

[01] More technology for better air: Bosch is helping cities worldwide in the battle against pollution

[02] How Bosch is taking action to improve air quality

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More technology for better air: Bosch is helping cities worldwide in the battle against pollution Talks underway with 100 municipalities and regions across Europe

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- ▶ Dr. Volkmar Denner: “Clean air concerns us all. At Bosch, we recognize that we too have a responsibility to combat pollution.”
- ▶ Bosch is advising German and international cities on traffic management.
- ▶ Bosch is striving to make mobility as emissions-free as possible.
- ▶ A Bosch web special on [urban mobility and air quality](#) is now online.

Stuttgart, Germany – Around the world, people are flocking from rural areas to cities. By 2050, there will be more than six billion people living in megacities, twice as many as now. Over the same period, the volume of urban traffic is set to increase threefold, not least because the continuing boom in online commerce will feed further growth in delivery traffic. A denser population and more traffic mean deteriorating air quality. Across the globe, from Paris to Shanghai, major cities therefore face a major challenge: providing mobility for people and goods while also improving the quality of the air we breathe. This is no easy task: according to the World Health Organization (WHO), around 90 percent of the world’s population now live in areas where air quality is poor. The Organization for Economic Cooperation and Development (OECD) estimates that the economic impact of air pollution is around 5 trillion dollars worldwide. Rising healthcare costs account for the lion’s share of this sum. “Clean air concerns us all,” says Dr. Volkmar Denner, the chairman of the board of management of Robert Bosch GmbH. “At Bosch, we recognize not only our global responsibility for climate action but also our local responsibility for combating air pollution. And to meet that, we need more technology, not less. With technology that is ‘Invented for life,’ we can help cities and make the world a better place.” Bosch is therefore working both beneath and beyond the engine hood in order to make

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mobility as emissions-free as possible. Moreover, as an employer, the company is also taking on responsibility for improving air quality around the globe.

Understanding the factors behind air quality: different cities, different challenges

Technological advances and policy changes have significantly improved air quality, especially in Europe and the United States. Poor air quality is not caused by vehicle emissions alone. Industry, agriculture, and the energy sector also contribute to air pollution in varying degrees around the world. Air composition varies sharply from one location to another – as do levels of airborne pollutants such as particulate matter, ozone, sulfur dioxide, and nitrogen oxides. Other factors impacting air quality include chemical processes in the atmosphere triggered by temperature gradients, wind conditions, and solar radiation. For example, sunlight increases ozone concentration, and ozone can react with nitrogen monoxide to form nitrogen dioxide (NO₂). To gain a better understanding of these processes and to collect more data on air pollutants at various locations in urban areas, Bosch has developed a system for measuring pollution. Installed in a compact housing, this technology is currently being trialed in the Stuttgart metropolitan area, Paris, and Marseille. Its purpose is to deliver reliable data on air quality, which can then be used, for example, to map air quality in real time across a city as a basis for more efficient traffic management.

Beneath the engine hood: focusing on nitrogen oxide and particulate emissions

Bosch is using its know-how and considerable financial resources to make cars fit for the future. This involves a two-pronged strategy: advancing the development of electromobility and achieving further refinements to the internal-combustion engine. The aim is to design an internal-combustion engine that no longer makes any appreciable contribution to air pollution in our cities. With the development of new technology for diesel-powered vehicles, Bosch has taken a major step in this direction. This technology, which is now being successively rolled out in production vehicles, will reduce the emission of nitrogen oxides to well below the level of future limits. In other words, nitrogen-oxide emissions from new diesel cars will no longer be relevant. Thanks to the introduction of the particulate filter, this has also been true of particulate emissions from diesel vehicles for quite some time now. Bosch is also pursuing this aim for gasoline engines, and making good progress: modifications to engines and efficient exhaust-gas treatment can bring particulate emissions down to a level roughly 70 percent lower than the Euro 6d temp standard. In Europe, Bosch no longer carries out any development work for gasoline engines that are not fitted with a particulate filter. At the same time, the company is also seeking to minimize the particulate emissions produced by braking systems. Developments here include

the iDisc, which generates as little as ten percent of the brake dust produced by a conventional brake disc, and the regenerative braking system, which can cut brake dust by over 95 percent in electric vehicles.

