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The ECO-BOOSTER

How variable-speed pump drives increase climate protection and productivity.

Everyone must actively participate in the fight against climate change: this also includes plant operators and machine manufacturers. Variable-speed pump drives are an effective means of reducing CO_2 emissions of hydraulic systems while also increasing productivity. Supported by subsidies, retrofits pay off even faster. To what extent can CO_2 emissions and energy costs be avoided in practice?

Proehl Holger | Product Manager | Bosch Rexroth AG

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The EU's Green Deal, the global climate strike movement Fridays for Future and, last but not least, the CO_2 price that will apply from 2021 onwards are increasing the pressure on production companies to make their plants more energy-efficient in order to avoid CO_2 emissions. The Bosch Group is setting an example and has been climate neutral worldwide since 2020 . The European Union has set itself this goal for 2050. With more modern solutions and retrofits, machine manufacturers can make an important contribution to achieving their customers' climate targets . A particularly large lever for saving CO_2 emissions lies in the installed base of conventional hydraulic systems and their modernization with the help of variable-speed pump drives as a key component for more energy-efficient solutions and retrofits.

SAVING RESOURCES MAINTAINING PERFORMANCE

AVOIDING O_2 EMISSIONS WITH ENERGY ON DEMAND

VARIABLE-SPEED DRIVES INTEGRATED

LOWER CO_2 EMISSIONS BY UP TO 80%

AVOIDING CO_2 EMISSIONS WITH ENERGY ON DEMAND

In industrial hydraulics, energy efficiency is the biggest lever for climate protection. Every kilowatt hour that a press, injection molding machine or another hydraulic application saves during operation reduces the amount of greenhouse gases emitted during power production. Variable-speed pump drives are a particularly effective way of saving energy and avoiding greenhouse gases in the sense of the law. The highly dynamically controlled motor-pump combinations only draw as much energy from the power grid as is currently required to supply the connected consumers.

Under the product name Sytronix, Bosch Rexroth offers machine manufacturers a complete product range of energy-on-demand drives. Their components are standardized and can be combined to form individual solutions. In addition, the variable-speed Sytronix pump drives are at the heart of the highly integrated, intelligent CytroPac and CytroPox units and the servo-hydraulic CytroForce axis, which is also highly compact and can be supplied ready for installation.

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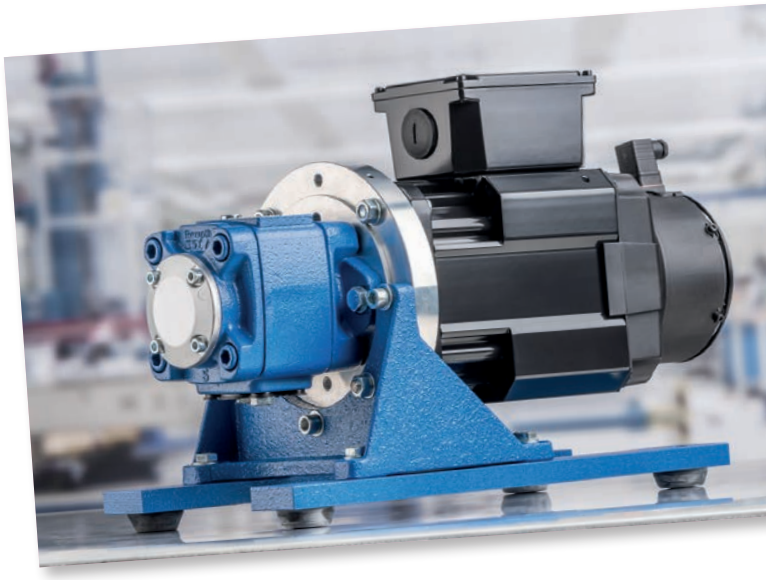
GREEN TECHNOLOGIES
FOR GREEN BUSINESS

The modernization of production technology is one of the biggest levers in climate protection. According to a joint study by the Boston Consulting Group and VDMA, annual greenhouse gas emissions can be reduced by up to 30 gigatonnes by 2050, from around 51 gigatonnes in 2020. The mechanical engineering sector plays a key role here because, in addition to new energy-efficient systems, it also offers its customers retrofits for optimizing the energy efficiency of existing systems. Variable-speed drives have particular potential for improvement in this respect. Because they provide the required power with pinpoint accuracy and switch to standby in idle phases, they save up to 80 percent of the previous energy consumption depending on the work cycle, and avoid CO2 emissions accordingly.

