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Bosch invests billions in climate action and air quality

2018 financial statements: sales and result at record levels

May 9, 2019

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- ▶ Sales revenue increases to 78.5 billion euros in 2018
- ▶ EBIT from operations reaches 5.5 billion euros in 2018
- ▶ Bosch to reduce carbon footprint to zero by 2020
- ▶ Near-zero pollution from traffic for clean air
- ▶ Bosch CEO Denner: “Climate action that makes business sense, together with air-quality solutions, can stabilize the social climate.”

Stuttgart and Renningen, Germany – For the Bosch Group, the 2018 business year was a successful one. The company increased its sales revenue to a record 78.5 billion euros. Earnings before interest and taxes (EBIT) from operations reached 5.5 billion euros. In spite of heavy upfront investments in areas such as the electrification and automation of mobility, EBIT margin from operations improved again in 2018, rising from 6.8 percent in 2017 to 7.0 percent. Bosch increased its expenditure on research and development to 7.3 billion euros, or 9.3 percent of sales revenue. Capital expenditure rose by 14 percent to 4.9 billion euros, or 6.3 percent of sales revenue. Bosch created almost 8,000 new jobs worldwide in 2018, more than half of them in research and development.

For the current year, Bosch expects economic developments to be subdued. The company forecasts that the global economy will grow by just 2.3 percent. Trade disputes, the high levels of debt in European countries, and the decrease in automotive production are among the factors putting a strain on the global economy. Despite the difficult environment in industries and regions that are important for Bosch, the company expects its sales in 2019 to slightly exceed their 2018 levels. The first three months of the year saw sales nearly on a par with the previous year. Regardless of this short-term outlook, the Bosch Group is intensifying its efforts to combat climate change and improve air quality.

“Climate change is not science fiction; it’s really happening. If we are to take the Paris Agreement seriously, then climate action needs to be seen not just as a long-term aspiration. It needs to happen here and now,” said Dr. Volkmar Denner, chairman of the board of management of Robert Bosch GmbH, at the company’s annual press conference. “We also take people’s concerns about clean air quality in cities very seriously. As an innovation leader, we want to deliver technological solutions to ecological problems.” Moreover, Denner noted, “Driving bans, diesel protests, yellow vests, and Friday climate strikes – all this shows that companies need to take climate action and offer new solutions for urban air quality, not least to stabilize the social climate.”

Bosch to be first carbon-neutral industrial enterprise from 2020

According to the International Energy Agency (IEA), manufacturing is responsible for almost one-third of global carbon dioxide emissions. This is reason enough for Bosch to intensify its already successful efforts to reduce its CO₂ output. “We will be the first major industrial enterprise to achieve the ambitious goal of carbon neutrality in a little over a year. From 2020, Bosch will have a net-zero carbon footprint,” Denner announced. “All 400 Bosch locations across the globe will be carbon neutral from 2020.” To achieve this, the company will be using four major levers. Bosch will increase energy efficiency, increase the proportion of renewables in its energy supply, buy in more green power, and offset unavoidable carbon emissions. This will avoid 3.3 million tons of CO₂ emissions by 2020. More information about Bosch’s climate action plans is provided [here](#).

Better air quality: near-zero pollution

According to the World Health Organization (WHO), around 90 percent of the world’s population breathe toxic air. Bosch is pursuing an ambitious goal to remedy this: “We want to reduce air pollution from traffic to virtually zero. To do this, we’re looking beyond the car’s hood,” Denner said. The company’s project to reduce the concentration of air pollutants to near-zero levels is built on three pillars: Bosch is developing low-pollutant powertrain technologies, working with municipal governments on projects to maintain steady traffic flows, and is running a company mobility management system at its own locations.

Optimizing internal-combustion engines – using artificial intelligence

The company forecasts that roughly 75 percent of all new cars and light commercial vehicles will still be powered by an internal-combustion engine in 2030. In view of this, Bosch is continuing to invest considerable sums in optimizing gasoline and diesel engines. The company is also using [artificial intelligence](#) to further develop internal-combustion engines. As an example, Bosch is using AI to predictively control exhaust-gas treatment according to patterns drawn from individuals’ driving behavior, as this can further reduce vehicles’ emissions. Some

3,500 associates in the company's exhaust-gas treatment and exhaust sensors units generated sales of 2.3 billion euros in 2018. This figure is set to reach 3 billion euros by 2025.

20 percent lower pollutant emissions

Bosch is currently in discussions with almost 100 municipal governments around Europe on what specific steps to take to improve air quality. In Stuttgart, Paris, and Marseille, Bosch is currently testing a mobile analyzer unit. These newly developed units continuously measure the level of contaminants in the ambient air. Together with simulations, these readings are set to deliver further insights into the relationship between vehicle emissions and environmental pollution. One project with the city of Stuttgart has shown that smooth traffic flows can reduce pollutant emissions from the existing fleet by up to 20 percent. In the future, it will be possible to create high-resolution pollutant concentration maps with the data from the analyzer units. These maps can then be used to optimize traffic management.

Company mobility management: better air quality in conurbations

The third pillar of the project is company mobility management. Its goal is to reduce the traffic, and thus the emissions, for which Bosch associates themselves are responsible, particularly in conurbations. The measures taken range from shuttle buses in large cities in Brazil, China, and Turkey, to telecommuting agreements and the [leasing](#) of bicycles and pedelecs. In addition, Bosch is harnessing the power of connectivity. For some weeks now, for example, the roughly 8,000 associates at the Reutlingen location have been able to use the [SPLT](#) ridesharing platform, whose app makes it easier for associates to form carpool. In the Stuttgart metropolitan area, where some 55,000 Bosch associates travel a combined distance of 1.5 million kilometers every day, the company is also a member of the Clean Air Alliance.

Electromobility: 14 million vehicles by end of 2022

Bosch also expects electric vehicles to play a major part in improving air quality in cities. In the emerging mass market for electromobility, Bosch is striving to become market leader. By 2025, the company aims to generate 5 billion euros in sales with electromobility, ten times the figure for 2018. "In the growing competition for value creation in the powertrain technology domain, we see good opportunities ahead. Our systems know-how, our broad product portfolio, and economies of scale in manufacturing make us the partner of choice for vehicle manufacturers and mobility providers worldwide," Denner said. Bosch powertrain components already feature in over a million electric cars around the world. By the end of 2022, this number is set to rise to 14 million. To date, the company has carried out powertrain projects for 50 electric vehicle platforms. Last year alone saw 30 newly acquired projects. "We also want to help fuel-cell technology make

a breakthrough,” Denner said. To this end, Bosch recently announced an [alliance](#) with Powercell, a Swedish manufacturer of fuel-cell stacks. Such stacks make up two-thirds of the value of a fuel cell system. “Together with Powercell, we want to commercialize stacks and launch them by 2022 at the latest,” Denner said.

