



Level



Pressure



Flow



Temperature



Liquid
Analysis



Registration



Systems
Components



Services



Solutions

Reduce energy costs

Tailor-made energy monitoring – rapid return on investment
For steam, air, gas, oil, water, electricity, heating and cooling

Endress+Hauser 

People for Process Automation

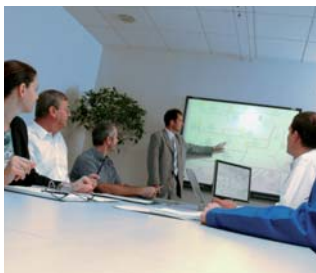
Endress+Hauser – Your Partner



Endress+Hauser is a global provider of solutions for instrumentation and automation. Supplying the production and logistic sectors of the process industry, the company develops sensors and systems that obtain information from the process, transmit this data and process it. High-quality products and cutting-edge services support our customers' competitiveness with top-notch quality, dependability and efficiency.



Endress+Hauser works closely with universities and research institutes, and also cooperates with business partners and competitors. The company is committed to continuously expanding its industry-specific know-how and ensuring the competence of its sales, marketing and service. The closely knit network of affiliated production and marketing companies as well as regional representatives establishes and maintains the group's powerful presence in all the world's markets – in other words right on your doorstep.



Endress+Hauser is a byword for independence, continuity and long-term customer relationships. Our 50-plus years of application experience are the foundation on which we have built our enormously wide range of products for metering flow, level, pressure and temperature, complete with fluid analysis, recording and system components.



Endress+Hauser is a single-source supplier, so you can always be confident that we will have the optimum solution for your measurement requirements.



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Did you know ...?

- that targeted measures can be used to lower the energy consumption of a plant typically by 5 to 15%?
- that the use of economizers can typically increase boiler efficiency by 2% for every 10 °C? And that at annual fuel costs of EUR 1 million this represents a saving of EUR 20 000 per year?
- that electricity accounts for 75% of the total operating costs for air compressors?
- that many countries already provide tax incentives for implementing an energy management system?
- that the energy cost of compressed air goes up approximately 6 to 10% for every unnecessary bar of pressure?
- that leaks in outdated, underground distribution networks for steam or hot water can push energy costs up by as much as 50%?
- that a 1 mm leak in a compressed air pipe can cause additional costs of EUR 120 per year? And that 50 to 80 leaks of this size incur annual additional costs between EUR 6000 and 9500?

- 1 millimeter leak
= additional costs of EUR 120/Year
- 3 millimeter leak
= additional costs of EUR 1100/Year
- 6 millimeter leak
= additional costs of EUR 4400/Year

Identifying potential savings

Global warming, reducing CO₂ emissions and the trend for rising energy prices are issues no plant operator can ignore. The questions always remain the same.

Do you want ...?

- transparency regarding energy flows?
- to uncover potential savings?
- to analyze, optimize and even increase system and energy efficiency?
- to track energy figures automatically?
- to create forecasts of energy requirements for multiple production units?
- to record energy flows and CO₂ emissions in line with EMAS, ISO 14001 or EN 16001?

You do?

If so, you can count on Endress+Hauser completely in regard to "Energy and Cost Savings"! For efficient energy monitoring, we offer the complete package – all from one source:

- Reliable measuring values as the basis for analyzing energy flows

- Intelligent devices for data recording and data transfer
- Made-to-measure software packages for analyzing and evaluating measured energy data

Only with targeted energy monitoring can the energy consumption and plant efficiency be assessed objectively and saving measures initiated. The benefits are clear:

- Reduction in energy consumption (typically 5 to 15% is possible)
- Recording energy flows with calibrated meters (required by EMAS, ISO 14001 and EN 16001)
- No time-consuming and error-prone reading of measured values
- Reliable triggering of warning messages (limit value not reached/exceeded)
- Simple generation of reports on current energy consumption, profitability of saving measures, etc.



