Rexroth 4EE – Rexroth for Energy Efficiency
4 Effective Levers for More Efficiency

Placing the levers at the right position: Rexroth systematically combines the potential for efficiency for all drive and control technology systems. This allows Rexroth 4EE to combine our efforts to work in a consistent and efficient manner in all phases of a machine’s life cycle.

From conception to commissioning, from daily operation to retrofitting: All phases of the machine’s life cycle present our customers with the opportunity for significantly improved efficiency and sustainability. In sophisticated and complex systems, however, those opportunities for progress are sometimes minor. In order to take advantage of sustained increase in efficiency, a systematic approach must be utilized so that the interactions of all technologies and the interplay of all components are factored into

The individual sections of the machine life cycle offer opportunities of different magnitudes to take up energy-efficient measures.
Energy Recovery – regeneration and storage of excess energy

Energy on Demand – demand-controlled energy use, standby mode

Energy System Design – systemic overall view, perfect project planning, simulation and consultation

the overall efficiency of the system. For this reason, Rexroth has bundled the components of all drive and control technologies in four powerful levers – Rexroth 4EE:

Energy Efficient Components
with optimized efficiency reduce the energy consumption with every motion. They form the basis for economical mechatronic system solutions.

Energy Recovery
stores excess energy generated during braking. Depending on the application and general conditions, storage-charging circuits and regenerative supply devices utilize this energy to supply it to other consumers in the system, and store it in a buffer for the next cycle or feed it into the electricity supply grid.

Energy on Demand
 calls up only the amount of energy that is currently needed. This demand-controlled energy use utilizes intelligent control strategies that consider the respective characteristics of the drive technologies.

Energy System Design
consists of the systemic overall view from analysis via simulation, project planning and consultation up to optimization of process flows using intelligent controls.
More Efficiency at Higher Productivity in All Markets

Energy costs affect the total cost of ownership up to 50 percent, frequently up to 70 percent, and for an entire series of machines and systems even up to 90 percent. Higher energy efficiency, therefore, can quickly and permanently reduce operating costs.

Higher efficiency, more efficient use of energy and lower consumption: By using Rexroth 4EE, users can significantly reduce operating costs and subsequently the total cost of ownership of all machines and systems. The Rexroth levers act in the entire spectrum of systems to gain renewable energies, via factory automation and industrial applications up to mobile applications.

Powerful gearboxes and drive solutions sustainably increase the efficiency of wind, solar and marine energy systems and contribute to a preserving handling of our resources. At the same time, Rexroth makes a significant contribution to reduce the emission of environmentally harmful CO₂ right at the power generation.

In industrial applications, Rexroth 4EE improves the efficient handling of energy while maintaining the same high level of productivity. This lowers the total cost of ownership across the entire machine life cycle and has a direct effect on the unit costs.

One important advantage: Rexroth 4EE are already using production-ready products and technologies. Machine manufacturers and users can thus quickly implement them in new designs or retrofit them in installed machines.
Rexroth enables a lower fuel consumption of mobile equipment and commercial vehicles with products and solutions that are specifically tailored to the challenges. The lower consumption reduces the exhaust gas emissions simultaneously. As a result, Rexroth ensures a positive energy balance throughout from energy generation via industrial production processes up to mobile applications.

Efficient use of energy with the highest of productivity in factory automation and industrial applications

Reduced energy consumption: Emission reduction of mobile applications

On the next pages, you learn more about how Rexroth 4EE operates in factory automation and industrial applications as well as in mobile applications.
Energy Efficient Components: More Power with Less Energy

Work is the result of force times distance. The distances are predefined by the process. For the necessary force, Rexroth provides drive solutions of all technologies that are optimized in efficiency, and they reduce the energy consumption with every motion.

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

High-performance machine tools for machining production immediately increase efficiency by using Rexroth components and solutions. For example, a machine tool with two 40-kW spindles: efficiency-optimized servomotors, variable-speed pump drives, electric/hydraulic recuperation as well as demand-controlled pneumatics and a continuous motion control reduce energy consumption by up to 35 percent – lowering the unit costs with every cycle.

IndraDrive Mi combines control electronics and servomotor in an ultra-compact unit. Utilizing this process, the control electronics uses the outside surface of the servomotor as a cooling element and reduces the overall volume by more than 50 percent.
By using innovative pole shoe technology, Rexroth increases the efficiency of servomotors to more than 95 percent. Drives integrated in the motor reduce the demand for a switch cabinet by up to 50 percent, thereby reducing the necessary cooling power. In addition, they reduce the cabling costs by up to 85 percent.