Automated driving: lower consumption and emissions

Automated driving will also play a part in improving air quality. According to the research firm KE Consult, automated driving can reduce fuel consumption by over 30 percent, and by 15 percent on German freeways. More than 5,000 Bosch engineers are now working on [automated driving](#), almost twice as many as two years ago. As Denner noted: “By 2022, we plan to have invested around 4 billion euros in automation and thus in sustainable mobility.” Driver assistance systems are contributing to growth on the path to automated driving. From current levels of around 2 billion euros, revenue is expected to increase by almost 15 percent this year. Sales of radar sensors are expected to grow by 20 percent, and sales of video sensors by 30 percent. Denner: “Automated driving is not just an area of future promise, it’s already a growth area for us today.”

Business year 2018: sales and earnings at record levels

“2018 was a successful business year for the Bosch Group,” said Prof. Stefan Asenkerschbaumer, CFO and deputy chairman of the Bosch board of management. As in 2017, sales and result again reached a high level. Sales revenue totaled 78.5 billion euros – a figure that was dented by substantial exchange-rate effects of 2.1 billion euros. After adjusting for exchange-rate effects and ignoring consolidation effects, sales grew by 5 percent. Nominally, they grew by 2.2 percent. Earnings before interest and taxes (EBIT) from operations totaled 5.5 billion euros, up from 5.3 billion euros the previous year. In spite of heavy upfront investments in promising areas, the EBIT margin from operations increased from 6.8 percent in 2017 to 7.0 percent. “Despite the economic challenges, in 2019 we will continue to invest large amounts in developing new technologies and areas of business in order to secure the company’s future viability,” Asenkerschbaumer said. “Equally, our commitment to reducing carbon emissions and climate action is not guided by short-term financial considerations, but takes a much longer-term view.”

The business year 2018 by business sector

All business sectors played a role in Bosch's good business performance in 2018: the **Mobility Solutions** business sector increased its sales by 3.5 percent (5.8 percent after adjusting for exchange-rate effects) to 47.6 billion euros. Consequently, Bosch's growth in this sector once again outperformed global automotive production. At 7.1 percent, EBIT margin from operations almost reached the previous year's level. The **Consumer Goods** business sector achieved sales of 17.8 billion euros. Adjusting for exchange-rate effects turns this 3.1 percent fall into a sales increase of 0.7 percent. The main reasons for this low growth were weaker demand in emerging markets and increasing competitive pressure in China. The EBIT margin from operations of 7.8 percent was slightly below the previous year's level. In the **Industrial Technology** business sector, sales rose to 7.4 billion euros. This represents an increase of 8.8 percent, or 11.7 percent after adjusting for exchange-rate effects. The EBIT margin from operations rose by more than five percentage points to 8.4 percent. In the **Energy and Building Technology** business sector, sales increased by 2.4 percent to 5.6 billion euros. After adjusting for exchange-rate effects, this was equivalent to 5.1 percent growth. At 4.2 percent, EBIT margin from operations remained more or less unchanged.

The business year 2018 by region

In **Europe**, sales revenue increased by 3.3 percent (4.8 percent after adjusting for exchange-rate effects) to 41.4 billion euros. In **North America**, sales totaled 12.3 billion euros. After adjusting for exchange-rate effects, this 2.7 percent rise equates to an increase of 7.4 percent. In **South America**, business recovered with exchange-rate-adjusted sales growth of 11.6 percent. Sales revenue totaled 1.4 billion euros. In nominal terms, sales fell by 6.2 percent. Bosch now generates almost 30 percent of its total sales in **Asia Pacific (including Africa)**. Sales in this region grew by 3.7 percent to 23.4 billion euros after adjusting for exchange-rate effects. Nominal growth was 0.7 percent.

Headcount development: career opportunities for specialists and executives

As of December 31, 2018, the Bosch Group employed some 410,000 associates worldwide. That is around 7,700 more people than in the previous year. The largest increases in headcount took place in Europe and Asia Pacific. In Germany, the number of associates increased by around 1,700. Bosch now employs just under 70,000 associates in research and development, some 4,000 more than in the previous year. 27,000 associates are software and IT experts. This number is due to increase further. "Over the next five years, Bosch plans to hire almost 25,000 new IT and software experts worldwide," Denner said.

An overview of key figures can be found [here](#).

Press photos: #1361887, #694554, #694562, #1105405, #1138651, #1161716, #1287729, #1351420, #1452374, #1713293, #1852120, #1852121

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The Bosch Group is a leading global supplier of technology and services. It employs roughly 410,000 associates worldwide (as of December 31, 2018). 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.

The company was set up in Stuttgart in 1886 by Robert Bosch (1861-1942) as "Workshop for Precision Mechanics and Electrical Engineering." The special ownership structure of Robert Bosch GmbH guarantees the entrepreneurial freedom of the Bosch Group, making it possible for the company to plan over the long term and to undertake significant upfront investments in the safeguarding of its future. Ninety-two percent of the share capital of Robert Bosch GmbH is held by Robert Bosch Stiftung GmbH, a charitable foundation. The majority of voting rights are held by Robert Bosch Industrietreuhand KG, an industrial trust. The entrepreneurial ownership functions are carried out by the trust. The remaining shares are held by the Bosch family and by Robert Bosch GmbH.

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Bosch key figures for business year 2018

Figures in billions of euros	2018	2017	Year-on-year change nominal (exchange rate-adjusted)
Total sales revenue¹	78.5	76.8	2.2% (5.0%)
– percentage generated outside Germany	79	80	
Sales revenue of business sectors¹			
Mobility Solutions	47.6	46.0	3.5% (5.8%)
Industrial Technology	7.4	6.8	8.8% (11.7%)
Consumer Goods	17.8	18.4	-3.1% (0.7%)
Energy and Building Technology	5.6	5.4	2.4% (5.1%)
Sales revenue in major regions¹			
Europe	41.4	40.1	3.3% (4.8%)
– of which Germany	16.1	15.0	7.0%
North America (including Mexico)	12.3	12.0	2.7% (7.4%)
South America	1.4	1.5	-6.2% (11.6%)
Asia Pacific (including other regions)	23.4	23.2	0.7% (3.7%)
EBIT² (earnings before interest and taxes) as a percentage of sales revenue ²	5.5 7.0	4.9 6.3	0.6
EBIT from operations² as a percentage of sales revenue ²	5.5 7.0	5.3 6.8	0.2
Research and development cost² as a percentage of sales revenue ²	7.3 ³ 9.3	7.0 9.0	0.3
Capital expenditure as a percentage of sales revenue	4.9 6.3	4.3 5.6	0.6
Depreciation of property, plant, and equipment	3.1	3.1	
Equity	39.2	37.6	1.6
Equity ratio (%)	47	46	

Figures in millions of euros	2018	2017	Year-on-year change
Unappropriated earnings (dividend of Robert Bosch GmbH)	242	241	1.0

¹ Adjusted for changes in consolidated group in 2017.

