

FACT SHEET XXL

MARCH 2016

MICROMOBILITY

BIO-HYBRID

SCHAEFFLER



A GLIMPSE OF THE FUTURE

World premiere:
Schaeffler's Bio-Hybrid

MOBILITY IN FLUX

As an innovation leader, Schaeffler
drives new concepts forward

EDITORIAL



Jörg Walz
Vice President
Communications and
Marketing Schaeffler
Automotive

Dear readers,
Zero-emission transportation, urban transformation, and footsteps left behind – these are important social issues dealt with not only by companies like Schaeffler. It's people like you and I going through life with an increasingly keen awareness,

developing new needs, and tackling the realities of life around the globe day in day out. Mobility plays a crucial part in this context and has many facets – whether we travel by car, rail, air, or bicycle. The way we move from A to B varies and in many cases is not optimally geared to our needs. No matter what, motion is what drives us and is linked to many positive emotions. In this Fact Sheet, we are presenting an all-new concept of transportation to you. With it, Schaeffler opens up a new form of mobility, providing a possible answer to questions that are increasingly being raised. Enjoy the read.

Sincerely yours,
Jörg Walz

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MOBILITY IN FLUX



CONDITIONS IN METROPOLITAN AREAS ARE BECOMING INCREASINGLY TIGHT, WITH A THREAT OF TOTAL GRIDLOCK LOOMING. THE SEARCH IS ON FOR VISIONARY CONCEPTS FOR THE FUTURE.

19 million. 7 billion. 900 million. Impressive figures. They reflect the current annual vehicle registrations in China, the world population, and the number of vehicles existing around the globe at the moment. The world population will have grown to more than eleven billion by the end of this century, according to UN estimates: a rapid development that also goes hand in hand with the unstoppable change in mobility needs and ways to satisfy them. Accordingly, traffic in metropolitan areas has been increasing at breathtaking speed. Cities like Istanbul, Tokyo, or Hamburg have long begun to search

for solutions to smog, noise, and lack of parking space. The results vary: novel sharing concepts, modified infrastructures, innovative business models, and rules creating specific boundary conditions, plus the gamut of topics focused on electric mobility. Norway is clearly a pioneer in this field. Related to the population, there is no other place that has more electric vehicles. Benefits such as free parking in designated areas, tax credits, and the right to use dedicated bus lanes are just a small excerpt from Norway's catalog of advantages. But this will not be enough. ▶

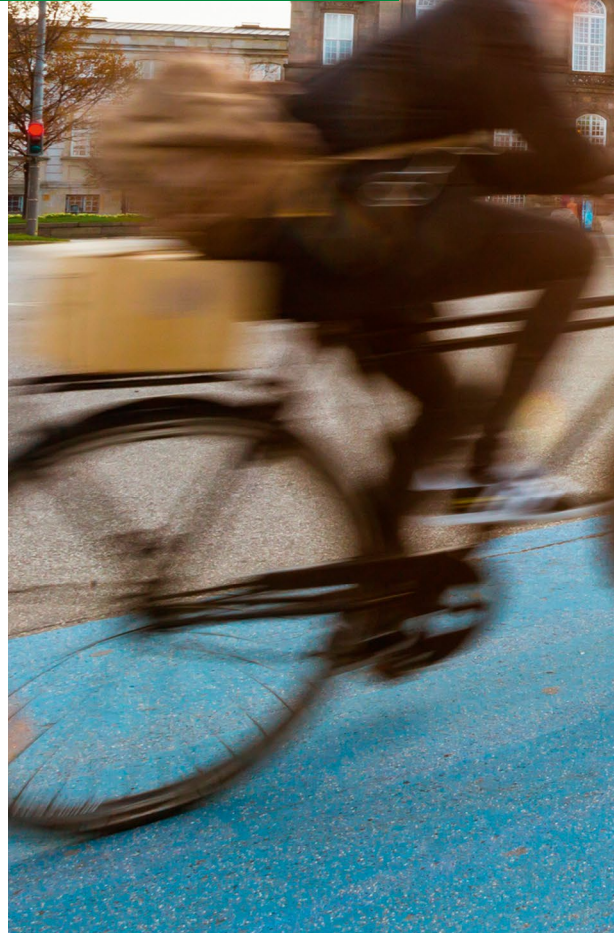


Dr. Heinrich Schäperkötter
Director of Innovation Strategy,
Innovation Management
and Collaborative Research
at Schaeffler

“The ways in which people get from A to B in metropolitan areas will change. There’s a clear trend toward new, compact mobility solutions. They offer major opportunities for small vehicles that can close the gap between electric cars and bicycles. Schaeffler is involved in actively shaping this trend and in the process of investigating future requirements, possible fields of application, as well as concepts and solutions for personal mobility today. We’re talking about micromobility.”

