receive a maximum buyer's premium of EUR 2.500 from the Federal Government if they purchase a cargo bike or a bike trailer equipped with an electric motor with at least one cubic meter of load volume. In some



federal states there is additional support for privately used cargo bikes equipped with or without an electric motor, the list of cities that also support is growing steadily.<sup>8</sup>

## Switching seamlessly between means of transportation

According to a mobility study conducted in Germany, the car remains by far the number one mode of transport. However, more and more people are using bikes and local public transportation. Transportation researchers attribute many possibilities particularly to the municipalities in terms of reducing the traffic-related strain on city centers and in promoting the shift from car travel to eco-friendly alternatives. Nowadays already, more than two thirds of all residents in many German cities combine different means of transportation on a route from A to B. They seamlessly change from their own car or bike to a bus or train and at their destination they cover the final

8 <https://www.cargobike.jetzt/kaufpraemien/>

route via rental bike or car sharing. The City of Düsseldorf has recently expanded its range of alternative modes of transportation: Since 2017, it has been offering electric scooters for rent in cooperation with the municipal utilities. A so-called 'eddy' can be booked via an app and flexibly parked anywhere in the city. More than 7,000 customers already use the emission-free speedsters. In the summer of 2018, the number of electric scooters was extended to 300.<sup>9</sup>

A pilot project in Augsburg aims to promote the seamless transition between means of transportation with a new concept. Municipal utilities and local transport operators are currently testing a so-called 'mobility flat rate' with 50 pilot customers. This will enable local public transport customers to make use of all services from the municipal utilities at a fixed monthly price - from public transport and car sharing to rental bikes - throughout the entire municipal area.<sup>10</sup> The trial offer is intended to examine the

9 <https://www.swd-ag.de/ueber-uns/presse/2018/mehr-eddy-fuer-alle/>

10 <https://www.sw-augsburg.de/ueber-uns/presse/detail/testkunden-fuer-geplante-mobil-flat-gesucht/>

mobility behavior of customers and show how often they actually use the various means of transportation. Another measure to make public transportation more attractive: For senior citizens who consider getting rid of their cars, the switchover should be made easier. Based on the example of other municipalities, they will receive a free annual subscription for local transportation in the following year, if they give up their driver's license.<sup>11</sup>

The City of Heidelberg relies on monetary incentives as well. Residents who take their cars off the streets will receive an annual subscription for local transport if evidence of deregistration is provided. Furthermore, a scrappage premium is paid for the purchase of a cargo bike or the conversion of a car to alternative drive technology such as natural gas, electric or hybrid drive. Because the first hydrogen filling station is due to open in the city center in spring 2019, the city will pay up to EUR 10.000 in addition for a fuel cell car.<sup>12</sup>

11 <https://www.augsburger-allgemeine.de/augsburg/Gratis-Nahverkehrsabo-statt-Fuehrerschein-fuer-Senioren-id52491221.html>

12 Christiane Calis, Office for Public Relations, City of Heidelberg, 20 November 18



## Car sharing and coop buses

Is it possible to be fully mobile without owning a car? In conurbations such as Cologne, 30 percent of households now forego the ownership of a car, according to the city, in the inner city even 50 percent and counting. A substantial alternative is the collaborative use of cars. Nowadays, a car sharing vehicle replaces up to 20 privately used ones. A little over a quarter of the new customers of the car sharing provider *Cambio* have now gotten rid of their own cars, according to a customer survey conducted by the company.<sup>13</sup> Meanwhile, the number of electric vehicles in the fleets has increased to 10 percent. One station-based car is used by 53 customers. The ones that can be parked flexibly have 215 users per vehicle. “With just over two million customers in 2018, car sharing is still a small market”, says Gunnar Nehrke, managing director of the German Car Sharing Federal Association, “but the growth rates show that we are leaving the niche market.”

<sup>13</sup> Press material *Cambio Car*



© DLR

In rural areas, a completely different concept prevails, especially in North Rhine-Westphalia and Lower Saxony. Where local public transport has wide gaps and car sharing offers are rare, citizens initiate so-called *Bürgerbus* associations.<sup>14</sup> Volunteers draw up timetables and drive the minibus financed by the association. In the municipality of Much near Cologne, for example, there are nine *Bürgerbus* lines operated by 36 volunteer drivers. In the town of Emsdetten in Muensterland, the second *Bürgerbus* is to have an electric drive. According to mayor Georg Moenikes, there are still a few hurdles on the way, also because so

<sup>14</sup> [http://www.buergerbusse-in-deutschland.de/01\\_Navigation/01\\_Buergerbus-in-Deutschland\\_01.html](http://www.buergerbusse-in-deutschland.de/01_Navigation/01_Buergerbus-in-Deutschland_01.html)

far only prototypes of electric low floor minibuses exist. With an appropriate battery, the e-bus could then achieve a range of around 100 kilometers. However, the operation of an on-board air conditioning is not secured with this kind of battery. In 2017, the *Bürgerbus* association transported more than 16,000 passengers conventionally. But until the new e-bus drives through the streets ultra-silently, a few open questions still have to be answered. ■

Kira Crome has been a specialized journalist in Cologne, Germany, since 2012. Her topics are inspired by her work as a research officer at the administrative office of the German Council for Sustainable Development in Berlin. She writes for different types of media. Her topics include sustainable consumption, renewable energy, environmental and climate protection.

“Imagine there were sharks or jellyfish in the North Sea that killed 3,500 people per year. Would the sharks not be shot and the jellyfish poisoned? Or imagine trains caused 3,500 deaths per year. Wouldn't all the rails be destroyed by now?”

Klaus Gietinger, 99 Crashes. Prominente Unfallopfer (prominent victims of accidents), Westend Verlag 2014

# Good traffic is all about eco-routine.

The transport transition could be initiated in a consistent manner by following the concept of what is called eco-routine. If, for example, roads and airports were not extended, but bus and train connections were, this would be the first step towards sufficient mobility. Construction and the transportation industry would still have enough to do. A call to action by Michal Kopatz. Translated by Luise Hoffmann & Kassandra Harth.



Ongoing congestion has become a part of daily life. Wherever you look, streets are congested. And as if it were not enough, within the last ten years, an additional number of seven million more cars have entered traffic. At the same time, younger city residents claim they no longer wish to have a car of their own. And car sharing has actually become very popular. Don't the millions of e-bikes that people ride have any effect?

Unfortunately, they do not. Contrary to popular belief, the situation has been getting worse. The energy transition is already on its way, but the transport transition is not taking place. Nevertheless, a combination of both would really accelerate progress (see "Decarbonization by 2030", page 9).

There is no other area for which the balance sheet of the last 20 years is as weak as it is for traffic. Since 1990, the energy industry has been able to reduce its Co2 emissions by almost 30 percent, with the results for industry and construction being similar. The only area where no progress has been made is mobility.