² 2017: figures adjusted due to amended accounting policies.

³ Calculated on the same basis as the 2017 figure (ignoring changes in accounting policy).

Headcount (Dec. 31, 2018)	2018	2017	Year-on-year change
Bosch Group	409,881	402,166	7,715
Europe	249,964	245,040	4,924
– of which Germany	139,422	137,701	1,721
Americas	45,092	44,309	783
Asia Pacific (including other regions)	114,825	112,817	2,008
Associates in research and development (Dec. 31, 2018)	2018	2017	Year-on-year change
Bosch Group	68,715	64,409	4,306
Europe	40,080	37,500	2,580
– of which Germany	30,474	28,678	1,796
Americas	3,247	3,204	43
Asia Pacific (including other regions)	25,388	23,705	1,683



Climate action: Bosch to be carbon neutral worldwide by 2020

Earliest carbon neutrality of any global industrial enterprise

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- ▶ Bosch's carbon-neutral initiative unprecedented in scope and timeframe
- ▶ Investments in plant, buildings, renewable energies, and green electricity
- ▶ More than a billion euros earmarked for energy efficiency

Stuttgart and Renningen, Germany – Bosch is to be fully climate-neutral as early as next year. Its over 400 locations worldwide,¹ and their engineering, manufacturing, and administrative facilities, will no longer leave a carbon footprint. This will make Bosch the first major industrial enterprise to achieve this ambitious goal in a little over a year. “We see climate action as our responsibility, and believe we have to act now,” says Dr. Volkmar Denner, chairman of the board of management of Robert Bosch GmbH. In a bid to swiftly achieve carbon neutrality, Bosch will buy more green electricity in the near term and compensate for unavoidable CO₂ emissions with carbon offsets. In the years to 2030, the company will gradually increase the share of renewable energy in the power that it generates and buys, and will invest a billion euros to boost its locations' energy efficiency.

Once Bosch achieves climate neutrality, it will no longer adversely affect carbon dioxide concentration in the atmosphere. The company is thus making an important contribution to the Paris climate agreement ratified in 2015, which calls for global warming to be kept well below two degrees Celsius above pre-industrial levels. “Everyone has to contribute to climate action,” Denner says.

Swift action to achieve early carbon neutrality

Industrial enterprises such as Bosch can make a significant contribution to the drive for global climate neutrality. According to the International Energy Agency, manufacturing accounts for around 32 percent of global carbon dioxide emissions. As it stands, Bosch emits around 3.3 million metric tons of carbon per

¹ All Bosch Group manufacturing and engineering facilities with 50 or more associates and other locations with 100 or more associates

year. The company has already reduced carbon emissions relative to its value creation by nearly 35 percent since 2007. “We are not starting from scratch. We have consistently exceeded our targets for the relative reduction of carbon emissions. Now the time has come for absolute targets. Let the final countdown begin,” Denner says.

Focusing on sustainable, renewable power supply

Starting in 2020, Bosch will compensate for any residual and unavoidable carbon emissions primarily by buying green power from legacy plants and taking part in carbon offset programs. The company is investing in environmental projects, certified to rigorous standards, aimed at supporting social and ecological development. Carbon offsets are to be gradually scaled back by 2030, and Bosch is stepping up investments in renewable energies to this end. It also intends to enlarge company-owned photovoltaic systems such as those in place at the Nashik and Bidadi locations in India. The company expects to achieve a tenfold increase in installed energy capacity with this move. Bosch will also sign long-term, exclusive supplier contracts with new wind and solar farms around the world, which can then operate profitably even without government subsidies.

A billion euros – and connected solutions – for greater energy efficiency

Enhanced energy efficiency is a powerful tool for achieving carbon neutrality. Bosch will invest a billion euros in the energy efficiency of its plants and buildings over the next ten years. “We want to reduce energy consumption and carbon dioxide emissions in absolute terms, and not just relative to value creation,” Denner says. By 2030, the company plans to save additional energy amounting to some 1.7 terawatt hours per year. This is more than one-fifth of its current annual consumption, and comparable to the amount of electricity consumed by private households in Cologne. Bosch has been vigorously pursuing environmental management practices for years. In 2018 alone, the company carried out some 500 energy-efficiency projects, reducing power consumption by close to 1.5 percent. Connected manufacturing has also become a key efficiency driver. Bosch has already deployed its proprietary energy platform, a part of the company’s portfolio of Industry 4.0 solutions, to more than 30 factories around the world. This platform is a cloud-based software solution that can track and control every single machine’s power consumption.

Climate action pays social and economic dividends

In the years up to 2030, the company will incur one billion euros in added costs by buying green electricity, engaging in carbon offset programs, and sourcing power from renewables. In that same period, Bosch will invest one billion euros to boost in-house energy efficiency. This increase in energy efficiency will save Bosch around one billion euros, thereby bringing the company's expenditure on carbon neutrality down from around two billion to one billion euros by 2030.

"Carbon neutrality is doable and, if pursued with the necessary determination, can be achieved quickly. Our investments benefit not only us at Bosch, but humankind in general as well," Denner says.

A selection of exemplary Bosch projects

The Feuerbach plant – energy efficient thanks to people and machinery

Feuerbach, Germany, is home to Bosch's oldest location worldwide. Established in 1909, it has steadily and systematically modernized its facilities to contribute to the company's overall energy efficiency. With training sessions in its "Energieerlebniswelt" (energy experience world), the local team focuses on energy monitoring and increasing awareness among the workforce. The plant has pursued heat recovery, room automation, machine power shut-off management, and shop renovation projects with great success. Its energy requirements are down more than 50 percent compared with 2007; its carbon emissions – relative to value creation – are down 47 percent.

Crunching data to conserve energy at Homburg

The Bosch location at Homburg, in the German state of Saarland, is edging ever closer to the vision of an energy efficient, self-learning plant. It has spared the world around 5,000 metric tons of carbon dioxide in the past two years and more than 23,000 tons since 2007. This approach pairs maximum transparency with technical innovation. An energy management platform developed by Bosch uses data from the machinery collected at some 10,000 measuring points. Associates can track, control, and optimize each individual machine's power consumption. Technical solutions include ventilation of manufacturing shops on an as-required basis, utilization of waste heat from various machining processes, and smart consumption management for machinery.

