Sustainability with System: Rexroth Solutions for Energy Efficiency

The Drive & Control Company
Savings with Every Cycle

Whether electricity or diesel consumption: For an ever-increasing number of end users in factory automation, such as in the mobile sector, energy consumption is the main purchasing criterion. Machine builders have to adapt quickly to these changed market conditions by implementing new solutions.

As a supplier of all drive and control solutions, Rexroth is developing the advantages of an unique energy-efficiency partnership: working across different technologies, branch-oriented and systematically – from the project design phase right through to everyday operation. Individual measures, however, are not enough. Just as with building an energy-saving house, efficient machines involve the interaction of many different factors: the direction of the house, the right type of insulation for floors, walls, windows and roof, using an efficient heating system, as well as the correct type of air circulation. State-of-the-art technology in this field has improved considerably over the last few decades. Users of machines and utility vehicles cannot wait so long and, fortunately, will not have to, either. This is because Rexroth, as a comprehensive system partner for energy efficiency, is able to shorten the development phase.

Rexroth possesses both the infrastructure and the know-how to give extensive consult to machine manufacturers and users, as well as being able to offer support in the realization of energy-efficient machines. Innovative design tools for all drive technologies help to optimize efficiency as early as during the concept phase.

Innovative mechatronic system solutions utilize the savings potential and make the required power available as and when required. Sophisticated closed-loop control strategies and open-loop control concepts optimize the movements and reduce the energy consumption in everyday operation. Thus Rexroth reduces costs for every cycle, ensuring also a lower total cost of ownership.

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Energy efficient drive technology
Mechatronic system optimization
In every phase of a machine life cycle there will be a range of different options when it comes to undertaking energy-efficiency measures. The most effective way is to consider these during the concept and modernization phases.
Always the right power: Not less, but not more either. With the drives and mechatronic subassemblies designed for use on a needs-oriented basis, design engineers are laying the foundations for energy efficient machines and vehicles. Rexroth supports you with a wide range of design and layout programs for all drive and control technologies.

Time and again over-dimensioned drive solutions and components use more energy than is actually necessary. Thus the user has to pay perhaps several times more for an inappropriate design: Higher procurement costs add up with unnecessarily high energy costs with every single movement over the complete life cycle. Motors that are too powerful, cylinders with too large diameters, unsuitable fan design concepts in vehicles or friction-intensive runner blocks soon drive up consumption and through it operating costs. Rexroth supports engineers with modern design programs for needs-oriented dimensioning and offers them effective solutions to combine energy efficiency with the required power.

The convenient design tools for electric drives, industrial and mobile hydraulics and pneumatics, as well as assembly and linear technology, open up the complete range of finely scaled Rexroth products for design engineers. The programs take into consideration the power requirements of the relevant movement and calculate the ideal combination for all technologies. Innovative calculation software already demonstrates, at this stage, exactly how much energy will be required for the respective automation solution once in operation.

And there is one unique benefit: Rexroth’s deep understanding of the physics pertaining to the advantages of all drive technologies. In-house developed simulation programs take into account the specific characteristics of fluid technology. Even in the run-up to the design phase the specialists are able to realistically determine and compare the performance of various concepts. With extensive, technology-neutral advice Rexroth offers manufacturers and users worldwide the best drive solution for every movement. In its application centers Rexroth combines the experience gained in applications in virtually every branch.
User-friendly design programs and configuration tools from Rexroth calculate the power as required based on specified performance data and automatically put together the components required. The user can then import the result into any commonly used CAD programs.

of factory automation, in mobile machinery and utility vehicles, and is thus able to accelerate progress by implementing more energy-efficient concepts. This means that user will always have the right power available and at the right location.

Savings through Experience
Rexroth is also increasing energy efficiency in assembly technology by providing convenient planning programs and consultancy services. The modular Desktop Factory reduces the installation space required for an assembly line by up to 75 percent, for example.
The Best in the World: Mechatronic Energy Management

The perfect interplay of energy-efficient components from all drive technologies in innovative mechatronic modules leads to the goal: With this Rexroth is reaching new dimensions of efficiency with intelligent closed-loop control systems and the recovery of previously unused energy sources.

Electric motors, direct drives and axial piston pumps, integrated pneumatic cylinders and valve units or low-friction linear technology, optimized with respect to efficiency, play an important part here. But it is the combination of intelligent closed-loop control strategies, optimized to the specific application to form ready-to-install modules, which means lets Rexroth achieve quantum leaps towards higher energy efficiency.

