

# The Future of Mobility

By Holger Glockner and Ben Rodenhäuser

*The following text is an extended and revised version of the chapter “The Future of Mobility”, which was published as a part of the FOCUS Market Analysis Mobility in 2008. The entire market analysis is available as a free download at [www.medialine.de/marktanalysen](http://www.medialine.de/marktanalysen).*

The automotive industry is forced to master a strategic balancing act. Near term, sales crisis, market collapse, production stops, and reduced working hours dominate the news, pinning down management resources and – only too understandably – rather distracting one’s focus from long-term strategic thinking. At the same time, the crisis of the automotive industry is in parts also one of its own making, and not merely the result of the upheavals in the global financial and economic system. The automakers’ model policies have been criticised in recent years, and deservedly so; challenges left unanswered **before** the crisis now have to be solved **during** the crisis, simultaneously to the pressing problems of day-to-day business, if manufacturers’ want to find themselves in a good position **after** the crisis, once the question of the outlines of future mobility returns with a vengeance. In the following, we will focus on the this long-term perspective.

## The Automotive Culture, Challenged

The 20th century was deeply influenced by the rise of the steel-bodied, fossil-fuelled, privately-owned automobile. It has become an integral part of our lifestyle in such a way that it has ceased to be merely a commodity, rather, it symbolises an entire culture – one currently facing tremendous challenges triggered by resource scarcity, urbanisation, climate change, and the growing sensitivity of life and work in a globalised and technologised world. If these are to be mastered, changes to global patterns of mobility will hardly be avoided: The steel hulks currently populating our streets represent a lifestyle which cannot last. Below, we will describe major trends in mobility – focussing on motorised private transport – and, based on these, will develop three scenarios which concentrate on three different qualities of change until 2020: 1.) the triumph of a “green” automobile which rethinks the car starting from its drive concept; 2.) new mobility services which eliminate the strict separation of modes of transport and render using and owning a vehicle independent of each other; and 3.) change driven by price and legislation, turning (auto)mobility into a luxury which will remain out of reach for many consumers. In line with our introductory remarks above we assume for all three scenarios that the current financial and economic situation will have serious, yet eventually manageable consequences and will not, in the long run, turn out to be disastrous.

## Race for the Next Generation Propulsion

New drive technologies are a key strategic challenge for the automotive industry. The race for alternatives to the traditional combustion engine is under way, but it remains unclear which alternative technology promises to become the eventual winner, or even whether a specific technology will manage to make a real breakthrough in the market. It is evident that, as Shell emphasises in its automobile scenarios, the passenger car will (have to) become consistently cleaner and more energy-efficient. Today, both the political community and business favour the

electric car as tomorrow's technology. However, since it is (currently) unable to compete with combustion cars with regard to range, the consumers have yet to arrive at a verdict. In the near future, we will very likely see economically justifiable, electrically driven cars in urban traffic, but from the consumers' perspective, they appear as a setback compared to today's universally usable automobile – the consumers' eventual usage decision remains open. "Plug-in hybrids" promise to be an alternative, featuring an electric drive with an expandable range – currently using a combustion engine, in the medium to long term based on a fuel cell. Should either electric or fuel-cell driven cars be introduced on a major scale, a radically new infrastructure will be necessary – in the case of the electric car, several hundred million Euros will be needed to prepare a country of the size of Israel. Investment cost for the United States were estimated by the Climate Group to be in the range of 100 billion USD. Figure 1 shows a plausible if ambitious development path. However, this outcome would require substantial investments by businesses and by the state, and considerable consumer interest in environmentally-friendly drive technology. The environmental track record for both hybrid cars and pure electric cars strongly depends on the way the electricity used is generated – if gasoline is merely replaced by coal converted into electricity in conventional power plants, it would be unjustifiable to speak of decarbonisation. During the coming decades, widely varying technologies will likely coexist, including alternative fuels such as second-generation biofuels or gas-to-liquid diesel, but also other innovations such as homogenous compression ignition.

