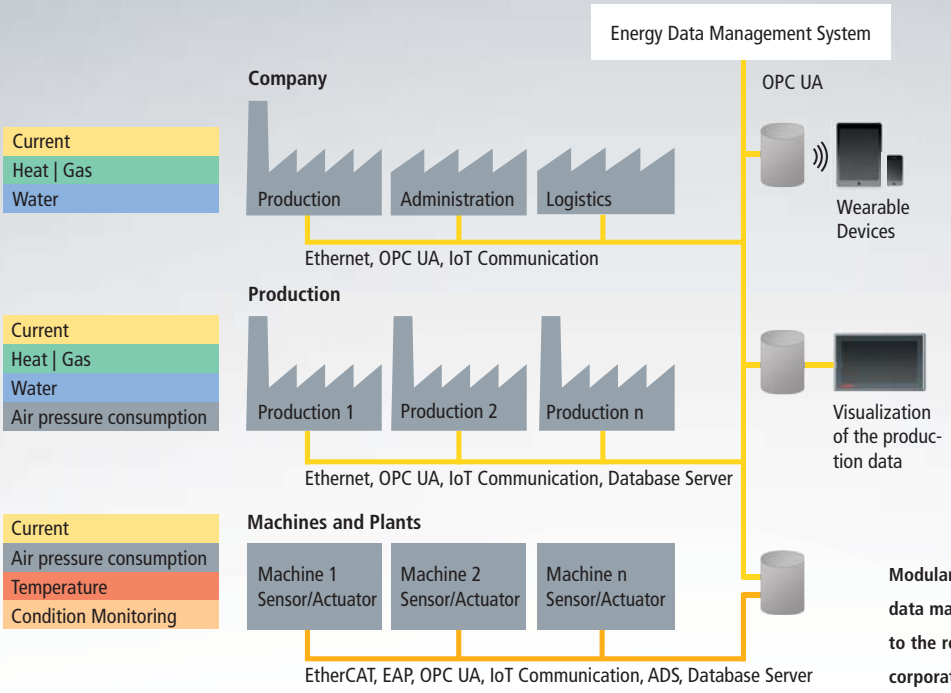
Integrated energy data management enhances PC-based control

Comprehensive and transparent energy data saves money from the building to the machine

An energy data management system that is integrated into the PC-based control system enables monitoring and analysis of all energy consumers – consistently and linked to the higher-level energy data management system.



Modular and finely scalable, the energy data management system can be adapted to the respective requirements on the corporate, shop floor or machine level.

More than ever, managing energy consumption in buildings, production facilities and machines is critical to the success of a company. Making correct cost reduction decisions requires the ability to collect and process all energy-related data. Scalable energy data management systems integrated into PC-based control equipment cover everything from the building to the machine and even each individual motor.

The only way to uncover all potential energy savings is by taking a comprehensive view of the entire business – the administrative level with its offices, conference rooms, and cafeterias; the production facility level; and the individual machine and equipment levels. To secure meaningful results, one must be able to identify all "energy hogs" and make appropriate improvements in some cases, while coordinating the operation of all energy consumers, based on comprehensive and reliable energy data.

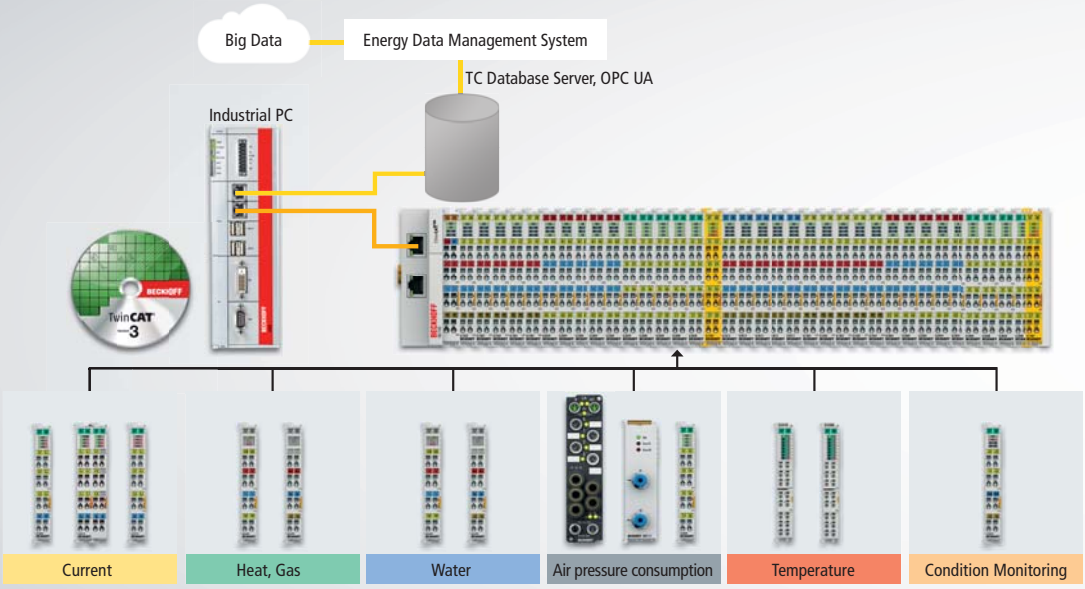
Energy-efficient Smart Factory saves costs

