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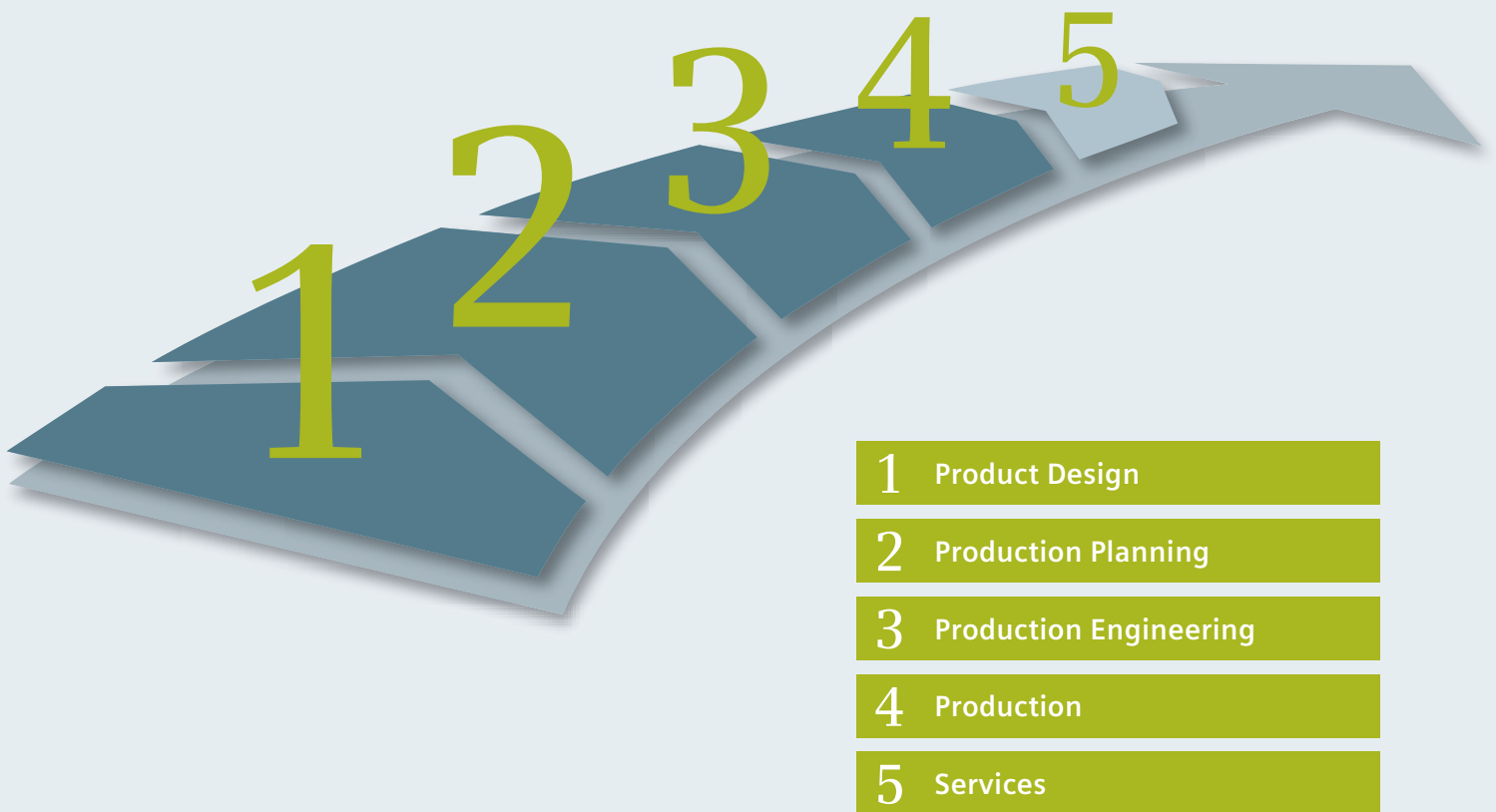
How energy is transformed from cost factor to success factor

Invest in complete energy-efficient concepts and profit faster

[siemens.com/energy-efficient-production](https://www.siemens.com/energy-efficient-production)

Energy efficiency across the board


Energy is one of the most important cost factors in industry. Although operating companies can still save energy in specific areas, the full potential of energy saving can only be leveraged through a holistic and integrated analysis of the complete value chain of the plant or system. As innovative partner, we offer industry energy-efficient solutions, based on our products and services, for all phases of the product development and production process.