Green roofs, photovoltaic systems, and carbon neutrality at Renningen

The Bosch location at Renningen has been carbon neutral since January 2019. Carbon offsets fully compensate for the carbon footprint of the natural gas burned by its heating system. The facility buys green electricity to cover its power needs. And the 460 photovoltaic modules installed on the roofs of buildings generate electricity for the campus's own use. To help control temperatures inside the buildings, roofs on the research campus are covered in greenery; a 3,600 m³ underground cistern collects rainwater that seeps through the plant cover for use in the air-conditioning system's cooling towers. The green rooftops also provide an insulating buffer against direct sunlight and excessive accumulation of heat on the roof. This combination reduces the amount of energy needed to air-condition buildings by 20 to 30 percent. The location also operates a water treatment plant that enables Bosch to conserve around 20,000 m³ of drinking water a year.

Sustainable heating at Rodez

Reduce the site's carbon footprint – that was what the team at Rodez in France set out to do when it started making plans as far back as 2009. The location now has a biomass heating plant, up and running since 2013. It burns wood chips obtained from local certified sustainable forestry resources. Rodez uses its power to heat water and generate process heat. On average, the wood chip-fired plant covers 90 percent of the location's heating requirements. It consumes some 6,600 metric tons of wood chips a year. Burning this biomass releases no more carbon than the trees had taken from the atmosphere. The factory has reduced its yearly emissions by around 600 tons.

Reducing the carbon footprint at Bidadi and Nashik, India, with power generated on site

Bosch India is pursuing carbon neutrality by tapping locally available, natural sources of energy. Spurred on by the idea of supplying the location with fully renewable power during daytime hours, the team at the Nashik location began installing its first photovoltaic systems in 2015. It now has 50,000 solar panels in place on roofs, parking lots, and the grounds to generate around 20 percent of the power required by the plant each year. The facility has reduced its carbon emissions by some 23,000 tons and saved around 25,000 megawatt hours of energy since 2015. This is equivalent to the power consumed by some 23,500 Indian households. Bosch experts have also developed an eco-friendly solution for cleaning the modules: water is recycled several times and purified using environmentally sound methods.

The Bidadi plant, located around 1,100 kilometers south of Nashik, has also embraced solar power. This location is able to cover around 30 percent of its energy needs with a photovoltaic system that also offers a further benefit: it provides ideal conditions for growing vegetables and herbs to keep the plant's cafeteria well stocked with local produce. The sun is not the only resource put to good use at this location, which also channels rain into a small lake to replenish the water supply for the local population.

Renewables as the main source of power for Bosch in Mexico

Mexico has revamped its energy policy. An energy reform launched there calls for the country to source 35 percent of the electricity from non-fossil fuels by 2024. With many hours of sunshine annually and high-wind regions, Mexico's geography and climate would certainly support that goal, providing a solid foundation for change alongside committed support from government and business. Bosch is part of this movement, and has already set a high standard: power sourced exclusively from the Dominica wind farm in the state of San Luis Potosí covers more than 80 percent of the energy requirements of all Bosch locations in Mexico. Bosch Mexico was able to save 56,000 metric tons of CO₂ in 2018 by switching to predominantly renewable energies.

Press photographs: #1854170, #1848394, #1848454, #535824, #1849869

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**Bosch embraces sustainability:
climate neutrality worldwide by 2020
and new solutions for better air in cities**

Presentation by Dr. Volkmar Denner,
chairman of the board of management, Robert Bosch GmbH,
and Prof. Stefan Asenkerschbaumer,
deputy chairman of the board of management,
at the annual press conference on May 9, 2019

Check against delivery.

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There are images, ladies and gentlemen...

...that can change how we see the world. So it was almost exactly 50 years ago with the *Earthrise* photo, which shows the Earth peeking out from beyond the lunar surface. More than anything else, it is an image of the vulnerability of our blue planet. Its effects continue to be felt to this day – up to and including this annual press conference, to which I wish to welcome you.

More than ever, we're concerned with the question of what companies can do to prevent our blue planet from overheating. Specifically, we want to quickly reduce a certain number to zero: the 3.3 million metric tons of CO₂ emissions Bosch produces every year. For the continued existence of our civilization and of our economic system, climate action is a crucial undertaking. Companies like Bosch must also act without delay. Today, therefore, we would like to announce our own corporate moonshot project. By 2020, all Bosch locations worldwide will be completely carbon neutral. Let me be clear: I mean that all our locations worldwide, not just German plants or new buildings, will effectively never again leave a carbon footprint. In a little over one year, we will be the first major industrial enterprise to achieve this ambitious goal.

Climate change is not science fiction. It's really happening. But all too often, the grand goal of climate action is seen as just a long-term aspiration – one that, when it comes down to it, should not cost our generation anything. Bosch is taking a different view, and swiftly and boldly investing in the future of our blue planet, and thus in its own future as well. Put simply, we will be spending a billion euros on carbon neutralization by 2030. Global warming is not something that will miraculously solve itself by the end of the century thanks to the power of wishful thinking.

Such a “happily ever after” scenario will not materialize if energy consumption and CO₂ emissions continue to set new records, such as those just confirmed by the International Energy Agency for 2018. Climate action certainly requires staying power, but equally it calls for immediate measures – and last but not

least it needs the determination of companies like Bosch to aim for carbon neutrality, not at some distant point in the future, but here and now.

- However, environmental protection is about more than climate action. I will also be addressing Bosch's efforts to improve urban air quality as part of my strategy overview. We see ourselves as having responsibility that is both global and local.
- First, however, let us look back at Bosch's financial performance over the past business year. Despite a cooling economy, Bosch sales and result once again reached record levels in 2018.
- Our sales and result forecasts for the current business year are cautious. The economic outlook for 2019 is subdued. In addition, there are growing risks from trade barriers across the globe.

Mr. Asenkerschbaumer will now discuss Bosch's business performance this year and last in more detail.

**The business situation of the Bosch Group:
Good progress in 2018, subdued outlook for 2019**

Ladies and gentlemen,

I would now like to walk you through the key financial figures. As Mr. Denner said, our company developed well overall in 2018, despite an ever stronger headwind in the automotive market, which is currently gathering force.

First of all, let's take a look at last year's macroeconomic conditions:

- On average for the year, the global economy developed better than expected in 2018. Global GDP grew by 3.2 percent, almost as much as in 2017. However, the global economy slowed down as the year progressed.
- Moreover, the development of worldwide automotive production was already much less positive in 2018. We had expected slight growth here, but in fact production fell by around 1 percent to 97.3 million vehicles. One important factor was the slump in automotive production in China, the first time this had happened in decades.
- By comparison, mechanical engineering experienced a robust recovery, even if here, too, there was less momentum than in the previous year.
- The growth in global private consumption was at a level similar to last year's, although it lagged behind expectations, particularly in China.
- In addition, the growth in global construction activity decreased slightly year on year.