Data acquisition

Data analysis

Reports

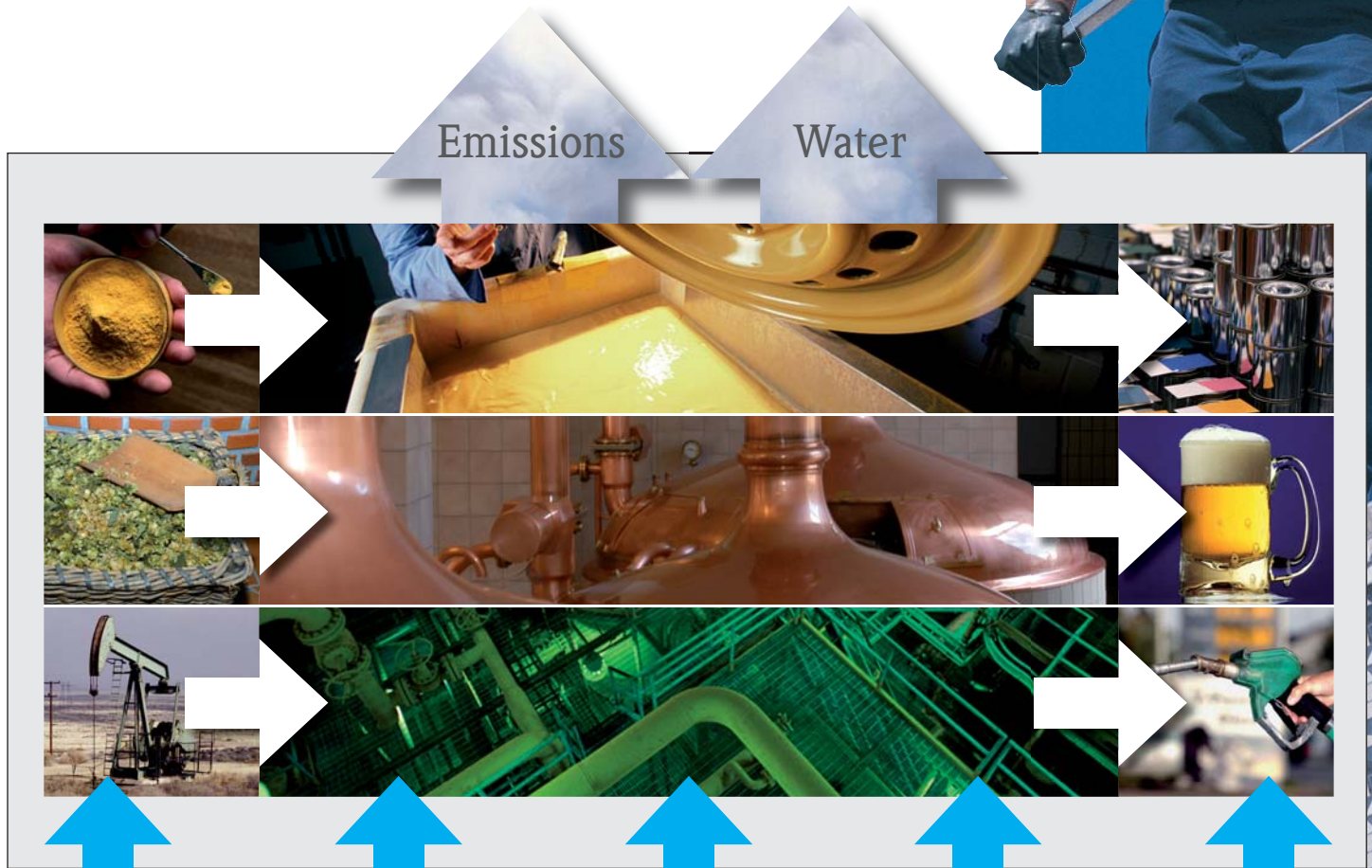
Optimization



You can control only what you measure

Utilities provide energy for plant operation in all sectors of industry. Air, steam, fuels, cooling or heating water are just a few of the media used. Generating, transporting and distributing these media requires a considerable amount of cost and energy. Therefore, every plant operator's goal must be to run and control these processes as efficiently as possible. The single-source provider Endress+Hauser offers you all the devices you need.