1 Product Design

What would be the most energy-efficient machine for your application? This is what step 1 of our 5-step approach is all about: the product design. Alternative machine designs are developed and simulated and the most effective measures are then defined for you. Only well designed products achieve maximum energy efficiency.


- Mechatronic support: development of machines with low energy usage
- Machine analysis: energy-efficient operation, transparency of plants and machines
- SIZER: the energy usage is already calculated in the design phase
- NX engineering software: speeds up development, engineering and manufacture of products with virtual engineering and simulation

 Result: the most energy-efficient machine

2 Production Planning

Efficient and productive plants can already be designed in advance – by simulating the entire production on a screen. Digital models and analyses are used to optimize the motion sequences of your machines, for example, or to prevent load peak overlaps. We also offer special software tools that can calculate how quickly investments pay off in energy-efficient solutions.


- Plant simulation: modeling, simulating, visualizing and optimizing energy usage in production plants and systems
- SinaSave: web-based tool to calculate energy-saving potential of drive products and systems which are then compared with one another

 Result: higher degree of planning security regarding energy efficiency

3 Production Engineering

An energy management system enables efficient energy and cost control. Our totally integrated engineering framework helps you to configure your plant efficiently by ensuring that hardware and software interact perfectly. Integrated automation and drive solutions, efficient motors, gear units, controls or converters can be combined and incorporated simply and quickly on a single screen.


- Integrated Drive Systems: seamless integration of every drive component in any drive system, any automation environment and even in the entire lifecycle.
- SIMATIC B.Data: transparent energy flows as a result of energy management support you in developing potential for optimization and in forecasting the energy demand of your production.
- TIA Portal: optimum drive configuration
- Control Energy functions, for example, motor staging, energy recovery, energy equalization in multi-axis operation, bypass mode and ECO mode and SINUMERIK Ctrl-E
- SIRIUS switching and protecting devices: energy-efficient industrial switchgear for switching, protecting and measuring fixed-speed drives
- SENTRON: hardware and software for the implementation of a company energy management system according to ISO 50001
- Control cabinet optimization: energy-efficient, cost-optimized control cabinet design

 Result: the optimum configuration for energy-reduced operation

4 Production

Innovative drive technology with energy-efficient components and solutions reduces the energy consumption of your plant quite significantly. If required, entire production units can be controlled centrally by means of flexible switching-on and switching-off concepts.


- Integrated Drive Systems: the elements of totally integrated drive systems – frequency converters, motors, gear units and couplings – can be perfectly matched to each other throughout the drive train, in the automation environment and even over the entire lifecycle.
- PROFlenergy: measured value acquisition directly at the load
- SIMOTICS: comprehensive range of efficient motors up to 100 MW
- SINAMICS: application-specific drive portfolio
- SIRIUS soft starters: to reduce mechanical and electrical peak loads
- SIMOCODE pro: motor management system for integration into higher-level energy management and automatic load management
- SINUMERIK and SIMOTION: energy-efficient motion control for the operation and monitoring of plants and machines
- SENTRON: powermanager power monitoring software for transparent energy flows and high plant availability
- Process instrumentation: continuous information flow from the process
- SITOP power supply: power supply units with high efficiency and low idling losses

 Result: energy usage is slashed by up to 70%, e.g. by using innovative drive technology

5 Services

Support with financial, product, system and application-related services – from the planning up to the installation of a plant or system

- Financial services: customized and attractive financing models are offered
- Mechatronic support: mechanical machine and plant optimization
- Energy& Environmental Services: integrated and seamless portfolio of services to improve transparency and specifically implement energy-efficient measures

 Result: customized energy-efficient solutions for every production environment

5 steps to increase efficiency

Make sure you fully utilize the potential for energy efficiency in your production – with our comprehensive range of products, systems and solutions covering all phases of the product development and production process. The objective of our energy efficiency concept is to reduce the energy consumption of machines and systems continuously and extensively, with an aim to enhance the competitiveness of our customers. As your lead technology partner, we can accompany you through every phase of the product development and production process – from product design to production planning and engineering, all the way to production itself and the related services. Because maximum energy efficiency in production is only possible if all the components interact perfectly with one another. Our ongoing innovations ensure that your investments in energy efficiency will pay off faster.