Modern mobility solutions are on the agenda. The RS 1 cycle highway is a prestigious project in the Ruhr District. It’s planned to traverse the region from Duisburg to Hamm. The cycle highway will be four meters wide and connect ten cities, plus four universities, with each other. Alongside the cycle highway, there will be a separate pedestrian lane. Copenhagen and Amsterdam have been making impressive advances in this field as well. Wide bike lanes, bike parking facilities, stations with bicycle pumps, trash cans placed at an angle along bike lanes, and bike guidance systems are just the beginning. Up to 30,000 bikers, for instance, commute across Queen Louise’s Bridge in Denmark’s capital every day. Riding bicycles – including pedelecs, in other words bicycles assisted by electric power – is increasingly becoming a focal topic, and evolving into a problem-solving and health-promoting way of life.

The major trend of extending bicycle infrastructures is fully justified. More than 2.5 million pedelecs are traveling on German roads by now. Sales are expected to triple by 2023. Around the globe, an increase by nearly 30 percent can be anticipated within the same period of time. In 2012, 132 million bicycles were sold worldwide – and their number keeps growing.





MOBILITY FOR TOMORROW

FOR SCHAEFFLER, INNOVATION HAS BEEN PART OF ITS CORPORATE DNA EVER SINCE THE COMPANY WAS FOUNDED. IT IS BASED ON LATERAL AND INTERDISCIPLINARY THINKING.

Schaeffler is known as an innovation leader delivering a wealth of technologies that make automobiles more fuel-efficient, environmentally friendly, and safer, as well as products for trains, aircraft, wind turbines, and many other industrial sectors. Schaeffler can be found wherever things are in motion – and motion means mobility as well. The challenges facing mobility of the future are immense. That’s why Schaeffler is committed to its holistic “Mobility for tomorrow” concept geared to finding sustainable solutions for the world of tomorrow.

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Prof. Tim Hosenfeldt
Senior Vice President Corporate
Innovation at Schaeffler

“In its development projects, Schaeffler draws on the company’s long-standing expertise in both engineering and manufacturing. The core task is to develop energy-efficient drive systems. In these projects, we not only focus on individual technologies but on system-oriented total solutions. The company, for instance, leverages the cross-functional know-how of its engineers in the fields of engine, transmission, chassis/suspension, and electric mobility, as well as Corporate Research and Development, to develop innovative powertrains for hybrid and fully electric vehicles. By interlinking the industry and automotive segments, we also successfully advance topics such as micromobility from a holistic view that includes technological and social implications.”



1



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Mobility for tomorrow –
under this concept,
Schaeffler concentrates
on the four focus fields of
Environmentally friendly drive
systems 1, Urban mobility 2,
Interurban mobility 3
and energy chain 4



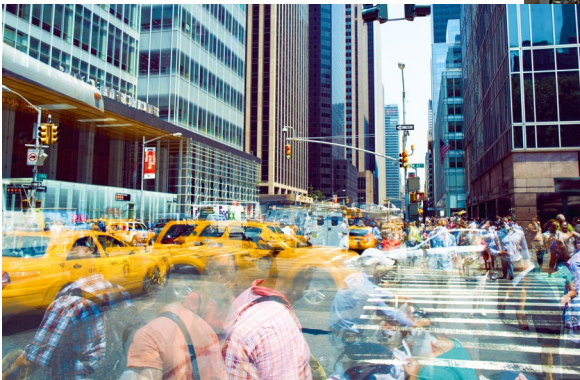
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A GLIMPSE OF

SCHAEFFLER IS INVESTIGATING POSSIBLE FIELDS OF APPLICATION FOR PERSONAL MOBILITY CONCEPTS.

Mobility can be looked at from various angles.

