PROFIBUS and PROFINET • North America

A PTO White Paper

Get Energy Costs under Control

January 2010

Get Energy Costs under Control

Norbert Brousek,
Siemens AG

With PROFIenergy, for Energy Management on PROFINET, users can actively and effectively manage energy in their automation systems. By purposefully switching off unnecessary consumers, energy demand and, thus, energy costs can be drastically reduced.

During the idle period on the weekend, it is common for equipment to still consume about 60 percent of the energy used during production. Up to now these consumers were typically not switched off. The reasons for this are complex. First and foremost, additional hardware would have to be installed outside the machine. Many users are reluctant to put in the engineering effort required for this. This situation can be avoided in the future by purposefully switching off "energy-wasting" components from the higher-level controller.

While external cabling is currently required for switching consumers, the use of equivalent commands eliminates this need. The consumers themselves "speak and understand" PROFIenergy—a cross-device and cross-manufacturer profile featuring the relevant energy-saving measures that is currently under development by PI. By relocating the switching operation to the device, the manufacturer can decide how to optimize its device for maximum energy savings. Up to now the use of a hard external switch-off meant that some consumers had to keep running during short pauses since they otherwise would not reach ready-to-operate status in time for the start of production. The new features and commands allow device manufacturers to react flexibly to idle times and, for example, to switch off just a few parts of the machine. In this way the potential for energy savings can be fully tapped.

Real-world energy management with PROFIenergy

In order to optimize application of the new profile in the real world, use cases (UCs) have been defined in close collaboration with users. These serve as the basis for the specification activities for PROFIenergy.

UC 1: Switching off and on during brief pauses

In this use case, the system selectively stops the equipment, e.g., during lunch breaks, and switches off those energy consumers that will save energy during brief periods but that can be powered up again on time. Accordingly, only individual devices or equipment components are addressed. Important safety-related functions are retained. When production operation starts, the system activates the consumers in a defined switch-on sequence and checks whether all consumers have started up correctly. The system then starts the production process.

UC 2: Switching off and on during long pauses

This use case is very similar to the first one. Because the pause is longer, however, additional devices can be switched off, and the devices internally switch off more consumers.

UC 3: Switching off and on during unscheduled pauses

In contrast to the two types of pauses examined previously, the timing and duration of the pause described in this use case are unknown. Interruptions due to equipment malfunctions are a typical example of this type of pause. For this reason, the energy demand is reduced initially as if for a brief pause. If it turns out that the repair work will take longer, the possibility exists

to place the equipment into an even more energy-saving state.

UC 4: Acquiring measurement data

An additional use case is the acquisition of measurement data. In addition to measuring instruments in the true sense, a number of devices are currently built into equipment that measure energy values implicitly. Frequency converters are a typical example of this.

These four use cases represent the basis for additional applications. For example, PROFIenergy also allows a load-dependent machine control system as well as the avoidance of peak loads.