Actually, everyone knows that we cannot go on like this in the long term. This is a topic that is often discussed when having dinner with friends. 90 percent of people then say that something urgently needs to be done against climate crisis. Afterwards, the guests use their cars to drive home for what might be less than 3 kilometers. After all, you do not have to start right now and surely not with yourself. Besides, it is of no use if one person chooses not to go by car but everyone else keeps doing so. And then, if you have a look at what is going on in China or India, the tiny amount of Co2 that you or even Germany as a whole are causing will not have any kind of impact.

Individually speaking, this argumentation is rational. But sadly, this individually rational behavior leads to a collectively irrational result. Because it is obvious that nobody wants climate change.

According to many experts of the automotive industry, this is not a problem at all. Our cars are becoming more and more efficient, especially in

terms of resources. But this is no good if motor vehicles, at the same time, are becoming heavier and more in number. And they are more powerful. In 1995, the average car had 95 horsepower, today they have more than 150.<sup>1</sup>

## Travelling like in the era of the stage coach.

Our life in society is becoming faster and faster. Even the smallest time advantage is enough for choosing to go by plane from Hamburg to Cologne for business travel. In the meantime, the state is building new freeways and federal roads so we can travel even faster. The high-speed railway lines of the *Deutsche Bahn* (the German railway company) work by the same concept. Is faster always better?

The acceleration in many spheres of life over the last few decades has not made us happier at all. Survey results are leaving no doubt concerning this point. Do people have more free time today and do they spend less time in cars, trains and airplanes? The answer is a clear 'no'.

<sup>1</sup> Kraftfahrt-Bundesamt (German federal motor transport authority)



This is due to a strange cultural phenomenon. Today, we invest an average of 80 minutes per day in mobility. Every minute we save, for example thanks to a bypass or a newly built expressway, leads to us covering more distance. Today, people spend the same amount of time on travelling as in the era of the stage coach.<sup>2</sup>

Commuting times stay the same, but commuting distances have been getting longer. Between 2000 and 2016, German citizens covered an additional distance of almost 80 billion kilometers in their ever bigger cars.<sup>3</sup> In short, we go at breakneck speed. We go further and further, but we do not gain any time. Air taxis and hyperloops will not make a change either.

## Why new roads don't help

Actually, new roads are supposed to decrease congestion, but instead, it increases. For many years, there have been several studies that confirm this connection.<sup>4</sup>

On the contrary, the ministries of the German Federal Government and regional states give the impression that they have never heard of such research results. Between 2000 and 2017 alone, they extended the *Autobahn* (the German freeway network) by an astonishing 1,481 kilometers.<sup>5</sup>

<sup>2</sup> Mobilität in Deutschland MiD 2017 (Mobility in Germany), 2017

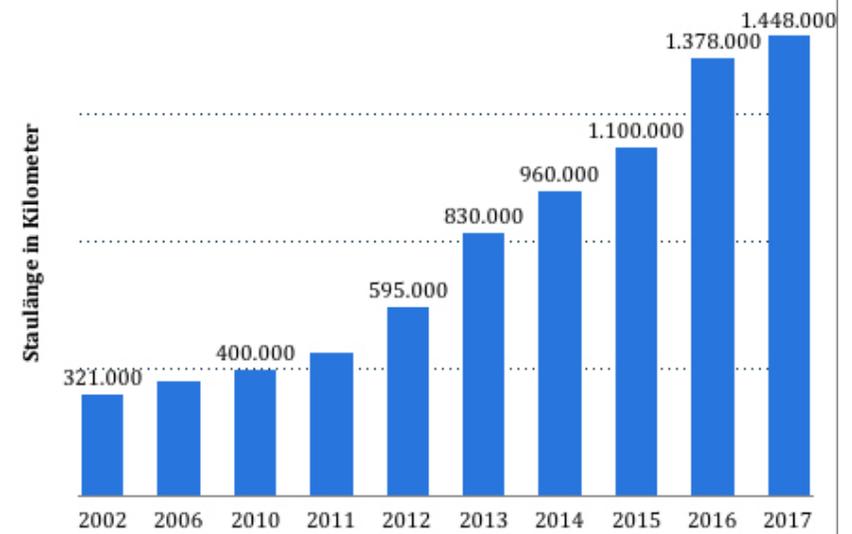
<sup>3</sup> DIW Wochenbericht 32/20018, p. 692, Kraftfahrtbundesamt, 2005:559,5 kilometers per year – 2016:636,9 kilometers per year

<sup>4</sup> Umweltbundesamt (German Federal Environment Agency), 2005: Determinanten der Verkehrsentstehung (determining factors of traffic), UBA-TEXTE 26/05 Page 46

<sup>5</sup> Statistisches Bundesamt (Federal Statistical Office), 2018



© istockphoto.com/ Easyturn



Total congestion length on the freeway.

Federal roads and freeways are being expanded, but the congestion has increased in length. More roads are not going to solve the problem. The only way out is by default.

This extension is a growth driver, not least of all for truck traffic. Predictions claim that it is going to increase by 40 % by 2030, with consequences for heavy traffic and the infrastructure already strained by it. Upcoming gigaliners are not even taken into account.<sup>6</sup> This is how the ministries are becoming the enablers for this disastrous development.

## Setting limits

If we are serious about climate protection, we will have to significantly restrict this further expansion. For example, Germans clearly fly too often. Flying even more would be a disaster. My suggestion is that we limit take offs and landings to the current level. This sounds quite simple, really. The Federal Government would not even have to lift a finger. If the government did not issue any more clearances for take-offs and landings and if Munich and Hamburg did not expand their airports, then the limit would be achieved automatically.

<sup>6</sup> www.bmvi.de: Press release »Verkehrsprognose 2030: Verkehr wird deutlich zunehmen« (traffic prognosis 2030: traffic will increase significantly) (11 June 2014)

Sometimes, all it takes to make things better is to not make them worse.

Road construction should also be limited. Only if no new roads are built or improved can the massive increase of truck traffic be avoided. Instead, the Federal Ministry of Transport and Digital Infrastructure could invest the freed up funds into the development of the railroad system for the sake of sustainability. This is a chance for forwarding agents to change their habits.

## Imposing a limit on cars to reduce congestion

The streets are congested and the air pollution in our cities is constantly getting worse. What can be done against this? At first glance, a limit might sound radical. However, some cities have already implemented a resolution like this.

For example, since 1 February 2018, private car owners in Singapore can obtain a vehicle registration only if the required certificate becomes available by scrapping an old vehicle. As



© istockphoto.com/MCCAIG

a result, there is zero growth in private car traffic — and yet no popular uprising has occurred.

The car density of Singapore is already significantly lower than in other cities. The per-capita car ownership rate is one car per ten citizens whereas it is almost five times as many in Munich. The reason for this is that a vehicle registration in Singapore costs between EUR 30,000 and EUR 60,000. This scares away even those who make a decent amount of money.<sup>7</sup>

However, the government does not only demand but also offers something in return. The network of buses and trains is excellent and is constantly being expanded. Ticket prices are also very cheap. A lot of people use local

<sup>7</sup> “Keine Lust auf Stau,” Süddeutsche Zeitung, 1 February 2018 (Southern German Newspaper, daily newspaper) ▶



transport and therefore tax subsidies are not necessary.

