■ Energy Efficiency

Intelligent Energy Management

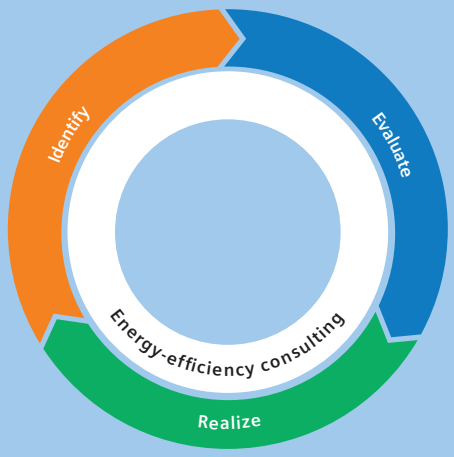
Reducing energy consumption helps reduce costs and contributes to greener, lower-carbon production. Automation and drive technology can make a valuable contribution to increasing the energy efficiency of production and manufacturing.

There are basically three levers for optimizing energy consumption: the use of energy-saving units (especially drives), load optimization within production, and tariff optimization through intelligent order management. Which of these possibilities will have the greatest effect in the long term differs from plant to plant and requires a precise analysis of consumption in every case.

In plants that are operated and monitored by Simatic WinCC or the Simatic PCS 7 process control system, the software for efficient analysis and evaluation of the electricity consumption of individual devices can be easily retrofitted. The add-on product Simatic powerrate records energy data and presents it in preprepared faceplates. This has the advantage that energy data are visualized by the same system as process values and diagnostic data. A key function of Simatic powerrate is integrated limit monitoring. This serves, for example, for monitoring the 15-minute power average values that are used for electrical energy accounting and for controlling consumption based on forecast trend values in such a way that the limits agreed with the supplier are not exceeded and at the same time important production processes are not impaired. Ideally, greater consumption peaks can

Energy-efficient production: a comprehensive approach

Under the motto "Identify – Evaluate – Realize," Siemens has presented a number of products and solutions for intelligent energy management at this year's Hannover Fair. These products and solutions also help identify and exploit unexpected potential. Many products in automation and drive technology are already capable of making a contribution to energy management. Investments in additional equipment are usually amortized quickly and sustainably reduce the total cost of ownership of a plant.



be compensated and kept constant within a narrow tolerance band so that a continuously low reference level – and thus lower energy costs – results.

A number of automation and drive technology products such as Sentron circuit breakers, Sinamics frequency converters, and ET 200 motor starters can already communicate electricity values and therefore make an important contribution to energy management. Other devices can be integrated into the energy management system by Sentron PAC multifunction measuring units, for example.

Efficient drive technology

Electricity consumption can be reduced first and foremost where it is primarily needed: in the operation of the motor itself. In the future, electric motors will be classified in new international efficiency classes by the IEC 60034-30 standard according to their energy consumption behavior: as IE1 Standard Efficiency (formerly EFF2), IE2 High Efficiency (formerly EFF1), and IE3 Premium Efficiency. IE1 motors were previously the standard. As of June 16, 2011, the minimum efficiency in the European trade area will be specified as IE2. Changing over from IE1 motors to highly efficient motors means a lot of work. But it is worth the effort because the higher the efficiency, the lower the energy budget. As of 2015, IE3 – or, alternatively, an IE2 motor in combination with a frequency converter – will become the minimum efficiency.

Frequency converters are now an equally important possibility for reducing energy consumption. Through variable-speed operation with frequency converters alone, energy consumption can be reduced by up to 70 percent in comparison with constant-speed operation. This is an advantage, above all, in flow machines such as pumps, fans, and compressors, for example, especially in comparison with the previous flow controls with mechanical throttle valves. The higher investment costs will be amortized in shorter and shorter intervals in the future as energy prices continue to rise. But it is crucial to observe not only the production process itself but also all utilities. Plants are often overhauled and renovated without subjecting the media supply to critical inspection. The compressors for producing compressed air, for example, might possibly have become greatly oversized in the meantime, and the available pressure much higher than necessary. A design that is adapted to current requirements and the use of energy-saving drives can create substantial savings.

