Automation meets energy

REAL ENERGY MANAGEMENT | Energy is an increasingly expensive raw material, and pure water is also following this trend. Breweries, in particular, are looking for suitable solutions in this area of conflicting interests between cost-effective production and responsibility to consumers, the environment and legislative authorities. Implementation of a systematic energy management system to DIN EN ISO 50001 is not only the key to cutting operating and manufacturing costs considerably, it is also proving to be a competitive advantage and effective marketing tool, too.

INFO

Company: ProLeiT AG
Sector: Energy management
Location: Herzogenaurach
Country: Germany

In Germany, a certified energy management system is the prerequisite for particularly energy-intensive businesses to be partially exempted from the renewables surcharge and to reduce prospective electricity and energy tax bills in the future. Companies reap the rewards of investing in energy management from day one.

In mid-2007, the German government, faced with the problem of satisfying the dramatically increasing energy and resource requirements of a rapidly growing world population, felt compelled to address the situation and assumed a pioneering role in promoting climate protection. Guidelines specified by an integrated energy and climate programme define the goals for an agreement with the German economy, which seeks to introduce energy management systems in medium-sized and large companies by offering them electricity and energy tax benefits.

Energy management systems (EnMS) in manufacturing companies must:

- Make the most of existing potentials to improve energy efficiency and
- Determine and document the amount of energy required to manufacture each product while constantly reducing this level of consumption

Six steps to energy management

Recording all the resource and energy flows within a company is key to minimising energy consumption and optimising energy efficiency. The internationally recognised standard ISO 50001 provides guidance and supports a continual improvement process based on the PDCA cycle (Plan Do Check Act). The prerequisite for this is an EnMS whose core element is a data-specific infrastructure with a central database for all energy-relevant values.
This involves integrating every energy meter for both primary energy sources (electricity, oil, gas and water) and secondary energy sources (heating steam, sterile steam and hot water) into this data-specific infrastructure. Furthermore, the consumption levels of other media, e.g. cooling agents or gases, must also be captured and integrated into the common data pool to guarantee comprehensive energy management. Just six steps are necessary to:

1. Record the as-is state of all energy and resource flows.

2. Achieve monitoring for analyses purposes.

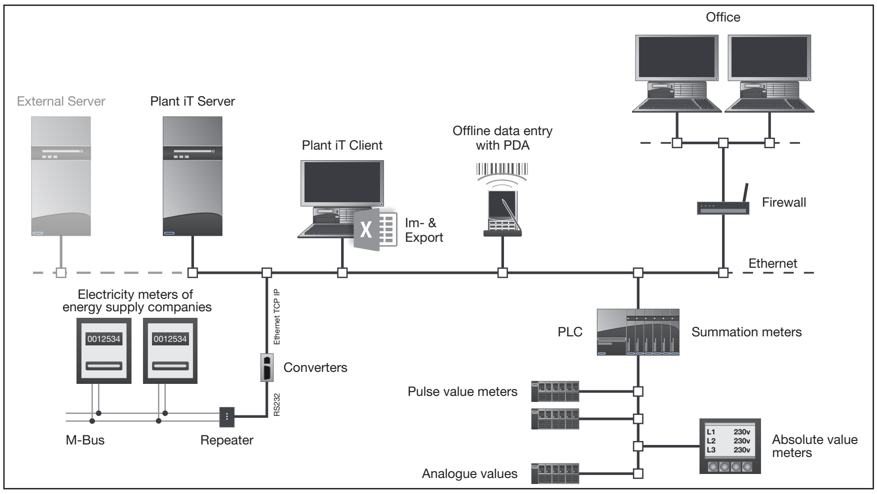


Fig. 1: All the energy meters – the energy and consumption-relevant real-time data from the process control system (bottom right), the meters of the respective utility companies (bottom left) and the offline meters through use of PDAs – are integrated in a common data pool

