

# Campaign for efficiency and sustainability

## KUKA Robotics is pushing ahead with product development for energy optimization

*For decades, the energy consumption of robots was not regarded as important. Today, things are quite different: For some time now, the topics of energy efficiency and sustainability have significantly influenced robotics development. KUKA Roboter GmbH is a member of the blue competence initiative by the VDMA, and is committed to finding sustainable solutions in industry and production.*

The worldwide CO<sub>2</sub> debate, efforts by leading industrial companies to achieve sustainability, more restrictive energy management demanded in ISO 50001 as well as permanently rising energy prices are attracting more and more attention to the topic of ecology nowadays. Robot manufacturers are called on to reduce energy consumption by new technology and progress in the disciplines of lightweight construction, drive engineering, programming and control engineering, and to ensure that the machines can be operated sustainably.

KUKA Roboter GmbH has already surmounted several hurdles in this direction. The Augsburg-based company has been able to initiate ground-breaking developments, and today it has a complete range of six-axis robots in its portfolio, all of which are known for the prudent way that they handle energy. The average energy consumption of the machines is between 1 and 3 kWh depending on the payload class, which puts them on the same footing as many domestic appliances.



## **Integrated package of measures**

Dipl.-Ing. Peter Klüger from the Strategic Product Development department at KUKA Robotics takes the example of the KR QUANTEC robot generation and the innovative KR C4 controller to explain what progress has already been achieved: "The systematic use of energy-efficient technologies has made it possible, both during motion and in standby mode, to reduce energy consumption significantly. In the production motion itself, the six-axis robots use around 30 percent less energy than the predecessor model. In the operating state 'wait under servo-control', the potential saving achieved is even higher at 60 percent due to the reduced brake application time."

KUKA uses a complete package of measures to achieve these significant improvements. Amongst these, the topic of lightweight construction was at the top of the wish list, because after all if there is less mass, then of course there will be less energy. A targeted selection of material and configuration made it possible to reduce the inherent weight of the robot arm by more than twelve percent. Furthermore, high-quality gear units with very low friction losses and energy-efficient motors contribute to the outstanding consumption values. In addition, drive engineering with optimized use of energy and optimum matching of servo drive modules and motors ensures that the robot systems are operated with optimum consumption. Together with intelligent path planning and new motion commands with optimized consumption, it has ultimately been possible to reduce energy consumption in motion by about 30 percent.

## **Focus on production time and standstill time**

However, it is by no means sufficient to concentrate on energy consumption during work. Why? The answer is provided by an analysis of the times that the robot spends in motion and stationary in the body shop: The robot is only moving for 26 percent of the time, while for the remainder it is at a standstill. Peter Klüger summarizes what these insights mean in terms of the effort to optimize energy efficiency: "Since the robot is in wait positions or standstill positions for 74 percent of the time, we must naturally not focus solely on productive motions with a view to energy-efficient operation, but must systematically tap the savings potential in the non-productive phases."



through consistent energy management, KUKA has succeeded in significantly minimizing energy consumption during waiting times. The savings in the variously defined standby modes are between 15 and 80 percent. The achieved energy savings are based, amongst other things, on PROFIenergy, a feature that provides functions and mechanisms for ProfiNet to enable energy-efficient production. Incredible, but true: depending on the standby operating state, the new robot controller only consumes between 30 and 200 watts.

### **Total energy consumption significantly reduced**

All in all, with the KR QUANTEC robot generation and the KR C4, KUKA has achieved a total energy saving for average robot use in body production of 36 percent compared with the previous series. Three-shift robot operation five days a week and two days shut down at the weekend thus results in a savings volume of around 2,500 kWh per year and per robot. This is roughly the annual energy consumption of an energy-conscious two-person household.

When a KR QUANTEC robot is used in the body shop, it is possible to reduce the emissions of CO<sub>2</sub> per robot by more than 1,400 kilograms annually. This sustainable production also works to the advantage of the system operator, who saves more than 250 euros in energy costs per robot per year. With thousands of robots in operation, the savings potential over the lifetime of the robots runs into the tens of millions of euros.

### **Sustainability written large**

It is thus also the service life of robots that leads to exemplary positioning in terms of sustainability. The concept behind this term is that objects should last for a long time after they have been produced. This goes for KUKA machines to a particular extent: Users all over the world confirm that robots from Augsburg enjoy an above-average service life, even under the harshest application conditions.



It is by no means rare to encounter six-axis robots in factories that have been working reliably for twenty years and even longer. Two factors are decisive for this unusual level of performance: high-quality robots and perfect after-sales service with a reliable stock of spare parts.

The course has been set for using the working machines day-in, day-out over several decades in production amidst harsh industrial surroundings. The latest production methods, reliable processes, integrated quality assurance systems as well as test runs under the toughest conditions – KUKA does everything to set the standard in terms of efficiency, reliability and durability.

Even after their lifecycle, the robots also prove their green credentials. The machines can be almost completely recycled. This is where forward-looking product development pays off, in which the use of single-grade, reusable materials is preferred. The proportion of metal in a robot arm is about 90 percent – material that can be returned to the production cycle almost in its entirety by means of recycling. The remaining materials of the robot system also have a high level of recyclability.

Sustainable production, energy-efficient operation with long service intervals, a service life that is much longer than the average as well as an exemplary recycling quota make robots from KUKA into an overall system with an outstanding ecological balance sheet throughout their entire lifecycle.

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