The Rexroth solutions take into consideration the specific characteristics of the relevant drive technologies and combine short response times with reduced power consumption in pauses between cycles. This is how speed-variable pump drives are able to regulate exactly the energy required in hydraulic systems, electropneumatic pressure control valves control air consumption according to need and innovative combinations of materials reduce the moved generating power always exactly when it is needed and thus considerably increasing the overall efficiency degree of the automation process: With a comprehensive mechatronic energy management system Rexroth utilizes to the maximum the efficiency potential of all drive and control technologies for industrial installations and mobile machinery.
The compact dimensions of the LS04 Valve series permit assembly in the direct vicinity of the actuators with short lengths of piping, thus allowing a more economic machine design.

Electropneumatic compressed air valves from the ED Series control the air consumption exactly as required.

Closed-loop speed-controlled hydraulic pumps reduce energy consumption and noise.

Power control via energy-optimized variable displacement pumps without throttle losses in the energy train.

Roller bearing technology with reduced friction coefficients.

Masses of actuators in linear technology. Here Rexroth opts for open interfaces in both hardware and software, permitting the integration into virtually any automation architecture. The Rexroth mechatronic energy management simply combines the best of all automation technologies.

In mobile applications Rexroth considers the main drive of the diesel engine and the hydraulics as a connected system. In this way closed-loop controlled hydrostatic fan drives reduce the fuel consumption, at the same time creating essential conditions to ensure that emission requirements, which have become more stringent worldwide, are met.
Getting the Balance Right: Recovering Energy Effectively

Using available energies efficiently: With its system solutions for the recuperation of braking energy, which have been unused until now, Rexroth is opening up new perspectives and realizing considerable energy savings.

So why feed in new energy, when at some other location within the system excess energy is flowing out unused? Specifically with mobile machines and utility vehicles, which are frequently having to brake and start up again, the Hydrostatic Regenerative Braking System (HRB) from Rexroth clearly reduces energy consumption. In a range of system solutions the HRB stores the braking energy in a hydraulic accumulator, feeding it back during acceleration into the drive train via an intelligent closed loop control system. The system, which is made up of series components, uses the high power density of hydraulics and has proved itself in field trials to reduce energy consumption by up to 25 percent.

In factory automation Rexroth is also making marked improvements in efficiency by exchanging oscillating process energies – even among the different drive technologies. Whether with presses, machine tools or handling devices: The intelligent reversing action of electric motors into generator mode with the help of feedback-enabled supply devices is recuperating energy that has been unused until now, then making it available at another location as required. In hydraulics, too, the closed-loop controlled change-over from pump to motor mode, coupled with the integration of accumulators in the energy circuit, ensures the excess energy is recuperated. And so the balance is right: Energy-efficient solutions from Rexroth convert losses into a profit for the complete system.

The Hydrostatic Regenerative Braking System (HRB) is able to achieve a reduction of up to 25% fuel consumption in heavy utility vehicles, also reducing brake wear by up to 40%.

Using accumulators with appropriate accumulator circuits in press applications to utilize potential and kinetic energies.
Recuperating oscillating process energies: Intelligent closed-loop control strategies from Rexroth accumulate braking energy, making it available to other axes in an efficient way.
Always within the Green Range: Continuous Motion Management

Car drivers have been aware for a long time that a car is only as economic in fuel consumption as the way of driving permits. Whereas with the gas pedal a certain amount of discipline will be enough, complex automation solutions demand intelligent software solutions for continuous motion control. It is the functionalities that Rexroth provides: Innovative software tools analyze the motion sequences in everyday operation and optimize them. This can also reduce energy consumption in existing machines.

Energy savings using the example of a thermoforming machine: Optimization of the motion profile reduces energy consumption – and that is by the same level of productivity.
Measuring takes place at the start of any optimization process. This is because only someone who knows the actual consumption of the individual actuators will be able to step in with appropriate efficiency-improving measures. Rexroth closed-loop control devices thus continuously and accurately record the actual consumption of each individual axis. This also creates a measurable basis on which to work. Control-integrated cycle-time and energy-efficient tools analyze the motion sequences within the machine and offer help in optimizing processes.