Beyond the engine hood: understanding, planning, and managing city traffic

Bosch's activities to improve air quality go beyond the engine hood as well. "We're focusing on the big picture here," Denner says, "and looking at long-term mobility trends, particularly in urban areas." Bosch is now in talks with over 100 municipalities and regions across Europe. The aim is to improve air quality. On the basis of the acceleration and braking patterns of single vehicles, Bosch can reliably extrapolate to the behavior of the total fleet of vehicles on the road and thus to the total current emissions. Bosch is therefore now collecting anonymous data in Stuttgart and neighboring municipalities in order to determine how traffic must change to reduce emissions. It is on this basis that Bosch is advising cities on traffic planning and traffic management. In Stuttgart, for example, at Germany's busiest traffic junction, Bosch has shown that by maintaining a steady flow of traffic, it is possible to reduce current vehicle emissions by as much as 20 percent. This is just one of many lines of attack currently being pursued by Bosch. Another is the launch of the e-scooter sharing service COUP. This Bosch subsidiary operates a combined fleet of 5,000 electric scooters, providing locally emissions-free mobility for people in Berlin, Paris, and Madrid. Bosch is also employing pure software solutions to improve air quality. The Trifix app, supplied by the Bosch startup of the same name, provides real-time customized routing information from A to B, including alternative routes, direct from the city's traffic control center. In so doing, it helps prevent urban traffic from grinding to a halt.

Responsibility as an employer: mobility management for associates

Yet the very best way to stop traffic from coming to standstill is to prevent congestion altogether. This is the basic principle behind the mobility management system that Bosch operates for its associates. In the Stuttgart metropolitan area alone, some 50,000 Bosch associates, though only one-eighth of the company's global headcount, cover a combined total of over 1.5 million kilometers a day. The solution is to use shuttle buses, which eliminates many of these individual journeys. Bosch runs shuttles not only in Stuttgart but also in Istanbul (Turkey), Curitiba and Campinas (Brazil), and Changsha, Beijing, Shanghai, and Suzhou (China). In Shanghai, for example, ten long-haul and seven short-haul buses transport more than 1,000 passengers a day. Alternatively, by using the ride-share platform SPLT, which Bosch acquired in 2018, associates can create their own carpool and commute to work together. This platform was recently introduced in Mexico and is now being used in the Stuttgart metropolitan area. In addition, Bosch associates are also being offered

the option of telecommuting from home or from a more convenient company location. As Bosch's broad-based approach shows, it will take a whole range of measures to improve air quality. Only by adopting such strategies will cities around the world be able to breathe easily again and continue to provide their swelling populations with a high quality of life.

Press photos: #2316123, #2316124, #2316125, #2316127, #2316129, #2316131, #2316133, #2316134, #2316135, #2316136

EXPERIENCE BOSCH AT THE IAA 2019 in Frankfurt: Rethinking mobility and making it as safe, emissions-free, and fascinating as possible – this is the goal Bosch has set itself. On a technological level, the supplier of technology and services wants to achieve these aims through personalization, automation, connectivity, and electrification. At the IAA 2019, Bosch will be presenting its latest solutions for making driving safer and more efficient, for making mobility available on demand, and for turning cars into personal assistants.

BOSCH PRESS CONFERENCE: From 12:55 p.m. to 1:10 p.m. CEST on Tuesday, September 10, 2019, with [Dr. Volkmar Denner, chairman of the board of management of Robert Bosch GmbH](#) and [Dr. Stefan Hartung, chairman of the Mobility Solutions business sector](#), at the Bosch booth C02 in Hall 8.