Against this backdrop, Bosch Group sales developed well. Without consolidation effects, we were able to increase sales by 2.2 percent to 78.5 billion euros; after adjusting for exchange-rate effects, this figure is 5 percent. Accordingly, once adjusted for exchange-rate effects, sales growth exceeded our forecast. The consolidation effects of 1.3 billion euros mainly relate to the carve-out of the former Starter Motors and Generators division at the end of

2017. In addition, the exchange-rate burdens of 2.1 billion euros in 2018 were far above average. If we include consolidation effects, sales increased by 0.5 percent; adjusted for exchange-rate effects, the increase was 3.2 percent.

How was performance by business sector and region? Again, the most significant figure is growth adjusted for consolidation effects.

In these terms, our largest business sector Mobility Solutions increased its sales by 3.5 percent to 47.6 billion euros; or by 5.8 percent after adjusting for exchange-rate effects. This positive result was achieved despite a challenging market environment, thanks to a variety of product successes ranging from systems and components for exhaust-gas treatment, transmission technology, and driver assistance systems to attractive solutions for e-bikes, motorcycles, and commercial and off-highway vehicles. But we too felt the considerable slowdown in automotive production in China; on top of this, power-train technology was affected by the continued decline in the proportion of newly registered diesel vehicles in Europe.

The Industrial Technology business sector was very successful, increasing its sales by 8.8 percent to 7.4 billion euros; after adjusting for exchange-rate effects, this was a double-digit increase of 11.7 percent. This growth was driven by the Drive and Control Technology division, which developed very well following a successful realignment. Connected Industry 4.0 solutions also played an important role. As reported, after intensively and thoroughly considering all strategic options, we have decided to sell our packaging machinery business. The divestment process is currently underway.

In Consumer Goods, performance was modest. Sales fell by 3.1 percent to 17.8 billion euros; after adjusting for exchange-rate effects, they increased slightly, by 0.7 percent. BSH Hausgeräte was hit somewhat harder than Power Tools by the decline in sales and by exchange-rate effects, which were particularly pronounced in this business sector. By contrast, the Energy and Building Technology business sector continues to grow, with sales rising

in 2018 by 2.4 percent to 5.6 billion euros, or by 5.1 percent when adjusted for exchange-rate effects.

Business performance also varied widely by region. Sales growth was encouraging in Europe, increasing by 3.3 percent, or 4.8 percent after adjusting for exchange-rate effects. If we take the exchange rate-adjusted growth figures as the basis, then the Americas grew the fastest. Our sales in North America rose 2.7 percent to 12.3 billion euros, or by as much as 7.4 percent after adjusting for exchange-rate effects. In South America, business also recovered with exchange rate-adjusted sales growth of 11.6 percent. Nominally, however, sales fell again by 6.2 percent to 1.4 billion euros. With an increase of 0.7 percent to 23.4 billion euros, and of 3.7 percent after adjusting for exchange-rate effects, growth in Asia Pacific including Africa has slowed considerably compared to previous years. A main reason for this is the weak development in China, where automotive production fell in 2018 for the first time in roughly two decades – and by a hefty 4 percent at that. In Africa, incidentally, we managed to surpass 500 million euros in sales, partly on account of the complete takeover of a Bosch Rexroth joint venture in South Africa.

Despite the falloff in automotive production and substantial upfront investments in areas of future importance – whether in the form of research and development spending or capital expenditure – we again managed to increase our result from operations year on year, from what was already a high level. In the Bosch Group, we generated an EBIT from operations of 5.5 billion euros in 2018 compared to 5.3 billion euros the previous year, and an EBIT margin from operations of 7.0 percent compared to 6.8 percent the previous year. As in previous years, the impact from depreciation and amortization in connection with the full acquisition of the former joint ventures BSH Hausgeräte and Automotive Steering in 2015 has not been not factored into the result from operations.

The EBIT reported in the statement of income also rose to 5.5 billion euros, compared with 4.9 billion euros the previous year. This is also due to a non-

recurring extraordinary effect resulting from a change in accounting standards, and more specifically to the changed reporting of the company pension scheme with regard to additional benefits in the event of disability or death. The good result also led to a further increase in the equity ratio to 47 percent from the previous year's already high level of 46 percent.

Moreover, all business sectors contributed to the good result from operations. In Mobility Solutions, EBIT from operations amounted to some 3.4 billion euros. Despite heavy upfront investments, this matched the previous year's level, while the margin from operations was slightly below the previous year's level. Industrial Technology saw its EBIT rise sharply to around 630 million euros and its margin increase to over 8 percent. Despite the drop in sales, the Consumer Goods business sector was able to achieve high levels for both result and margin, with 1.4 billion euros and 7.8 percent respectively. Energy and Building Technology achieved a result on a par with the previous year's level.

Moving on to research and development spending, we once again increased our upfront investments substantially in 2018. However, a portion of that – the development work charged directly to customers – is no longer recorded as development cost. Under the revised IFRS accounting standards that apply to the 2018 financial statements, this is now disclosed under cost of sales. But to give you an idea nonetheless: if the same standards had applied, our research and development expenditure would have increased by some 300 million euros to approximately 7.3 billion euros. Under the new accounting standard, research and development cost for 2018 amounts to 6 billion euros. The Mobility Solutions business sector accounted for three-quarters of our research and development spending. Key areas for upfront investments in this sector are electrification, automated driving, display and infotainment systems, and sensors.

Our comprehensive upfront investments in the future are also apparent in our capital expenditure, which rose significantly to 4.9 billion euros compared to

4.3 billion euros the previous year. The increase in capital expenditure in the Mobility Solutions business sector was particularly pronounced. The main focus areas were electromobility, automated driving, and our new wafer fab for 300-mm technology in Dresden.

So much for the good business year in 2018. The outlook for 2019 is decidedly more subdued.

We are skeptical about the prospects not only for the global economy, but also for most of our major market segments. Only in global construction activity do we expect the rate of growth to remain unchanged, albeit with regional differences. Accordingly, we are expecting growth of global GDP growth to slow considerably in 2019, to just 2.3 percent. In addition, the risks posed by the worldwide trade disputes, the high levels of debt in major European countries, and the Brexit situation remain high.

Particularly affected by the economic slowdown is our largest market, the automotive sector. We expect automotive production to fall by 3 percent to 94.7 million vehicles. This will be the first time that production figures have contracted in two successive years since the financial crisis. In fact, figures will probably drop below 2016 levels. This trend affects all regions. In Asia, another sharp decline in China and much slower growth in India will play a major role. But in Europe and especially in Germany, we expect automotive production to decrease considerably. In North America, we expect production to be slightly weaker.

