

Drive & Control profile

Viewpoint

Intelligence and integration will drive mobile technology forward

There is an important dynamic underway between the technological issues that the off-highway industry addresses in the normal course of doing business—such as better machine performance, cost control, equipment designs to fit tight machine spaces—and the larger societal issues, such as emissions control, climate change and energy demand. Companies active in the off-highway industry have not only the opportunity, but also the responsibility, to offer solutions that consider both.

Climate change and environmental responsibility increasingly influence corporate behavior. More and more companies are committing to reducing the carbon footprints of machines and manufacturing—a commitment Bosch Rexroth shares and actively pursues, targeting a 20 percent reduction in its own carbon footprint by 2020 compared to 2007 levels.

Additionally, Rexroth's "local for local" strategy and GoTo™ Focused Delivery Program also help reduce its carbon footprint by cutting the need for long-distance shipping. Further, there is also an opportunity to help control greenhouse gas emissions

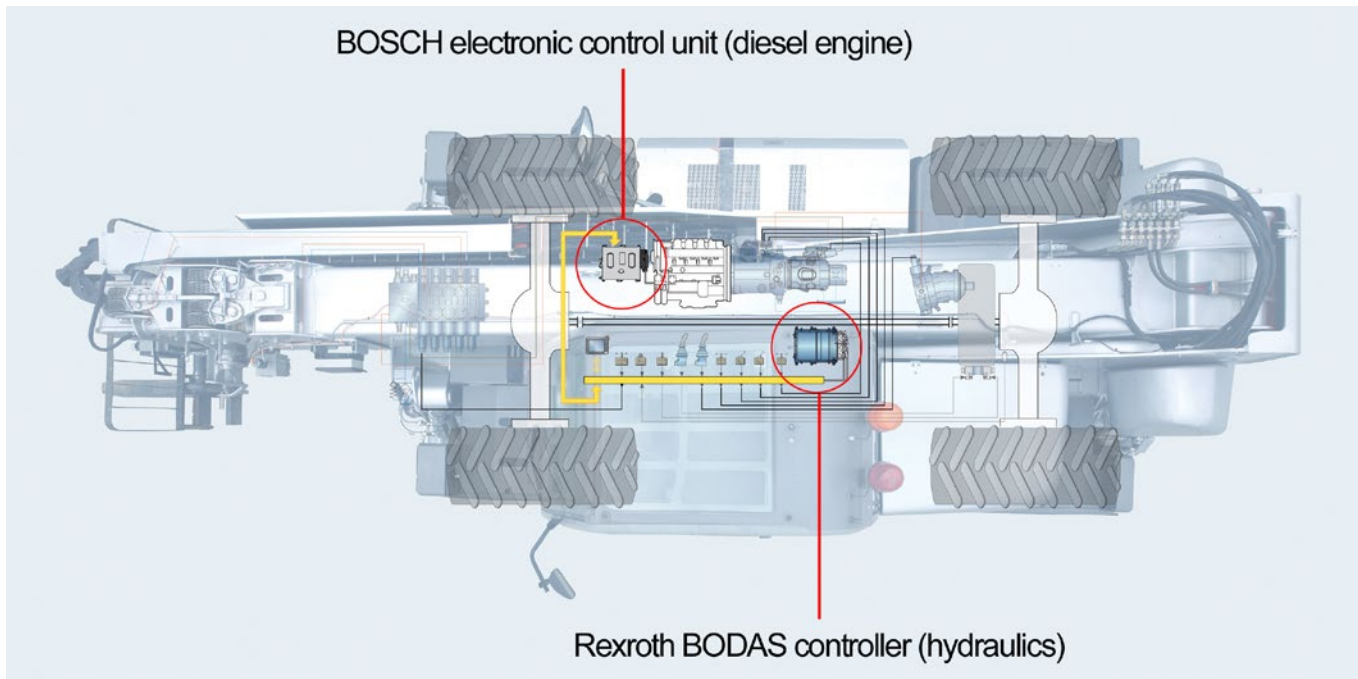


Intelligent integration involves approaching the design, component selection and integration of different mobile machine powertrain and drive components in a systematic way to maximize both energy efficiency and operational productivity.

and reduce carbon footprints in Rexroth's development efforts for the on- and off-highway equipment industry segments. In particular, there are opportunities to be smarter about the way energy is used in mobile machines, and at the same time make those mobile machines more flexible, more productive and better equipped to deliver hardworking performance out in the field.

The systemic approach: Rexroth 4EE for energy efficiency

The key is intelligent integration: approaching the design, component selection and integration of different mobile machine powertrain and drive components to maximize both energy efficiency and operational productivity. For Bosch Rexroth, the pursuit of this intelligent approach is called Rexroth 4EE: Rexroth for Energy Efficiency.



Innovative new solutions at work that elevate the connectivity with machines—the way information is exchanged between diesel control and hydraulics control, for example.