FOLLOW the **Bosch IAA 2019** highlights at www.bosch-iaa.de and on Twitter: #BoschIAA

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Mobility Solutions is the largest Bosch Group business sector. In 2018, its sales came to 47.6 billion euros, or 61 percent of total group sales. This makes the Bosch Group one of the leading automotive suppliers. The Mobility Solutions business sector pursues a vision of mobility that is accident-free, emissions-free, and fascinating, and combines the group's expertise in the domains of automation, electrification, and connectivity. For its customers, the outcome is integrated mobility solutions. The business sector's 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 410,000 associates worldwide (as of December 31, 2017). The company generated sales of 78.5 billion euros in 2018. 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 460 subsidiary and regional companies in over 60 countries. Including sales and service partners, Bosch's global manufacturing, engineering, and sales network covers nearly every country in the world. The basis for the company's future growth is its innovative strength. At nearly 130 locations across the globe, Bosch employs some 68,700 associates in research and development.

Additional information is available online at www.bosch.com, iot.bosch.com, www.bosch-press.com, twitter.com/BoschPresse



How Bosch is taking action to improve air quality From electromobility to telecommuting

May 9, 2019

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Stuttgart, Germany – Clean air concerns us all. Poor air quality is not caused by vehicle emissions alone. Manufacturing, agriculture, and the energy sector also contribute to air pollution, albeit to varying degrees in different parts of the world. The amount and types of airborne pollutants vary considerably from one location to another. Bosch is putting a host of measures aimed at improving air quality into place – measures that include, but are not limited to, technological innovations. The supplier of technology and services also offers its associates a wide range of opportunities to play their part in improving air quality.

Mobility management at Bosch

E-bike leasing: On average, half of all commuters in Germany travel less than ten kilometers to work. Bosch is helping its associates make the transition from four wheels to two with a subsidized bike-leasing scheme. On offer are conventional bicycles as well as e-bikes from some 4,000 dealerships. Bosch then handles all of the paperwork for a lease that includes insurance and inspections. The scheme is financed by a deferred compensation tax model with Bosch paying the first installment. The company then deducts subsequent installments from associates' gross salary, which means they also enjoy a tax advantage. The program has caught on: more than 9,000 bicycles and e-bikes have been leased to date, including 1,500 in the greater Stuttgart area alone.

Carpooling: Carpools are a great way to significantly reduce the number of cars on the road and improve air quality. Bosch helps its associates form carpools using its internal Bosch Connect platform. Associates can also share the commute to work with the help of the ridesharing platform SPLT, which Bosch acquired in 2018. After recently being introduced in Mexico, the platform is now being launched in the Stuttgart metropolitan area, where some 55,000 Bosch associates travel a combined distance of 1.5 million kilometers every day.

Telecommuting: Thanks to a comprehensive telecommuting policy, Bosch associates are free to work from home or at a Bosch location closer to their home as the need arises. Associates may also opt for flextime to avoid rush-hour traffic and take advantage of more convenient public transportation connections. One in five Bosch associates in the Stuttgart area works from home for one day per week on average.

Opting for public transportation when air pollution is high: Bosch associates have been able to use their company ID as a free ticket for Stuttgart's public transportation network on days when fine particulate levels are high and the city issues an air quality alert.

Shuttle buses: Bosch also operates shuttle buses for its associates working at locations such as Istanbul in Turkey, Curitiba and Campinas in Brazil, Changsha, Beijing, Shanghai, and Suzhou in China, and Stuttgart in Germany. The ten long-haul and seven short-haul buses in Shanghai, for example, together carry more than 1,000 passengers a day.

Bosch innovations under the hood

48-volt powertrain: Bosch has developed a 48-volt powertrain system tailored for urban mobility and featuring a finely tuned package of electric motor, ECU, battery, charger unit, display, and app. Bosch is thus making urban mobility more efficient. On top of that, rapid acceleration from a standstill makes for a "wow" factor. Whether two, three, or four wheels, this system is available for all classes of light electric vehicles. As it is made up of off-the-shelf automotive components, manufacturers will have the benefit of production-tested parts and minimal development expense. This gives both established automakers and new players the opportunity to launch vehicles within 12 to 18 months.