At Bosch, we are also feeling the effects of this business climate. In the first three months of 2019, Bosch Group sales were nearly on a par with the previous year. For the year as a whole, we currently expect sales to be slightly better than the previous year. EBIT margin from operations should be some 6 percent – partly due to substantial upfront investments in areas of future im-

portance, but also due to the costs associated with our company's transformation. And speaking of "the future," I would like to hand over to Mr. Denner again.

Bosch strategy and logic: "Invented for life"

...Thank you, Mr. Asenkerschbaumer. In my remarks about Bosch strategy, I will show just how serious we are about our "Invented for life" imperative. We firmly believe that we can make the world a better place with more technology. And environmental questions also call for technological answers. Even when faced with negative consequences of technology, such as the risk of accidents on our roads, we respond positively with new and improved technical solutions. That is the logic of Bosch – and the best thing an innovative company can do.

Specifically, we are currently focusing on two topics:

- First, the issue of climate change is becoming more pressing than ever before. Rising sea levels, extreme weather conditions, droughts, flooding – I don't need to spell out the foreseeable consequences of climate change here. But this much I will say: they endanger the stability of our world. A company like Bosch, which wants to improve people's lives with technology, cannot ignore this. Consequently, we are taking a fast route to carbon neutrality in all our locations worldwide.
- As well as climate action, Bosch wants to make a contribution to air quality – and that is my second sustainability topic. A lot of things have improved over the past decades, yet the WHO still cites air pollution as the greatest environmental threat to human health. According to the OECD, it also causes major economic damage: health costs in particular are set to increase worldwide from 21 billion dollars at present to 176 billion dollars by 2060. Studies like these assume that no progress will be made, but this makes us want to do even more. Confirmation for this point of view comes in the form of the recommendations made by the Leopoldina academy of sciences to the German federal government. It says that

driving bans fall short of the mark, and that what is really needed is a traffic sea-change.

Responsibility here and now:

Bosch to become first carbon-neutral industrial enterprise by 2020

But first, let us look at carbon dioxide, which is obviously not a contaminant in our air, but the principal greenhouse gas. Like no other topic, climate change epitomizes the ecological side of globalization. And hardly anything else is as symbolic of global responsibility as the Paris Climate Agreement. However, the temptations to shift responsibility are unmistakable – whether into the future, as the changes are in any case long term, or into other people’s backyards – polluters who, either in fact or allegedly, emit more CO₂. Bosch is countering this with its “here and now” approach.

Climate change waits for no one. We must respond in shorter timeframes to reach the Paris targets: limiting the temperature increase in the Earth’s atmosphere to a maximum of 2 degrees Celsius by 2100, and if possible to 1.5 degrees, compared to pre-industrial levels. The latest special report by the Intergovernmental Panel on Climate Change (IPCC) calls us even more urgently to action. According to the report, the 1.5-degree target only has a chance of success if global energy consumption becomes carbon neutral by the middle of our century. It is precisely this carbon neutrality that Bosch wants to achieve – not in 2050, not in 2030, but in 2020. It wants to become the first industrial company with locations around the globe to accomplish this.

Why do we think we can do it? Well, partly because we have clearly exceeded all our CO₂-reduction targets up to now. In 2007, Bosch undertook to reduce the CO₂ emissions of its locations by 20 percent relative to value added by 2020. We achieved this goal by 2014, in just half the time. So we decided to raise our target to a reduction of 35 percent. And we will achieve that, too. After all, last year the CO₂ emissions of our locations, measured as

a proportion of value added, were some 30 percent lower than the baseline value twelve years ago. The question that then arose was what we would do beyond 2020. Making all locations carbon neutral – we initially discussed this possibility with an eye to the next decade. But prompted by the latest IPCC special report, the scientific discussion grew more intense again. Against this backdrop, we moved up the deadline for Bosch’s major climate-neutrality goal from 2030 to 2020. The calculations show that it is possible. So what are we waiting for?

**Climate action is taking concrete shape:
Rapid measures by 2020, further refinement by 2030**

Basically, we can apply four levers in striving for our goal: one, increase energy efficiency; two, expand our supply of green energy; three, procure more green electricity; and four, offset unavoidable CO₂ emissions. We will be moving the latter two levers more in the near future, and beyond next year, we will increase our use of the other two. This means that we can reach our major goal of carbon neutrality next year, but we won’t then discontinue our efforts to achieve a transition to a green energy economy. Instead, we will further improve the quality of our climate action.

But what will we be doing up to 2020? We will be stepping up our energy-saving efforts right from the start, which I’ll say more about in a moment. However, it is impossible to immediately and radically reduce Bosch’s energy consumption – in 2018, it was around 7.8 terawatt hours, which is equivalent to the annual power consumption of all the private households in Berlin and Munich put together. But it is possible to completely neutralize the corresponding CO₂ emissions – some 3.3 million metric tons last year. We will be using two rafts of measures in particular to counterbalance these emissions next year:

- First, by buying in green electricity, we will be ensuring our energy mix is much greener than the current worldwide energy mix. According to our

plans, this bought-in energy will make up almost 40 percent of our energy consumption. And by green electricity, we mean sourced from existing solar or wind farms, and no fossil energy sources.

- Second, we will seek to offset just under 40 percent of our energy consumption. The reasoning behind this is clear: we are ensuring that the same amount of CO₂ emissions that is still unavoidable in a foundry, for example, is avoided somewhere else. Wind farms in the Philippines and the Caribbean, forest conservation in Africa, reforestation in Panama, taking emissions of the greenhouse gas methane and converting it into electricity – with measures like these, we are already offsetting all our natural gas consumption in Germany this year. Very importantly, these projects promote social as well as environmental development, and are certified by independent third parties according to strict standards.