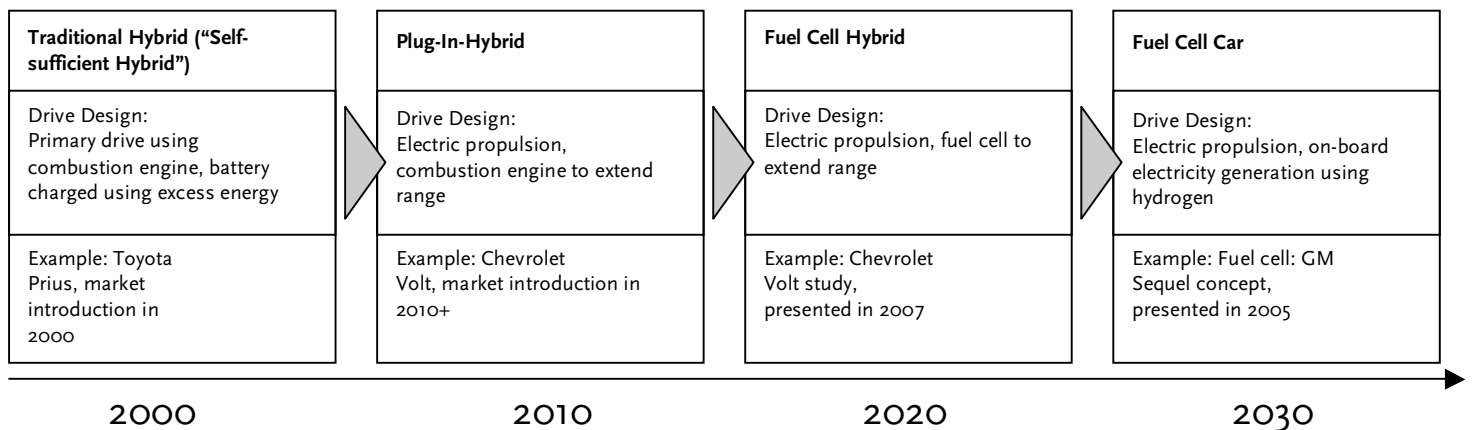


Figure 1. Roadmap from combustion to fuel cell.

## Changing Value Creation, New Alliances

If they want to be fit for the future, manufacturers will have to develop and extend skills in many areas. For electric drives, deeper know-how is needed in chemical, electrical, and control engineering. In the case of a breakthrough, the supply structure in the automotive industry would change dramatically: According to estimates by the Fraunhofer Institutes ISI, the share of the automotive industry in value creation would drop from its current 63 percent to 4 percent if fuel cells were used. At the moment, automakers are feverishly forging alliances to build new skills and secure knowledge advantages. Battery output is the key to the future of the electric car. Bosch has just established a joint enterprise with Samsung to develop and produce lithium-ion batteries. Evonik has increased its share in the Saxon battery manufacturer Li-Tec and is cooperating with Volkswagen, Bosch, and BASF in an industry syndicate. Also working on innovations in this sector are, e.g., Volkswagen with Sanyo, General Motors with Continental, and Nissan with NEC. With the aim of creating a supply infrastructure for electric cars, General Motors is collaborating with 30 electricity producers in 37 federal states. The "Project Better

Place”, founded by the former SAP executive Shai Agassi, is planning to establish a network of electricity service stations beginning in Israel and Denmark. Cooperation partners are Renault and Nissan. In general, Germany has no reason to rest on its laurels – China is investing massively into electric cars, currently building, e.g., the world’s largest plant for electric cars near Beijing designed to manufacture 20,000 cars annually.

## Energy Efficiency Offers Savings Potential

It is possible to significantly improve the life-cycle assessment of vehicles with conventional drives. Assuming current growth rates, global energy usage will have increased by 50% by 2030. According to BASF estimates, energy efficiency measures have the potential of cutting this increase by some two thirds. In the automotive sector, most likely measures would be improved aerodynamics and lightweight materials (rule of thumb: 10% reduction in weight means 5% better mpg). McKinsey calculated that London has the potential of avoiding 1.2 megatons of CO<sub>2</sub> emissions until 2025 by using more efficient vehicles. However, orientating vehicle construction consistently to energy efficiency would require an overhaul of philosophies by precisely those automakers which have so far translated technology leadership in terms of performance alone. Many experts say that it is specifically the lack of efficient, fuel-saving, and hence low maintenance vehicles which make the current sales crisis so severe.