Flow ■ Pressure ■ Temperature ■ Analysis ■ Recording ■ Display ■ Components



Water

Applications

- Coolant
- Heating agent
- Solvent (fresh water, service water)
- Waste water

Energy-saving measures

- Minimize leaks
- Re-use water
- Reduce pressure losses
- Isolate heating/cooling systems
- Optimize pump systems

Air

Applications

- Compressed air for operating tools, control and for cleaning

Energy-saving measures

- Minimize leaks (lower compressor costs)
- Keep system pressure as low as possible
- Use compressor waste heat (process air)
- Intake air for compressor at the coldest point
- Filter monitoring

Gas/Oil

Applications

- Gas and oil as fuel for steam generation
- Warm or hot water generation in boilers

Energy-saving measures

- Burn oil at optimum viscosity and temperature
- Optimize steam system
- Reduce pressure losses

Electricity

Applications

- Electricity for:
- Motors
- Compressors
- Pumps

Energy-saving measures

- Load management
- System optimization (minimize leaks in air system, etc.)

Steam

Applications

- Saturated steam as heating agent
- Superheated steam for electricity production

Energy-saving measures

- Minimize leaks
- Isolate lines
- Shut down unused line networks
- Service of steam traps

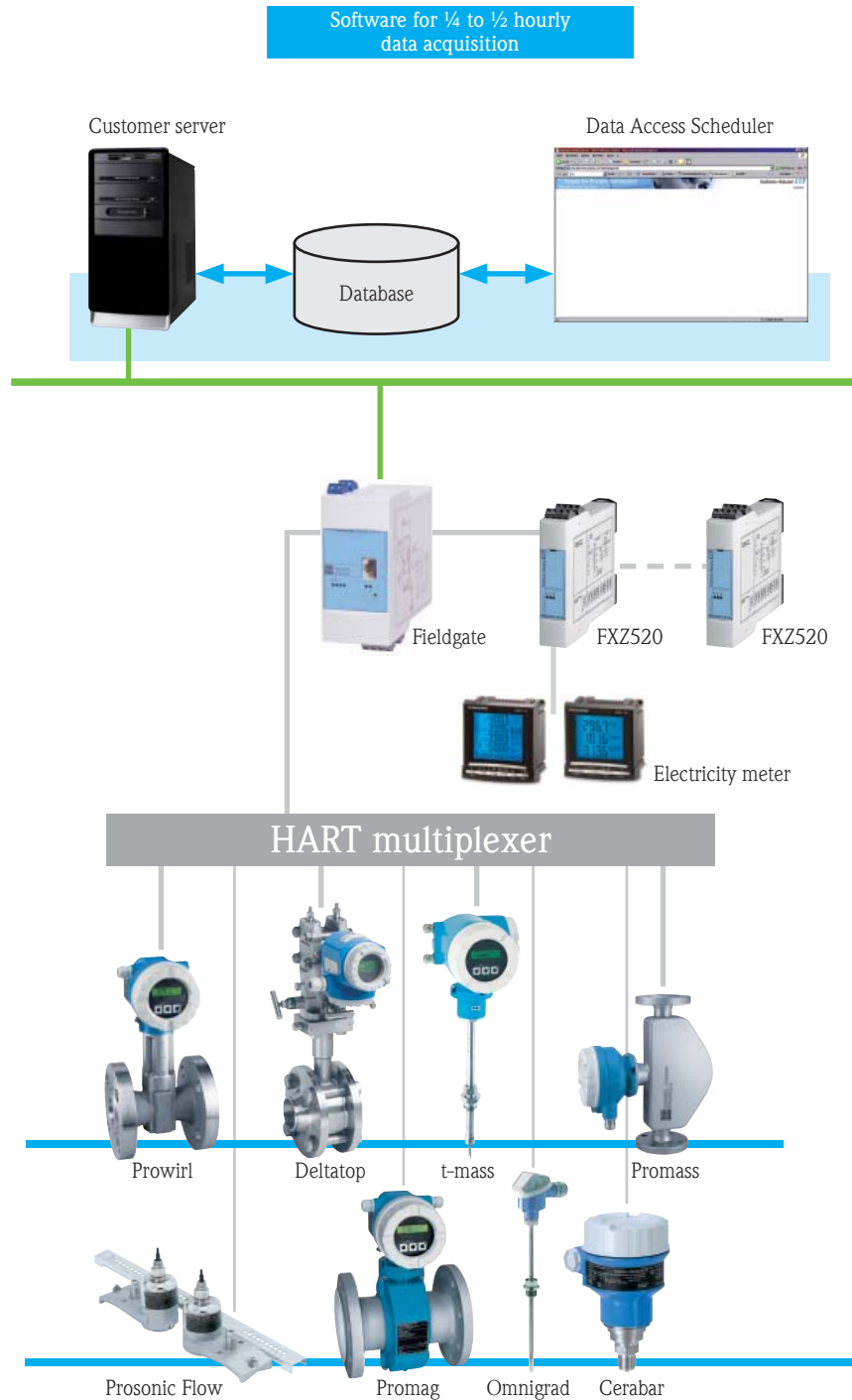
Turnkey solutions for energy monitoring