If the same were to happen in Germany, the following scenario could become possible. The *Kraftfahrt-Bundesamt* (German federal motor transport authority) would dictate a registration rate for new vehicles and would thus stabilize the nationwide car growth until a gradual reduction occurs.

## Sustainable mobility

A policy that is designed with future generations in mind and that targets climate-friendly mobility would set the stage for inexpensive local transport while gradually reducing the number of available parking spaces and increasing distances to our cars. Such a policy would also encourage the

use of particularly economical cars. Climate-friendly routines of the future have already been initiated. The EU-Commission decided to do without the combustion engine by raising the standards. As from 2021 and onwards, an automobile manufacturer's fleet may emit on average no more than 95 grams of CO<sub>2</sub> per kilometer. It has already been decided that this requirement as well will be tightened further. As a result, zero-emissions vehicles will not be a long way off anymore.

If we stopped the expansion of roads, ports and airports, there would be a few billion euros available to improve the railway system. Further funds would be made available due to higher congestion charges for trucks. Forwarding agents and traders will change their ways of conducting

business only if truck transports become more expensive and more complex, while rail transport becomes faster and cheaper.

Many more billions for the expansion of local transportation systems would be made available by abolishing the tax advantage of company cars and diesel fuel. The saved sums could be used for the reintroduction of streetcars — while simultaneously doing without resource-intensive infrastructure upgrades such as subways. In terms of transport policy, this would be a very big step forward. Streetcars double the transport capacity while being very popular at the same time.

The introduction of the Blue Badge is considered very urgent. Since many cities already have a signage system for fine dust in place, the additional effort and cost needed would be minimal. The prohibition would only apply to city centers. People would still be able to drive to city limits with their own cars. ►

From there, they would continue by bus, train or rental bike.

As from 2023 and onwards, cities should be given the chance to introduce a "Pink Badge" for completely emission-free cars. Many cities have already decided to forever banish combustion engines from their city centers. Thus, an additional bonus for electric cars would be superfluous.

It is true that only a few people are ready to voluntarily restrict themselves if others will not. That is why structural innovations are so crucial. It is not easy to do without flying. But this need to forego air travel will not even be necessary. Limiting aviation, speed on freeways and the number of cars would make sustainable mobility easy.

It is not just about influencing consumers in such a way so that they buy only certain eco-friendly cars in an effort to act responsibly for future generations. According to the principle of the eco-routine, the entire production system needs to be transformed. There are already countless products available that have become more eco-efficient through the implementation of legal

standards. Neither are consumers aware of this, nor do they miss the less eco-efficient products.

## What should be done?

As responsible citizens, we can not just sit back and wait for our political representatives to set limits and standards. The solution also does not include trimming back our private consumption but rather partaking in public protest. The protesters from the Hambach Forest have accomplished more by participating than by changing their electricity provider.

In practical terms, this would mean joining initiatives that support utility cycling, buses and trains. People could also participate in the so-called 'Parking Day', during which parking spaces are used in an alternative manner or take part in events called 'Car Free Sunday'. Every month, the 'Critical Mass' coordinates bike protests in numerous cities, during which cyclists claim the streets in convoys. Why not demonstrate against the expansion of roads, shipping ports and airports? It would be an

important step if not only residents from the affected noisy regions gathered there but — as in Hambach — people from all over Germany came together to fight for sustainable mobility that is truly deserving of that name.

After all, whoever limits their political influence to the ballot box leaves their grandchildren's future in the hands of corporate interests. ■

Dr. Michael Kopatz is a social scientist and project leader in the Wuppertal Institute's research group for energy, traffic and climate policy. He is an adjunct lecturer at the universities of Kassel and Lüneburg, and he coined the term Eco-routine. The second edition of his book "Eco-routine" (2017) has already been published.



**“Whoever is driving a car in Berlin has too much time on their hands. We are going to reduce the main roads to a single lane, because we need the space for something else.”**

Jens-Holger Kirchner, State Secretary of Transport, February 2017.

# From the Automotive Industry to the Mobility Industry.

The automotive industry, with the millions of jobs that it provides in factories as well as for suppliers, is responsible for a large share of net domestic value creation. With the mobility transition at hand, this share is going to decrease, in part due to changes in drive formats. Regardless it could also possibly increase again by acting as a mobility service provider. What future models for companies and employees are going to look like and how the state is able to facilitate the exit via industrial policy.

By Oliver Lah. Translated by Vincent Knatz & Alexandra Kiourtsi



© istockphoto.com / Dmytro Aksonov

Wheels move the world. This is not going to change in the future. The main question is: how many wheels are needed and how are they going to be powered? It is regarded as a fact that the demand for transport is going to increase further, especially in developing and threshold countries. With this in mind, the mobility sector is going to remain a key engine of growth for economic development. The deciding factor in facilitating this is to recognize the patterns and to develop new business models in a timely manner. The European automotive industry had previously failed to recognize the new trend towards electromobility and now has to try to keep up with its competitors, most notably China. This is not only about a change in drive technology, but also about a new outlook on mobility. This means that not only the vehicle by itself is to be regarded as the primary product of a changing industry but other technologies as well.

Electrification and automation could become contributing factors in this process, but only as integrated

parts of a larger transformation to a sustainable mobility system. This is how the vision of automated driving without a steering wheel can already be experienced in trams, subways, suburban trains or urban railways. Things that are often lacking are efficiency, reliability and the general appeal of the various options, as well as convenient connections to be able to finish the final steps of each journey. The innovative power of industry is desperately needed in this regard, instead of developing new technologies to circumvent current regulations, while trying to keep outdated drive systems and mobility patterns alive.

### Possibilities for the society and the economy

Even in the most optimistic scenarios, the transport sector is going to sustain its current level of greenhouse gas emissions. The growth of the demand for mobility largely surpasses the increase in efficiency that can be attained by utilizing the current technological advances. Even when

© istockphoto.com/ cirano83



taking into account a substantial introduction of more efficient vehicle technologies and several traffic relocations, the CO<sub>2</sub> emissions produced by the transport sector are going to remain at 7.5 gigatonnes of CO<sub>2</sub> until 2050 (International Transport Forum, 2017). If the number of cars and individual mobility were to continue to increase at the same rate as it has done in recent years, the greenhouse gas emissions produced by the transport sector could possibly even double by 2050 (Sims et al., 2014).

This is why climate protection in the transport sector is of paramount importance for global efforts to combat climate change, by stabilizing global warming well below two degrees Celsius. To contribute to this goal, industrialized nations have to

decarbonize their transport sectors as soon as possible over the coming decades (a decrease by 80 percent by 2050). Developing and threshold countries have to implement measures to facilitate mobility growth by utilizing non-motorized and public passenger transportation and to limit the demand for individual motorized mobility to a maximum increase of 70 percent by 2050. If we take a closer look at the contributions of individual countries to the Paris agreement (of Nationally Determined Contributions, NDC), it becomes apparent that there is a large gap between the necessary mitigation measures and the suggested political measures of each country.

