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# Press release

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## Hannover Messe 2025: Bosch embraces hydrogen production

Using Bosch industrial excellence to achieve economies of scale in stack production

- Bosch and FEST exhibit electrolysis system with Hybrion stacks at Hannover Messe.
- International customer orders of some 100 megawatts even before official sales launch.
- Bosch's industrial excellence ensures scalability of hydrogen production.

Stuttgart and Hannover, Germany – Whether in the chemicals, transportation, steel, or energy industries, there is enormous potential for decarbonization if hydrogen is used as an energy source – especially if it is produced using renewables. With an expected global capacity of 100–170 gigawatts by 2030, electrolysis is a strategic growth field for Bosch, despite the slowdown in the ramp-up of the hydrogen economy. To mark its entry into this market, the company is showcasing technology for electrolyzers at Hannover Messe. Bosch is premiering two Hybrion PEM (proton exchange membrane) electrolysis stacks as a modular container solution integrated into an electrolysis system. Such stacks are at the heart of the electrolyzer. The complete system, with an output of 2.5 megawatts, is supplied by FEST, based in Goslar, Germany. "To counter climate change, we need alternatives to fossil fuels. Green hydrogen, produced with renewable energy, will play a vital role in massively reducing carbon emissions in the industrial, transport, and energy sectors. Producing this hydrogen requires electrolysis systems – and Bosch's Hybrion stack is the key component for them," says Dr. Stefan Hartung, chairman of the board of management of Robert Bosch GmbH.

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Bosch aims to apply its fuel-cell expertise to hydrogen production. The company wants to use its experience in volume production to achieve economies of scale and reduce costs in the future. In 2025, it is planning to work on several projects in Europe with various partners. Even before the official sales launch in April, Bosch has already acquired orders amounting to some 100 megawatts – for example, Neuman & Esser will be integrating 16 Bosch Hybrion stacks into an electrolyzer with a capacity of 20 megawatts. Bosch is also working with companies including AKA Energy Systems, Andritz, Pietro Fiorentini, Hyter, H2B2, iGas, IMI, Nikkiso, and Técnicas Reunidas. “Hydrogen is a strategic growth field for Bosch – we expect sales revenue to run into the billions by 2030,” says Dr. Markus Heyn, member of the board of management and chairman of Bosch Mobility.

**Stack production and hydrogen cycle in Bamberg**

The Hybrion stacks will initially be manufactured at the Bosch location in Bamberg, Germany. For each unit, over one hundred electrolysis cells are arranged in layers. For this, Bosch has developed a special clamping tool that greatly simplifies and accelerates the manufacturing process. Each stack can produce up to 23 kilograms of hydrogen per hour when supplied with a maximum power input of 1.25 megawatts. This is enough for a 40-ton truck with a fuel-cell powertrain to travel around 250 to 300 kilometers. In the individual electrolysis cells, a proton exchange membrane – made using a special polymer – separates the anode and cathode from each other. To produce hydrogen, ultrapure water is first fed into the anode side of the PEM electrolyzer. As a result of electrical voltage at the two electrodes, the water at the anode reacts to form oxygen and free electrons and protons. The protons cross the membrane and combine with the electrons to form hydrogen gas at the cathode. Bosch’s Hybrion PEM electrolysis stacks are suitable for hydrogen production in modular plants starting from 1 megawatt, but also for large, gigawatt-scale industrial plants.

A FEST electrolyzer with integrated Bosch PEM electrolysis stacks is set to go into operation at the Bamberg plant as part of a hydrogen cycle in 2025. Bosch intends to use the hydrogen produced there for the endurance testing of mobile fuel-cell stacks, which are also manufactured in Bamberg. The power generated during that testing will in turn flow into the electrolyzer, thus closing the cycle. The hydrogen itself is initially intended for the company’s own use.