Well advised on the topic of energy efficiency

Just how efficient is your company's energy supply? How can you reduce the greenhouse emissions of your company? One thing is certain: increasing energy prices and stricter environmental legislation are making the energy requirements of your company a hot topic. Energy efficiency and maintaining environmental standards are now decisive success factors for a company. With Energy & Environmental Services, as competent partner Siemens provides customized services within the context of energy and resource efficiency. We support you by creating transparency and identifying energy-saving potential in your complete facility. We provide you with this information as decision-making basis for specific optimization measures. And when required, we can also provide the technical implementation.



Energy efficiency pays off: Increasing energy efficiency quickly results in companies being able to slash their energy costs by 20 percent and more – with payback times that are often less than two years. This is why it certainly makes a lot of sense to think about efficiently using energy and other resources.



A portfolio to address your requirements

We can offer you tailored consulting services, solutions and service, which allow you to optimally utilize the energy you use. For your projects, we support you by creating transparency, identifying energy-saving measures, therefore reducing your energy costs. To achieve this, we have developed a comprehensive portfolio of services, where the focus is on your business goals. Together with you, we systematically analyze and assess the plants and production processes regarding their energy and resource efficiency. When required, our experts can also help you when negotiating contracts with your various energy suppliers – to optimize the commercial conditions when you purchase energy.

Our portfolio in detail:

- Awareness: energy efficiency management workshop, launching an energy management system, supporting you to achieve certification (e.g. ISO 50001)
- Transparency: Analysis regarding data transparency, developing a data management concept, implementing an energy data management system
- Efficiency: Technical energy analysis, technical concept and design study, implementation of technical optimization measures

Additional information about Energy & Environmental Services at: www.siemens.com/ees

Energy efficiency specifics: examples from the field

The following applications will show you the energy-saving potential of our products, systems and solutions that can be obtained in specific applications, and how quickly an investment in leading-edge technology can be paid back.



Efficient irrigation thanks to intelligently controlled pumping station

Energy-saving drive system that reduces the stress on the plant

Adapting the flow rate to the water demand

The Alentejo region in the south of Portugal is known for its severe summer drought conditions. Profitable agriculture is only possible here thanks to extensive irrigation provided by Empresa de Desenvolvimento e Infra-Estruturas do Alqueva (EDIA). Their most important requirements regarding the pump drives: They must be in a position to continually adapt the flow rate to the prevailing water demand, which fluctuates depending on the temperature, humidity of the soil and the growth phase of the plants – and without wasting any energy.

Pumps have a high energy-saving potential


Energy wastage is of special significance for fluid-flow machines such as pumps, as the power they draw increases exponentially with the speed. For conventional mechanical control concepts, an especially high energy loss occurs in partial load operation – i.e. when the maximum possible flow rate is not required. This is because the motor always operates at its maximum speed, while the excess water is throttled using mechanical control elements. On the other hand, a variable-speed system with frequency converter always precisely adapts the speed to the currently required flow rate, and in turn only draws as much energy as is actually required at any point in time.

Variable-speed drive system for Brinches Laje

With this background, EDIA decided to use variable speed drive systems for its Brinches Laje pumping station. Brinches Laje is a pumping station designed for a flow rate of 3 m³/s to irrigate 12,000 hectares. A total of 10 low-voltage motors were installed, whose speed is controlled by SINAMICS G150 frequency converters.

Determining the load profile

It is important to know the load profile when selecting the appropriate drive concept for pumps, fans and compressors. What are the most important quantities: Is it the pressure, the dynamic performance and accuracy, or can a reservoir offer sufficient capacity? The relevant values can be acquired and evaluated using ultrasonic flowmeters in conjunction with pressure and temperature sensors. In operation, not only are leakages in pipes detected at an early stage, but also pollution and blockages. In this case, the loss of valuable raw materials in the pipeline, environmental aspects when the environment is polluted and the efficiency of a pump when there are no blockages in the pipe all play an important role. The energy efficiency can be significantly increased using a preventive condition monitoring system. The use of clamp-on flowmeters offers the advantage that existing plants and systems can be simply and cost-effectively retrofitted.



SINAMICS low voltage drives continually adapt the speed to the actually required flow rate. This slashes energy consumption in the double-digit percentage range.

Evaluating with SinaSave

Based on individual operating characteristics as well as system-specific parameters, the SinaSave web-based tool calculates the energy requirements of various drive products and systems. Further, SinaSave tells you the payback time when investing in an energy-efficient drive solution.