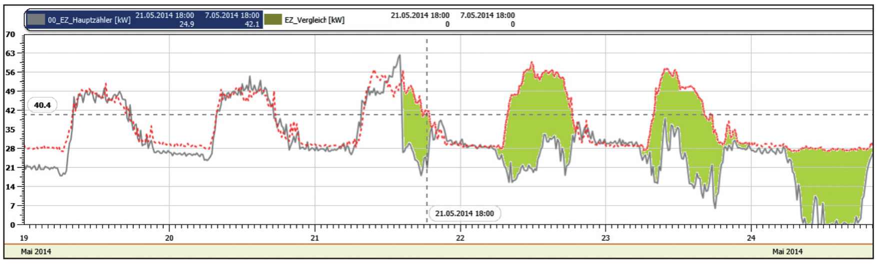


Fig. 2: Monitoring enables comparative analyses due to the simple stacking of data from various time periods

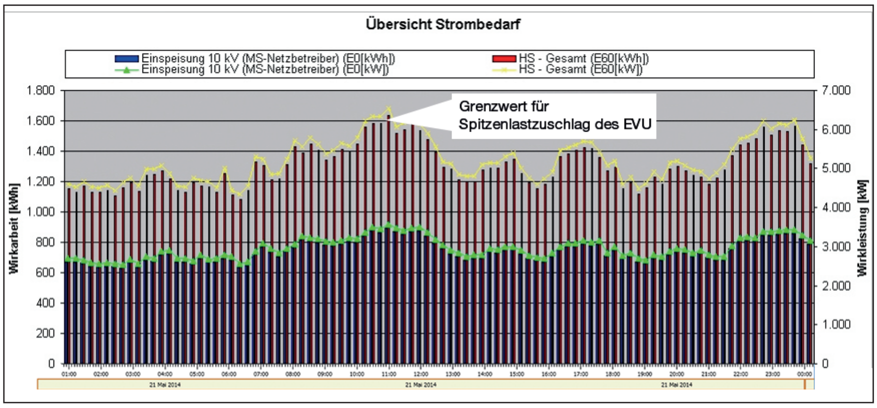


Fig. 3: The energy management system can, e.g., be used to carry out a peak load analysis of electricity consumption

3. Initiate comparative reporting, e.g. over certain periods of time.

4. Define load peaks for limit values.

5. Trigger alarms when limit values are likely to be reached or exceeded.

6. Enable proactive actions in order to reduce load peaks and utilise load valleys.

Simple access to EnMS

The energy management-relevant measuring points in a brewery can quickly total several hundred. It is therefore recommendable to base the meter structure on the following top-down principle of the physical structure:

- Supply of all primary energy sources;
- Energy conversion (e.g. boiler house, combined heat and power plant, sub-distribution of electricity);
- Energy consumers.

The process control system brewmaxx is equipped with a high-performance real-time database in which all operating, process, machine and energy data is recorded, processed and provided. Thanks to the continuous data, information and communication structure, it offers an ideal platform for the integration of an energy management system. This enables, for instance, the reproduction of the physical structure of the energy meters as data in ProLeiT-EnMS and the precise definition of each measuring point as an object. Parameterisation determines the hierarchical level of the meters. A special energy recording class is used to define the data format in which each meter records values and whether the values need to be mathematically adjusted, e.g. totalled, averaged and otherwise processed. Conversion to standardised and comparable values in kWh is not only wise, but also quite simple through parameterisation. The following types of meter are available as standard: Differential meter, integral meter, pulse meter, absolute value meter, current value, manual input, virtual meter. External sources from other brewmaxx servers or energy supply values provided by utility companies in Excel format are also relevant as the type of meter. Utility company supply meters are connected directly depending on the available interface (Fig. 1).

