Battery electric vehicles (BEVs)

High hopes are being placed on the battery electric powertrain particularly with regard to achieving the climate targets by 2030. In urban traffic, it will increasingly become the mainstay of low-CO_2 personal transport. The advantages are clear: high efficiency, zero local emissions, and a whole lot of driving fun!

Through continuous development of the underlying technology, the cost of vehicles can be reduced further, and their range increased. Consumers can already take advantage of numerous incentives today, thus making the vehicles increasingly attractive from a financial perspective too. Nevertheless, further efforts in the area of the charging infrastructure required are necessary to achieve the breakthrough. Policymakers and industry have already made corresponding announcements, but now they must be implemented swiftly.

Alongside a ramp-up of electromobility, it is also necessary to speed up the expansion of renewable energies. After all, it will only be possible to manufacture and operate battery electric vehicles with a truly net-zero carbon footprint if the underlying electric power is also generated entirely using CO_2-neutral sources.

Fuel cell electric vehicles (FCEVs)

The advantages of this type of powertrain are due to the longer ranges of fuel cell electric vehicles and their shorter refueling times. Both of these aspects are comparable to the diesel engine. Car drivers who frequently need to travel long distances are therefore pinning high hopes on this technology. Furthermore, fuel cell technology holds great potential particularly in goods transportation with heavy-duty commercial vehicles. Since battery-based powertrain systems for trucks on long-haul routes are probably not an option due to the size of the necessary batteries and the protracted charging times, an alternative is urgently needed.

New EU requirements regarding the CO_2 emissions of truck fleets will come into force as early as 2025. By means of fuel cell technology and renewably produced hydrogen, vehicles can be operated with a net-zero carbon footprint. In order to gain more experience with this new technology, it is important to get initial prototypes and test vehicles onto German and European roads as early as possible. The obstacles to a breakthrough of the fuel cell technology are the currently still low availability of green hydrogen, inadequate refueling infrastructure, and high purchase costs. It has been possible to reduce the latter significantly in recent years, but the market price of hydrogen can only be brought down to a competitive level through large-scale industrial production processes. Since it is easy to transport hydrogen in large quantities, the production of green hydrogen offers great economic export potential for regions with a lot of sun and wind.

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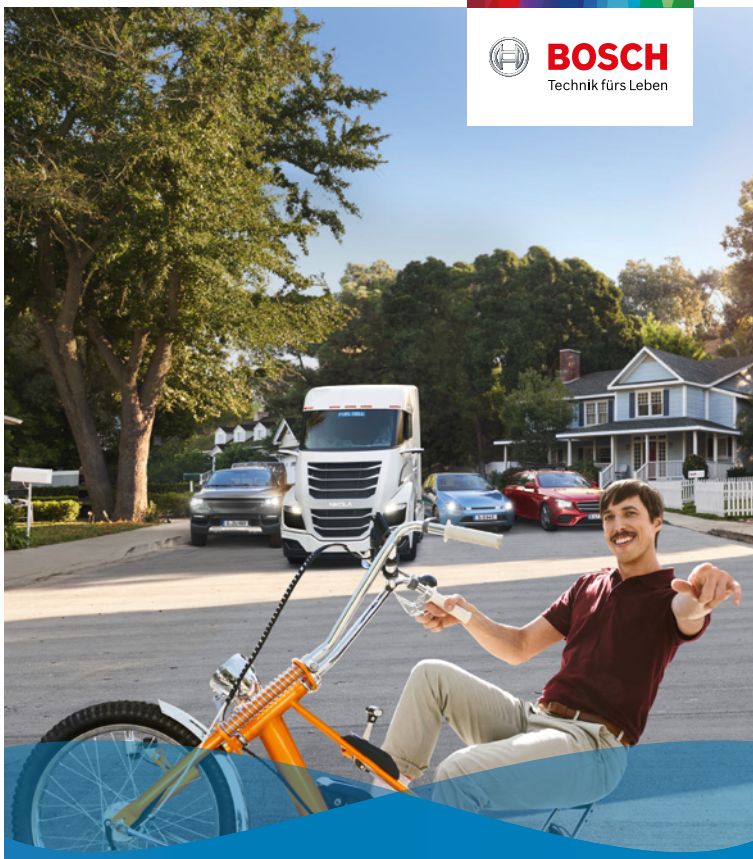