Additional significant energy savings, up to 50 percent, can also be achieved in applications in which large masses are moved or high braking energy occurs, for example, in presses and punches, hoisting units, centrifuges, conveyor belts, and escalators and elevators. The braking energy is fed back into the electricity grid by a simple, high-quality feedback and reused. Even the low-cost Sinamics G120 frequency converter for standard tasks is now available with a power module with the innovative Efficient Infeed technology. As this technology also reduces brake heat dissipation, it eliminates the number of drive components and considerably simplifies configuration and commissioning. Moreover, the drive solution with feedback has a smaller footprint, as no braking resistors or line reactors are needed.

Load optimization

It's a sad fact of today's manufacturing environment: during production breaks (e.g., weekends), the typical manufacturing line will consume 60 percent of the energy used during production. Units and systems remain in hot standby mode to ensure immediate availability at the beginning of the next shift. Because units with various start-up times work together on the lines, the management of the data for these various start-up behaviors and the triggering of the appropriate switching processes for safe start-up by the automation system has until now been too complex.

This situation has changed since the introduction of PROFIenergy, a vendor-neutral protocol developed and standardized by Profibus and Profinet International (PI). ▸▸

» There really is low-hanging fruit. «

Comment by Dr. Gerd-Ulrich Spohr, Head of the Innovation & Technology Department in the Industrial Automation Division

"The designers of new plants today usually strive for and achieve the highest possible degree of energy efficiency. However, one area is frequently totally ignored: the existing utilities. The media supply often comes from predecessor plants and is more than 20 years old. But as long as the pressure provided is sufficient, it is used without questioning whether the compressed air volume really must be maintained all the time.

"The integration of these systems in the automation of the entire plant pays off very quickly. Energy flows can then be visualized and analyzed, and utility operation can be coordinated with the operation of the overall plant so that heat and pressure are generated automatically on a demand drive basis.

"The 'proven assets' in the factory building normally operate reliably – but as far as savings potential is concerned, this low-hanging fruit is definitely worth picking."

PROFIenergy is a Profinet-based data interface that allows individual devices or entire subsections of a plant to be switched off automatically – in a highly selective manner and without the aid of external hardware. The power-down process is coordinated on a vendor-neutral basis and is controlled centrally. Other automation components can continue to operate during breaks, so safety-relevant sections of the plant remain in operation. The exact energy savings potential depends to a great degree on the specific application. However, measurements have demonstrated that there is considerable potential. Through the coordinated shutdown of devices that are not needed, it is possible to reduce energy requirements in long downtimes by up to 80 percent. Even in short breaks, savings of up to 40 percent are possible.

Cost optimization

If the possibilities for saving energy have been exhausted, there is still the possibility of buying cheaper energy. Plant operators today have two options to choose from if their energy consumption fluctuates: they can either buy electricity from their utility on demand to cover load peaks that exceed negotiated purchase levels or pay for higher consumption than is normally needed to cover the peaks. Both options are quite costly. There is a third way, however, that is more cost-efficient: avoiding load peaks by mutually locking particularly energy-intensive processes, either at the production level or through coordinated order management.

b.data software is available as another add-on to Simatic WinCC and Simatic PCS 7 for order and tariff optimization. Company-wide transparency can be achieved through calculating key performance indicators (KPIs) that are vital instruments for optimizing efficiency of energy production, distribution, and consumption systems. b.data has interfaces to company control systems such as SAP. In this way, product-related consumption data can be coordinated with order management, for example. This leads to load and requirement forecasts that improve planning security and support purchasing in the procurement of energy.

Exploiting synergies

The uniform architecture of Totally Integrated Automation enables gradual energy optimization of a plant with comparatively little effort. This adds energy data to the already high data transparency in Totally Integrated Automation. The transparency of energy data can also assist in the status monitoring of a plant and in optimizing maintenance. As a result, efficient energy management leads to synergies that affect more than the energy budget. The effects of these synergies on the total cost of ownership are difficult to estimate in advance – but anyone who uses them will certainly learn to appreciate them. ■

info	www.energy-efficient-production.siemens.com