To record offline meters, e.g. water meters or electricity meters without a data interface, ProLeiT offers a mobile data recording system, referred to as a Personal Digital Assistant (PDA). A barcode label is used to detect measuring points that need to be recorded offline. The PDA uses the barcode to identify the respective installation site, saves the manually input meter reading and checks the plausibility of the input value. The data is then transferred to the database.

Moreover, the EnMS offers the opportunity to break down and/or assign energy flows to individual consumers via virtual meters. This significantly facilitates setting up a comprehensive measuring point network.

Monitoring and reporting

After setting up an integrated network for recording all the energy meters, it is possible to carry out standardised evaluations and analyses. These analyses permit both very quick and surprising insights into critical operating conditions. Uneconomic “bad actors”, e.g. transformer short circuits, compressed air network leaks, defective air conditioning systems, inefficient boiler plants as well as extremely expensive load peaks, can be detected as locally and as quickly as possible.

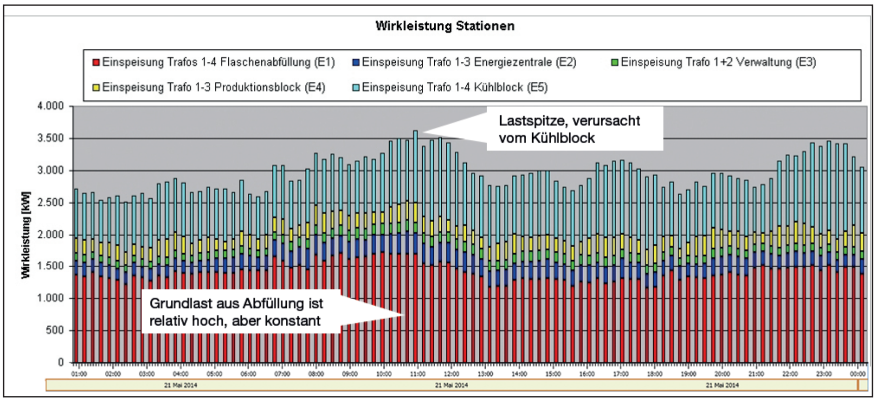
Monitoring also enables the comparison of procedures at different time intervals. It is possible to select between 15-minute, daily, weekly, monthly and yearly intervals. Consumption, min-max values, mean values or standard deviations are then compared in predefined time periods, e.g. today, yesterday, this week, last week, this month, last month, incl. freely definable time windows (Fig. 2). Analysis results and comments can be saved in these evaluations.
EnMS reporting is Excel or SSRS-based (Microsoft SQL Server Reporting Services). Special Excel reports can be further processed very easily thanks to the familiar interface.

The front end of is a stand-alone operating unit. It utilises a secure router (firewall) to access brewmaxx server data via the company network. This cost-effective option therefore does not require an additional brewmaxx client and can, as a real management tool, be positioned where it is actually needed for carrying out analyses, planning and making decisions.

The front end of this EnMS enables:

- Detection of areas with the most energy hungry consumers (Fig. 3)
- Detailed analyses of critical plant components;
- Peak load analyses (Fig. 4)
- Analysis of special consumption patterns

This is the basis for developing strategies to reduce load peaks permanently. Any number of limit values can be specified in the process control system which trigger intervention scenarios with multi-stage reactions. It is possible to define not only the switch-off and restart priorities for each production unit, but also the minimum runtime as well as minimum and maximum downtimes. Process requirements – along with load-related Fig. 4 and 5 automated disconnection strategies – can thus be taken into account. Actions which, due to energy management, have an impact on the process are displayed on the same user interface as the process management. In the same view that displays information on the actual process, plant operators are notified that peak loads may soon be reached and that defined areas of the plant will be temporarily disconnected. Complete integration of energy management in the process control system helps to prevent “abrupt” shutdown and to incorporate technology-friendly “gentle” shutdown with coordinated load shedding.