VARIABLE-SPEED DRIVES...

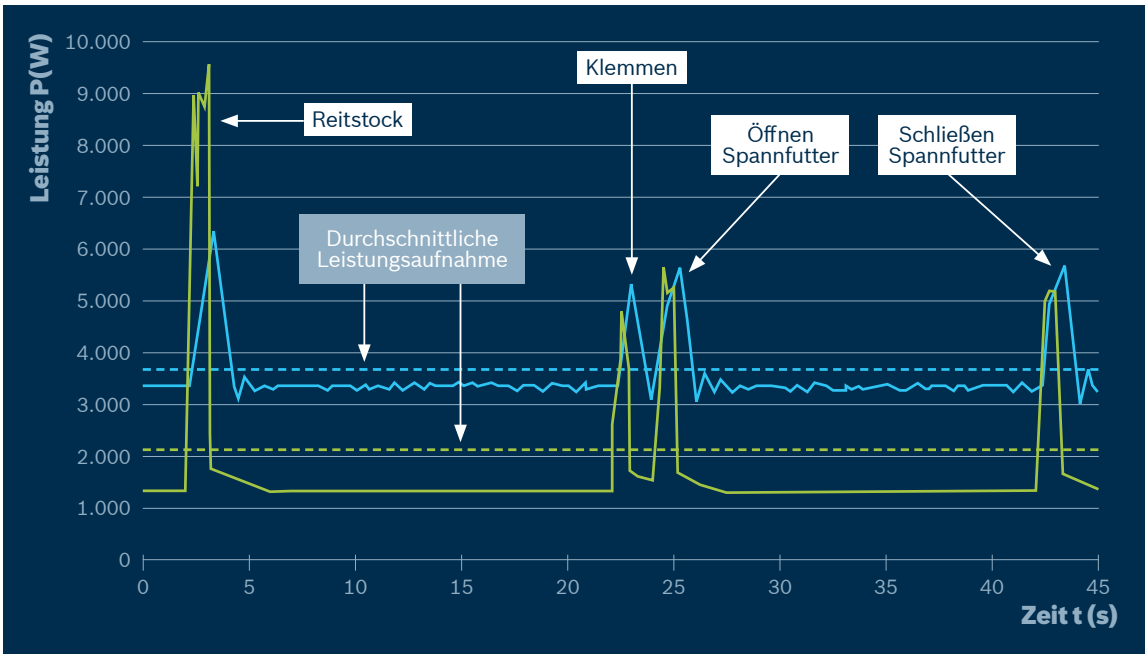
A variable-speed pump drive consists of an electric motor, a constant or variable displacement pump, a pressure sensor and a frequency converter with a software which adjusts the motor speed to the optimal operating point depending on load. Unlike a conventional hydraulic system with a constant drive which “blindly” produces energy, a variable-speed pump drive works based on demand. If less energy is required, the intelligent electronics automatically reduce speed and power. The drive is also designed to reduce electric losses in the motor as well as frictional losses in the motor and the pump. This is particularly true for highly efficient servo motors with a permanent magnet and in connection with a sleep/wake function which completely turns off the motor when it is not needed.



▲ **01 Drehzahlvariabler Pumpenantrieb Sytronix**

...LOWER CO_2 EMISSIONS BY UP TO 80 %

Presses, injection molding machines and machine tools particularly benefit from this increase in efficiency, but also complex hydraulic applications as can be found in metallurgy. All in all, the energy consumption is thereby reduced by up to 80 percent. This also reduces the CO_2 emissions associated with electricity production. For the operator, this means that climate goals can be reached more quickly and that he has to compensate for fewer emissions or pay fewer CO_2 taxes as a result.