Simple handling

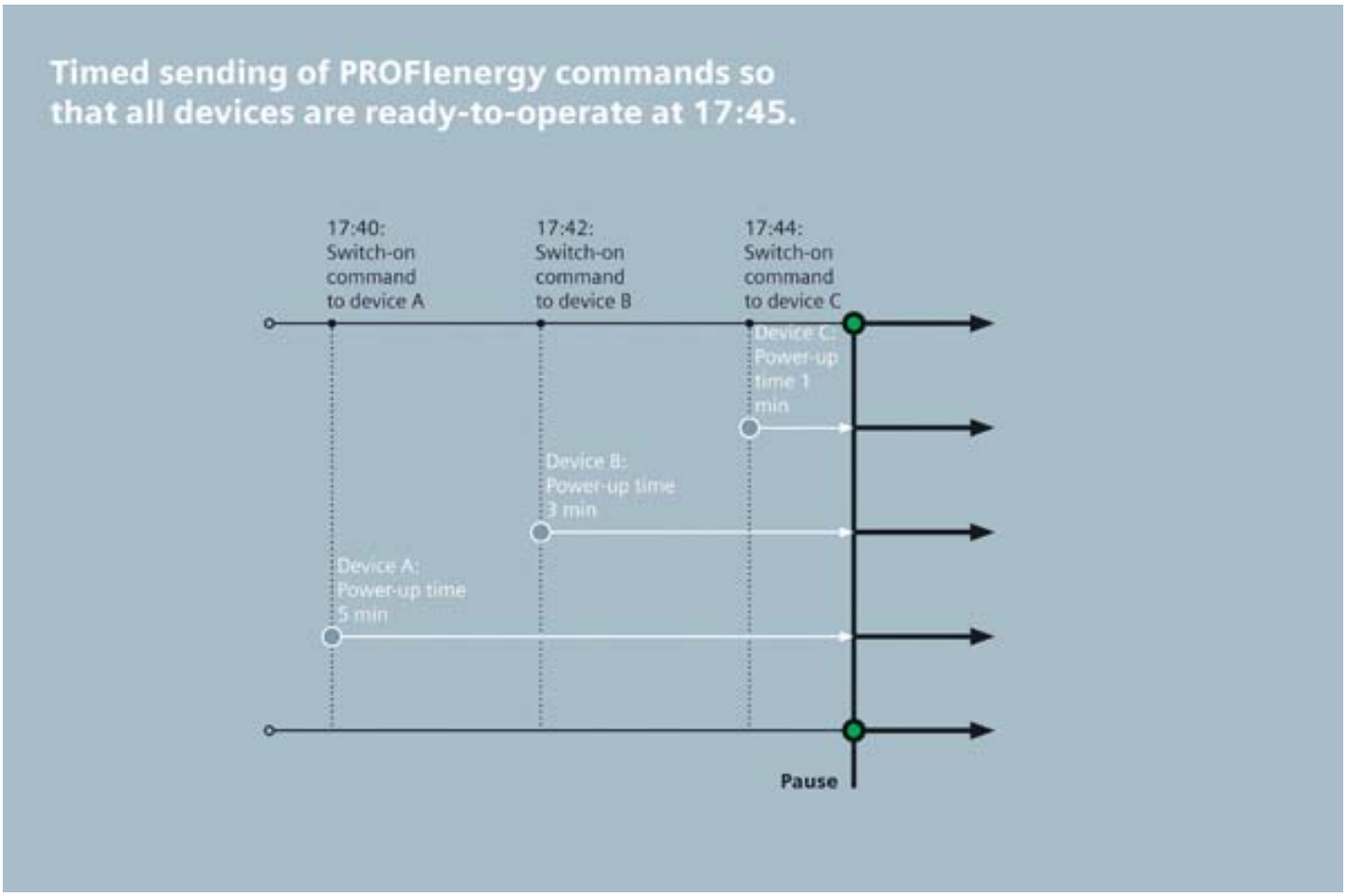
Handling couldn't be simpler. The user sends the device a command that indicates the duration of the idle time. The subordinate device then decides autonomously which parts can be switched off and still reach ready-to-operate status again when this idle time expires. It makes no difference whether the device is a single-component device, such as a drive, or a complex device, such as a machine tool.

To switch the device back to ready-to-operate status, the user only has to send a switch-on command. This enables the equipment to power up in a coordinated manner according to the respective application. The devices provide their power-up times to the user to enable a coordinated switch-on of devices with different power-up times. The user can thus calculate the timing for the switch-on command.

The demand for simple handling as a basis for widespread acceptance is thus met. The engineering effort is minimal. The user only has to integrate the two commands into his program. In so doing, the user can strictly separate the actual control logic for the process from the energy management. Device and system manufacturers can also support users by developing appropriate modules, for example that cover the handling of communication mechanisms.

To take into account the user's desire for upgradability and compatibility, these commands will be mapped onto existing well-proven PROFINET services—in this case, onto records. These acyclic services do not occupy additional addresses in the process image. That is, the volume of user data of a PROFINET device is not altered. Thus, the new commands can be used in existing program libraries and factory standards without repercussion.

