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EICMA 2017: How Bosch is taking the motorcycle into the future Bosch's two-wheeler and powersports business is growing twice as fast as the market

November 6, 2017
PI 9849 BBM IEh/af

- ▶ Dr. Dirk Hoheisel, member of the Bosch board of management: "Megatrends such as urbanization and sustainability will fundamentally change mobility and the motorcycle as we know it today."
- ▶ Bosch is set to reach sales of one billion euros with motorcycle technologies
- ▶ Bosch technologies make the motorcycle fit for the future: first by making it safer, second by making its powertrain more efficient
- ▶ Tiny titans: Bosch's powertrain system for light electric vehicles reduces complexity and cost – for manufacturers and thus also for anyone who wants to drive electrically through their city

Milan – "Megatrends such as urbanization and sustainability will fundamentally change mobility and the motorcycle as we know it today" says Dr. Dirk Hoheisel, member of the board of management of Robert Bosch GmbH. "Bosch technologies make the motorcycle fit for the future: first by making it safer, second by making its powertrain more efficient." Bosch's vision is to make the mobility of the future accident-free, stress-free, and emissions-free – and this goes for motorcycles as well.

Whether as a transportation option for the emerging mass markets or as an element of multimodal mobility in megacities: two-wheelers are increasingly in demand. By 2021, the annual global production of two-wheelers is forecast to reach around 160 million units – one-third more than today. This makes motorcycle technology a remarkable driver for business. Bosch's Two-Wheeler & Powersports business unit, based in Yokohama, Japan, continues to gain momentum in the important global motorcycle and powersports market. The business unit has registered sales growth of more than 20 percent compared to

2016 – twice as fast as the market. And by 2020, Bosch is set to reach sales of one billion euros with motorcycle technologies. The company offers assistance systems, connectivity solutions, and modern powertrain and electrification systems for two-wheelers and powersport vehicles.

Connectivity: the next step in the evolution of riding safety

One of Bosch's goals is to make riding accident-free. At Bosch, two-wheeler safety starts right from the e-bike. With the market's first production antilock braking system for eBikes, the success-story of Bosch assistance systems for two-wheelers continues. With this system, the braking distance can be shortened and the risk of flipping over the handlebars is reduced. According to a Bosch accident research study, around one-fourth of pedelec accidents could be reduced if all bicycles were equipped with the ABS system. As the world's leading supplier of motorcycle technology, Bosch has made motorcycle assistance systems such as ABS, MSC (motorcycle stability control), and side view assist a firm feature in the market. Yet the possibilities for developing innovative technology for safer riding have by no means been exhausted: "Our vision for the future is to use connectivity to prevent accidents from happening in the first place," Hoheisel says. "Technologies for automated and connected driving are taking the development of cars forward at an incredible pace; if motorcycles are to overcome the challenges related to future mobility, they need to have access to the same technology," Hoheisel says.

For this reason, Bosch is creating connectivity systems that allow riders to communicate with vehicles, the infrastructure, and other road users in general, like the digital protection shield. It allows motorcycles and cars to talk to each other. Long before drivers or their vehicles' sensors catch sight of a motorcycle, this technology informs them that a motorcycle is approaching, allowing them to adopt a more defensive driving strategy. Another solution which allows the rider to be connected and safe is the connected horizon; riders can look around the next bend and get advance warning of possible hazards. By 2025, more than 70 percent of newly registered motorcycles worldwide will be connected.

Small size, big impact

It is not only connectivity that is continuing to pick up pace at Bosch, but also electromobility. In the years ahead, the market for light electric vehicles like eScooters is expected to grow by about 40 percent. Studies indicate that some 100 million such vehicles will be manufactured worldwide by 2020.

