Press release

Bosch aims to generate billions in sales with green tech for industry

Technology supports ecological transformation of business and society

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- In 2021, Bosch generated sales of over 800 million euros with environment- and climate-friendly industrial technology.
- By 2023, the company aims to generate sales running into the billions from green tech for industry.
- Bosch is employing smart Industry 4.0 software to control climate-neutral manufacturing operations.
- Bosch is developing modular, energy-efficient systems and machinery for sustainable factories.
- Bosch manufacturing technology for batteries and fuel cells will help transform mobility.
- Rolf Najork: “Industry will become a driver of ecological transformation in business and society.”

Stuttgart, Germany – In the fight against climate change, technology is paving the way, and Bosch is at the forefront of these endeavors. In February 2020, Bosch became the first global industrial company to achieve carbon-neutral production. It is developing green technologies that conserve resources, reduce energy consumption, protect the environment, and mitigate global warming. “Industry will become a driver of ecological transformation in business and society. Bosch is mobilizing all its resources and contributing its technological know-how and many years of manufacturing expertise,” says Rolf Najork, the member of the Bosch board of management responsible for industrial technology. In 2021, green tech for industry generated sales of over 800 million euros for the company. That is just under 14 percent of the total sales of Bosch’s Industrial Technology business sector (6.1 billion euros in 2021). The green tech market is growing by 8 percent annually (source: BMU, 2021). “Bosch is growing faster than the market. By 2023, we want to break the one-billion-euro mark in sales of green industrial technology,” Najork says. Ecological transformation is paying off: according to the VDMA, the association of German machinery and

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equipment manufacturers, the systematic use of green tech can cut industrial greenhouse gas emissions by almost 90 percent (source: VDMA, 2020). The VDMA study also says that by 2050, the expansion of climate-friendly technologies in the industrial sector will create a market potential of over 300 billion euros a year. At Hannover Messe (May 30–June 2, 2022), Bosch will be presenting its green tech solutions – from industry, for industry, and beyond.

Green factories: digitalized and connected

Mitigating climate change is a challenge for society as a whole. The industrial sector accounts for around one-fifth of global CO_2 emissions. “Industry must and can play a crucial role in environmental and climate action,” Najork says. “Far from being a pipe dream, green factories are a reality. All we need now is more of them.” Energy efficiency is a key lever, helping machinery and equipment to consume less energy. This is where digitalization comes in. It also helps pinpoint where energy is being consumed. To manage the consumption of heat, electricity, and compressed air, Bosch relies on its own Energy Platform in combination with Nexeed Industry 4.0 software. This makes it easier to predict energy consumption, avoid peak loads, and recognize and correct deviations in individual machines. The platform is now used at more than 120 of the company’s locations and in more than 80 customer projects. In Bosch’s Industry 4.0 lead plant in Homburg, Germany, this software is helping cut energy requirements by over 40 percent per manufactured product. Artificial intelligence offers even more possibilities. At its Eisenach plant, also in Germany, Bosch is currently piloting its Balancing Energy Network. Based on the Energy Platform, this AI solution manages and optimizes the energy requirement of 1,000 machines. The AI shows how production and logistics data, weather information, and energy prices relate to each other and offers recommendations for action. AI is expected to help further lower the location’s annual energy costs by around 5 percent.

Efficient machinery: higher performance, lower consumption

Connecting machinery and processes intelligently and dovetailing them with information and communications technology creates the basis for energy-efficient production. Increasingly, this involves relocating functions from hardware to software, augmented by digital twins. “In the factory of the future, it will be possible to adjust many things at the touch of a button,” Najork says. Here, Bosch takes a modular approach. The only static elements of such a factory will be the floor, ceiling, and walls. Everything else will be dynamic and variable, with machines constantly rearranging their constellations and changing their configuration, depending on the job in hand. As a result, plant and equipment will last longer, and the amount of raw materials used in the production of new hardware will decrease. Digital twins provide ways of designing, developing, and

testing production systems to make them more resource-efficient. “Virtual copies of physical assets in the real factory allow us to simulate and optimize workflows and processes – and this without interrupting operations,” Najork says.