Rexroth 4EE is a systematic approach to help engineer energy efficiency into our latest drive and control technologies, including the high-performance hydraulics, electrohydraulics and hybrid systems we supply to the industry. It uses four “levers” that on their own, or in combination, can have a dramatic impact on energy efficiency—which in many working machines, can translate into reduced emissions.

There are some who view hydraulics as a mature technology with limited opportunities for impactful breakthroughs. However, we have begun applying the 4EE concept with significant results. The first lever in our 4EE system is selecting the most energy-efficient components.

There are several examples of this approach: The compact Rexroth A1VO axial piston pump brings the fuel savings of load-sensing technology to

the smaller power classes of mobile machinery. And for equipment such as telehandlers, wheel loaders and skidsteer loaders, our intelligent, electronically-controlled hydrostatic fan drive systems that use the Rexroth BODAS RC electronic controls and the A1VO pump can help keep combustion engines operating at an optimum temperature, while minimizing fuel consumption and emissions.

The second 4EE lever is energy recovery. If there is a waste of energy or an abundance of surplus energy—mechanical, electrical or hydraulic—in a system’s design, then machine designers should consider technology that can recover, store and re-use that energy. Rexroth’s Hydraulic Start-Stop HSS system is a hybrid system that uses existing accumulator energy storage system technology with our proven A10V product and BODAS RC electronics. This system allows an engine to be shut off when the

machine is not providing the primary work function, such as in a wheel loader, and then provides the stored energy to “start” the engine when the machine needs power, saving up to 2,000 liters of fuel over the machine’s service life.

The third 4EE lever is energy on demand. Instead of running pumps and drivetrains at the same level at all times, energy on demand considers the hydraulic and control choices so that the machine uses only the amount of energy that’s required for the duty cycle at that moment. The Hydraulic Start-Stop HSS technology fits this category as well, but an even better example is Rexroth’s Diesel Hydraulic Control DHC, which combines our experience with hydraulic controls with the diesel engine management expertise of our partners at Robert Bosch GmbH.

DHC uses load-sensing electronic flow management technology of the Rexroth M4 or M7 valve and BODAS RC electronic controller that conveys anticipated load requirements of the working hydraulics to the diesel engine controller in advance of the actual hydraulic load on the engine. This system provides the benefit of interfacing between the functions of the Bosch control units (for engine management) and Rexroth control units (for the drive and working hydraulics). Based on the DHC inputs, the diesel engine delivers the exact amount of torque and power needed by the hydraulics to provide optimum function of the machine at a given engine speed; as a result, diesel consumption drops by up to 20 percent.

Currently available and advancing generations of mobile electronics make this possible, increasing overall machine performance, enabling engine downsizing and optimization of the transfer of available energy for use in the function of the machine. For machine functions such as hydraulic implement control, work/travel drives, fan control and hydraulic power demand management, the BODAS (Bosch Rexroth Design and Application System) mobile electronics “fit for duty” platform intelligently combines electronic components and software to boost machine performance and flexibility

with reduced available power of the engine.

The fourth 4EE lever is energy system design: utilizing cutting-edge technology, design, simulation and testing to look at a machine’s energy requirements as a complete system, and designing the system from the ground up to ensure that energy efficiency is optimized.

One example where Rexroth has made strides using energy system design is in the development of the Hydromechanical Variable Transmission (HVT) platform for wheeled loaders, dumpers and bulldozers. After analysis and modeling, we combined the advantages of a mechanical travel drive with a torque converter and a hydrostatic travel drive to create a hybrid travel drive platform that offers fuel savings of up to 25 percent compared to a conventional transmission.

Intelligence in integration

Implementing this approach in mobile machinery takes two kinds of intelligence: thoughtful engineering, but also the intelligence to create the most efficient interplay of the various machine components to deliver the energy performance envisioned. We are seeing determined deployment of this kind of intelligence by our customers as they seek to offer the most efficient machines to

their customers. There has clearly been a paradigm shift in the mobile applications market—a shift that, with our partners at Robert Bosch GmbH, Rexroth has actively sought to drive as a key value proposition for its customers.

We are seeing innovative new solutions at work that elevate the connectivity with machines—the way information is exchanged between diesel engine control and hydraulics control for example, or the way software now plays a greater role throughout all functional elements of a machine.

This weaving of intelligence into the mobile working machine design is part of a larger Industry 4.0 trend. Within a very short time, in many manufacturing production processes, we will see rapidly escalating potential for substantial efficiency gains, thanks to advancing sensor technologies and network-capable components with built-in intelligence, where software takes care of a growing number of tasks previously carried out mechanically.

Rexroth is committed to helping its customers, both OEMs and end-users, stay at the front of this growth curve in intelligence and integration. And we are already partnering with many of them, leveraging our systematic Rexroth 4EE approach, to help them take advantage of these opportunities.

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