Drive #LikeA**Bosch**

Taking a technologically neutral approach on the path to CO_2 neutrality

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Introduction

In the Paris Agreement on climate protection, almost all states of the international community have agreed on ambitious targets. The aim is to keep the global temperature rise by 2050 to well below 2 degrees Celsius above pre-industrial levels. To achieve this and to meet the national targets set out in the German government's climate protection law, CO_2 emissions in the transport sector must be reduced to zero by 2050. Bosch is committed to the climate protection goals and is working on powertrain technologies for passenger cars and commercial vehicles that provide the best possible protection for the environment and climate.

Bosch is convinced that in order to achieve the targets in the transport sector the entire bandwidth of powertrain technologies available today will be required at least until 2050. This includes further development of efficient internal combustion engines alongside the use of fully battery-powered vehicles and fuel cell powertrains running on hydrogen and synthetically produced e-fuels.

Ultimately, each individual application will determine which powertrain technology makes the most sense. What is certain, though, is that it is crucial to take a holistic approach when appraising the CO_2 emissions of each particular powertrain. It should ideally take into account the vehicle's entire life cycle (cradle to grave) and at a minimum should consider how the fuel was produced (well to wheel). This is the only way to ensure CO_2 emissions really are being reduced and not simply relocated. After all, climate protection is a challenge for society as a whole and the entire world.

On the following pages, we would like to present the various technological approaches that Bosch envisages will shape the future of mobility.

Efficient internal combustion engines

The demand for electrified powertrains is growing continuously. Robert Bosch GmbH welcomes this development, but it is important to bear in mind the current situation in the transport sector. Vehicles with a battery electric or fuel cell electric powertrain are still the exception on the roads today. The internal combustion engine continues to play a key role in our powertrain mix. In addition, this will remain the case over the coming years. Bosch currently assumes that in the year 2030, a combustion engine will power at least two in every three new passenger cars and light commercial vehicles on the roads throughout the world and many of them will be hybrids. The combustion engine will still be needed. That is why we have to continue to develop its technology and make it even more resource efficient.

1. Further development of the combustion engine is useful for the climate and environment

With our portfolio of high-performance subsystems, we have been able to help vehicle manufacturers reduce the nitrogen oxide emissions of new diesel vehicles on the roads to a level that is significantly lower than the emissions limits that have come into force this year[1]. In the case of gasoline engines, it has been possible to reduce particulate emissions even more dramatically: for example, 70% less particulate matter than is permitted by the applicable Euro 6d-TEMP standard – as has been verified on the test bench and by measurements in road traffic in accordance with EU6 RDE. We are therefore getting closer and closer to the goal of ensuring that road traffic conserves the air in cities.

2. Hybridization

Many consumers are not yet receptive to the idea of switching from combustion engines to driving on battery electric power alone. In view of the slow pace of infrastructure expansion as well as the still limited range and high purchase price of battery electric vehicles, hybrid cars are an excellent alternative. By combining efficient combustion engines with battery electric powertrains, it is already possible to reduce CO_2 emissions significantly right now. Fuel savings of up to 15% are already achievable today with 48-volt hybridization solutions.

3. Advanced fuels

Certified biofuels based on renewable raw materials offer a CO_2 reduction potential that is already available today and can make an important contribution as an admixture to conventional fuels. In future, renewable electricity will also be used to produce fuels – known as e-fuels. In terms of the technology, it is already possible to produce e-fuels today, but further efforts are required in order to ramp up the necessary production capacities to serve the market. Using these kinds of fuels in road transport could be realized quickly. Consequently, a credit transfer mechanism for the use of e-fuels should be included in the relevant regulations at national and international level. At the very latest when the discussion turns to climate-neutral shipping and air traffic, synthetic fuels will become indispensable.

[1] https://www.bosch-mobility-solutions.de/de/highlights/antriebssysteme-und-elektrifiziertemobilit%C3%A4t/die-zukunft-des-diesels/