**Bosch offers a broad portfolio of products and solutions for hydrogen**

Bosch has an exhaustive hydrogen portfolio. “In developing hydrogen technologies, Bosch also relies on its proven expertise in industrial technology. We offer solutions from industry for industry,” says Dr. Tanja Rueckert, member of the Bosch board of management. Bosch Manufacturing Solutions, for example, offers water treatment systems that can be used to produce the ultrapure water required for electrolysis. These systems use thermal and electrochemical processes to remove impurities such as salts or metals from the water. Bosch is also actively using hydrogen in mobile fuel cells and hydrogen engines. Together with FirstElement Fuel, the U.S. market leader for the commercial operation of liquid hydrogen filling stations, Bosch Rexroth has achieved an important technology milestone for refueling infrastructure. CryoPump stations cut operating costs by up to 70 percent, bringing them down to an economical level, while shortening refueling processes for heavy trucks to around ten minutes.

**Press photos and infocharts are available on the Bosch Media Service at [www.bosch-press.com](http://www.bosch-press.com).**

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# Press release
*Bosch Compact*

## Hannover Messe 2025: Bosch offers intelligent and efficient solutions for industry
Eight trade-fair highlights at a glance

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- AI-based tools and software as a growth area
- Applications for efficient hydrogen production and use
- Solutions for the entire value stream of battery production

Stuttgart and Hannover, Germany – At Hannover Messe, Bosch presents solutions for industry – from hydraulics and electrolysis to software. In each case, the focus is always on improving the efficiency and productivity of manufacturing and enabling sustainable production. There is a significant role for hydrogen in making production sustainable – and in Hall 13, Booth C33, Bosch will be showcasing technologies for producing and using this resource. Bosch Rexroth will also be presenting its broad portfolio of industrial technology in Hall 6, Booth D26. In addition, Bosch experts will be sharing their thoughts with industry through presentations and panel discussions.

**Bosch technical highlights make industry fit for the future**

Hydraulic Hub: With its comprehensive range of digital services, the Hydraulic Hub simplifies and accelerates the servicing and maintenance of industrial hydraulic products, thereby increasing machine availability. Users of this digital service platform can access Bosch Rexroth's hydraulics and service expertise 24/7 via its intuitive interface. The Hydraulic Hub also offers support with documentation and with proactive maintenance of hydraulic systems. AI-based tools provide answers to specific questions, such as what to do in the event of an oil leak, and help identify and rectify faults. Bosch Rexroth is working with Amazon Web Services, among others, to apply AI technologies.

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Electrolysis stack: Hydrogen production by way of electrolysis using renewable electricity has a central role to play on the path to a climate-neutral economy. In 2025, Bosch will launch its first electrolysis stack, the heart of every electrolyzer. The Bosch stack comprises more than 100 electrolysis cells that employ electricity to split water into oxygen and hydrogen. It is designed for an output of 1.25 megawatts, which corresponds to a hydrogen production rate of 23 kilograms per hour. On the hydrogen side, the resulting pressure is more than 30 bar. The stack is suitable for use in modular systems from 1 megawatt upward as well as in large gigawatt-class industrial systems.

Water treatment system: The Pure Water System offered by Bosch Manufacturing Solutions (BMG) is a container system for the production of ultrapure water for electrolysis. Impurities in the water can render electrolyzers inoperative in a very short time. BMG's water treatment system uses thermal and electrochemical processes to remove impurities such as salts or metals, thereby producing ultrapure water. The first step uses an energy-efficient and water-saving distillation technology called mechanical vapor compression. This is followed by electrodeionization (EDI), in which an electric field removes the remaining ions from the distillate. The Pure Water System requires no filter media or chemicals at all to treat salty water. The system's product water meets the strict purity requirements of all electrolyzer technologies.

Electrolyzer stack testing system: Bosch Manufacturing Solutions (BMG) offers an innovative system for the safe and efficient end-of-line testing of PEM electrolysis stacks up to a size of 1 megawatt. Automated contacting of the electrolyzers at the anode, cathode, and power supply increases precision and reduces the time required for testing. The software's test procedures can be flexibly adapted to the specific requirements of different tests. Moreover, its customizable data evaluations enable a detailed analysis of the test results, which supports quality assurance in stack production. BMG also offers a modular, customizable electrolysis system for efficient hydrogen production, as well as a broad portfolio of assembly and testing systems for the development, manufacture, and quality assurance of fuel cells and fuel-cell power modules (FCPM).