Endress+Hauser has one of the world's most comprehensive range of measurement and control technology products. We supply everything you need to objectively assess energy consumption and plant efficiency – sophisticated measurement technology including data transfer through to software for energy monitoring.

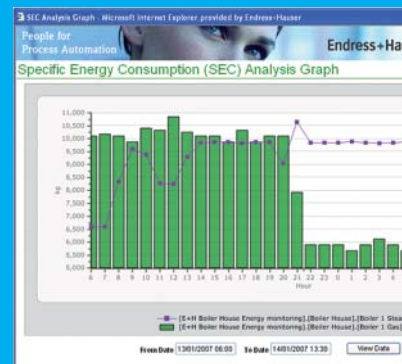
The right device installed correctly at the right place permits the accurate metering of flow, pressure, temperature and other important process values. The outstanding field accuracy and long-term stability of Endress+Hauser devices form the basis for all subsequent evaluations and analysis – and therefore also for planned energy-saving measures.

Our modular and open energy monitoring system guarantees seamless integration of many different components, such as flowmeters, electricity and gas meters, data loggers, energy computers and recording devices. The data is transferred via HART as well as fieldbuses (PROFIBUS, FOUNDATION Fieldbus, MODBUS) or wirelessly if the measuring point is difficult to access.

- Intelligent data manager → Page 12
- Evaluating energy data → Page 14
- Precise metrology → Page 17



eSight® - Registered trademark of eSight Energy Group Limited



Media consumption per unit of end product kilogram of steam)

Energy monitoring software



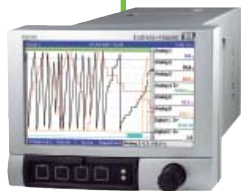
Existing SCADA or building management system