"Electromobility will take off much more rapidly in small-vehicle segments. Small electric vehicles have a bright future, worldwide," Hoheisel says. This is why

Bosch has developed scalable powertrain systems that enable the electrification of light vehicles on four, three, or two wheels, such as the Govecs eSchwalbe or the AIMA eScooter. The systems comprise a motor, control unit, battery, charger, display (HMI), and connectivity box, as well as an interactive app that connects the rider's smartphone with the vehicle. Bosch's electrified powertrain solutions are scalable across all performance classes between 0.25 and 20 kW. Vehicle manufacturers benefit from a comprehensive systems solution that can be quickly integrated, and that also means less development effort. This reduces complexity, variants, and cost – for manufacturers and thus also for anyone who wants to drive electrically through their city. One further advantage: the small vehicles not only reduce emissions, but noise as well.

While Bosch is stepping up its efforts related to electrified mobility, it is also continuing to improve the combustion engine with electronic engine management solutions. These allow two-wheelers and powersport vehicles to satisfy the latest emissions regulations, such as Euro 5 and BS 6 (Bharat stage), and can reduce CO₂ emissions, while still meeting the demand for the latest functionalities and improved performance.

EXPERIENCE BOSCH AT THE EICMA 2017: Whether smart assistance systems, connectivity solutions, or new energy for the powertrain: Bosch has the right solutions for the motorcycles and powersport vehicles of the future. At the EICMA 2017, Bosch will be presenting its latest solutions in each of these three spheres at booth G62 in hall 13.

More information:

<http://www.bosch-mobility-solutions.com/en/company/trade-fairs-and-events/eicma>

Press photos:

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Mobility Solutions is the largest Bosch Group business sector. In 2016, its sales came to 43.9 billion euros, or 60 percent of total group sales. This makes the Bosch Group one of the leading automotive suppliers. The Mobility Solutions business sector combines the group's expertise in three mobility domains – automation, electrification, and connectivity – and offers its customers integrated mobility solutions. Its main areas of activity are injection technology and powertrain peripherals for internal-combustion engines, diverse solutions for powertrain electrification, vehicle safety systems, driver-assistance and automated functions, technology for user-friendly infotainment as well as vehicle-to-vehicle and vehicle-to-infrastructure communication, repair-shop concepts, and technology and services for the automotive aftermarket. Bosch is synonymous with important automotive innovations, such as electronic engine management, the ESP anti-skid system, and common-rail diesel technology.

The Bosch Group is a leading global supplier of technology and services. It employs roughly 390,000 associates worldwide (as of December 31, 2016). The company generated sales of 73.1 billion euros in 2016. Its operations are divided into four business sectors: Mobility Solutions, Industrial Technology, Consumer Goods, and Energy and Building Technology. As a leading IoT company, Bosch offers innovative solutions for smart homes, smart cities, connected mobility, and connected manufacturing. It uses its expertise in sensor technology, software, and services, as well as its own IoT cloud, to offer its customers connected, cross-domain solutions from a single source. The Bosch Group's strategic objective is to deliver innovations for a connected life. Bosch improves quality of life worldwide with products and services that are innovative and spark enthusiasm. In short, Bosch creates technology that is "Invented for life." The Bosch Group comprises Robert Bosch GmbH and its roughly 440 subsidiaries and regional companies in some 60 countries. Including sales and service partners, Bosch's global manufacturing and sales network covers nearly every country in the world. The basis for the company's future growth is its innovative strength. At 120 locations across the globe, Bosch employs some 59,000 associates in research and development.

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The Bosch innovations on show at the EICMA 2017

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- ▶ Connectivity systems: connected solutions for more convenience
- ▶ Assistance systems: greater safety without compromising on riding enjoyment
- ▶ Powertrain systems and electrification: new riding experience and sustainable powertrain technology

Milan – Whether smart assistance systems, connectivity solutions, or new energy for the powertrain: Bosch has the right solutions for the motorcycles and powersport vehicles of the future.

Connectivity systems: connected solutions for more safety and convenience

Bike-to-vehicle communication:

Up to ten times a second, vehicles within a radius of several hundred meters exchange information on details such as vehicle type, speed, position, and direction of travel. Long before drivers or their vehicles' sensors catch sight of a motorcycle, this technology informs them that a motorcycle is approaching, allowing them to adopt an appropriate driving strategy. A communication technology similar to the public WLAN standard (ITS G5) is used as the basis for the exchange of data between motorcycles and cars. Transmission times of just a few milliseconds between transmitter and receiver mean that participating road users can generate and transmit important information relating to the traffic situation.