Be it our first steps as toddlers, our first few meters on a bicycle, our first ride on a bus, getting our driver's license, or boarding our first flight – the things we associate with mobility are positive. The horse-drawn coach, the bicycle, the train, the automobile, and the airplane have all opened up new forms of mobility for us. But: mobility varies – depending on regions, nations, or regional characteristics. The general conditions for mobility in Tokyo are a far cry from those in Berlin. The rules in New York are not the same as those in Mumbai. And the mobility needs of people living in suburbia or even in rural areas differ from those living downtown. ▶



THE FUTURE

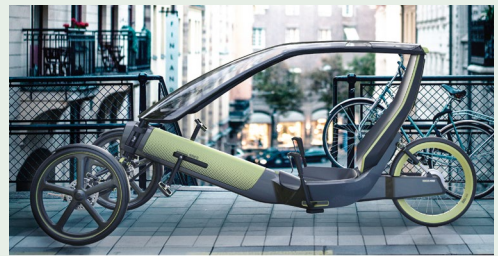




THE CONCEPT DESIGNS



1. WEAR This innovative vehicle concept has been designed for the target group of commuters and addresses the search for parking space in urban areas. Due to its light frame structure and thanks to the drive unit having been shifted to the rear axle, the concept can be parked vertically.

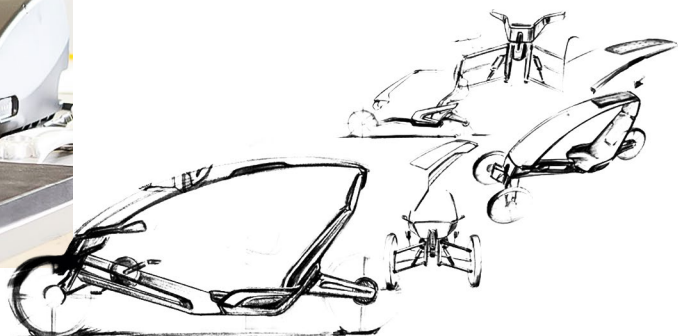


2. VARIED A concept that integrates daily routines and recreational uses, and can be adjusted to individual lifestyles both visually and functionally. It offers a choice of two modes: sportive and daily going.



These were the prerequisites under which Schaeffler tested a new, independent vehicle platform. A diversified team analyzed a wide range of conditions, performed market analyses, reviewed global needs, set its own benchmarks, and ultimately tested potential applications.

Following the creation of numerous concept designs and intensive research and development work, an initial concept for a solution was established: a new form of personal mobility. The pioneering **Bio-Hybrid** – see the following spread – combines advantages such as stability and weather protection with the light weight, energy consumption, and space utilization of a pedelec. In addition, as a vehicle, it's suitable for integration into existing infrastructures.



3. AZOR This concept combines the comfort of an automobile with the flexibility of an e-bike to create a new vehicle class. The development was focused on compact exterior dimensions, everyday user needs, rain protection, and solving the problem of urban parking.



4. BALANCE Due to its swivel-type and stowable weather protection, this concept maximizes the feeling of freedom. Featuring a combination of electric and muscle power, drivers will find it to offer them a mix of sportiness and comfort. The concept with extensible stowage space and a jump seat is closely oriented to the current design of the Bio-Hybrid.

SCHAEFFLER BIO-HYBRID

**SCHAEFFLER'S DESIGN AND DEVELOPMENT CONCEPT.
AN INNOVATIVE PILOT PROJECT FOR MOBILITY OF TOMORROW.**

- Higher traffic safety
- No driver's license/registration required
- Easy charging (230 volt socket)
- Ride emphasizing comfort

*Flexible
weather protection*

*Ergonomic
seat and handlebar
adjustment*

*1+1-seater
(child seat)*



FACTS & FIGURES

- **Bio-Hybrid**
- Electrically assisted ride (up to **25 km/h**)^{*}
- Starting assistance (**boost**)
- Range **50–100 km**
- Recuperation mode
- Reverse gear (electric)
- Total weight **80 kg**^{**}
- Tires **24-inch**



^{*}250–750 watts rated power output (depending on national legal provisions); ^{**}target weight: ~ 60 kg



THREE QUESTIONS FOR ...

**PROF. PETER GUTZMER, DEPUTY CEO AND
CHIEF TECHNOLOGY OFFICER SCHAEFFLER AG.**

HOW IS THE BIO-HYBRID POSITIONED?