Electromobility: Bosch wants to be the go-to partner for electric driving, and to be the leader in the mass market for electromobility that will emerge after 2020. In the electromobility business, no automotive supplier is as broadly diversified as Bosch – from bicycles to trucks. The company's electric powertrain components already feature in more than a million vehicles around the world. Its portfolio ranges from power electronics, 48-volt mild hybrid batteries, and electric motors to electric axle systems.

iDisc: A new brake disc from Bosch is helping to tackle the problem of particulate matter pollution in cities. The iDisc generates 90 percent less brake dust than a conventional brake disc. On top of that, its tungsten carbide coating reduces wear and increases reliability. The iDisc is suitable for all types of vehicle, from electric cars to vans and trucks.

New diesel technology: Bosch continues to advance the state of the art in diesel technology. The company has managed to cut diesel vehicles' NOx road emissions to well below the statutory limit that will take effect in 2020. It achieved this result using a sophisticated combination of engine and exhaust-gas treatment in which thermal management plays a pivotal role.

Regenerative braking: Bosch's regenerative braking systems are key components of hybrid and electric vehicles. They extend electric vehicles' range and reduce brake dust emissions by more than 95 percent. When vehicles equipped with these systems brake, their kinetic energy is recuperated and stored in a high-voltage battery for the electric motor to use. With conventional vehicle, most of this energy dissipates into the environment.

Bosch technology beyond the hood

Community-based parking: Drivers looking for a place to park account for around a third of city traffic. Bosch's community-based parking simplifies the search for a suitable spot. The vehicle uses the parking assist system's ultrasonic sensors to identify and measure the gaps between parked cars as it drives past. The system uploads the collected data to a digital parking map in real time for all connected cars to access. Drivers can then simply let themselves be guided straight to the nearest free space.

COUP: Bosch's e-scooter sharing service provides emission-free local transportation to users in Paris, Madrid, and Berlin. The COUP fleet count stands at 5,000 e-scooters. Anyone 21 years or older with a Class B or international driver's license is welcome to use the service. Finding the nearest e-scooter is an exercise in convenience with the service's app. Reserve, pay, and set off – no key required. A helmet and two spare batteries are located under the seat. COUP recharges the batteries; customer don't need to worry about anything. Powered by green electricity, these scooters travel at speeds up to 45 kph and may simply be parked after use in designated zones within the area served by COUP.

Air-pollution measurement system: Air quality is usually only measured at a few locations with large and expensive stationary equipment. Despite this, the readings from a single measurement point are often used to generalize about air quality across the entire city. To better understand the relationship between different emissions sources and the environment, Bosch has developed a new air-pollution measurement system. The compact boxes can be flexibly deployed around urban areas, for example mounted on streetlights or bus shelters. They measure particulate matter and nitrogen dioxide as well as temperature, pressure, and humidity in real time. Bosch creates an air-quality map on the

basis of this data and uses it to advise German and international cities on traffic planning and management. In Stuttgart, at Germany's busiest traffic junction, the company demonstrated that maintaining a steady flow of traffic can reduce the existing fleet's pollutant emissions by as much as 20 percent.

moveBW: This mobility assistant app provides a digital traffic management service for urban areas. Headed up by Bosch and based in Stuttgart, the mobility platform intelligently plans journeys that link and flexibly combine all modes of transportation. moveBW considers individual wishes as well as collective needs in its traffic management. Designed to avoid traffic jams, the app guides commuters to the nearest park-and-ride location. Unlike conventional routing applications, moveBW has access to municipal traffic data. With real-time access to information, it is able to provide extremely precise routing recommendations.

Trifix: This Bosch startup's eponymous app transmits rapid, route-specific traffic reports. Drivers only receive traffic updates that are relevant to their itinerary. The startup's partnership with the Stuttgart traffic control center allows it to provide real-time alerts about events such as accident-induced traffic jams. Instant messages pushed to smartphones enable drivers to better plan alternative routes and avoid lengthy traffic jams. A second pilot phase is currently underway in Stuttgart.

Related link: Web special [air quality in cities](#)

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