Integrated connectivity cluster:

The integrated connectivity cluster is an all-in-one rider information and communication system developed especially for motorcycles and powersport vehicles. It allows riders to connect their bike to their smartphone via Bluetooth. The integrated connectivity cluster went into production in the BMW R 1200 GS in 2017. In cooperation with BMW, a newly added navigation function is available for riders. Especially in urban areas, this new feature enhances riders'

convenience as well as their safety. In addition to the navigation feature, BMW's integrated connectivity cluster offers two functions that make riding more convenient and enjoyable. It enables riders not only to receive calls, but also to make them, and allows them to easily access their contact lists and recent calls. Moreover, riders can use the ergonomically designed controls on the handlebar to effortlessly access their music favorites stored on their smartphones. The integrated connectivity cluster's intuitive interface and innovative technology make it easy to read in all situations, and allows riders to focus on enjoying their ride.

mySPIN – smartphone integration solution:

mySPIN enables riders to transfer the content of their smartphones to their motorcycle, scooter, or powersport vehicle. In 2017, mySPIN went into production for the first time in BRP's on-road Can-Am Spyder trike. mySPIN will be featured in more and more popular powersport vehicles. The reasons for selecting mySPIN are the way it allows the expertise of key third-party apps to be leveraged, its simplicity of use, and its capacity to minimize distractions compared with the other solutions in the market (smartphone cradles, touchscreens).

Lean connectivity unit:

The lean connectivity unit is an optimized connectivity solution enhancing the safety and convenience of motorcycle riders. It was designed especially for the emerging markets. If the rider has an accident, the device automatically detects the accident and uses the lean connectivity unit app to send an emergency message containing the rider's location information to the emergency contacts stored on the rider's smartphone. In situations in which the rider feels insecure, the handlebar remote control can be used to send an emergency message with location information to the same emergency contacts. Furthermore, the system also protects vehicles against theft by using the smartphone as an additional key. Telephone functions are available as well, allowing the rider to answer or reject incoming calls directly via the handlebar remote control. When riding with friends, the lean connectivity unit permits the riders to track their location or estimated arrival time. Thanks to CAN communication, it is possible for motorcycle manufacturers to realize additional value-added functions such as remote diagnostics that increase riders' convenience.

Assistance systems: greater safety without compromising on riding enjoyment

Motorcycle ABS:

Since 1984, Bosch has been continuously perfecting motorcycle ABS technology. Its smaller, lighter design with enhanced performance increases riding safety for riders worldwide. According to a study by Bosch accident research, around one-quarter of all powered two-wheeler accidents in Germany and India could have been prevented by ABS. Worldwide, an increasing number of countries, such as the European Union, Japan, Taiwan, and Brazil are or will soon be mandating motorcycle ABS. In the middle of 2018, motorcycle ABS will be mandatory in India for all new vehicle types with an engine displacement above 125 cc. This Indian legislation may possibly influence other emerging markets, such as Indonesia and Thailand, where small two-wheelers are also the most important means of transportation. Bosch's smaller and lighter ABS 10 is designed specifically to meet the requirements for two-wheelers in emerging markets such as India, Indonesia, and Thailand.

Motorcycle stability control (MSC):

MSC motorcycle stability control is the world's first all-in-one safety system for two-wheelers. By monitoring two-wheeler parameters such as lean angle, the system can instantaneously adjust its electronic braking and acceleration interventions to suit the current riding status. In this way, the Bosch system can prevent motorcycles lowsiding or righting themselves when braking in bends, which is the cause of the majority of motorcycle accidents. The new Bosch 6D sensor, which features benchmark signal performance, and vibration robustness, will be integrated in the MSC system in the near future. It will go into production in 2018. This sensor unit is the smallest and lightest design on the market. Capable of handling any sensor orientation in the vehicle, it significantly improves mounting flexibility.