Likewise, device manufacturers can use a firmware

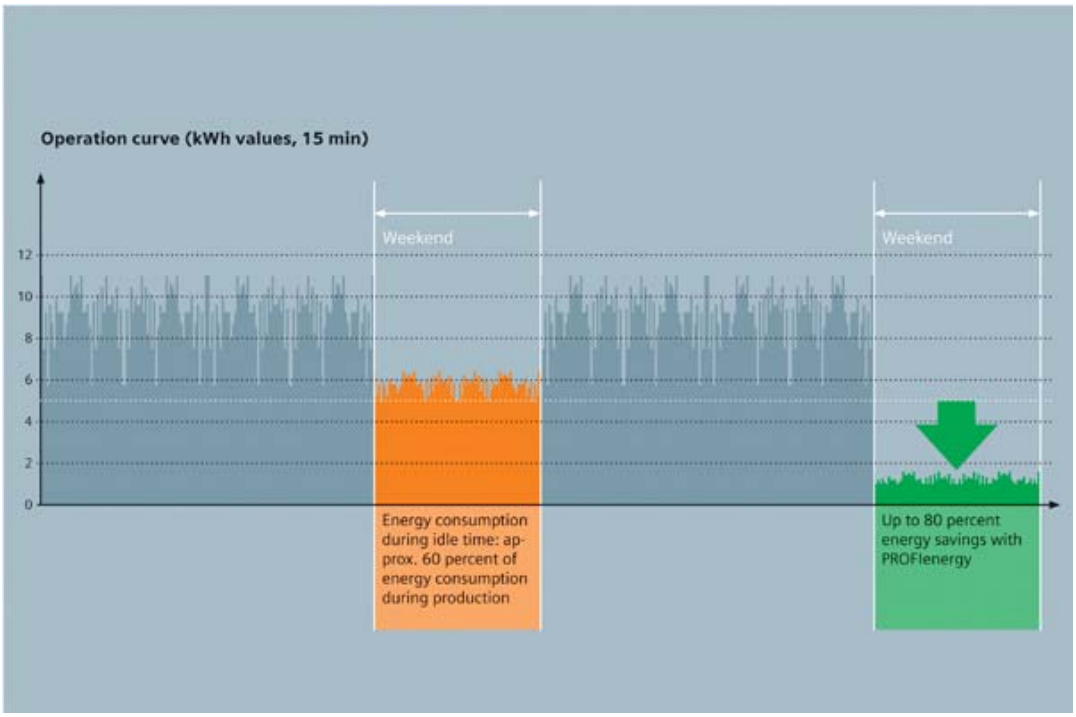


update to expand their existing components to include the new functionality. This enables fast implementation, even in existing products.

High savings potential

The main benefits for the end user are the energy savings and related cost savings. The goal is to switch off non-required equipment in part or in whole. This is the focus of PROFIenergy. Users can expect to achieve savings of up to 80 percent.

Another focus is the expedient use of available energy during production. For example, certain secondary processes can be paused during production, as well. PROFIenergy is thus the basis that allows the user to manage energy efficiently.



Measures are currently available in selective cases to switch off equipment components during idle times. However, these are very application-specific. In addition, these measures often combine the actual control task and the energy management. All of these factors complicate programming and, in particular, the updating and maintenance of this type of software. In addition, the actual switching operation requires external hardware, which must be configured, installed, and maintained. The effort involved for this quickly exceeds the actual savings.

The new profile provides an economical situation in this case, as well. The switching functions are already integrated in the devices. Furthermore, there is a clear separation between the program sections for energy management and for the control logic. As a result, both sections of the program can be tested and commissioned independently. Structured programming also greatly simplifies the updating and maintenance of the user program over the long term.

Profile with value added

PROFIenergy guarantees a uniform interface for energy management. The user is thus free to choose devices from different manufacturers. He can look for the device that is best suited to his application and saves the most energy. The end user benefits from the competition among device manufacturers and system manufacturers to develop energy-saving solutions.

The goal of PI and its member companies is to adopt the PROFIenergy profile by the end of 2009. To assure the suitability of the profile for real-world applications, the work group includes representatives of device manufacturers as well as various institutes and users. In addition, the work group is in close contact with the Automation Initiative of German Automobile Manufacturers (AIDA). A few companies have already announced their plans to quickly implement PROFIenergy into their devices and a variety of customers have also expressed great interest. As a result, the first components and solutions are anticipated to become available in 2010.