It is above all these two levers that will bring Bosch's carbon footprint down to zero by 2020. But we're not stopping there: instead, in the years up to 2030, we'll be increasing the ecological quality of our carbon-neutrality measures. For example, we're planning to roll back the proportion of green electricity we buy in from existing plants. Instead, over the next decade, two other levers will come to the fore:

- First, we want to increase energy from renewables as a proportion of our power consumption to as much as 40 percent. To this end, we're also expanding our own photovoltaic plants – indeed, recently we built the largest plant of this kind in the Indian automotive industry at our Nashik site. In total, the installed capacity of our on-site renewable energy supply will increase tenfold by 2030. In addition, we're backing "new clean power." That means we are concluding long-term, exclusive supplier contracts with new wind and solar farms. We're also seeking to sign such contracts outside Germany. In Mexico, we're already covering over 80 percent of our energy demand with such new clean power.
- Second, we're striving to cut energy consumption by 1.7 terawatt hours, more than a fifth of our current annual consumption, equivalent to the

power consumption of all private households in Cologne. Energy efficiency is hard work, but we will not stop once we reach carbon neutrality. On the contrary, our efforts are more ambitious than in earlier years, as we want to reduce energy consumption and CO₂ emissions in absolute terms and no longer just in relation to value added. We will therefore reduce our consumption by 1 to 2 percent each year up to 2030 – something we managed to do in 2018 with almost 500 energy-efficiency projects. We're well on our way, and it's worth noting that the significant progress we're making is coming from the cumulative effect of many small projects. These include measures like heat recovery and on-demand ventilation and cooling. Moreover, connectivity in manufacturing has now become a main driver of efficiency. We're already using the energy platform from our Industry 4.0 solutions portfolio in more than 30 plants around the globe. This allows the plants to monitor and control the power consumption of each individual machine. In Homburg, more than 10,000 measurement points are connected via the platform. The result on site: almost 5,000 metric tons of carbon dioxide have been saved over the past two years alone – a reduction of 11 percent. Because of the success of the solution internally, we're also marketing it externally.

Viewed systematically, two of our major strategic fields converge here: energy efficiency and connectivity. Energy efficiency has always been a driver of innovation at Bosch. Since the first oil crisis in 1973, energy-saving priorities have been at the forefront of our product development. At that time, we first launched our "3S" program to make driving safer, cleaner, and more economical, or "sicher, sauber, sparsam." That was the starting point of our "Invented for life" strategy, which is now the guiding principle for all the business sectors in our portfolio. When we tap the market of the connected world today, then we do so again with three S's – with know-how in sensors, software, and services. This also results in all kinds of efficiency solutions, and not least with regard to energy efficiency. It is precisely here that Bosch makes climate action technically feasible and commercially viable.

Climate action pays off:

energy efficiency makes environmental goals economically attainable

There remains the question of how our efforts to achieve climate neutrality will pay off over the coming years. Once again, energy efficiency is key.

There are three main points in particular in our model calculation up to 2030:

- First, we will incur added costs of a billion euros for buying in green power, offsetting CO₂, and increasing our supply of renewable energy.
- Second, we will invest a billion euros in increasing our energy efficiency.
- Third, we will save a billion euros by virtue of increasing energy efficiency. After all, every kilowatt hour we do not consume avoids CO₂ and saves money at the same time. Ultimately, then, the cost of the carbon-neutrality project will be reduced to one billion euros.

That said, we're very much aware that the value of climate action goes far beyond such considerations. The foremost of Bosch's values is future and result focus – and it is precisely this value that we're re-imagining and placing in a wider context. We think that a company like Bosch should also focus on the future of its environment. Whenever we forgo revenue, then it's generally in favor of upfront investments in research and development: that is, for the business of tomorrow. But climate action also needs upfront investments – this time for the future of our blue planet. And yet we're not splashing out wildly, as business sense and environmental action converge in the topic of energy efficiency. And one of the reasons why we're laying bare our calculations is because we hope that other companies will follow our example.

Beyond the car hood:

Bosch works to improve air quality, also with new solutions for mobility

Finally, ladies and gentlemen, climate action hinges on global efforts – but the air we breathe can only ever be improved locally. Nonetheless, the quality of air in cities around the globe is a no less pressing issue – and Bosch has

things it can contribute, as I will show in my second topic. Last year at this point, we reported on our breakthrough in diesel technology. And we have further progress to show this year. At the same time, however, we're looking beyond the car's hood, working together with cities to develop clean air solutions that are aimed at road traffic as a whole.

But first of all, what progress have we made beneath the hood? We've made our breakthrough in diesel technology even more robust – bringing emission levels down even lower, including in critical driving situations. These advances are being incorporated into all customer projects for upcoming diesel vehicles. Even now, some of them feature in production vehicles, as is attested by 70 independent test reports: they state that 84 percent of newly tested diesel vehicles fall well within the emissions limits that will apply only as of next year. The emissions from modern internal-combustion engines will no longer make any appreciable contribution to air pollution in our cities. Particulate emissions are also no longer an issue – neither for diesel nor gasoline engines.

Nonetheless, we're continuing the work, which includes going above and beyond upcoming emissions standards. Although we estimate that around 25 percent of new cars and light commercial vehicles on the world's roads will be all-electric by 2030, the flipside of this is that some 75 percent will still have an internal-combustion engine on board. In addition, environmental legislation is getting tighter across the globe. This is serving to drive technological development. To this end, we're employing artificial intelligence as part of our approach – for example, to predictively control exhaust-gas treatment according to patterns in individual driving behavior. The growing legal requirements are also acting as a market driver. For example, exhaust-gas treatment and exhaust sensor technology are two growing business units at Bosch – they currently employ 3,500 associates worldwide and collectively generated sales of 2.3 billion euros in 2018. This figure is set to reach 3 billion euros by 2025.

With the expertise from these business units, we're now also developing mobile analyzer units to continuously measure urban air pollution. We're already testing them in the Stuttgart metropolitan area as well as in Paris and Marseille. In addition, we use the driving behavior of individual cars to draw reliable inferences from the vehicle fleet as a whole and thus derive the emissions for the current traffic situation. To do this, we work with simulation models. In the future, we want to gain a much better understanding of the relationship between emissions and air pollution: that is, between road traffic and the environment.

In the end, the question is how traffic needs to change to bring about an improvement in air quality. This is precisely what we want to determine with our analyzer units used in conjunction with the simulation models. For example, we've been able to demonstrate that steady traffic flows can lead to an almost 20 percent reduction in pollutants. In the future, it will be possible to create new services based on the data from mobile analyzer units. This can include things like high-resolution pollutant concentration maps, which would permit more precise traffic management. It is our goal to provide the necessary data and services. This is just one example of how we can improve the air quality in cities with a broader approach. Our vision is a smart city that will also be a clean city.