## Increase or Decrease of Car Traffic?

Prevalent forecasts still assume that motorised private transport in Germany will increase, and that the car will continue to dominate the “modal split”. However, a stagnation or reduction seems currently more likely (see also scenarios below). An increase in energy prices means that the car will be less attractive compared to other modes of transport. Furthermore, the future will very likely bring toughened access controls for cars in urban centres, and an increase in the taxes and duties levied on cars. Deutsche Bahn has already reported to have benefited greatly from higher fuel costs in 2008. In the United States, cars travelled 16 billion kilometres fewer in May 2008 compared to May 2007. Experts agree that once the global financial and economic crisis has been overcome, oil prices will increase significantly.

## More Cheaper Cars

New Asian automakers will increase the pressure on the highly saturated car markets in Germany and Europe. Many signs indicate that “lowest cost cars”, in particular, will meet with rising demand in industrial nations, too. To the same degree that western societies become socially polarised, a “mobility divide” opens: While some remain able to afford mobility in comfort, others only manage to finance a mobility minimum. The success of the Dacia Logan has already given an impression of the potential offered by “discount cars” such as the Indian Tata Nano. Its European market entry has been envisioned for 2012. The low-cost market already belongs to the most important growth markets globally – European automakers will be forced to enter it, too.

## BRIC: Escape from the Saturation Trap

This applies for the fact alone that the European and US-American car markets will continuously lose in importance compared to the emerging markets. The BRIC-nations Brazil, Russia, India, and China have eagerly been envisaged as an escape from the market saturation trap. Some of the major automakers have been active in these markets for twenty years – Volkswagen in China – or thirty years – Fiat in Brazil – already. The current significance of these markets becomes obvious when one considers that in 2008, the number of cars sold in the BRIC nations equalled those sold in the USA. Framework conditions and consumer needs, however, differ widely between the four nations, necessitating a regional adaptation of strategies – in China and Russia, for instance, consumers prefer large – by western understanding “showy” – cars, whereas modern compact cars are well received in Brazil, as the Economist notes. Chances are that in the medium term, China will boast the world’s largest car population. It goes without saying that reproducing western mobility lifestyles in the emerging markets will place great burdens on climate and environment. Against this background, the issue of sustainable mobility becomes much more pressing.

## Innovation Opportunity Integrated Mobility Services

Product-supporting services have long since become a key competitive factor in the automotive industry. According to a study by Booz Allen Hamilton, only 8% of the profit generated over a car’s life time cycle come from sales, 46%, however, come from financing and insurance. Here, one key innovation area are services which are not limited to cars, but – particularly in urban areas – result in comprehensive mobility services. The mobility mixes of urban dwellers differ widely and range from cars to public transport and bicycles. Here, integrated services enjoy a great potential. The Fraunhofer Society highlights first and foremost services located “between” cars and public transport, e.g. car sharing models or demand-driven public transport without fixed routes. In order to enable better future mobility services, researchers and start-ups are intensively exploring new vehicle designs. MIT, e.g., has developed an electro scooter for urban traffic which can be folded and pulled like a trolley. It is to be rented to townspeople with selective high mobility needs but afraid of parking space issues. MIT also presented a similar concept, CityCars, which are to be space-savily stacked like shopping trolleys. The Aptera 2e developed by a Californian start-up is to enter the US market in 2009, boasts extremely high mpg and is also superbly suited for usage in the context of new operator models. Tram and car fuse in the ULTRa approach (“Urban Light Transport”): small vehicles operate independently on permanently installed routes (“guideways”), but may be used by up to four people depending on demand. The first ULTRa route is currently built at Heathrow Airport.

## The Key Role of Information Technology

According to some estimates, 90% of all automotive innovations stem from the electronics sector (not counting drive designs). It has to be emphasised that in the future, cars will be increasingly software-based. IT is essential when it comes to driver assistance systems ranging from night vision to automated parking and collision warning systems; it delivers new software and protocols for car-to-car communication and new traffic control systems; it promises to integrate the multitude of controlling systems using an IP-based on-board network; and it enables new services, e.g. solving issues by remote maintenance. Conversion to electronic steering modelled on airplanes (“X by wire”) also promises considerable reductions in weight.