Value-added functions:

Bosch is using its motorcycle ABS and motorcycle stability control (MSC) as the basis for realizing value added functions. These are programmed into the ABS and MSC units by means of smart algorithms. The latest example of a value-added function for motorcycles to emerge from Bosch is its "side-slip angle control," which enhances the performance of dynamic vehicle control in all riding situations. By analyzing two-wheeler-specific key data such as lean-angle, vehicle side-slip angle, and deceleration, the system adjusts brake pressure to

increase vehicle stability and braking performance. A “dynamic slide control,” which uses the vehicle’s side-slip angle information, is used to allow and control a certain rear wheel slide during hard braking. The function is designed especially for race-track use, and will go into production with the new Ducati Panigale V4 in 2018.

Safety systems for eBikes:

Pedelec biking is about to become safer than ever. Bosch is now about to launch the market’s first commercial antilock braking system for eBikes. Thanks to an intelligent and innovative system, this new development will make it possible to prevent the pedelec’s front wheel from locking up, and also to limit the lifting of the rear wheel. In this way, braking distance can be shortened and the risk of flipping over the handlebars reduced. According to a study by Bosch accident research, around one-fourth of pedelec accidents could be reduced if all bikes were equipped with the ABS system. The Bosch eBike ABS will be available from autumn 2017 onward – initially for selected fleet partners. Production for trekking and city eBikes furnished with the Bosch drive system is planned to start in autumn 2018.

Powertrain systems and electrification: greater efficiency and a more enjoyable ride

Engine management systems:

Electronic engine management systems are the core element of efficient and economical technology. They allow two-wheelers to fulfill future emissions regulations such as Euro 5 and BS 6 (Bharat stage), including OBD I/II. In combination with advanced sensor technology, engine management systems are considerably more efficient than conventional carburetor systems, and can reduce CO₂ emissions by up to 16 percent, depending on the situation. The control unit is the main component of these new engine management systems. This small computer analyzes all the data from the powertrain sensors, and adjusts parameters such as ignition and the amount of fuel on the basis of this data. Bosch has the portfolio to deliver optimized solutions across the entire range of vehicles, from single-cylinder, low displacement vehicles to high-performance two-wheelers and powersport vehicles.

Powertrain systems for light electric vehicles:

With its integrated systems for light electric vehicles, Bosch creates the technological basis for urban mobility solutions. Depending on the customer’s needs, two powertrain versions are available: an in-hub system for the power range up to 3 kilowatts and a central drive system for power ranges between

4 and 20 kilowatts. Motor, control unit, battery, charger, display, and connectivity box and app are perfectly harmonized to enable the electrification of light electric vehicles on two, three, and four wheels. Two examples of two-wheelers that are electrified with Bosch powertrain solutions can be seen at the Bosch booth: the Aima eScooter with its in-hub system and the Elmoto HR-8 sportsbike with its central drive system.

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Digital protection shield: when motorcycles and cars talk to each other

New Bosch technology could prevent nearly one-third of all motorcycle accidents

May 23, 2017

PI 9688 BBM IEh/af

- ▶ Connecting bikes and cars ensures motorcycles' digital visibility
- ▶ Dirk Hoheisel, member of the board management of Bosch: "We are creating a digital protection shield for riders."
- ▶ Riders are 18 times more at risk of being killed in an accident than drivers
- ▶ Bosch development project with partners Autotalks, Cohda Wireless and Ducati

Stuttgart, Germany – The first warm days of the year mark the start of motorcycle season – and, unfortunately, a rise in the number of road accidents. Motorcyclists are among the most at-risk road users, 18 times more at risk of being killed in an accident than drivers. Last year, there were approximately 30,000 motorcycle accidents in Germany alone, roughly 600 of which were fatal. One of the main reasons is that riders of two-wheelers are often overlooked in road traffic, both at intersections and during passing. Bosch wants to change that. With its partners Autotalks, Cohda Wireless, and Ducati, it has developed a prototype smart solution. "We let motorcycles and cars talk to each other, creating a digital protection shield for riders," says Dr. Dirk Hoheisel, a member of the Bosch board of management. The goal is to prevent dangerous situations from occurring in the first place.