Existing production data



Ethernet



Memograph M



Energy computer



Field Controller



Fieldgate

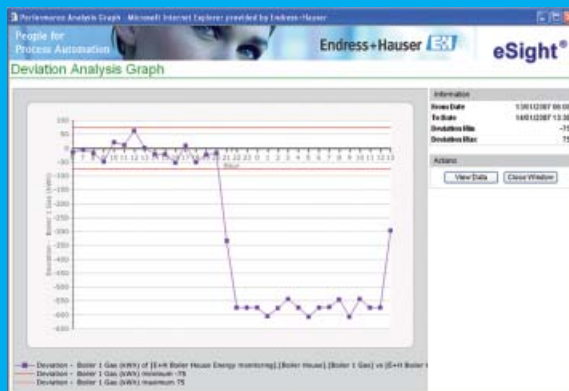


Gas/water counters

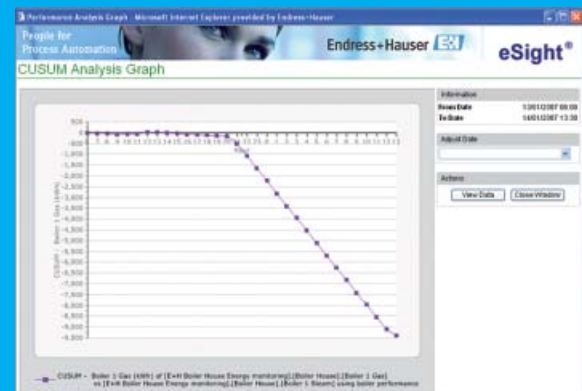
Energy analysis modules



produced (e.g. per



Alarms issued automatically if limit values are not reached or are exceeded



Display of the profitability of successfully completed saving measures (ROI)



What our customers say

“HANS KOLB Wellpappe has been developing and producing packaging for a wide range of sectors for over 75 years. Many of our manufacturing processes need steam to be generated for heating, requiring considerable amounts of energy. Because of this we installed a ceramic insert in our steam boiler to save energy. Thanks to the Endress+Hauser energy monitoring system we are able to check the efficiency of our boiler continuously to determine the exact energy savings. We can now also call up energy data at the touch of a button. For us this means automatic monitoring across the entire steam system, greater system availability, reduced costs thanks to optimized load distribution and planning security in the future expansion of our energy systems.”



Armin Sahliger

Head of Energy and Environmental Technology

HANS KOLB Wellpappe
(Germany)

“Chimay is a Trappist brewery in Belgium producing the famous Chimay Trappist beers and cheese. Endress+Hauser's energy monitoring solution enabled us to uncover the potential energy savings in our steam utilities network. By implementing the correct measures based on the information obtained, we succeeded in reducing our steam consumption by 35%. The entire project, including instrumentation and the implementation of measures to reduce energy in our steam system, paid for itself within a year. A key success factor for the project was the excellent support provided by Endress+Hauser's service organization.”



Daniel Henriët

Technical and Energy Manager

BIÈRES DE CHIMAY S.A.
(Belgium)





Compressed air

Calculated loss limitation

10 percent of electricity consumption in industry – equating to the output from 75 nuclear power stations – is used to generate compressed air using compressors. Up to 95 percent is lost as unproductive waste air in the process.

Up to 30 percent of the compressed air generated “disappears” due to leakages in the supply network. Experience has shown that by implementing appropriate measures, this proportion can be reduced by up to 10 percent, also reducing power consumption. In large-scale systems this can quickly equate to tens or thousands of euros per year. Financial losses due to inefficient compressed air systems nevertheless continue to be underestimated, ignored or simply accepted as a given. It doesn't have to be like this!

The questions plant operators need to ask themselves are therefore always the same: How much compressed air do I actually need? Does this requirement vary depending on the time of day? What is the basic load? How much electricity (kWh) does it take to generate one standard cubic metre of compressed air? And above all: How efficiently are the compressors in my system working? Energy monitoring from Endress+Hauser enables you to record data reliability and to clearly identify weak points in your compressed air system.