This is in spite of the existence of a great potential for decarbonization of the transport sector that could be generated by fuel savings. Less and more efficient infrastructure and vehicles would also be helpful. These savings could possibly account for about USD 50-100tr and therefore significantly more than compensate for the cost of decarbonization (IEA 2016). There are several additional possibilities

that could provide more sustainable mobility. Improvements in transport safety, better air quality and reduced travel times could be arguments made to promote the decarbonization of traffic. New mobility systems and services could also offer greater potential for society and industry as a whole. Innovation in the sense of a transformation of the sector does not mean a gradual development of existing technologies, but an immediate and substantial change of the entire industry.

### Awakening after a long sleep

Half of the world's e-mobility market share is currently held by China. Almost 90 percent of the electric busses that are currently being operated on a global scale are produced in China. Most of them are being used in China as well. The city of Shenzhen by itself has a fleet of over 15,000 electric busses. In comparison, the city of Berlin currently only has four and none of them are being operated on a regular

© istockphoto.com/35007



basis. In September of 2018, Audi proudly announced the introduction of a new e-tron model, the first battery powered electric SUV produced by the automobile manufacturer based in Ingolstadt, Germany. But how sustainable and useful for society as a whole could a 2.5 ton vehicle possibly be, that is intended for the transportation of, in most cases, only one single person? Its battery alone weighs 700 kilograms. The resources required for its construction could be used to build 85 electric scooters.

At least *Piaggio* entered the market this year with the first electric Vespa, though many years after small business startups like *UNU* and *NIU* marketed electrically driven scooters that were produced in China. Nowadays these startups can hardly keep pace with

the high demand. In 2014, *Deutsche Post AG*, the biggest German postal operator, gave up waiting any longer for electrically driven vehicles from German automobile manufacturers for its growing fleet of delivery vehicles. Since then, the company has been going its own way by producing vans and cargo bikes under the name *StreetScooter* (see this issue, page 28).

As a matter of fact, even big European suppliers like *Bosch* or *Valeo* have recognized the potential of new business models, even if new mobility solutions still make up a small portion of these companies' portfolio. Examples for such solutions are innovative rental systems for electric scooters like the *Bosch* subsidiary *Coup* or the startup *Emmy*. In addition, various bike rental systems established themselves in many cities and numerous public transport operators are working on finding innovative solutions in order to make sustainable mobility more attractive.

The electric mini-taxis, also called Tuk Tuks and mostly known from abroad, are produced in Thailand and India and cost between EUR 2,500 and 10,000, depending on size and equipment. Today, they can also be seen in cities like Lisbon, Paris or Berlin.

## Progressive industrial policy sets framework conditions

However, even though ambitious startups are setting the stage for innovative vehicles and services in all areas of



© istockphoto.com/ sanjeri



electromobility, it is the political framework conditions that allow for a wider transformation of the entire sector. China's quota system for electric vehicles clearly also results from considerations of industrial policy. As China is hardly able to win a race with European and American competitors for conventional drive technologies, it is logical to rely on electromobility, not only with regard to the air quality, but also considering practical economic reasons. India and Brazil also pursue electromobility with a clear industrial policy background.

Coupling the new vehicle technologies with innovative usage models that connect private and public as well as individual and shared forms of mobility is the crucial step towards a sustainable mobility that reconciles economic possibilities, social inclusion and unrestricted accessibility with air quality, life standards and climate goals. Both politics and industry in Europe have been widely overlooking many trends for innovative mobility solutions, but it is not too late to build a bridge between economic potential and social necessity.

A way of creating such links between political goals and actors is being developed by the *Wuppertal Institute*, the *UN-Habitat* and further partners within the Urban Electric Mobility Initiative (UEMI). The initiative is currently working on pilot projects that entail developing innovative vehicle and usage models which should guarantee significantly improved access to mobility services, improve air quality and reduce greenhouse gases, and contribute to the local value chain ([www.uemi.net](http://www.uemi.net)). ■



© istockphoto.com/ mgkaya

Oliver Lah is head of the Mobility and International Cooperation research unit at the Wuppertal Institute.

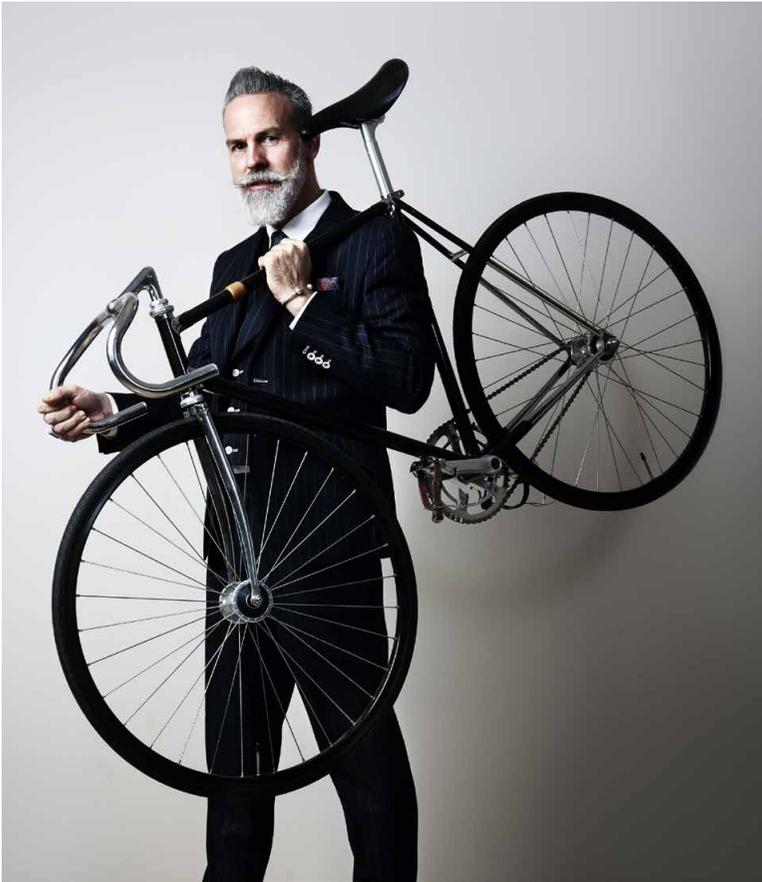
“Building more roads to prevent congestion is like loosening one’s belt to fight obesity.”

Lewis Mumford, 1955, *The Roaring Traffic’s Boom*.

# A new Perspective on Entrepreneurial Mobility

The route to work, business travel, the vehicle fleet: Nowadays a good corporate mobility management (CMM) organizes these aspects in an efficient and sustainable way. In this context, the companies do not only take care of their employees, they also reduce emissions and resource consumption. Municipalities and regions can easily support CMM-initiatives and profit from them as well. The Bergisches Städtedreieck region shows how it can be done.