Connectivity could prevent nearly one-third of motorcycle accidents

According to estimates by Bosch accident research, motorcycle-to-car-communication could prevent nearly one-third of motorcycle accidents. "Through safety systems such as ABS and motorcycle stability control, Bosch has already made riding a two-wheeler significantly safer. By connecting motorcycles, we are taking safety to the next level," Hoheisel says. Here is how it works: up to ten times a second, vehicles within a radius of several hundred meters exchange information about vehicle types, speed, position, and direction of travel. Long before drivers or their vehicles' sensors catch sight of a motorcycle, this

technology informs them that a motorcycle is approaching, allowing them to adopt a more defensive driving strategy. For example, typical dangerous situations arise when a motorcycle approaches a car from behind on a multi-lane road, ends up in a car's blind spot, or changes lanes to pass. If the system identifies a potentially dangerous situation, it can warn the rider or driver by sounding an alarm and flashing a warning notice on the dashboard. In this way, all road users receive essential information that actively helps avoid accidents.

Vehicles exchange information within just a few milliseconds

The public WLAN standard (ITS G5) is used as the basis for the exchange of data between motorcycles and cars. Transmission times of just a few milliseconds between transmitter and receiver mean that participating road users can generate and transmit important information relating to the traffic situation. Parked or idling vehicles also transmit data to any surrounding receivers. To allow riders and drivers who are farther away to reliably receive the necessary information, the technology makes use of multi-hopping, which forwards the information automatically from vehicle to vehicle. In critical situations, therefore, all road users know what is happening and are able to take appropriate action in advance.

Video on motorcycle-to-car-communication:

<https://www.youtube.com/watch?v=Cfn5sbUqHig>

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Safety first Bosch launches ABS for pedelec users

June 2017

PI9721

- ▶ Improved safety thanks to Bosch eBike ABS
- ▶ More efficient braking resulting in more stable eBiking
- ▶ Introductory phase with selected fleet partners starting Autumn 2017

Stuttgart/Reutlingen – Pedelec biking is about to become safer than ever. Bosch, the leading producer of motorbike safety systems, is now about to launch the market's first series-produced anti-lock braking system for eBikes. Due to this new development it will be possible to prevent the pedelec's front wheel from locking up and also to limit the lifting of the rear wheel – thanks to an intelligent and innovative system. In this way the braking distance can be shortened and the risk of falling over the handlebars is reduced. According to a study carried out by Bosch's Accident Research Division, pedelec accidents could be reduced by as much as 25 percent if all bikes were equipped with the ABS system. The Bosch eBike ABS will be available from Autumn 2017 onwards – initially for selected fleet partners. Series production for trekking and city eBikes provided with the Bosch drive system is planned for Autumn 2018.

Bosch studies: fewer accidents thanks to eBike ABS

Every year more and more people are opting for the pedelec. In Germany alone, roughly three million cyclists are currently using electric assistance. As Claus Fleischer, CEO of Bosch eBike Systems, explains: "In order to establish this modern form of mobility for the longer term, safety is a pivotal factor for eBikers and their environment." Two studies undertaken by Bosch Accident Research indicate that the accident rate can be reduced if the pedelec is equipped with an anti-lock braking system.

In the first study, researchers examined more than 500 bicycle accidents in Germany. Their main finding: With the correct braking behaviour, many accidents can be avoided – or their consequences alleviated. They found that in 20 percent of cycling accidents the rider had fallen before the actual collision occurred. Many

of these falls were the result of an incorrect braking response (or a failure to brake). ABS ensures more stable and more effectively controlled braking when critical situations arise.