## Mobility 2020: Four Scenarios

The future of mobility is, in many respects, open and characterised by imponderables. In order to create a clear picture of the possible developments until 2020, we will condense these uncertainties into two key dimensions with two values each: With regard to innovation dynamics, a real innovation impulse on the market is possible, but it is also conceivable that most new ideas get bogged down during implementation. When we look at peoples' mobility behaviour, we find two options – one where mobility remains car-centred, and another which sees a multi-modal mobility behaviour, i.e. usage and combinations of transport modes vary according to need. If we combine all values, we arrive at four scenarios (see Figure 2). In the scenario “For the Love of Green Cars”, current hopes on a breakthrough of new drive technologies are realised, and the roadmap presented above is implemented. “Passenger Pleasure” is also characterised by an innovation boost – here, however, integrated mobility services benefit most. In the third scenario, “Advantage by Necessity”, high energy prices and political regulations put pressure on motorised private transport. These three scenarios will be presented in rough outlines on the following pages. The fourth scenario – “Business as Usual” – needs no further introduction: It paints a world where no change in mobility behaviour has happened until 2020, or significant innovations have been achieved, and in this respect is merely a continuation of what we already know.

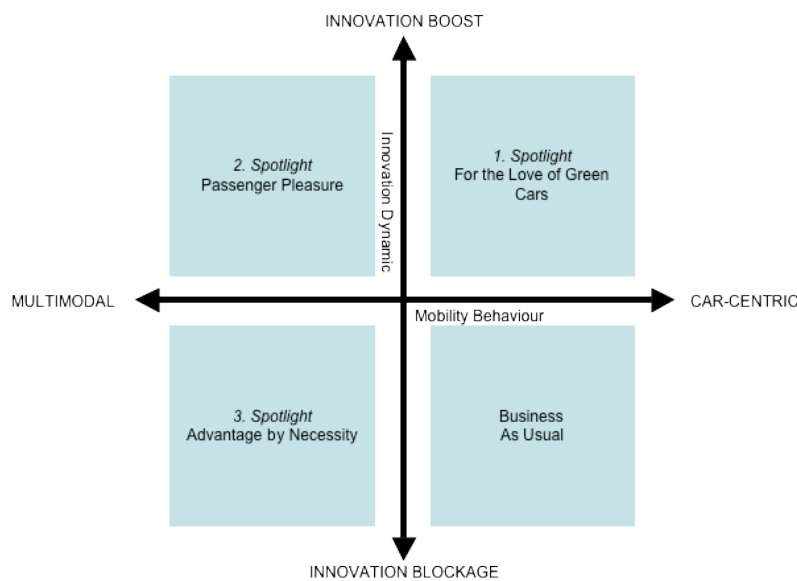


Figure 2. Mobility 2020: Four Scenarios.

## 1. Scenario: For the Love of Green Cars

In this scenario, the new drive technologies fully live up to the expectations: By 2020, the transformation towards low-emission private transport has succeeded. A significant contribution comes from the fact that power generation is changed in rapid steps towards renewable energies. The European Union, nation states, and automakers work in concert to achieve the development of an infrastructure for electric cars. By 2015, pure electric cars are already used in urban traffic, and are embraced by more progressive consumer groups. Yet even in 2020, pure electric cars are still not “long distance worthy” – the range of affordable Lithium-Ion batteries available on the market remains insufficient. Plug-in hybrids, however, become an unqualified success from 2010 onwards. As a result, all automakers focus on this technology, infrastructure development is rapidly pushed forward. Simultaneously, R&D efforts on fuel cells continue. Around the year 2020, first cars are available which use a fuel cell to boost driving ranges. In 2020, hopes are high that the large-scale entry into the hydrogen economy will have succeeded by 2030. In the scenario “For the Love of Green Cars”, German automakers manage to re-position themselves: they enter technology alliances, continue to reduce vertical integration, and focus on the development of brand strengths and vehicle design. Consumers change their attitude towards cars. They continue to form emotional bonds, but learn to treasure other aspects – e.g. the stable sanctuary offered by cars in a mobile world. Another success factor is the reduction of the gridlock issue. Across Germany, an intelligent traffic control system based on “Floating Car Data” is introduced on motorways. Built in a public-private partnership, investments are refinanced by a national motorway toll. At the same time, a general speed limit is introduced. All three measures considerably reduce congestion.