By Alina Ulrich and Carolin Schäfer-Sparenberg.  
Translated by Melina Lanz & Vincent Knatz



Most people start their morning like this: Getting up, having breakfast, getting into the car and driving to their workplace. Are there any alternatives? The route to and from work<sup>1</sup>, which is usually no longer than five (19 percent) to ten kilometers (26 percent), could certainly be covered by bike or public transport — and without congestion or searching for a parking space. Even for longer routes, there are options that are better for the environment and for human health than a private car.

*Corporate mobility management* (CMM) is the magic word that makes it possible to break this routine and to point out and promote healthier alternatives for the route to and from work. CMM can be understood as a strategy to efficiently and sustainably organize the traffic of a company and encompasses the areas of worker mobility, business travel and the vehicle fleet. It is a means of maintaining the health of employees and improving the entrepreneurial impact on the environment and the climate. It serves

1 This refers to the main purpose of the route with highest priority according to *Mobilität in Tabellen* (mobility in charts, MIT 2017). Available online, only in German, under <https://test1.q-dot.de/mit/login.html>

as a catalyst for continuing change, even in the employees' environment, and it improves corporate culture.

It has considerable potential to improve the company's climate and resource efficiency as well. The latest survey on mobility in Germany shows that a third of passenger transportation journeys can be attributed to corporate mobility. In terms of transport capacity, no fewer than 42 percent of the kilometers travelled are due to professional reasons.<sup>2</sup> Motorized private transport, and especially the car, are predominant. Corporate mobility therefore forms a crucial part of the largely fossil and climate-damaging transport sector.

With a precisely tailored CMM, companies can create economic, social and ecological benefits not only for themselves, but also for employees, cities and neighborhoods, for the environment and society. They can save costs, contribute to the satisfaction of their employees and simultaneously

2 BMVI (Ed.) (2018): *Mobilität in Deutschland. Kurzreport. Verkehrsaufkommen – Struktur – Trends* (Mobility in Germany. Short report. Volume of traffic – Structure – Trends.) Accessible online (only in German) at [http://www.mobilitaet-in-deutschland.de/pdf/infas\\_Mobilitaet\\_in\\_Deutschland\\_2017\\_Kurzreport.pdf](http://www.mobilitaet-in-deutschland.de/pdf/infas_Mobilitaet_in_Deutschland_2017_Kurzreport.pdf)

help reduce motorized private transport and CO<sub>2</sub> as well as improve resource efficiency.

Many companies are already showing what is possible. With CMM-measures like purchasing business bikes, pedelecs and transferable tickets for public transport, electrifying the vehicle fleet and using car sharing vehicles, the Munich-based housing association *GEWOFAG* achieved savings of 42.7 tons of CO<sub>2</sub> per year. In addition, *GEWOFAG* is committed to making the mobility of its tenants sustainable. For instance, there are service stations for bikes, charging points for electric cars or car sharing opportunities in the association's housing estates, and new tenants receive information about sustainable mobility design in the residential environment. Here is another example. The German Chamber of Industry and Commerce, *IHK Rhein Main Neckar*, reduced its use of motorized private transport within its corporate mobility system by 40 percent. This was achieved thanks to a combination of parking facilities management, i.e. paid parking, and the introduction of discounted so-called



*Jobtickets*<sup>3</sup> that are distributed by *Deutsche Bahn*, the German railway company, to employees.

## Avoiding and shifting traffic and improving the traffic situation

Corporate mobility management aims at the realization of these three corporate activities. Worker mobility covers all the routes it takes for the employees to travel from their home to their workplace and vice versa. Business travel includes all of the employees' routes during their working hours and the vehicle fleet consists of all the company's vehicles.

Companies who plan to establish a corporate mobility management usually take the following five key steps: an analysis of their mobility situation, the development of corresponding measures, the realization of those measures, their evaluation and finally their permanent integration.

The guiding principle for the development and realization of measures is — like in any sustainable mobility planning in general — all about avoiding and shifting traffic as well as improving the traffic situation. In the context of corporate mobility management, this means that routes that are not necessary should be avoided. For example, routes of the worker mobility system can be reduced thanks to home office and the number of official channels can be decreased with the help of a structured planning of business appointments or telephone and video conferences.

<sup>3</sup> For more information, go to [https://www.mittelstand-energiewende.de/fileadmin/user\\_upload\\_mittelstand/MIE\\_vor\\_Ort/MIE-Praxisleitfaden\\_Betriebliches\\_Mobilitätsmanagement.pdf](https://www.mittelstand-energiewende.de/fileadmin/user_upload_mittelstand/MIE_vor_Ort/MIE-Praxisleitfaden_Betriebliches_Mobilitätsmanagement.pdf)



© istockphoto.com/ Tomml

As, however, often a lot of routes within the corporate mobility system cannot be avoided, the corporate mobility management focusses on shifting routes. Instead of using their private cars like before — with often only one person per vehicle — employees now cover these distances by means of EcoMobility, i.e. by public transport, by bike or on foot. With regard to worker mobility, these are measures that make the routes from and to the workplace more sustainable. Companies can offer discounted *Jobtickets*, encourage the use of bikes, e-bikes and speed pedelecs and provide the employees with secure and weather-proofed bicycle parking units. For this purpose, it is important to inform the

employees about the advantages of alternative means of transportation — for example about the positive impact of riding a bike on fitness and health.

To determine the character of their business mobility, companies need to analyze which business travels could be transferred from the streets to the rails or combined by means of car pools and if the employees can make use of fleet vehicles equipped with alternative drives instead of their private cars.

And especially a company's vehicle fleet offers many opportunities. This is because, besides the possibility of downsizing the vehicle fleet as needed, companies can also decide on more eco-friendly drive technologies like natural gas or electricity. In addition, car sharing can replace employees' rarely used privately owned vehicles. Employers that supply EV charging stations for electric cars provide an incentive for employees to change to e-mobility. Many enthusiastic drivers of electric cars have already had the chance to test e-mobility in the environment of the workplace.

All this clearly shows that the portfolio of measures is diverse and in almost every company there is potential for improvement. The range of measures includes *Jobtickets*, the possibility to lease a bike, electrified vehicle fleets, ecological guidelines for business travels, offers of car sharing, parking facilities for bikes, EV charging stations and carpooling websites. It is important to combine these measures with communication and information measures, for example in-house mailings, workshops and employee magazines.

### Bergisches Städtedreieck as a pioneer: United Corporate Mobility Management

A project of the Wuppertal Institute in North Rhine-Westphalia in the west of Germany shows how cities and regions can support corporate mobility management. In the so-called *Bergisches Städtedreieck*, a union of three cities — Remscheid, Solingen and Wuppertal — scientists working at the Wuppertal Institute and the



© istockphoto.com/ AndreyPopov

University of Wuppertal plan to help local companies to develop sustainable mobility management in cooperation with the *Neue Effizienz* company and mobility consultants of *EcoLibro*, a consulting company. Its special feature is the following. Corporate mobility management is not only planned to impact the corporate level but also the respective neighborhood, i.e. the respective district, for instance by also developing and realizing cross-company measures. Seven different types of districts are considered within this research project. Because of this, it can provide knowledge that may be applied to similar structures throughout Germany. It also offers some interesting advantages for the companies in the

districts. Thanks to connections to other companies and local participants, synergies are developed that help to efficiently shape their corporate mobility system.