Low-friction seals reduce the frictional resistance of linear guidance systems by up to 50 percent. Innovative material combinations reduce the weight particularly for vertical axes. This saves drive power and energy.

Axial piston pumps with improved efficiency increase the productivity of hydraulic power units. In pneumatics, complete cylinder/valve units reduce pressure losses. Designers can place particularly light and compact valves in the immediate environment of actuators. This reduces the tube lengths and the masses to be moved.

Whether electrical, hydraulic, mechanical or pneumatic: Energy-efficient components from Rexroth offer more power with less energy – for any motion.
Using existing energies efficiently: Rexroth opens up new perspectives with system solutions for the recovery of brake energies unused to date and thus implements considerable energy savings.

Why feed new energy if surplus energy is drained at other locations in the system without being used? After every acceleration, an axle must brake again. This is a potential that has been underutilized until now, because this energy is frequently destroyed and dissipated as heat without being used.

In factory automation, Rexroth develops significant increases in efficiency by exchanging oscillating process energies – even between the different drive technologies. The intelligent switching of electric motors to generator mode using supply devices capable of regeneration recovers the brake energies that have been previously unused and makes them available at other locations upon demand.

In hydraulics, the controlled switching of pumps to motor mode and the integration of accumulators in the circuit provide a recovery of excess energies. At the next acceleration process, they are available again to reduce the overall energy demand – for every cycle.

By using a variable-speed pump drive, high-efficiency servomotors, regeneration-capable drives and electrical/hydraulic recuperation, the energy consumption of an edging press with a press force of 1,000 kN is reduced by up to 45 percent.

Use of accumulators with the corresponding charging circuits in press applications for utilizing potential and kinetic energies.
Energy on Demand: Always Only as Much as Needed

The perfect interplay of energy-efficient components of all drive technologies with intelligent closed loop controls advances to new dimensions of energy efficiency. They demand only as much energy as currently required by the process, thereby saving reactive power.

In the ready-to-install solutions, Rexroth considers the specific characteristics of the respective drive technologies. This combines short response times with a reduced consumption and provides at least the same high productivity. Variable-speed pump drives use it to generate demand-specific energy in hydraulic systems. They manage with up to 50 percent less energy – with the same machine output. Electro-pneumatic pressure control valves control the air consumption on demand and divide the motion into different phases for this purpose. The result: Up to 25 percent less air consumption.

The closed loop control of numerous pump and fan drives operating at constantly high speeds previously held an enormous savings potential. Economic servo drives and frequency converters lower the energy consumption quickly and sustainably. Rexroth relies on open interfaces in hardware and software, and enables the integration in almost every automation architecture.
Energy System Design: Systematic Efficiency

From concept up to commissioning and optimization in the daily work routine: Rexroth supports designers and users during the entire process with innovative software tools and intensive consulting.

The convenient dimensioning tools for electric drives, hydraulics, and pneumatics as well as assembly and linear technology make the entire spectrum of the finely scaled Rexroth products available to the designers. The programs take the performance demands on the respective motion into consideration and calculate the ideal combination for all technologies. During this phase, innovative consumption calculators already show how much energy the automation solution requires in later operation.

A unique advantage: The in-depth physical understanding of Rexroth for the strengths of all drive technologies. Simulation tools developed in-house take the characteristics of fluid technology into consideration. In advance of the design, the specialists can already use them to realistically determine and compare the performance of various concepts. With its extensive, technology-neutral consulting, Rexroth supports manufacturers and users throughout the world in the selection of the best drive solution for every motion.

No matter whether you want to solve a simple or complex drive task – IndraSize, the convenient program for drive dimensioning, accurately guides you to the optimal drive for your machine in the shortest period of time.
Innovative tools and functionalities integrated into the controls also help in daily operation to reduce energy consumption and optimize cycle times. As automation partner, Rexroth provides systematic efficiency.

Energy savings using a thermoforming machine as an example:
The optimization of the motion profile reduces the energy consumption – while maintaining the same productivity.

The detailed analysis of the machine processes using time-synchronous process data recording shows optimization potentials.

Overview diagrams for machine and process contribute to achieve an optimal and constant machine utilization.

The visualization of the energy demand during the process can point to energetically critical processing.