### My Car, a Feel-Good Area

*This is the year 2020. Today, German cars represent a symbiosis of ecology and driving for pleasure: Consumers treasure the fact the cars are extended living rooms which make passengers feel home away from home. On-board infotainment systems, e.g., adapt automatically to the driver's mood, and several wellness elements are integrated into the interior. Using fragrance management, the car's atmosphere and hence the passengers' moods can be purposefully influenced. Cars are networked with their environment and offer selective tips to drivers, e.g. regarding free parking spaces near their destination. The feel-good car can, if need be, be changed into a work environment, elegantly staving off boredom during the occasional traffic jams.*

## 2. Scenario: Passenger Pleasure

In this scenario, the strong demand for mobility services is the crucial driver of change. An integrated transport market results, encompassing busses, trains, cars, bicycles, and planes. From the consumers' perspective, the focus is no longer on different transport systems, but on precisely tailored solutions for individual mobility needs which differ according to situation. The answer to the consumer's question "How do I get from A to B?" differs according to his specific context and includes widely varying transport providers. From the consumer's perspective, the car is merely one element in his individual mobility profile. Furthermore, ownership of cars is no longer considered to be crucial. Quite the contrary, many people feel relieved that they no longer need parking spaces. Rather, cars are only used at the exact moment when they're needed – as a service. Even though the overall share of cars in transport services provided decreases, automakers contribute to the transformation to a new mobility paradigm by entering the market for mobility services. They no longer sell cars, but rather occasion-relevant mobility, offering a wide variety of mobility rates tailored to individual mobility needs. Comfort is crucial: In 2020, booking and payment of these services happens without personal contact, transferring from one carrier to the other is achieved without frictional losses. A change in lifestyles also contributes to the strong prevalence of mobility services: People consider working and living in urban environments attractive, residing in suburbia has lost its lustre and its position as a social model.

### Mobile Using MobiFlex

*"Real mobility can only be achieved with motorised private transport" – today, in 2020, this statement no longer applies unreservedly. Real-time route planning has made combining several carriers far more comfortable. Highly developed fleets of rental cars make it possible to change to the best suitable means of transportation at any time. New offers interlink carriers: When purchasing a new car people also usually acquire what is referred to as a MobiFlexcard. For an annual fee, it offers access to public transport and the option of renting a bigger vehicle for transports. Deutsche Bahn have extended the attractiveness of their high-speed networks and considerably grown their customer base through a spectacular PR campaigns which gave away one million BahnCard 25s.*

### 3. Scenario: Advantage by Necessity

With no groundbreaking innovations forthcoming in the mobility sector, economic and political factors are the dominating drivers of change in this scenario.

Whereas the two scenarios described above are based on, in total, favourable economic conditions, the scenario “Advantage by Necessity” assumes a less positive economic development which results, in particular, in an intensified polarisation of society into winners and losers. The outcome is a “two-tier mobility” confronting a highly mobile elite and a broad class of more or less mobile people. Energy prices lead to mushrooming costs for vehicle owners. In 2020, market growth can only be had for small, budget-friendly cars and exclusive mobility offers targeted at a narrow social stratum. On the policy level, regulation of motorised private transport is intensified dramatically with the aim of reducing CO<sub>2</sub> and particulate matter emissions and countering soil sealing. Access management for cars in congested areas is severely increased. In public procurement, only cars with a first rate life-cycle assessment are approved. Even though, alternative propulsion technologies enjoy little success in this scenario, since consumers fail to embrace them. Hence, consumers also contribute to this scenario’s innovation blockage – they merely reduce kilometres travelled and turn to public transport, rail, and bicycles. With the social divide, many consumers lack choices for economic reasons alone: They can no longer afford to own a car. As a result, other carriers gain transport shares in this scenario, but fail to become more attractive. Here, too, no innovations are forthcoming, the integration which characterised “Passenger Pleasure” is entirely lacking.

#### **Mobility: More Chore than Pleasure**

*This is the year 2020. Today, mobility is more of a chore than a pleasure. People find themselves abandoned with their mobility problems. More and more cars are scrapped, new cars are hard to sell. With only low-emission vehicles allowed into urban centres, many consumers are forced to park their cars outside city gates. Many people use public transport – not a very pleasurable experience in view of overcrowded trains and loose networks. Papers already speak of “mobility proletarians”. The highly mobile elites, by contrast, enjoy their privileges to the fullest. On the motorways, fast lanes were introduced which require a fee. Here, plug-in hybrids zoom along which remain unaffordable for the majority of the population.*

**Z\_punkt GmbH The Foresight Company is a consulting agency for strategic future issues based in Cologne.**

*Holger Glockner is Z\_punkt’s Director Foresight Consulting und consults businesses in strategy and innovation processes. Ben Rodenhäuser is Z\_punkt’s Director Foresight Research and works mainly for customers in mobility and ICT.*