Reducing energy usage

Depending on the particular application, the 2-level control, closed-loop speed control with a frequency converter and partially or fully controlled cascades promise enormous energy-saving potential compared to mechanical throttles. A combination of soft starters and/or drives ensures an efficient operation. In extreme cases, the energy usage of drives for fluid-flow machines can be slashed by up to 70%. This also has a positive impact on the environment: this is because an efficiency-optimized drive system sustainably lowers CO₂ emissions. The actual load profile defines which solution is finally selected.

An overview of the customer advantages:

- Energy consumption was slashed by a double-digit percentage as a result of the high motor efficiencies and variable-speed operation
- Valuable resources are carefully used through precise, flexible process control
- High system availability thanks to the reliable components that are perfectly coordinated with one another
- Complete solution that perfectly addresses customer and project-specific requirements of the irrigation project



Servo drive reduces energy costs

Hydraulic injection molding machines
with new drive

Highest efficiency is a criterion that is becoming more and more important when optimizing hydraulically driven drives. For instance those used in injection molding machines.

Highest efficiency across the board

Energy-efficient, electric servo drives for hydraulic systems offer the optimum solution. The SINAMICS servo pump with high dynamic performance increases the machine yield and slashes energy consumption by up to 50%. Together with converters from the SINAMICS drive family and distributed I/O, an energy-efficient solution was created for hydraulic injection molding machines, as is shown in this example of the Häfner Company. In this application, the gear pumps with controlled servo drive slash the energy consumption of the hydraulics used in the well-proven injection molding machines by about half.

New technology for the well-proven Häfner machines

The company Häfner & Krullmann GmbH is one of the leading manufacturers of plastic reels. In order to improve the technological competence of the company and simultaneously the cost situation, cost-saving potential was leveraged within the scope of the modernization. Two injection molding machines that were still in good mechanical shape, but where the control and drive technology were no longer up to date, were equipped with new technology.

Servomotors for controlled operation

New servomotors that comply with the process requirements replace swing and fixed displacement pumps equipped with induction motors. The 46 servomotors are each operated with a SINAMICS converter with a Control Unit. These modernized systems only use as much energy as the injection molding process demands in the particular phase.

PROFIBUS as fieldbus

A power measuring device is connected via PROFIBUS to monitor the success. This also supports setting-up technicians, who can then understand the immediate effects for certain machine settings - and can therefore develop a feeling for more energy efficient injection molding.

An overview of the customer advantages:

- Improved system availability
- Lower oil tank volumes as a result of less heat being developed
- Elimination of the hydraulic reservoir
- Lower dependency on the oil temperature
- Quieter than conventional hydraulic solutions



Up to 50% more efficient

Drives that recover the braking energy

Application: Servo pumps
Application: Hoisting, braking, lowering

In hoisting applications, centrifuges or conveyor belts, drives must frequently brake large masses. This results in high levels of braking energy, which conventional drive systems simply waste by dissipating the energy in braking resistors as heat. Here, frequency converters with energy recovery significantly reduce the energy usage.

Feed back energy

By using converters capable of energy recovery, for example in hoisting applications, energy usage can be slashed by up to 50%. An additional positive spin-off: Components such as braking resistors can be eliminated and the current required is decreased by approx. 20%.

Energy equalization in multi-axis systems

In addition to the possibility of recovering energy, SINAMICS converters offer what is known as energy equalization in multi-axis systems for motion control applications. In this case, the energy released when braking or when lowering one or several axes can be used by other axes or drives using energy equalization via the common DC link in the drive system. Energy usage can be reduced by up to 10% depending on the load cycle.

Optimally equipped for an emergency

The energy in the DC link can also be utilized for a favorably priced emergency failure concept. The power supply efficiently converts the 600 V DC into 24 V DC which is available to the electronics for some time even if the power fails. In an emergency, this allows the axes to be retracted in a coordinated fashion, for example.