With such an energy measurement system, the forward-thinking company supports the creation of a "Smart Factory", from the aspects that it meets the requirements of the DIN EN ISO 50001 standards as well as from an energy perspective, all with minimal effort. In addition, the integrated and, therefore, low-cost energy data management system does not require large investments. Since the necessary sensors and meters can be integrated into existing buildings and machine automation systems and expanded when necessary, developing a comprehensive energy data management system step-by-step becomes relatively easy, and any investment costs quickly pay for themselves. The end user can analyze and potentially smooth out peak loads based on collected data. In addition, companies can reap clear and long-term cost benefits by consistently optimizing energy usage, which is particularly important against the backdrop of almost certain future price increases.

Also, being "green" is becoming more important to society in general, with businesses facing increasing governmental and political pressure to reduce energy consumption and CO_2 emissions. For example, the repayment of the so-called "renewable energy surcharge" in certain countries depends on the introduction of an energy management system (EnMS) or EMAS certification. The EnMS model of the DIN EN ISO 50001 standard, for example, defines detailed energy monitoring, metering and analysis requirements which can be easily implemented with a Beckhoff solution consisting of modular I/O terminals, TwinCAT and open communication standards such as EtherCAT and OPC UA. In addition, continuous improvement of an energy data management system is just as important as its initial implementation because receiving a refund of the renewable energy surcharge as well as the power and pollution tax requires continuously improved compliance with the DIN EN ISO 50001 standard or EMAS certification. Beyond that, the new Energy Services Act (EDL-G) in several countries requires that all companies not falling under the definition of "small enterprises" implement an energy audit as well as an energy or environmental management system. Such improvements are only possible with a continuous stream of accurate energy consumption data.

Comprehensive and integrated energy data collection

Beckhoff PC-based control technology makes the programming of advanced measurement systems more efficient. The modular and highly scalable PC



The Beckhoff concept of Scientific Automation combines control and measurement technology in a single system with the help of powerful measurement and condition monitoring terminals.

Control technology works not only for machines, but also for building automation applications with a single, universal software system that can handle all control and energy data. This makes it easy to process, combine, and correlate all relevant data, forwarding it to the energy management software. The user also benefits greatly from the flexibility and openness of PC-based control. On the one hand, all signals can be easily integrated into the control system via the modular and extremely broad I/O spectrum. On the other hand, all popular fieldbus systems and transmission standards, such as OPC UA as well as telecontrol protocols, and the EtherCAT protocol are all supported and seamlessly integrated into the PC-based control system.

To maintain a highly efficient energy data management system, end users require a generalized view that can still show every detail. Controlling the company's overall energy consumption is just as important as having precise usage data for every consumer. To accomplish this, energy usage is measured locally and with minimal wiring wherever it occurs – in each department, on each machine and on each actuator. The raw data is transmitted to the controller and TwinCAT via the fast, broadband EtherCAT network for pre-processing, scope or HMI functions. Thus, all power, heat, water, gas and compressed air consumption data is available to the energy management system via standard interfaces like OPC UA.

The benefits of a fully integrated energy data management system become especially apparent in highly complex solutions. The metering components can be added to the existing automation technology easily – even to what is already in place – without having to set up a separate metering and control system. Additionally, the seamless integration enables much faster responses to important energy-related events.