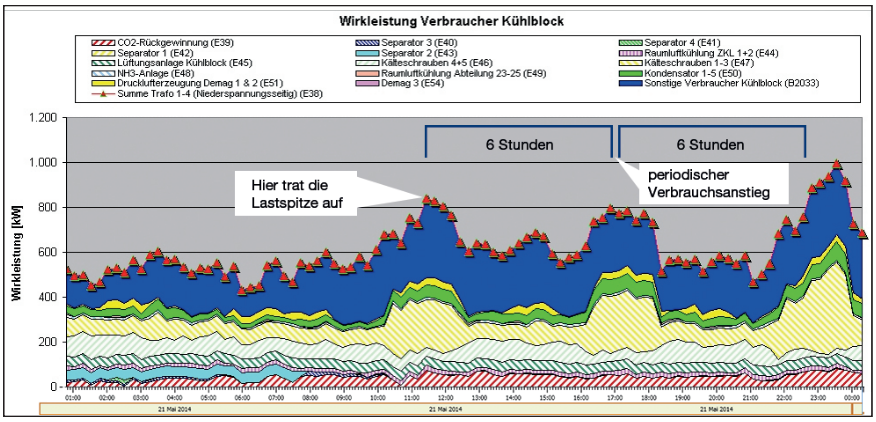


Fig. 4 and 5: Starting up a cooling system at the same time as other processes can result in expensive load peaks; strategies in the energy management can prevent the simultaneous operation of energy intensive units – without any negative impact on the process.

Three stages are usually defined which enable the following reactions:

1. Sending configurable messages to the operator and shutting down “unimportant” consumers, e.g. air conditioning systems.

2. Time-monitored shutdown of technological consumers, such as fermentation tank cooling zones, CIP systems or air injection systems of purification plants.

3. Abrupt shutdown, e.g. of chillers.

The technical design of this multi-stage shutdown strategy ensures production is restricted as little as possible.

Visions and consequences

Today, energy labels can be found on most goods – from light bulbs and refrigerators to motor vehicles. The logical consequence is that energy certificates will soon be available to end customers for consumer goods, such as foodstuff. It probably will not be long before we have to specify the CO2 footprint of a bottle of beer or it is used as a marketing instrument.

The Association of German Machine and Plant Manufacturers (VDMA) is working towards establishing a common industry understanding and has focused its attention on MES figures (Manufacturing Execution Systems) in order to indicate energy consumption in terms of each machine, workplace, order and even produced part. Besides energy efficiency, which focuses firmly on reducing energy consumption through behavioural changes and investments in efficient systems, the VDMA believes reducing energy use during production processes is a key strategic objective of energy management (draft VDMA standard sheet VDMA 66412-4). The goal is to give a clear answer to the question of: How much energy is consumed by each finished product?

Standard ISO 50001 ensures energy management is more attractive for companies, as it provides benefits, such as subsidies or potential tax savings. The directive on the promotion of energy management systems, which came into force on 18 March 2015, places administration of the support programme in the capable hands of the German Federal Office for Economic Affairs and Export Control (BAFA).

The BAFA has added the ProLeiT energy management system to the “list of promotable energy management software”. Therefore, brewmaxx in combination with the energy management system also provides access to government funding.

Top-down management approach

Energy management cannot be simply “purchased”, it must be implemented at every level of an organisation. The office of the German EMAS Advisory Board (UGA) accordingly provides the following information to meet the requirements of standard DIN EN ISO 50001: “The overall responsibility for the installed energy management system must be located with the top management. An energy officer and an energy team should be appointed. Furthermore, the organisation has to formulate the energy policy in form of a written statement which contains the intent and direction of the energy policy.
The energy policy must be communicated within the organisation. The energy team is the connection between management and employees. All employees and other participants must be aware of and capable of carrying out their energy management responsibilities. The establishment of this kind of system is only effective if the continual improvement process is implemented from the management down to all levels. The incorporation of staff in the organisation’s energy policy and the establishment of an energy suggestion system are the logical consequences.

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