Less reactive power – lower costs

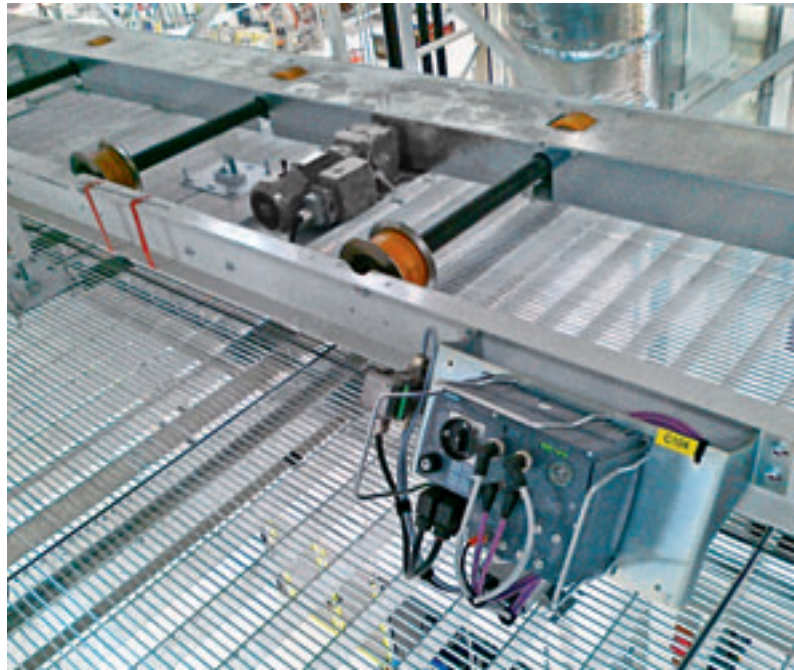
With the SINAMICS system, the use of Active Line Modules (ALM) allows capacitive and/or inductive reactive power of the complete machine to be automatically compensated. This reduces the costs for separate compensation equipment. As a consequence, up to 100% of the reactive power costs can be saved.

An overview of the customer advantages:

- Energy-saving through energy recovery when the motor is in the generator mode
- Braking resistors and braking choppers can be eliminated
- Favorably priced emergency failure concept and reactive power compensation

Efficiently conveying cars

Optimizing energy efficiency in production



In conveyor technology, success is especially defined by productivity across the board. Intelligent energy management plays an important role here. This is because the way to achieve comprehensive energy efficiency in an industrial operation is through completely integrated systems and solutions, as verified here in the main Seat factory in Martorell.

Solutions from a single source

Siemens supplied a turnkey conveyor system for the Audi Q3 production line. The system involves state-of-the-art technology based on the TIA (Totally Integrated Automation) concept, which is used as the new standard for Seat production lines. The roles that Siemens can play when it comes to energy efficiency can be seen in the new high-tech production hall for the Audi Q3.

Focus on usage

If you want to save energy, then you must precisely know what you use. With the B.Data energy management system, Seat energy controlling always has the complete overview. Using the usage allocation according to the “user pays” principle, company-internal motivation can be set regarding energy-saving measures.

Data flow

Once the usage values have been acquired, it must be precisely evaluated as to when and how usage can be reduced. The measured data acquisition functionality is already integrated in the SIRIUS switchgear and continually supplies B.Data with the necessary information.

Comprehensive approach to productive processes

In the production areas, the body shells are automatically controlled from one position to the next across two levels. Energy-efficient motors from our environmental portfolio drive the transport conveyors and vehicle body elevators. SIRIUS soft starters are used to ramp up to the set point speed in an energy-saving fashion while reducing stress on the mechanical system. And by using SINAMICS frequency converters, part of the energy used when the conveyor system brakes is fed back into the line supply.

Seat also depends on SIRIUS for its switching and protection technology: The devices have low intrinsic losses. In operation, they have a lower temperature rise than comparable solutions. As a consequence, a smaller control cabinet cooling system was able to be used, which in turn reduces the energy consumption and the plant investment costs.

Also when it comes to the 24 V supply, Seat reduces energy and the amount of heat that is dissipated. Compact SITOP power supplies with a high efficiency over the complete load range very efficiently supply the control cabinets with a regulated DC voltage.



“Volkswagen is not only working hard to develop the most environmentally friendly vehicles, but also to build them as sustainably as possible. This is why we have set ourselves the goal to make the production environment of the Volkswagen Company 25% more environmentally friendly by 2018.”

Dr. Martin Winterkorn

SINAMICS also in the high-bay warehouse and painting shop

Further, SINAMICS converters are used in the automated high-bay warehouse for engines. They feed the energy, which is released when the hoisting drives of the stacker cranes brake, back into the line supply. This allows the energy consumption to be significantly reduced. This also applies to the converters used in the painting shop. Traditionally, this represents about 45 percent of the energy consumption in automobile production. To improve the efficiency, Seat retrofitted the electric drives of the large fans with SINAMICS systems. When compared to mechanical controls, energy usage can be slashed by 60 percent and more. In the Seat factory, enough electric power was able to be saved so that the converters had an extremely short payback time.