The specific goal is to create a permanent local corporate mobility management within this union of three cities. In this way, the cities want to transfer the employees' routes and the routes of business travel to sustainable means of transportation, turn the companies' vehicle fleets into sustainable ones and combine or reduce them as needed.

The status quo was developed with the help of an analysis and an employee survey within the companies. The following example of a typical analytical result shows the potential. For instance, a third of a company's employees like to ride their bike in general, but 90 percent of them rarely or even never ride their bike to their workplace, even though one third of them live within a distance of up to five kilometers, which is easily reachable by bike, and more than half of them live within a distance up to ten kilometers that can be covered by pedelec. 'A third of the employees make use of the time and cost advantages that local transport offers compared to the employees' using their private car' was also a point that applied to many local companies.

In order to make full use of this potential, the project partners develop tailored concepts of measures with the companies and concepts of mobility for the respective districts.

And initial success has been achieved. In the district of Solingen-Scheuren, a business park that covers an area of 70 hectare and is characterized by trade and the producing



© istockphoto.com/LightFieldStudios

sector, first measures have been realized. In cooperation with the local transport company, for example, first timetable adjustments have been made to adapt the times of arrival and departure to shift schedules of employees. Further improvements are being discussed for supporting the development of new alternatives to the strongly 'car-oriented' employee traffic from which the district can benefit in the future. The project creates five guidelines for further initiatives of this kind to improve the corporate mobility system.

## Five lessons learned for a successful corporate mobility management

### 1. *How to use the 'window of opportunity' when addressing companies*

Factors like the 'psychological strain' stemming from the current mobility situation, the commitment of individuals that are responsible in the companies, the company size and company culture as well as the persuasive efforts it takes decide whether companies are interested in corporate mobility management or not.

### 2. *The consulting process: external and focused on results.*

External support and intensive external consulting can further the companies' development and realization of measures, as many businesses are not able to provide own resources due to a shortage of staff.

### 3. *Selection and implementation of measures: getting started easily and immediately*

Companies prefer measures that can be implemented easily and quickly. In this way, changes within the company will quickly become visible, which will enable the parallel development of further measures.

### 4. *Thinking ilocally*

The district-related approach shows the way a company's individual corporate mobility management actions and a network on the neighborhood level lead to a new kind of quality, which goes beyond the companies, as well as to a considerable added value for entrepreneurial and district related public mobility. For this purpose, it is necessary to ensure a moderate and mediating link between the metropolitan transportation planning, the mobility service providers and the already existing company and dealer networks which do not necessarily participate in the project. Moreover, the cooperation in



© istockphoto.com/ golerio

the districts improves the negotiating positions in the course of the dialogue with business partners such as municipality or transport companies.

### 5. *Involving business partners at an early stage*

The integration of practice partners such as municipal utilities, urban planning authorities or car sharing providers increases the acceptance and offers more diverse opportunities in order to create an attractive mobility suggestion for the companies.



## On the way to the transport transition

Further strategic measures have to be implemented at a higher level in order to ensure the comprehensive functioning of corporate mobility management, which goes beyond the company's individual and partly regional approaches, as well as a significant contribution to the transport transition. This requires the Federal Government's reform of taxation for company cars. First, the Federal Government should enable a deduction of costs depending on the CO<sub>2</sub> emissions of the car and second, it should introduce a combined lump sum tax on vehicles as a function of mileage and emissions. For instance, in France and Great Britain they tax company cars based on ecological criteria.

A further development of the energy tax on fuels could as well contribute to an incentive effect. On the one hand, the Federal Government could continuously increase the energy tax in order to counteract the consistent growth of the transport capacity. On

the other hand, it could set the energy content and the CO<sub>2</sub> intensity as a basis of assessment to promote alternative drives and energy efficient vehicles.

Germany can learn a lot from the positive examples from abroad. For instance, in Italy and Belgium there already exists an obligation to establish business mobility plans. Italian businesses with more than 300 employees on one site have to hire a mobility manager. These kinds of actions contribute to the fact that mobility is given a higher priority when it comes to entrepreneurial activities and thinking. Also, companies' mandatory local transport taxes such as the *Versement transport* in France (since 1973) as well as the *Dienstgeberabgabe* in Vienna (since 1970) provide positive impulses for a shift to public transport, as they contribute to the stability of investment and operating costs of the public transportation network (ÖPNV).

These examples show that there are numerous approaches to creating corporate mobility in a sustainable way. Nevertheless, the responsibility lies on the companies. The politics should also

set suitable framework conditions. The competitive advantages that come along with healthier and climate protective locations and districts, healthier and satisfied employees and residents as well as a better climate impact, significantly compensate the presumed locational disadvantages through additional conditions. They especially contribute to a necessary, collaborative and economic transition. ■

Alina Susann Ulrich, engineer for transport science and Carolin Schäfer-Sparenberg, specialist in urban planning work in the department Energy, Transport and Climate Policy of the Wuppertal Institute for the project BMM HOCH DREI.



**“The Stone Age did not end because of a shortage of stones.  
And the Oil Age will not end because of a shortage of oil.”**

Klaus Töpfer, former German Minister for the Environment.

# Can we make the automotive industry great again?



The German automotive industry stands on the threshold of a significant change. Meanwhile, incentives for the renewal are being set rather by other countries or IT Groups. The market is growing, as climate protection and the lack of resources make the ecological transformation of the transport system necessary throughout the world. Innovations in digital networking, drives and infrastructure enable a restart of established automobile manufacturers as resource-efficient mobility providers. With the aid of revitalized urban and regional economic cycles, a changed construction and environmental policy could even reduce the pressure that comes along with mobility as a whole.

By Heike Holdinghausen.

Translated by Diana Romanenko & Selina Miltner

The moderator was impressed. Two days after the *Vernetzungskonferenz E-Mobilität* (networking conference on e-mobility) at a Berlin hotel in mid-November 2018, he had the impression that everyone is going to go electric first thing tomorrow. Nevertheless, there were only two charging points in the huge hotel underground parking garage and one of them was apparently not used at all. The moderator's anecdote describes very well the status quo. It's true, mobility is currently undergoing a period of transition. Worldwide, there are new business models, companies and technologies emerging and old ones are disappearing. However, Germany, the country of congested cities, driving bans and 'pollution emissions cheaters' is stuck in a traffic jam when it comes to transport policy. Today's leading suppliers for mobility network and electric driving are based in Asia and in the United States.