The second study, based on data from more than 5,400 bicycle collisions and falls, also confirms that no braking took place in up to 75 percent of collisions. This is where ABS systems can be invaluable. According to the accident researchers, almost a quarter of pedelec accidents could be avoided through the use of ABS. Moreover, the number of accidents with severe injuries could be reduced further, they found. Fleischer is convinced that "the introduction of a system of this type can improve road safety in the longer term."

Efficient braking with the Bosch eBike ABS

State-of-the-art, high performance braking systems optimise braking behaviour and reduce braking distances. The Bosch eBike ABS combines front-wheel ABS with a rear wheel lift-off regulator, thus increasing safety substantially. By regulating the braking pressure of the front brake during critical braking manoeuvres, the situation for the biker is stabilised and the risk of falling off is significantly reduced.

Fleischer adds: "With front-wheel ABS, wheel speed sensors monitor the speed of both wheels. As soon as the front wheel threatens to lock up, for example in the event of a brake application which is too strong, the Bosch eBike ABS regulates the braking pressure and thus optimises the stability and manoeuvrability of the eBike." This is a decisive advantage, especially on slippery road surfaces or on loose, wet terrain as it means that the pedelec can be slowed down carefully and brought to a standstill.

The rear wheel lift-off regulator in the Bosch eBike ABS ensures that the rear wheel stays on the ground in the event of extreme overbraking, especially on a surface with good grip or on descents. Wheel speed sensors detect when the rear wheel is lifting and adjusts the application of the front-wheel brake.

Fleischer: "The Bosch eBike ABS reduces the braking force at the front wheel briefly, with the result that the rear wheel quickly regains contact with the ground. This lessens the probability that the eBiker will fall head-first." Thanks to this regulating function, the front-wheel brake can be used actively and efficiently.

Development and technological partnerships

When developing the eBike ABS, Bosch has made use of its in-depth know-how, its many years' expertise and long-established technology partnerships. Bosch has been manufacturing anti-lock braking systems for motorbikes since 1995. Since 2007, the systems have been developed in the Bosch Competence Center for two-wheeler safety in Japan. Bosch eBike Systems has been able to use

elements of the motorbike ABS in the eBike ABS – specially adapted to suit the riding and braking habits of pedelec users. The company's partner for the development of brake technologies is Gustav Magenwirth GmbH & Co. KG (Magura). Bosch has been working closely with this firm for a number of years in such areas as the supply of spare parts and accessories, service hotlines, warranty claim processing and training courses for salesmen. The Bosch eBike ABS will be launched with the CMe-ABS, which has been specially developed by Magura.

Selected fleet partners start trial phase

During the introductory phase from autumn 2017 onwards, selected fleet partners will be the first users of pedelecs with Bosch eBike ABS. The system will then be available at retailers starting autumn 2018. Initially the Bosch eBike ABS will be installed only on trekking and city bikes with 28" rims. The eBikes for fleets are equipped with the Performance Line (Cruise and Speed) combined with the Intuvia display.

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About Bosch eBike Systems

A new generation of bikes is taking town and country by storm and is already a part of everyday life. eBikes are a modern means of transport for modern people: people in a hurry and people who prefer to take it easy, the fit and the comfort lovers, commuters and pleasure cyclists and, of course, young and old. The tailwind of technology-leading eBikes made by what are already more than 70 leading brands in Europe is powered by components that Bosch is developing to perfection. The Bosch portfolio ranges from the highly efficient drive unit (motor and gearbox) and high-quality batteries to a smart on-board and cycle computer that can be used intuitively. Perfect coordination of components holds the key to typical Bosch performance in terms of both comfort and efficiency.

Like other Bosch products, the eBike systems benefit from the Bosch Group's technology and production know-how. From conception and engineering to manufacturing, marketing and after-sales service, Bosch eBike Systems constantly set new standards for the eBike industry. The Bosch Group's experience in the areas of electric motors, sensor technology, displays and lithium-ion batteries ensures that Bosch eBike systems use technology that is invented for life and that eBike users have their fun.

For more information please visit www.bosch-ebike.com

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