The automobile plant is transformed into a power plant

Less energy consumption is good. Even better is when energy comes from renewable sources or is produced very efficiently. In Martorell, Seat therefore generates some of the electric power itself using photovoltaic systems with SINVERT inverters and a Siemens gas turbine.

An overview of the customer advantages:

- Certification according to the international ISO 50001 standard
- Energy saving using a coordinated portfolio of energy-efficient products and solutions

Common theme for higher efficiency

Comprehensive power monitoring in textile production



The path to achieving energy efficiency across the board in industrial operations is through seamlessly integrated systems and solutions. Especially in the manufacturing environment, power monitoring systems play a decisive role in defining the productivity and competitiveness of companies.

Spin fibers – save energy

The Turkish Aksa Group is one of the world's largest producers of acrylic fibers, producing 300,000 tons of fibers every year. The technical requirements on production are correspondingly high when it comes to reliability, quality and especially energy efficiency. The company is responding to growing requirements for efficient production with the implementation of an all-encompassing power monitoring system.

Recording energy flows

When the Aksa production machines are spinning at full speed, then the energy flows in the complete production operation are being precisely detected and monitored. A total of 425 measuring devices from the SENTRON portfolio precisely and reliably capture the energy usage data of the various systems, as well as voltages, currents and powers. The values of the main power distribution center, which supplies the widely branched production lines as well as also the usage data of the various machines, which in some instances operate independently of one another, are continually acquired and buffered. Not only this, they supply important measured values to assess the plant state and the line quality.

„Siemens begleitet uns Schritt für Schritt auf dem Weg zu mehr Energieeffizienz und leistet damit einen wichtigen Beitrag zur Steigerung unserer Produktivität.“

Levent Arabacıoğlu, Project Manager in the Aksa Group

The powermanager power monitoring software analyzes the energy flows of the world's largest producer of acrylic fibers and shows energy-saving potential.



Visualizing energy flows

The data of the higher-level PC-based powermanager power monitoring software is provided via an Ethernet connection. This visualizes the energy flows in the plant, records them and archives the data. This intelligent software solution guarantees transparency and therefore provides a stable decision-making basis for implementing energy-saving measures.

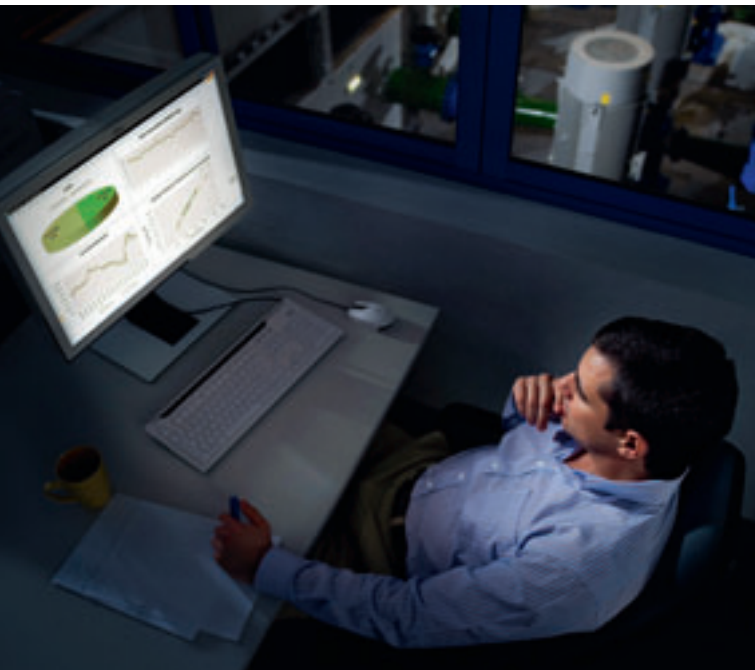
Sustainably saving energy

When producing acrylic fibers, there is interaction between complex processes, which make it necessary to use efficient drive technology, which also reduces use of resources and lowers costs. Standstills when spinning fibers using the melting technique are fatal. When the drives stop, the spinning nozzles can dry out and must either be replaced or cleaned. The consequence – production loss, time loss and high costs.