CryoPump station: Bosch Rexroth has worked together with FirstElement Fuel, the U.S. market leader for the commercial operation of liquid hydrogen filling stations, to develop an important technology milestone for refueling infrastructure. CryoPump stations cut operating costs by up to 70 percent, bringing them down to an economical level, while shortening refueling processes for heavy trucks to around ten minutes. Compared to conventional crankshaft-based pumps, the technology increases efficiency to over 95 percent and

extends maintenance intervals to over 4,000 hours. With a footprint of less than 11 m² and a noise level of less than 65 dB(A), the stations are ideal for use in existing filling stations, even in residential areas.

Battery production solutions: Battery production is considered a key technology for the energy transition. The only way manufacturers can hope to meet heavy future demand is by rapidly scaling up their battery production capacity. At Hannover Messe, Bosch Rexroth will be demonstrating how to realize complex value streams and extremely dynamic material movements using real material flow solutions along the entire value stream: from the virtual warehouse and cell preparation through module and pack assembly to transport and end-of-line testing.

Compact gas compressor: Efficient and cost-effective hydrogen compression and storage is a key issue in the energy transition. Based on a proven automotive application, Bosch has developed a gas compressor that can compress over 11 standard cubic meters of hydrogen per hour to as much as 350 bar. This corresponds to more than one kilogram of hydrogen. The compressor's compact dimensions and extremely low weight of less than ten kilograms make installation and maintenance considerably easier. In addition to hydrogen, the compressor is also suitable for other gases such as nitrogen, helium, and carbon dioxide, which greatly expands its range of application.

HeyBosch: Bosch and Microsoft have expanded their partnership to introduce HeyBosch, an advanced AI platform based on Microsoft Azure. HeyBosch improves data management for industrial companies by providing insights into data and knowledge, making complex engineering data easy to understand, and using generative AI to enable user training. The platform integrates conversational AI, VR/AR functions, and business intelligence tools to offer a consistent and user-friendly experience.

**Press photos and infographics in the Bosch Media Service at www.bosch-press.com.**

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# Press release

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## Bosch aims to break the billion-euro barrier with sales revenue from factory software

Digital orchestration of manufacturing through software

- Bosch Industrial Technology aims to achieve sales revenue of around 1 billion euros from software and software-related services by the beginning of the next decade.
- Tanja Rueckert: “We know factories like the back of our hand. Our software solutions are made by users for users.”
- Bosch Rexroth’s ctrlX AUTOMATION offers a rapidly growing ecosystem for factory automation.
- Bosch customers, as well as some 150 Bosch plants, use software from Bosch Connected Industry’s NEXEED portfolio.
- Bosch Semantic Stack is the basis for digital twins of products and the key to unlocking the value of data.

Ulm, Germany – Bosch is continuing its software offensive. The technology company’s Industrial Technology business sector is pursuing ambitious goals: by the beginning of the next decade, it wants its sales revenue from software and software-related services to have reached around 1 billion euros. “Bosch is one of the world’s biggest manufacturing companies. We know factories like the back of our hand. This know-how flows into our software development. Our solutions are made by users for users, since we also use our software in our own plants,” says Dr. Tanja Rueckert, member of the board of management of Robert Bosch GmbH whose responsibilities include the Industrial Technology business sector. This business sector comprises Bosch Rexroth, Bosch Manufacturing Solutions, and Bosch Connected Industry. Bosch has the expertise and knowledge to make fully software-assisted manufacturing a reality. Its software solutions for the operations management level, such as Bosch Connected Industry’s NEXEED, and for the control level, such as Bosch Rexroth’s ctrlX AUTOMATION, dovetail seamlessly. Bosch Manufacturing Solutions also offers AI-based process optimization for existing manufacturing landscapes.