The US bustling internet giants, always in search of new business models, have long recognized that the basic principles of the conventional automotive industry do not work

anymore. According to a study for the Heinrich Böll Foundation, which was conducted by the scientists Stefan Bratzel and Jürgen Thömmes from the Center of Automotive Management (CAM), the following three principles are still predominant in Germany: First, the combustion engine is the core of the value-added. Second, the end users always want to have their own car. Third, cars have to be driven by well-trained drivers. The computer scientists at Google and Co. had come to realize much earlier than Daimler and VW the fact that people just want to get easily and affordably from A to B, no matter the means of transportation. They had foreseen that with the aid of this form of mobility, it is possible to make money without having to sell cars. Yet map services would be an advantage.

© istockphoto.com/michael1959



## Starting over instead of improving continuously

Already 20 years ago, the Harvard economist Clayton M. Christensen described the so-called 'Innovator's Dilemma' of leading companies: It focuses on the fact that the leading companies tend to move with confidence in emerging markets. They satisfy the customers' wishes, improve their products and increase their sales. Nevertheless, in times of sudden and disruptive changes, it may well be exactly the wrong thing to do. In this case it would be much smarter to restart instead of offering improved old products. It is better to develop inferior, new products and to ensure penetration of small markets than to meet the demand of most customers. With this, Christensen very precisely anticipated the situation of the German car companies – in contrast to that of the newcomer Tesla – in 1997.

The drivers of the 'disruptive changes' in the transport sector are diverse. One of the most important megatopics is that of climate change. ►



If the states want to achieve the goal set at the Paris Summit in 2015 of limiting global warming to well below two degrees, they have to change course quickly. In order to implement these goals, the Federal Government has stated in its Climate Action Plan that the CO<sub>2</sub> emissions from traffic should be reduced by 40 percent compared to the levels of 1990 by 2030. The Berlin Think Tank *Agora Verkehrswende* (Agora transport transition) calculates that the Federal Government can never achieve this goal with the measures planned so far. Even with a 35 percent reduction in CO<sub>2</sub> from the vehicle fleet by 2030, alternative fuels in air traffic, and a “somewhat more” in bicycle and pedestrian traffic, traffic is going to miss its target by 50 million tons of carbon dioxide.

## Where industry benefits from political rules

First of all, a much faster electrification of traffic would be needed. Other countries are leading the way. Norway stipulates that all new cars must be emission-free from 2025 on, while the Netherlands, Great Britain, and other European countries are planning similar measures. In China, manufacturers have to reach a quota with electric cars or hybrid vehicles in their fleets from 2019 on – and have to buy points from competitors in case of non-compliance with the quota. China has long been regarded – by the management consulting firm Ernst & Young as well – as the global engine of electromobility. The central government is expanding the infrastructure, investing greatly in the charging infrastructure,



© istockphoto.com/ Cebas

and the development of new vehicles. Customers are now able to choose from 100 different models of electric cars in China.

Likewise, India's government reveals itself to be open to the future and promises a high growth rate in e-vehicles through innovative financing models. India, with 1.2 billion inhabitants has an advantage over the industrial countries. While in the USA there are 800 cars per 1,000 people, in India there are only 20. The subcontinent could virtually skip the combustion engine as a technology. However, the interesting announcements made by transport, energy and environment ministries have not yet been followed up by the necessary actions. This is in contrast to China to get more e-cars on the roads.

It is certainly not only the noble desire to protect the climate and to have better air quality in cities that stand behind China's investments and India's plans. China, in particular, has seized the opportunity to reduce the technological leadership of the automotive international market

leaders in Europe and the USA, which have relied on the growth market of the giant empire and are now dependent on it. The quota decision of the communist leadership had first led to disbelief among German automobile manufacturers and then to hectic action; now it has led to VW's latest decision to invest around 30 out of EUR 44 billion in electromobility, networked and autonomous driving by 2023. After years of insisting on using the combustion engine, German automobile manufacturers now changing direction and heading towards the age of electromobility.

© istockphoto.com/ schloi



## Together instead of alone

However, the transformation of the transport system is about more than electric drives which manifests itself in more than just the megacities of India, China and Africa. The growth markets in the emerging countries with their consumption-oriented middle classes need other solutions than cars in order to satisfy their need for mobility. In the urban centers in Germany and Europe – for example the Ruhr area, Paris or London – individual mobility reaches its limits every day as well. For example, already about one third of all roads in cities are necessary to find a parking space. This not only demands too many resources but also the time and nerves of car drivers.

Therefore, mass private transport by car in the megacities of tomorrow is the opposite of a good solution. Technical developments, from autonomous driving to smartphones and better storage technologies, open the door for new business models and make old ones superfluous. Companies have already understood this as

well – to some extent at least. Thus Daimler and BMW have bundled their businesses in Berlin beyond automobile construction and are going to continue working on them together. The fusion of the carsharing subsidiaries Car2go and DriveNow, and mobility service providers such as Mytaxi and Moovel cleared the hurdles of the cartel law at the end of 2018. Together, the services already have around 40 million customers, mainly in Europe.

The supplier Schaeffler, which currently earns his money with gearboxes for combustion engines, is also working on the mobility of tomorrow. The company introduces platforms at industry gatherings at which various displays can be placed as required. They drive fully autonomously and electrically and can transport commodities or people. As robo-taxis, they could, for example, ensure a connection between a fast and automatic transport through cities while being mostly free from emissions – as long as the energy that powers their vehicles comes from renewable sources. As a possible sector, Schaeffler has the

metropolis of South-East Asia in view as of yet. However, within the next ten years, German manufacturers want to get autonomous vehicles on the roads as well. According to the Japanese chemist Akira Yoshino, the developer of the lithium-ion battery, the electric car will only be able to fully exploit its strengths when it drives autonomously and, if necessary, automatically selects and heads for an EV charging station. Despite the fact that the battery technology is developing rapidly and individual models theoretically already are able to cover distances of 400 kilometers today, this could defuse the debate regarding range.



© istockphoto.com/ schlot

## Producing and consuming regionally shortens distances

Climate-neutral and people-friendly mobility in cities would rely on shared electric cars, digitally interconnected with a strong public transport and wisely sponsored pedestrian and bicycle traffic. In the study *Mobiles Baden-Württemberg* (mobile Baden-Württemberg) by the Baden-Württemberg foundation, the authors paint a picture of sustainable transport to come. This goes beyond a mere consideration of the automobiles drives, the authors also look at how people are going to live, work and consume in the future. The crux is that mobility is declining because living, working and producing take place in more closely and better connected areas. Shared vehicles are mainstream, possessing one's own vehicle is the exception for only a few strata of society. The authors of the study believe that the backbone of mobility in this sustainable future will be an attractive, flexible local public transport that can offer different



modes of transportation depending on the region and demand. The times when large buses were either empty or overcrowded are over. Between cities, it is mainly the train that connects people, along with good car-sharing options.

In this sustainable future, goods will mainly be transported by rail from well and efficiently managed logistics centers. For the last mile, the goods are transported in small vehicles or freight bicycles – also to get dangerous trucks out of the city centers. This scenario also includes a differently bustling and structured city. Food and consumer goods are also produced locally. There is no longer a separation of life and production. In the scientists' scenario, this ultimately leads to a slight decline in freight transportation. Keywords here are regional economic cycles and a social trend towards deceleration. It is currently impossible to predict how trucks will be driven in such a scenario: by hydrogen or as hybrid vehicles that drive electrically on freeways by using overhead contact lines. But even if the technology pathways are still open... In times when climate change, urbanization and digitalization define people's lives, a hotel with only two charging points for electric cars in its underground parking garage will no longer be able to keep up.