Aktuelle Leistungsaufnahme
- Speicherladeschaltung
- SYTRONIX

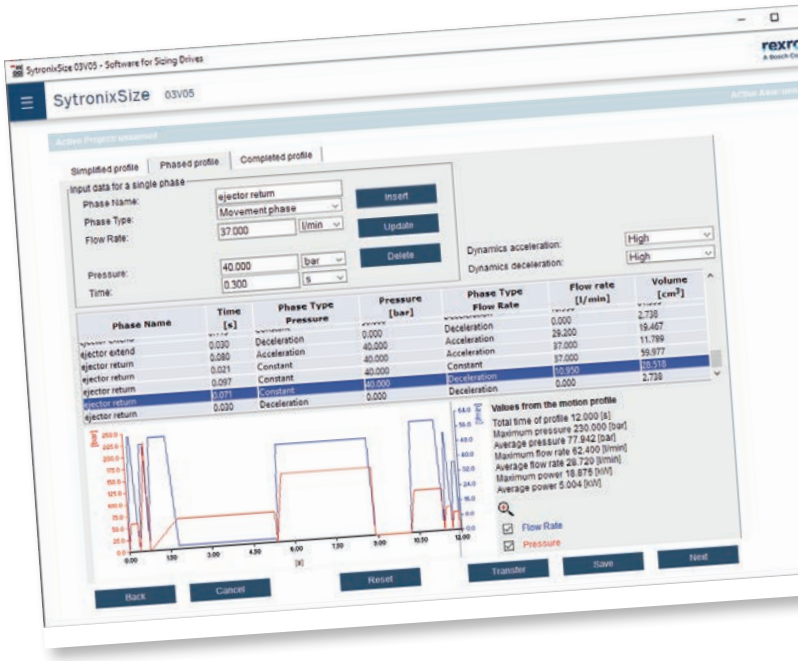
Mittlere Leistungsaufnahme
- Speicherladeschaltung
- SYTRONIX

Lastprofil in einer Werkzeugmaschine. Die Differenz zwischen den mittleren Leistungsaufnahmen zeigt das Einsparpotential für den drehvariablen Pumpenantrieb.

▲ **02 Lastprofil einer Werkzeugmaschine**

SAVING RESOURCES WHILE MAINTAINING PERFORMANCE

Due to their excellent efficiency, variable-speed pump drives require a smaller installation space and fewer resources. Thanks to simplified valve technology, less control electronics are necessary. The highly dynamic control results in smaller tanks and reduced oil consumption. In addition to reducing power consumption, the minimalistic motor design also reduces the heat input into the hydraulic fluid, which means the cooling system can be downsized or eliminated entirely. However, an exact system design is required for this purpose which fully utilizes the overload range. Machine manufacturers can adjust the total of eleven system boundaries themselves using the software tool Size&Select Assistant to achieve optimum efficiency for their customers.



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MINIMAL ECOLOGICAL FOOTPRINT

By using variable-speed pump drives, machine manufacturers can help their customers to reduce electrical and pressure losses in hydraulics. Depending on the motor-pump combination, this can be achieved with both short-time operation and periodic operation with and without interruption, with individual constant loads as well as load or speed changes. If standard solutions are used, the small ecological footprint can be reduced even further. This can be achieved with autonomous servo-hydraulic axes or as a part of the intelligent compact units CytroPac and CytroBox. Compared to a conventional unit, the CytroBox's integrated control blocks are 40 percent smaller thanks to CFD simulation and 3D sand core printing, ensure optimal flow ratios and require only 75 percent of the fluid volume.

FEDERAL FUNDING FOR ENERGY EFFICIENCY IN COMMERCE

As part of the "Federal funding for energy efficiency in commerce," the BMWi supports, among other things, projects for greater energy efficiency.

The support package is open to all sectors and technologies and leaves plenty of scope for individual measures. With regard to the subsidy, companies can choose between a direct grant from the Federal Office of Economic Affairs and Export Control (BAFA) and a repayment grant as part of a KfW loan.

More information at:

PRACTICAL APPROACHES TO AVOIDING CO_2 EMISSIONS

How large precisely is the volume of greenhouse gas emissions that can be avoided by the modernization with variable-speed Sytronix pump drives? To find an answer to this question in field operation, Bosch Rexroth has measured the energy consumption of the original drives including cooling and compared it to the new variable-speed solution. The difference can be used to calculate not only the electricity cost savings, but also the amount of greenhouse gas emissions avoided, specified with the CO_2 equivalent [CO_2e] . For example, the modernization of a plastic molding press (example 1) brings yearly energy savings of 87,000 kWh (-78 %). With an average electricity cost of 17.69 cents per kilowatt hour (kWh), the yearly operating cost savings amount to 15,390 euros. With one kilowatt hour in the German electricity mix releasing 0.489 kg of CO_2e, the modernized unit avoids 43.3 tons of greenhouse gas emissions per year. For more complex applications, the savings can amount to several hundred tons per year (example 4).