This continuous motion guide opens up considerable potential for improving efficiency, at the same time reducing cycle times. By avoiding unnecessary acceleration and deceleration operations or by reducing sudden changes of direction and speed, machine motion, as well as other movements are reduced. By guiding the speed with limited jerks, smoothing out rapid movements and optimized speed profiles and ramp functions Rexroth controls can also increase energy efficiency with machines already installed, at the same time helping the automation process to operate permanently within the green range.

Highly efficient reduction in consumption by a combination of different measures: from a mechatronic overall consideration and innovative energy-efficient products from all technology fields through to cycle-time and energy-analysis tools.

Diagrammatic overview for machine and process contributes towards achieving optimum and consistent machine utilization.

Detailed analysis of machine sequences by the chronologically synchronized recording of process data demonstrates optimization potential.

Thermoforming machine with 2 punch-toggle mechanisms

Visualization of energy consumption during the process can point to energy-critical processes.
Efficient Partnership: Putting Know-How into Practice Together

Experience and innovation: Like no other Rexroth links worldwide application experience with innovative solutions and, in collaboration with machine manufacturers and users, sets new benchmarks for energy-efficient automation solutions.

Decentralized servo drive is revolutionizing automation, for example with packaging machinery.
Whether medium-sized machine manufacturers or major international automotive companies: Rexroth supports all its customers to the same extent with know-how and energy-efficient solutions, in order to drive these forward all over the world and on a sustained basis. With its broad network of subsidiaries in over 80 countries Rexroth guarantees proximity to the customer and swift solutions.

At the same time Rexroth is also committed to the conservation of resources in the way its own products are manufactured. Innovative motor-controller combinations, for example, are reducing the cabling required by up to 85 percent. Innovative combinations of materials are reducing the weight of numerous components, thus also making a further contribution to saving energy through lower drive power.

By working this way Rexroth solutions fit seamlessly into virtually all automation environments. Via open interfaces and adherence to internationally accepted software standards Rexroth is opening the door for intelligent closed-loop control strategies in all automation technologies. This enables mechatronic system solutions and a continuous motion management to noticeably increase energy efficiency in virtually every application. The efficient partnership with Rexroth guarantees significant success in energy efficiency.

The IndraDrive Mi combines closed-loop control electronics and servo motor in an ultra-compact unit. Here the closed-loop control electronics utilize the surface area of the servo motor as a cooling element and reduce the overall volume by more than 50%.
Increased Energy Efficiency: 
The Future Has Already Begun

Why wait for new solutions, when Rexroth is already offering series products and proven system solutions for increased energy efficiency? Whether in industrial automation or mobile applications: Realistic simulations and practical experience show what you can expect.

Innovative, energy efficient components, intelligent closed-loop control systems and a deep understanding of all drive and control technologies can already today help to reduce energy consumption to a considerable extent. This is demonstrated by simulation results, which have been confirmed by the practical results in everyday operation, even in the first applications.

Bending press: 
Minus 45 percent
Just how high the energy-saving potential is, can be seen in the comparison between a hydraulic bending press with fixed displacement pump and a variant using Rexroth optimized series components. Through the use of a speed variable pump drive, highly efficient servo motors, feedback-enabled drives and electric/hydraulic recuperation, energy consumption for a bending press with 1,000 kN pressing force can be reduced by up to 45 percent. The savings in operating costs exceed the additional costs within a very short period of time – a powerful sales argument.
We can work it all out for you

Rexroth supports machine manufacturers and users with energy efficient solutions and extensive technology-neutral advice over the complete life cycle, from the project design and construction phases right through to operation and retrofits. Our specialists are ready to calculate savings potential that you could achieve even now – at Rexroth the future has already begun.

Machine tools:
Minus 35 percent
Even powerful cutting machine tools are directly increasing their efficiency with the aid of Rexroth components and solutions. Here is a sample calculation for a machine tool with two 40-kW spindles: In efficiency-optimized servo motors, speed-variable pump drives, electric/hydraulic recuperation, as well as demand-oriented pneumatics and continuous motion guide reduce energy consumption by up to 35 percent – and this reduces the unit costs for every cycle.

Refuse trucks:
Minus 25 percent
Accelerating, braking, accelerating: The operating cycle of refuse trucks on extremely short distances makes them really suitable for energy savings using the Hydrostatic Regenerative Braking System from Rexroth. Field trials in Germany and the USA have demonstrated fuel savings of up to 25 percent in everyday operation. And the best thing is: The HRB can be integrated into existing vehicle concepts, thus also saving on space.