Heiko Holdinghausen is the editor of taz (daily newspaper) for economy and environment and writes a lot about the automotive industry and innovations. Her book Dreimal anziehen, weg damit (Put it on three times, then throw it away) about the true price of t-shirts, jeans, etc.. was published by Westend Verlag in 2015. Her new book Deutschland (Germany) will be published there in March 2019. Abstieg eines Umweltmeisters (The decline of an environmental champion). Unsere wahre Öko-Bilanz (Our true ecological balance sheet).



© istockphoto.com/ atlantic-kid

## Literature:

- ➔ [https://www.boell.de/sites/default/files/heinrich-boell-stiftung\\_alternative-antriebe-autonomes-fahren\\_v01\\_kommentierbar.pdf](https://www.boell.de/sites/default/files/heinrich-boell-stiftung_alternative-antriebe-autonomes-fahren_v01_kommentierbar.pdf)
- ➔ [https://wupperinst.org/fa/redaktion/downloads/projects/Mobilitaetsszenario\\_2035\\_Langfassung.pdf](https://wupperinst.org/fa/redaktion/downloads/projects/Mobilitaetsszenario_2035_Langfassung.pdf)
- ➔ Baden-Württemberg-Stiftung: Mobiles Baden-Württemberg (Mobile Baden-Wuerttemberg). Wege der Transformation zu einer nachhaltigen Mobilität (Ways of transformation to a sustainable mobility). Publication series of Baden-Württembergstiftung No 87, Stuttgart 2017
- ➔ [https://www.ey.com/Publication/vwLUAssets/ey-als-treiber-der-erfolgreichen-transformation-der-automobilindustrie/\\$FILE/ey-als-treiber-der-erfolgreichen-transformation-der-automobilindustrie.pdf](https://www.ey.com/Publication/vwLUAssets/ey-als-treiber-der-erfolgreichen-transformation-der-automobilindustrie/$FILE/ey-als-treiber-der-erfolgreichen-transformation-der-automobilindustrie.pdf)

“Whether a city is civilized does not depend on the number of its expressways, but on whether a child can get anywhere by bicycle without any worries.”

Enrique Penalosa, former mayor of Bogota.

# factory<sup>y</sup> is the magazine for sustainable management

factory stands for industrial production and factory, but also for the factor Y, by which the resource consumption must change in order to ensure the same conditions for future generations. This understanding for sustainability includes all aspects of sustainable management which means that consumption is also included besides production and services.

factory aims to emphasize the importance of companies in achieving sustainable development of the society and to engage economic actors in the social debate. It is about resource efficient management and the development of sustainable production and consumption patterns. factory is published four times a year as a PDF magazine and online at [www.factory-magazin.de](http://www.factory-magazin.de)

factory - Magazin für Nachhaltiges Wirtschaften (magazine for sustainable management)  
ISSN 1860-6229,  
15. Year Edition 1-2019

## Editors:

Person in charge of content according to Section 10 (3) MDStV (German treaty for media services):  
Ralf Bindel  
Am Varenholt 123  
44797 Bochum  
Tel. 0234-9799513  
[rb@factory-magazin.de](mailto:rb@factory-magazin.de)

## Advertisements:

rabe – medienbüro  
Tel. 0234-9799513  
[www.rabebuero.de](http://www.rabebuero.de)  
Advertising price list 1.2012 applies

## English Translation:

University of Mainz, School of Translation, Linguistics and Cultural Studies, Prof. Dr. Donald Kiraly & students [www.fask.uni-mainz.de](http://www.fask.uni-mainz.de)

## Editors:

Effizienz-Agentur NRW  
Dr.-Hammacher-Straße 49, 47119 Duisburg  
Tel. 0203-37879-30, Fax -44  
[efa@efanrw.de](mailto:efa@efanrw.de)  
[www.efanrw.de](http://www.efanrw.de)

Wuppertal Institut für Klima, Umwelt, Energie gGmbH  
Döppersberg 19, 42103 Wuppertal  
Tel. 0202-2492-0, Fax -108  
[info@wupperinst.org](mailto:info@wupperinst.org)  
[www.wupperinst.org](http://www.wupperinst.org)

## Design layout:

Oktober Kommunikationsdesign GmbH, Bochum  
[www.oktober.de](http://www.oktober.de)

## Implementation:

ubb Kommunikation, Bochum, [www.ubb-kommunikation.de](http://www.ubb-kommunikation.de)

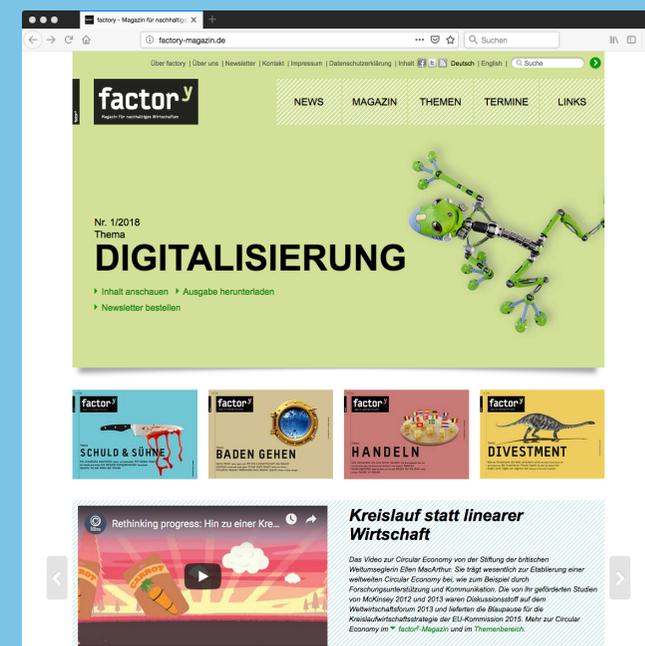
## Print:

Circlematt White matt coated, picture print of 100 percent recycled paper, labeled with the Blue Angel and the EU Ecolabel.  
Gebrüder Hoose GmbH, Druckerei und Verlag, Bochum

The articles in factory do not necessarily reflect the opinion of the editors. The editors are grateful for unsolicited manuscripts, photographs and materials. However, no warranty will be assumed. The copyright lies with the respective authors or editors; reprinting or duplication (also in extracts) is permitted by the editors on request and provided that the author and the link [www.factory-magazin.de](http://www.factory-magazin.de) is mentioned.

## Read more and get more service online

Subscribe to our newsletter, be informed about current news and dates, read articles and make use of further service offers. Follow us on Facebook and Twitter and spread the word about factory and the idea of sustainable management.



► [www.factory-magazin.de](http://www.factory-magazin.de)

► Subscribe to our newsletter