EXAMPLE 1: PLASTIC MOLDING PRESS - 78% SAVINGS

Original drive solution:	displacement pump, pressure control valve,
New solution:	Variable-speed pump drive with highly efficient synchronous motor and energy recovery via the converter
Consumption old (Process + cooling)	112.000 kWh/a (67.000 + 45.000)
Consumption new	25.000 kWh/a (17.700 + 7.300)
Energy saved	87.000 kWh/a (49.300 + 37.700)
Savings in energy costs	**15.390 € / year**
CO_2 emissions avoided:	**43,3 t / year**

EXAMPLE 2: CASTING MACHINE - 83% SAVINGS

Original drive solution:	Constant speed: 11 kW motor + displacement pump, closing force: 50 t Cycle time: 7,5 s
New solution:	variable-speed pump drive
Consumption old	74.810 kWh/a
Consumption new	12.590 kWh/a
Energy saved	62.220 kWh/a
Savings in energy costs	**11.000 € / year**
CO_2 emissions avoided:	**30 t / year**

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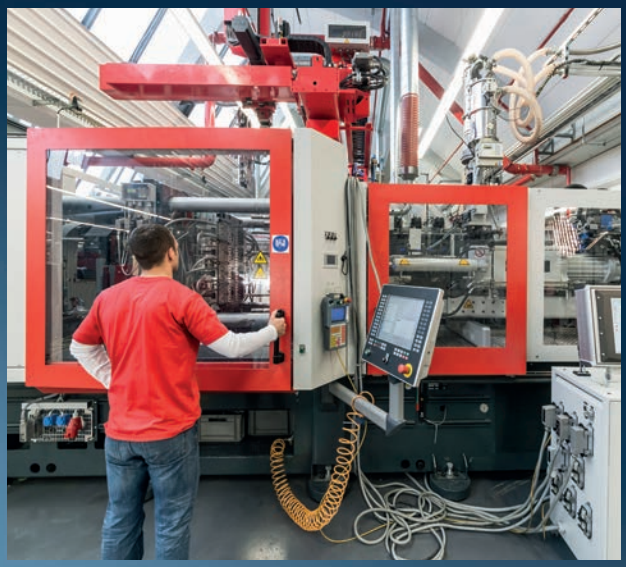
EXAMPLE 3: RUBBER INJECTION MOLDING - 78% SAVINGS

Original drive solution:	constant speed: 15 kW motor with load control and DFE pump; closing force: 50 t cycle time: 7,5 s
New solution:	variable-speed pump drive
Consumption old	21.460 kWh/a
Consumption new	5.920 kWh/a
Energy saved	15.540 kWh/a
Savings in energy	**2.750 € / year**
CO_2 emissions avoided:	**7,6 t / year**



EXAMPLE 4: WALKING BEAM FURNACE - 83% SAVINGS

Original hydraulic solution:	complex hydraulics, high repair and spare part costs
New solution:	speed controlled pump DFEn; quality control, automatic adjustment of the compression stroke
Consumption old	1.000.000 kWh/a
Consumption new	240.000 kWh/a
Energy saved	860.000 kWh/a
Savings in energy	**152.100 € / year**
CO_2 emissions avoided:	**421 t / year**

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TACKLING CLIMATE PROTECTION TOGETHER

The proven potential for energy savings qualifies variable-speed pump drives not only as an important component for the next generation of machines, but also as a tried-and-tested solution for inventory optimization. Together with design-related advantages such as compact design, simple controllability and engineering as well as fast commissioning, they offer machine manufacturers the opportunity to stand out from the competition with highly efficient solutions and attractive retrofits. The current subsidy opportunities and the annually rising CO2 price create additional incentives to increase energy efficiency quickly, effectively and cost-efficiently, thus making a significant contribution to general climate protection.

Sytronix

THE ECO-BOOSTER

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