The gear wheels are tempered at 1,200°C and then quenched in oil baths.
The production of torque-transmission gear wheels and components or spur gears and accessory shafts is extremely power intensive. To ensure more cost-effective and sustainable production, the Siemens gear manufacturing plant in Penig near Chemnitz, Germany, recently introduced a power management system. A number of advantages can already be seen.

At its plant in Penig, Siemens produces gears for industrial applications and rail transmissions. Siemens is one of the world’s leading companies in this field. Its customer base includes OEMs and industrial customers as well as all the major railway vehicle manufacturers in Europe and some in Asia. Railway drives from Penig are successfully deployed on every continent around the globe. The component manufacturing facility produces up to 600 torque-transmission parts every day. These are turned, milled, hardened, and polished in the finishing department or during the hardening work. The share of production costs attributable to power consumption is extremely high. With the B.Data power management system, Siemens wants to reduce power consumption during production.

Creating awareness

Dirk Jürgens, head of Business Subsystem, explains his decision to adopt B.Data: “It has been shown that in private homes, it is possible to save up to 10 to 15 percent by means of a committed approach to power. Knowledge of genuine savings possibilities is crucial. Only when users know what no-load losses, such as stand-by mode on the television, actually cost do they have an incentive to do something.” Jürgens is convinced that the savings potential in the industrial sector is just as high. “Naturally, we are aware that the software doesn’t automatically reduce consumption; the processes must be adapted first. In the numerous manual steps in our production process, employees can contribute a great deal to power savings. But we need to encourage them with clear messages. As long as it is not yet known whether it is worth switching off a machine during break periods for power reasons, employees will prefer to leave it on. However, if every individual is aware of the actual savings potential at his or her workplace, everyone will have an incentive to make this contribution as well,” the technical manager is convinced.

Optimizing the scope for decision making in total safety

In this case, the B.Data software creates maximum transparency. If the electricity consumption of individual machines were correlated to the operating status of each machine, it would be possible to determine exactly how much the process of switching on and off for breaks contributes to consumption and what the savings potential is by switching off. The hardening shop is particularly power intensive. Here, the parts are tempered for several hours at a temperature of up to 800°C. Afterward they are quenched in oil baths. The hardening process is set by means of a program, but because the oven is loaded and the parts are dipped in oil by hand, the operator still has some scope for decision making. For example, after the hardening process, the oil is still too warm for the subsequent quenching process. Should it be cooled further, or should it be left to cool down itself? Until now, these decisions have been made by experienced employees.

“The high level of transparency provided by B.Data promotes a sense of responsibility among our employees, as they can make a tangible contribution to the company’s energy balance.”

Dirk Jürgens, Head, Business Subsystem, Siemens Industrial Gears
employees according to their best knowledge. With the extremely high power costs at present, an optimization based on exact consumption data is the aim. “Transparency instead of general appeals also works as an incentive here,” Jürgens emphasizes. “It is already becoming noticeable, although we are still in the phase of measuring the consumption of individual machines before taking the next step toward identifying power-savings potential.”

All media are important

B.Data incorporates all forms of power. For example, PAC 3200 measuring devices monitor the consumption of expensive compressed air. In the Siemens gear manufacturing plant, two compressors feed a closed circular pipeline to which 130 machine tools and assembly stations are connected. This compressed air system runs at 6 bar, raising the question of whether the high pressure is really universally necessary or if it is overestimated as a precaution. B.Data facilitates analyses concerning leakages and leakage costs. It also determines exact consumption, thereby making it possible to reduce the pressure without risk to the availability of the machine. Even small adjustments can lead to clear savings. Because in general only 4 percent of electrical power can be used as compressed air power when producing compressed air, efficiency monitoring of the air compressors is also an important cost factor. That is why, when producing compressed air, the volume of compressed air (Nm³) is compared with the required electrical power by means of a pulse count on the power-measuring device. The key performance indicator (KPI) established (kWh/Nm³) indicates the efficiency of the air compressors.

The power and media consumption are automatically calculated and sent by e-mail to the units concerned. This situation
Expertise in power management

The B.Data power management system was implemented by Siemens Professional Services Energy Management in Linz, Austria. Taking account of various projects, project leader Gottfried Blumauer notes that achieving power savings of 10 percent through awareness training and subsequent efficiency measures is realistic: “B.Data, together with the flexible PAC measuring devices, creates the necessary power transparency. Power costs are ascribed to the units that ‘generate’ them. Only in this way can power efficiency be increased across all departments.”

Optimization reduces costs

With B.Data, the oversizing of power distribution can be avoided, as the system constantly monitors consumption at the individual power feeders. This is a clear advantage over conventional measuring instruments, which provide only snapshots. The measurements showed that the load on the distributors in the production plant varies considerably: many wires are oversized, while others are almost at their performance limit. “To prevent disturbances resulting from an overload, we place all power distributors on the same level. The rewiring costs are very low compared to the positive contribution to the increased availability of the machines,” explains Jürgens.

Power prices consist of the costs for the agreed normal load and the costs for peak loads. Using only the temporal recordings of the total power consumption, B.Data was able to demonstrate a means of reducing costs. It was therefore determined that it would be more favorable at the current tariff to agree to a higher peak load (4.5 instead of 4.2 MW), and this has already paid off.

Because industrial companies and car manufacturers are increasingly trying to reduce the environmental damage caused by their plants, sustainability is no longer just a sales argument – it also offers tax advantages. Evidence must nevertheless be provided that measures have been taken to minimize power consumption and CO₂ emissions. Suppliers that can already demonstrate the sustainability of their production processes are a step ahead. But according to Jürgens, being able to determine the real power-cost share of different parts has another advantage: “Previously, we used the same share as the basis for setting the prices of all parts. A transparent price-setting mechanism based on real costs promotes a partnership-oriented customer relationship.”

Project expansion in view

While the extent of actual power savings in component production is still unclear, Jürgens is nevertheless firmly convinced that the percentage value is in double digits. In addition to the financial aspects, he also feels that employee motivation is important. “If savings potential can be supported by precise figures, everyone pulls in the same direction. The high level of transparency provided by B.Data encourages our employees to develop a greater sense of responsibility because they can make a tangible contribution to the company’s energy balance.”

In a further project stage, the Siemens gear manufacturing plant intends to introduce a connection with ePS, the condition-monitoring solution for machine tools. Insights from power management and condition monitoring come together in maintenance. Valuable synergies can be derived from a combined vision. In real terms, the automatic correlation of a machine’s operational status and power consumption is expected to provide information concerning process optimization and machine maintenance. It is clear to all those in charge that reduced power consumption and increased availability and productivity are ambitious goals that can nonetheless realistically be achieved with the help of B.Data and ePS.