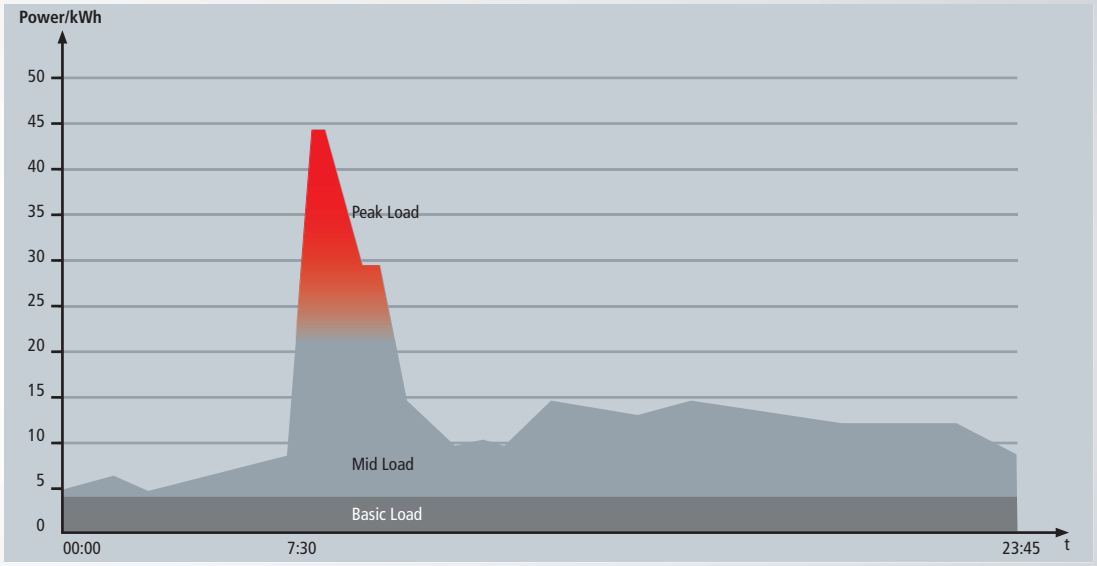
Detailed data analysis with standard control software

With the open PC-based control system, energy data is available for analysis and further processing on all software levels, not just in a higher-level energy management system. Since the TwinCAT automation software operates directly on the control level, the consumption data can be analyzed directly in the control algorithms to improve plant energy efficiency. TwinCAT also supplies a wide range of advanced monitoring and analysis tools. The TwinCAT Condition Monitoring Library, as an example, features a modular toolbox of mathematical algorithms for analyzing the energy status of machines and systems, with functions that cover the areas of analysis, statistics and classification.

The energy data can also be monitored with the TwinCAT software oscilloscope, which combines fast data logging with a powerful visualization tool. The logger can process long series in addition to very fast cycles in the millisecond range, for example, from EtherCAT monitoring I/O terminals such as the EL3773 with oversampling functionality. The results are displayed via the Scope View component, which provides an almost unlimited number of curves in high resolution over time. This enables the viewer to see, for example, whether sinusoidal voltage profiles or harmonics are present. Because of the high resolution, even short peaks become visible, which are very hard to analyze with conventional systems.

Application scenarios for better management of energy costs

Realizing all potential improvements requires a comprehensive energy data management system. This enables users to integrate the collection and analysis of energy consumption data into the building automation system on the administrative level in order to optimize the consumption of power, water, gas and heat with an Embedded PC, TwinCAT and I/O terminals. In industrial envi-



PC-based control provides detailed energy consumption data that lets users map load curves to identify peaks and balance the overall load.

ronments, an Industrial PC with TwinCAT in connection with EtherCAT Terminals provides the ideal data management solution for evaluating cost centers such as the usage of power and compressed air. Installed within the machine, PC-based control produces and manages accurate data down to the sensor and actuator. It also provides comprehensive condition monitoring as the basis for cost-optimized preventive maintenance. This helps users generate load curves and identify peak usage periods for future load balancing. PC-based control also enables determination of each single load share, as well as the basic and average loads. Companies can also use the information to analyze the machines' power requirements relative to each other and use the results as the basis for further improvements. Identifying "energy hogs" can reduce electricity costs and make it easier to accurately allocate them to the appropriate cost center. Detailed energy data can also be used for control purposes, for example, to make the entire production process more stable and to prevent failures.

Module-based integration of all energy data types

The PC-based control technology with its scalability and modularity provides the ideal basis for integrated and detailed energy management solutions. It also features a broad I/O system that enables data collection for all forms of energy usage within the enterprise. For example, one can collect data directly via the KL/EL3403 power measurement terminals. In addition, the EL3413 and EL3433 power measurement terminals and the EL3773 power monitoring oversampling terminal provide extended analytical functions. Consumption data for gas, water and heat, on the other hand, can be integrated indirectly into the energy data management system. The KL6781 and KL6401 Bus Terminals with M-bus and LON interface, respectively, make it easy to link popular gas, water and heat meters to the system. The typical counter pulse output can be integrated with digital input terminals.

Temperatures can be controlled directly via thermocouples or RTD resistance sensors via KL3xxx Bus Terminals and EL3xxx EtherCAT Terminals. The compressed air usage can be measured with KM37xx differential pressure measuring terminals and the locally installed EP3744 IP 67 differential pressure metering EtherCAT Box, making it easy to identify energy-wasting leaks. Compressed air sensors can be indirectly integrated into the system via KL/EL3xxx analog input terminals. Sensors with IO-Link interface can also be used. Further, the EL3632 analog input terminal is suitable for condition monitoring applications in which fluctuations are recorded by means of acceleration sensors or microphones. With condition monitoring, impending failures can be recognized early on so that countermeasures can be taken before developing problems bring the application to a halt.

Further information:
www.beckhoff.com/energy-data-management