One striking example is ctrlX Automation, the new Bosch Rexroth control technology, with its app technology and web-based engineering. This allows the volume of all automation components to be reduced by up to 50 percent on average. What’s more, the drives weigh up to one-third less. The lighter the hardware, the less drive power and energy are required. Three years on from market launch, more than 300 customers are already using this Bosch automation technology, which works like a smartphone. The company is even rethinking hydraulics and unlocking its potential: machine tools, injection molding machinery, and presses often use smart hydraulic power units such as Bosch Rexroth’s CytroBox. The integrated variable-speed pump drive reduces energy consumption and electricity costs by up to 80 percent compared to conventional drives. CytroBox’s load-dependent control means that it is always in the optimum operating mode. It switches to standby mode when not in use.

Sustainable industries: the basis and the trailblazers of the green economy

German companies are among the leading providers of environmental technology, making up 15 percent of the global green tech market. Pre-eminent among these German companies are manufacturers of machinery and equipment – this sector has the largest share of the German green tech market (source: BMU, 2021). “Establishing a green economy hinges on industry. It’s where the innovations will be developed that sustainably shape not only industry, but also a variety of other sectors,” Najork says. To take the example of mobility: Bosch is the world’s biggest automotive supplier, and the innovation leader in electric driving. No other company offers such a broad portfolio – from e-bikes, to passenger cars, to commercial vehicles. Bosch Rexroth is taking this one step further and accelerating the electrification of mobile machinery such as excavators, forklifts, and tractors. Volume production of electric motors for off-highway applications is scheduled to start in the second half of 2022. But Bosch is also one of the leading suppliers of factory equipment. The company supplies both its own factories and those of its customers with machinery and equipment. It will only be possible to transition to electromobility if high-quality energy storage systems are developed that are sustainably produced and then recycled. For the production and recycling of battery modules and packs, Bosch offers everything from a single source, ranging from individual components and systems solutions to complete assembly lines. Together with Volkswagen, Bosch is looking to develop factory equipment for producing the core component of electromobility: the battery cell. A project unit is currently examining the market

and is tasked with verifying and preparing the establishment of a new company by the end of the year.

In addition to batteries, hydrogen-based fuel cells will power the mobility of the future. Bosch's special-purpose machinery unit supplies efficient manufacturing and testing technology tailored to the individual requirements of automakers and suppliers, as well as customers from the aviation industry. For example, this year Bosch will equip the manufacturing facility operated by its partner Nikola in Arizona with production lines to assemble fuel-cell systems for trucks. When it comes to establishing infrastructure, the hydrogen extracted through electrolysis needs to be compressed at filling stations. Bosch Rexroth is developing hydraulic drives and electric controls, including software, for hydrogen compressors that raise the gas pressure to up to 900 bar. The aim is to equip some 4,000 hydrogen filling **stations** with Bosch technology by 2030. "Industry is opening the door to a climate-neutral future," Najork says.

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The Bosch Group is a leading global supplier of technology and services. It employs roughly 402,600 associates worldwide (as of December 31, 2021). The company generated sales of 78.7 billion euros in 2021. Its operations are divided into four business sectors: Mobility Solutions, Industrial Technology, Consumer Goods, and Energy and Building Technology. As a leading IoT provider, Bosch offers innovative solutions for smart homes, Industry 4.0, and connected mobility. Bosch is pursuing a vision of mobility that is sustainable, safe, and exciting. 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 facilitate connected living with products and solutions that either contain artificial intelligence (AI) or have been developed or manufactured with its help. Bosch improves quality of life worldwide with products and services that are innovative and spark enthusiasm. In short, Bosch creates technology that is "Invented for life." The Bosch Group comprises Robert Bosch GmbH and its roughly 440 subsidiary and regional companies in some 60 countries. Including sales and service partners, Bosch's global manufacturing, engineering, and sales network covers nearly every country in the world. With its more than 400 locations worldwide, the Bosch Group has been carbon neutral since the first quarter of 2020. The basis for the company's future growth is its innovative strength. At 128 locations across the globe, Bosch employs some 76,100 associates in research and development, of which more than 38,000 are software engineers.

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-four percent of the share capital of Robert Bosch GmbH is held by Robert Bosch Stiftung GmbH, a charitable foundation. The remaining shares are held by Robert Bosch GmbH and by a corporation owned by the Bosch family. 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.

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