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**At the heart of factory automation – Bosch Rexroth's ctrlX AUTOMATION**

Bosch Rexroth's ctrlX AUTOMATION is an open automation system for factory automation. Since its launch five years ago, it has attracted over 2,000 customers. The partner network ctrlX WORLD with over 100 partner companies, extends the range of solutions to include software and hardware. The ctrlX OS operating system is also growing and becoming increasingly important. Open interfaces and standards make it possible to integrate all types of automation technologies and partners. "As the pace of digitalization increases, what's needed are new solutions that enable systems to be interconnected and open in all directions. Co-creation and open ecosystems let companies pool their strengths, develop innovations together, and react much faster to changes in the market," says Thomas Fechner, Member of the Executive Board of Bosch Rexroth with responsibility for the factory automation business. The company now offers more than 80 apps in its ctrlX OS store. These range from communication and IoT solutions to innovative vision and engineering apps, all of which are validated in accordance with strict Bosch Rexroth guidelines. Around half the apps come from third-party providers. This underlines the co-creation approach that is becoming increasingly prevalent in this domain. ctrlX AUTOMATION can also be connected to NEXEED.

**The brain of the smart factory – Bosch Connected Industry's NEXEED**

Bosch Connected Industry's software for Industry 4.0 controls the manufacturing process and provides the transparency that is needed for raw materials and other supplies to be used efficiently. It can detect and eliminate the causes of rejects at an early stage, and it permits predictive maintenance, retrofitting, and optimization for machinery and equipment. The result is factories that are up to 25 percent more productive, up to 15 percent greater machine availability, and a reduction in maintenance costs by as much as 25 percent. With NEXEED, everyone responsible for manufacturing has exactly the information they need. It uses artificial intelligence to provide assembly-line workers with support directly at the machine. In the future, they will be able to use an app to voice-record any incidents at a workstation, ask about similar situations, and request suggestions for solutions. NEXEED's international customers include Sick and Osram. It is also used in around 150 Bosch plants. Thanks to its open interfaces, the Bosch software can be integrated into common industrial platforms and existing infrastructure. The data it generates can also be used in other applications.

**The key to unlocking data's full potential – Bosch Semantic Stack**

One such application is the Bosch Semantic Stack. "Companies are sitting on a treasure trove of data, but very few of them know what to do with it. We have the key to unlocking the value of all that data," says Norbert Jung, CEO of Bosch Connected Industry. The Bosch Semantic Stack software portfolio creates a semantic data layer that makes product data understandable for humans and machines throughout the lifecycle. When this data is assigned to a digital twin, the result is consistent, reliable insights for well-founded business decisions. Instead of simply storing data, the Bosch Semantic Stack explains what the data means, making repeated rounds of data preparation and integration unnecessary. Using the solution itself, Bosch has already created more than 400 million digital twins of its products throughout the company. These make it possible to use data more easily and securely, also across company boundaries. For example, effective 2027, the EU will require battery manufacturers to create a digital battery passport for any batteries with a capacity of 2 kilowatt-hours or more. This passport must be able to show a wide range of data on the battery's lifecycle, including data on $CO_2$ from its manufacturing, performance data, and, for recycling, information about its constituent materials. The Battery Passport, a module of the Bosch Semantic Stack, fulfills these legal requirements by using digital twins to automatically create the passports needed for end-to-end data transparency over the battery's entire lifecycle.

**Bosch Rexroth model factory provides insights into the factory of the future**

At the Bosch Rexroth model factory in Ulm, Germany, the company shows how Bosch software makes factories and their control systems simpler and more efficient. Bosch uses concrete manufacturing scenarios to present its portfolio of high-performance industrial technology, including intralogistics and distribution. The exemplary manufacturing process also illustrates how existing factory environments can be transformed safely and cost-effectively. The model factory brings solutions for the automotive, battery, consumer goods, and semiconductor industries to life. Users can flexibly adapt their manufacturing to fluctuating demand and economically produce different versions or even very small batches. With its open standards, the Bosch software manages communication both between the machines and systems and with higher-level systems, ensuring seamless exchanges of information and complete orchestration of manufacturing operations.

Since the model factory opened in 2021, around 8,400 visitors have learned about topics such as sustainability in factory automation, flexible materials flows, and the benefits of modular software architecture.

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