The Bio-Hybrid is positioned very close to a bicycle, albeit without having the fundamental disadvantages of bicycles, which don't provide weather protection and no stowage space for major shopping for example. Thanks to the pedelec drive system being limited to 25 km/h, the Bio-Hybrid can be operated without a driver's license. Due to a track width of 80 cm and the vehicle's legal classification, the operator can use bike lanes as well. The weather protection, which in this initial concept is a roof located only above the operator's head, can be stowed in the vehicle by means of an intelligent rotary solution. As a result, you're traveling in a convertible in summer. The four wheels give the operator increased driving stability which enhances both traffic safety and driving pleasure in corners. The unique design emphasizes the lifestyle character and, due to smartphone connectivity, addresses the wishes of "digital natives" as well.



Prof. Peter Gutzmer
about new mobility concepts
from Schaeffler

2 WHERE DO YOU SEE FURTHER POTENTIAL, WHAT FUTURE EVOLUTIONS ARE CONCEIVABLE?

First of all, we're talking about a pilot concept here, about an idea Schaeffler has of a solution for urban mobility. Principally, the Bio-Hybrid already fits in with existing urban infrastructures today. However, a large number of other prerequisites inevitably have to be met before this type of personal mobility can successfully establish itself in the marketplace. Big cities have to continue to change – and they will. Even today, cities like London, Paris, and Singapore are investing hundreds of millions in new bike lane projects. Copenhagen, with bike lanes three meters wide, has already set an impressive example. High-speed bike lanes that connect cities like those in the Ruhr District will make it possible to develop evolutions of the Bio-Hybrid traveling at higher speeds. In Germany, there are related discussions about legislation that would allow speeds up to 40 km/h for bike lanes. All these correlations are conducive to our concept offering high potential of changing urban mobility. Electric mobility strictly in the passenger car segment will not suffice to guarantee sustainable, energy-efficient mobility for tomorrow. Beyond these aspects, the Bio-Hybrid can of course be integrated into the future world with its vast array of connectivity options.

3 WHEN WILL THE CONCEPT GO INTO PRODUCTION?

At this point, we have to act with caution in the relatively wide and, to some extent, completely new “micromobility” search box. From the more recent past we know that consumers are very slow in adopting products such as unicycles, skateboards and micro vehicles like the Twizy. In the approach selected by Schaeffler, the focus was initially put on a new mobility idea that we'd like to put on the road with innovative technologies and solutions. With respect to mass production, anything is conceivable, from proprietary developments through to new partnerships and cooperation agreements. We're going to closely watch the market and view a production launch as a realistic proposition. Initial pilot applications in cities will be providing important findings for validating the integration of the vehicle into urban structures.

FACTS & PROPOSITIONS

**ONE
FITS
ALL**

The Bio-Hybrid can combine the worlds of work and recreation.

2,500,000

pedelecs are traveling in Germany. This number is expected to triple by 2023.

30,000

commuters cycle across Queen Louise's Bridge in Copenhagen every day.

2.5 BILLION

vehicles might be on the road around the globe by 2050 (Shell forecast). The current number is approx. 900 million.

15 %

is the target rate for bicycles pursued by Paris. The city plans to invest 150 million euros in doubling its cycling network to 1,400 km. Paris aims to become the world's cycling capital by 2020.

6 km/h

is the average speed at which car traffic moves in Mexico City.

1.4

occupants on average are traveling in German passenger cars.

100 km

will be the length of RS1 – a four-meter wide bike highway through the Ruhr District.

0.5 %

of Istanbul's traffic consists of bicycles – a negative record.

NEW THINKING

The vehicle concept enables sustainably active mobility and appeals to all the senses.



PERSONAL FREEDOM

Personal mobility is a constant human need.

73

hours per year are spent in traffic jams by drivers in Stuttgart: the congestion record in Germany. Statistics for London even reflect 101.

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FACTS ABOUT SCHAEFFLER

| | |
|---------------|--|
| ≈ 84,000..... | employees |
| 13.2..... | bn. Euro revenues in 2015 |
| > 2,300..... | registered patents in 2015 |
| 170..... | locations in 50 countries |
| 60..... | Schaeffler components in automobiles worldwide (average) |



Find out more about mobility for tomorrow

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