Two advantages are obtained by using SIMOTICS energy-saving motors in conjunction with SINAMICS inverters connected to a DC bus. On one hand, even for voltage dips, continuous operation is possible and the risk of a standstill minimized. On the other hand, by exchanging energy between the driving and braking drive, high amounts of energy can be recovered. This reduces the amount of energy and therefore lowers costs. As a result of the motors being used, which comply with the International Efficiency Standard (IE2), the machines use between 25 and 30% less energy when compared to conventional drives in textile fiber production.

An overview of the customer advantages:

- Perfectly coordinated hardware and software components for the realization of a power monitoring system
- Transparency of the energy flows shows savings potential
- Highest possible availability of the power supply
- Optimum energy utilization



Energy data under control

High transparency through energy management based on SIMATIC powerrate and SIMATIC B.Data

A very high energy consumption and high degree of automation is typical in the process and production industries. What makes more sense than to integrate energy management into existing systems? SIMATIC powerrate for WinCC and PCS 7 monitors your power distribution and costs and makes them transparent. Beyond this, SIMATIC B.Data offers effective energy and cost control for all of the relevant areas – from purchasing through planning up to controlling. Flexible interfaces guarantee smooth integration into existing system environments.

Utilizing potential in fiber production

The Lenzing Company – a global player in the production of cellulose fibers was looking for a solution to systematically evaluate the huge amount of data associated with different energy flows. The objective: To optimize the efficiency of all of the processes from power generation up to the individual production processes down to the finest detail. With this as background, a decision was made to introduce a software-based management system. This then provides an even more detailed analysis of the production operations.

For a transparent energy balance

The SIMATIC B.Data energy management system was chosen. With SIMATIC B.Data, we offer a comprehensive tool for effective energy management at the company level, and which covers all three phases in the energy management process. In addition to the stand-alone solution used by Lenzing, it is also optionally available for the WinCC visualization system.

Allocating usage

SIMATIC B.Data seamlessly acquires energy flows and visualizes them throughout the company. It doesn't matter whether it involves electric power, steam, water, hot water, compressed air, cold, inert gas or vacuum. This means that the acquired usage quantities can be specifically allocated to the individual production processes. In the Lenzing factory, approximately 2200 variables are read into the system in a standard fashion. 95% of this data is automatically entered into SIMATIC B.Data via a real-time data acquisition system; only 5% of the values have to be manually entered.

Up until now, several energy management solutions were employed based on tables and lists in order to generate the monthly energy balance. Now, all of the measurement locations can be monitored and evaluated in real-time. This type of online overview of the energy usage means that Lenzing is in a position to take into account the time aspect, which is important when optimizing processes.



“An important aspect when selecting SIMATIC B.Data was that the system, with its open-system architecture, offers simple modeling, flexible assignment of variables and therefore allows practical applications to be generated.”

Wolfgang Hemetsberger,
Energy Optimisation & Controlling Business Unit Energy

Acquiring and evaluating data

An additional advantage of SIMATIC B.Data: It has an open-system architecture and offers extremely simple data handling. The energy data retrieved from the meters, switchgear panels and systems form the basis for invoicing energy quantities and determining characteristic values. In Lenzing, this data was combined via distributed I/O, transferred via PROFIBUS to the SIMATIC PCS 7 process control system and from there to the real-time data acquisition system. Further, the mobile data acquisition functionality of SIMATIC B.Data allows meters to be manually read.

Real-time monitoring

By using SIMATIC B.Data, Lenzing got the required information which enables them for a sound fault diagnosis. For instance, the efficiency of a steam boiler is monitored in real time. If the output quantity violates a defined value, then this is an indication of a fault in the boiler or in the downstream production process. This gave Lenzing two advantages: increased energy efficiency and improved fault diagnostics. And therefore higher productivity.

The energy standard for companies

The new international DIN EN ISO 50001 standard focuses on the energy usage and energy policy of your company. The most important components of DIN EN ISO 50001 involve planning energy usage and the energy program, its implementation and controlling energy usage. SIMATIC B.Data is an energy data acquisition system that has been tested by TÜV Süd (German Technical Inspectorate) - and on September 28, 2012, received the rating “Certified energy data management”.

An overview of the customer advantages:

- Transparency regarding the actual energy quantities and costs across all energy data – gas, steam, water and electric power
- Transfer of the energy consumption to higher-level ERP systems
- Model calculations and more accurate, optimized planning
- Reduction of the energy costs
- Can be simply expanded to achieve company-wide transparency

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