

Bauma 2022 with diesel, hydrogen, and electricity Bosch presents powertrain solutions to boost sustainability of construction machinery

Oktober 24, 2022
PI 11572 PS Ks/af

- ▶ Hydrogen engines serve as virtually climate-neutral powertrains.
- ▶ eLION offers scalable and robust electrification of off-highway vehicles.
- ▶ Wide range of diesel injection systems is supplemented with powerful SCR exhaust-gas treatment with double injection.

Stuttgart – Across the globe, millions of vehicles reliably go about their business in the construction, agricultural, and mobile machinery sectors. Yet as diverse as their applications are, virtually all of these machines are powered by conventional diesel engines. At this year's "bauma 2022" trade fair in Munich, Bosch is demonstrating how even this vehicle segment can make a greater contribution to climate protection in the future. "With hydrogen engines and electrification, we can make construction machinery significantly more sustainable," says Dr. Thomas Pauer, president of Bosch's Powertrain Solutions division. "But we also want to achieve further reductions in the consumption and emissions of diesel engines." With its solutions, Bosch is helping automotive manufacturers the world over to comply with current and future climate protection and emissions legislation.

According to Bosch studies, more than half a million construction machines in the performance class from 56 to 560 kilowatts will be produced across the world in 2022. With further growth predicted for this market in the coming years, the Bosch powertrain division expects to play an equally important role in these developments

The hydrogen engine – proven foundation, sustainable fuel

Hydrogen engines are based on established, tried-and-tested engine technology, which is adapted to ensure a sustainable future. When driven by green hydrogen, these powertrains are virtually climate-neutral. In addition, the powertrain concept represents an effective complement to fuel cell technology since it requires the same vehicle storage systems and an identical infrastructure. Bosch is working

on systems with port fuel and direct injection and is already involved in more than 100 technical trials with customers across the world. Moreover, the company has already landed its first volume production project in India. “Construction machinery is frequently used in stationary, high-load applications, and this is the exact environment in which hydrogen engines can shine with their high efficiency and robustness,” explains Pauer. “But the powertrain solution will also be used for agricultural machinery and in long-haul transport.”

In addition, the hydrogen engine represents a very promising option in the large-engine sector, for example, as a powertrain for dump trucks in the mining industry. This is another area in which robustness and reliability combined with a compact design are crucial to efficient operation. Along with the direct injection of hydrogen, the new AFI-LP (alternative fuel injector – low pressure) injector from Bosch also allows the use of other fuels, such as methanol, both for port fuel and direction. Engine manufacturers can thus benefit from maximum flexibility.

The eLION electrification platform – scalable solution from Bosch Rexroth

Bosch Rexroth offers an electric powertrain solution for mobile construction machinery in the form of eLION. The product platform is designed specifically for the off-highway sector and its demanding environmental conditions. It is highly scalable, extremely robust, and offers comprehensive functional safety according to ISO 13849. The high-voltage eLION electric motors (up to 850 volts) cover a nominal power range of 20 to 230 kilowatts (with peak outputs in excess of 550 kilowatts) and generate nominal torques of up to 1,300 newton meters as well as maximum torques of over 2,500 newton meters. Available in four different sizes, they are equally well suited to compact and heavy-duty mobile machinery and can be used for both travel and work functions. Initial pilot projects with customers have been underway since 2021.

Bosch is also presenting the SMG180 and SMG220 electric motors as well as the INVCON 3.3 inverter with its integrated DC/DC converter. These components were developed for use in light commercial vehicles and are also certified for off-highway applications.

Diesel injection systems – a tailored solution for every application

Despite these new and sustainable solutions, the diesel engine will remain the most commonly used powertrain for construction machinery for some time to come. Its continued attractiveness is largely attributable to its robustness, low operating costs, and quick and simple refueling. Even in 2035, Bosch expects that four out of five new construction machines with power ratings over 56 kilowatts will roll off the world’s production lines with a diesel engine under the

hood. In Munich, the company is presenting the perfect common-rail injection system (CRS) for each and every application:

- The system for commercial vehicles (CRSN) also serves as the ideal solution for many construction machines and delivers injection pressures of up to 2,500 bar.
- A version designed specifically for industrial applications and off-highway operation (CRS OHW) in agricultural and construction machinery impresses with its particular robustness. With an injection pressure of up to 2,000 bar, it offers up to 33 kilowatts per cylinder.
- For large engines operating at high and medium speeds, the MCRS modular common-rail system boasts injection pressures of up to 2,200 bar combined with cylinder outputs ranging up to 500 kilowatts.

With the use of synthetic fuels, all these systems can already make an important contribution to global CO₂ reduction.

Gas-powered engines can already now help to reduce particulate and nitrogen oxide emissions. For these powertrains, Bosch offers special dual-fuel ignition-injection systems as well as gas admission valves. These ensure reliable ignition and outstanding combustion of the gas/air mixture with high specific outputs. In addition, the gas admission valve for large engines can already be operated with hydrogen. This product is ideal for driving the transformation from natural gas to hydrogen. And this is another area in which Bosch has already won a volume production project for a hydrogen engine.

Exhaust-gas treatment – even lower nitrogen oxide with SCR double injection

To further reduce raw emissions, Bosch has enhanced its SCR technology for exhaust-gas treatment systems. Further reductions in nitrogen oxide emissions can be achieved with double injection in combination with powerful temperature management. To this end, the SCR system injects urea into one catalytic converter situated close to the engine and another located further away from the engine, according to the individual driving situation. The Bosch technology thus supports both commercial vehicle manufacturers and fleet operators in their ongoing efforts to meet current and future emission limits.

Bosch and Bosch Rexroth at bauma:

You can find us and our contacts at booth 327 in hall A3.

Press photos: #ae5eed42, #9057f835, #d4faa9be

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Mobility Solutions is the largest Bosch Group business sector. It generated sales of 45.3 billion euros in 2021, and thus contributed 58 percent of total sales from operations. This makes the Bosch Group one of the leading automotive suppliers. The Mobility Solutions business sector pursues a vision of mobility that is safe, sustainable, and exciting, and combines the group's expertise in the domains of personalization, 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 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.

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