Bike-leasing, ridesharing, telecommuting:

Bosch associates in cities can leave their cars at home

We recently set up a new project at Bosch to pursue the vision of near-zero air pollution from traffic. The project brings together what we're doing for air pollution in cities both beneath and beyond the car's hood – that is, the development of extremely low-pollutant powertrain technologies coupled with approaches to achieve steady traffic flows. Another pillar of the project is our company mobility management system. We may be automotive suppliers, but specifically in conurbations we help our associates leave their cars at home. This begins with shuttle buses that we run for our large locations – and incidentally not just in the Stuttgart region, but also in Brazil, China, India, and Turkey. It also encompasses new measures, such as those we are initially trialing in the Stuttgart metropolitan area. In addition, we have formed a Clean Air Alliance with other employers. Three examples show how we're changing the mobility of our associates:

- First, you don't need four wheels to get places quickly in conurbations. We offer our associates an attractive leasing model for bicycles and pedelecs and pay a subsidy for them.
- Second, we support telecommuting wherever possible. One in five associates in the Stuttgart metropolitan area works from home on average one day per week – that avoids trips to and from work and helps the environment and families alike.
- Third, we're bringing connectivity to commuting. We're already trialing the SPLT ridesharing platform in Mexico, and now we are introducing it in the Stuttgart metropolitan area, too. To begin with, the associates at our Reutlingen location have been able to use the ridesharing app since March. Harnessing connectivity for commuting is another effective way of reducing traffic.

**The mobility of tomorrow also helps improve air quality:
Bosch delivers progress in automated and electrified driving**

The last example suggests how we will take the progress we make in the mobility of the future and apply it toward the goal of improved air quality. Our engineers are working on three development paths – making driving not only connected, but automated and electrified as well. On these three strategic paths, we're making huge strides:

- First, automated driving – this also helps reduce consumption and emissions, already by virtue of the positive impact its steady driving speeds have on traffic flows. Above all, however, it can avoid one in every four accidents that result in injury, according to our accident researchers. So right from the start, we see that automation furthers sustainable mobility in two ways. We're pushing forward this development – with upfront investments totaling 4 billion euros by 2022, and with more than 5,000 engineers, twice as many as two years ago. This is a strong team that is already getting a front camera with artificial intelligence ready for production this year. The camera understands what it sees. Its artificial intelligence, for example, infers from a pedestrian's movement whether they are going to step out into the road or not, making the reaction times of automatic emergency braking even faster. Moreover, our developers are working together with Daimler on driverless robotaxis, such as the ones we will be testing in San José, California, before the year is out. It's very important here that legislation in Germany and Europe keeps pace with this rapid technological progress. Lawmakers must ensure that each subsequent level of automated driving functions is given the green light on European roads as well. In any case, the path to automation is already a commercial success. Its starting point is driver assistance, with which we'll also grow by 15 percent in 2019, with sales of around 2 billion euros. Sales of radar sensors alone will grow 20 percent this year, and those of video sensors by 30 percent. Technologically and commercially,

we're leading the way in driver assistance. It is an area of future promise that's already a growth area for us today.

- In the area of electric driving as well, we are growing rapidly. By 2025, we expect to generate 5 billion euros of sales in this field, ten times what it was in 2018. At the same time, however, we foresee growing competition for value added in the powertrain of the future. One reason we see opportunities for Bosch here is the unique economies of scale that enable us to supply a large number of automakers. Bosch powertrain components already feature in over a million electric cars around the world. By the end of 2022, this number is set to rise to nearly 14 million. We've already carried out powertrain projects for 50 electric vehicle platforms; last year alone, we managed to acquire 30 new projects worth a total of nearly 8 billion euros. Accordingly, we can say that our development work for electromobility is thoroughly energized. It's not enough that we offer powertrain technologies from bikes to trucks – we doing this on a technology-neutral basis. For example, we're preparing for the breakthrough of fuel-cell technology in cars, and particularly in trucks. Just recently, we entered an alliance with Powercell, a Swedish manufacturer of fuel-cell stacks. Such stacks convert hydrogen into electrical energy and make up two-thirds of the value of a fuel-cell system. Through the alliance, we want to commercialize the stacks; that means manufacturing them cost effectively and launching them by 2022 at the latest. Whatever the technology behind electric driving, it is emissions-free if the electricity is generated from renewable energy sources. Last but not least, because electric cars largely use regenerative braking, we're also able to reduce brake dust with them by over 95 percent. And this brings us back nicely to air quality in cities.

**Companies don't have to wait for politics:
environmental and climate action without abandoning growth**

Ladies and gentlemen, a company like Bosch has to understand and realize sustainability primarily in technological terms. From brakes to artificial intelligence, we're exploring all innovative possibilities. We want to do more for air quality than we have to. And beyond that, I'm convinced that it's time to take unconventional approaches to climate action. It's a subject that affects everyone, but it's not enough if everybody waits for others to make the first move. Everyone has to play their part. And a company like Bosch is not prepared to wait any longer either. The manufacturing industry must not of course lapse into environmental activism, but it can nonetheless be environmentally active – and its technological capabilities will make it particularly effective. To this end, it's vitally important that we should not have to abandon growth – not even for the goal of carbon neutrality. As Bosch is demonstrating, energy efficiency helps bring climate action and cost effectiveness down to a common denominator, showing us that with innovative environmental solutions, it is still possible to achieve growth. Consequently, we can absolutely strike a commercial balance between economic and ecological responsibility. But it's about more than that, including the responsibility we bear for the stability of our society. The yellow vest protests in France, the demonstrations by diesel drivers here in Stuttgart – both these phenomena indicate that large sections of the population believe that environmental protection and climate action cannot be reconciled with economic necessity. Although companies cannot provide direct political answers, they can ease the strain on politics with their technical solutions. If we successfully manage to bring about climate action that makes business sense, if we manage to noticeably improve the air quality in cities with new solutions for engines and transport, then we will also stabilize the social climate.

At Bosch, we take on responsibility – beyond the boundaries of our company – true to the example set by Robert Bosch.



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

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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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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, 2018). 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



Bosch campus for research and Advanced engineering in Renningen

May 2019

- ▶ Amount invested Roughly 310 million euros
(of which 217 million euros for construction work and 93 million euros for machinery and technical equipment)
- ▶ Start of construction work June 2012
- ▶ Inauguration October 2015
- ▶ Plot 100 hectares in total, of which currently 43 hectares are developed
- ▶ Buildings 14, including main high-rise building (60 meters high, 12 stories), 11 laboratory and workshop buildings (between 10 and 19 meters high, 2-3 stories), and 2 service buildings
- ▶ Associates on site Roughly 1,900 associates (including Böblingen satellite facility)

Research and Development at Bosch

- ▶ Associates Some 68,700 researchers and engineers worldwide, 1,700 of them in the corporate sector for research and advance engineering
- ▶ Locations International research network of the corporate sector for research and advance engineering comprises 12 locations in 8 countries (Sunnyvale, Pittsburgh, Boston, Hildesheim, Renningen, St. Petersburg, Moscow, Bangalore, Tokyo, Shanghai, Singapore and Tel Aviv); other engineering activities related to the development of products and production projects at some 130 locations worldwide
- ▶ R&D expenditure 7.3 billion euros (roughly 9.3 percent of Bosch Group sales) were invested in research and development in 2018