High-efficiency consumption reduction by bundling different measures:
From the mechatronic overall view via innovative energy-efficient products of all areas of technology up to the cycle time and energy analysis tools.
Energy Efficient Components:
Efficient Axial Piston Units Reduce Consumption

Rexroth 4EE offer complete performance with less consumption. Intelligent solutions and efficient components reduce sustained fuel consumption and emissions of mobile equipment and commercial vehicles.

Whether in agriculture and forestry, everywhere in construction, in commercial vehicles or in material-handling equipment: A combustion engine generally powers the working hydraulics and the hydrostatic travel drive. The efficiency of the hydraulic pumps and motors significantly affects the fuel consumption. Energy-efficient axial piston units of the latest generation demand less power from the main motor, thereby significantly reducing operating costs.

Axial piston pumps developed specifically for use in commercial vehicles, such as the A17VO, always provide the demand-specific and actually required pump capacity for the corresponding application, thereby offering optimal energy efficiency with simultaneous maximum performance.

The new high-performance travel drive from Rexroth also makes a significant contribution to lower the fuel consumption of mobile equipment and to reduce their emissions. The travel drive consists of an A4VG variable pump of the new series 40 and an A6VM hydraulic motor of the new series 71. These units operate with a nominal pressure that was increased by 50 bar to 450 bar and a peak pressure increased to 500 bar. The result: Higher power density for an increased energy efficiency.
Energy Recovery: Recovering Energies Effectively

Using existing energies efficiently: Rexroth opens up new perspectives with system solutions for the recovery of brake energies unused to date and thus implements considerable energy savings.

Why feed new energy if surplus energy is drained at other locations in the system without being used? Particularly for mobile equipment and commercial vehicles that frequently brake and start again, the hydrostatic regenerative brake system HRB from Rexroth significantly reduces the energy consumption. As a parallel or serial system, the HRB stores the brake energy in a hydraulic pressure reservoir and reapplys it to the drive train during acceleration via an intelligent closed loop control.

The system consisting of series components utilizes the high power density of the hydraulic pressure reservoir and has already demonstrated reductions in consumption in practical testing of up to 25 percent.

The hydrostatic regenerative brake system HRB can reduce fuel consumption in mobile equipment and commercial vehicles of up to 25 percent.

The driving cycle of garbage trucks with extremely short distances is ideally suited for energy savings by HRB. Another plus: Due to the low space requirements, the system can easily be integrated into existing vehicle concepts.
Energy on Demand: Low-Consumption Ideal Temperature

Worldwide emission regulations are now much more restrictive, making high demands on engine management. The engine must reach and maintain the optimal operating temperature as fast as possible. Tailor-made hydrostatic fan drives from Rexroth take on this task extremely efficiently and also lower consumption by up to five percent.

Independent of the head wind and the speed of the combustion engine, the intelligent hydrostatic fan drives provide demand-based cooling for low-emission combustion. A CAN bus-ready controller specifically optimized for the fan drive analyzes all important temperature parameters for coolant, oil, charge air and exhaust gas recirculation and controls a variable axial piston pump/external gear motor combination.

Compared to purely mechanical belt drives, this combination achieves a lower fuel consumption of up to five percent.

Another advantage: With the mechanical decoupling of combustion engine and cooler, vehicle manufacturers can position the cooler perfectly and make optimal use of the limited installation space.

Especially in rough environments, the hydrostatic fan drives perform an important additional function: Using a reversing block, the fan motor performs a short-term change of the direction of rotation and generates compressed to clean the cooling ribs. Hence, the cooler always operates with highest efficiency and maintains the combustion engine energy-efficient at optimal operating temperature – even on construction sites or in agricultural operation.
Energy System Design: Design Economy

Especially in the conception and design phase, manufacturers have the greatest potential of sustainably lowering the consumption. Rexroth supports them with know-how and state-of-the-art software programs.

The interaction of different components, the ideal system configuration and the installation in the mobile equipment: The Rexroth specialists in the industry-oriented application centers bundle worldwide application experience. Highest energy efficiency for lower consumption is one core competency.

Rexroth advises them in the configuration of tailor-made solutions that lower consumption and emissions. Extensive design tools and state-of-the-art simulation tools take the characteristics of fluid technology into consideration.

They realistically map the interaction of all components as early as the design phase. In particular, Rexroth has access to the unique knowledge in electronics of the Bosch Group and offers a broad spectrum specifically for the robust use of designed vibration and shock-resistant electronic controllers.

From the initial idea up to series assembly, Rexroth provides design economy as a system partner and helps machine manufacturers to lower the consumption.