Saving made easy

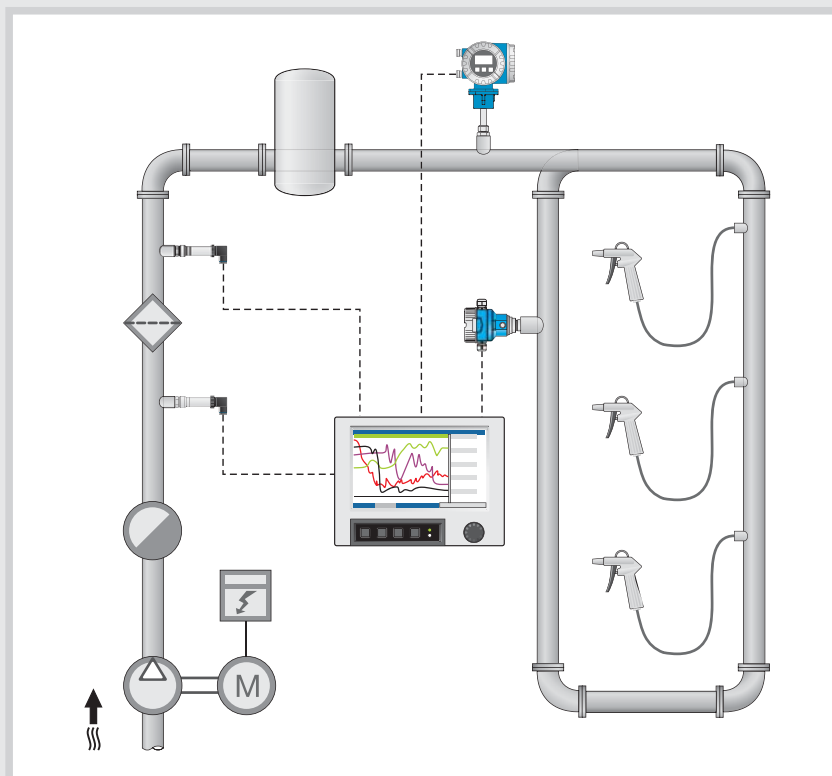
Waste heat, pressure losses, excess system pressure – all this also contributes to compressors being regarded as massive energy consumers.

That's why you need to:

- Minimize leaks (fewer pressure losses)
- Monitor filters (fewer pressure losses)
- Take in air for compressor at the coldest point (improved performance)
- Utilize waste compressor heat (process air)
- Keep system pressure as low as possible
- Shut down compressors during unproductive times

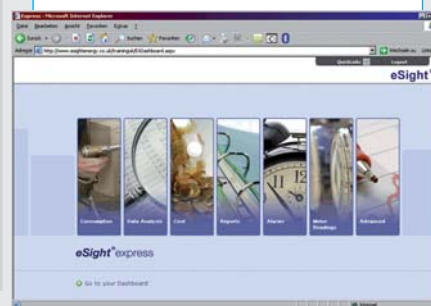


Our measurement technology



Energy monitoring software

- Monitor specific energy consumption
- Allocate generation costs across multiple cost centers
- Set and monitor target values based on historic data
- Uncover leaks
- Calculate additional profits due to energy-saving measures



t-mass

Thermal flowmeter

- Consumption measurement (standard volume, e.g. Nm^3)
- Tracing leaks

Prowirl 72/73

Vortex flowmeter

- Specifically for non-dried and unfiltered compressed air of low quality
- Pressure and temperature compensation via Prowirl, or using an external data manager such as Memograph M



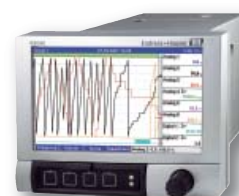
Cerabar M

Pressure sensor for recording system pressure



Cerabar T

Pressure sensor for monitoring filters (pressure loss due to blockages)



Memograph M

Data manager

- Recording (e.g. specific energy consumption, losses)
- Totalising (e.g. performance of multiple compressors)
- Monitoring setpoint values (e.g. differential pressure with blocked filters)
- Issuing alarms (e.g. if limit values are not reached or are exceeded)



Steam generation

Greater efficiency – reduced consumption



For heating or for power generation in turbines, for sterilization or for cleaning purposes – in many sectors steam is used on a grand scale. It is therefore not surprising that in industry a massive 40 percent of fossil fuels are used for steam generation in boilers.

The judicious use of fuels such as oil or natural gas is just one of the aims in energy monitoring. These days steam management covers a whole lot more than checking

Our measurement technology

① Steam production

Prowirl 73 (Vortex flowmeter):

- Volume measurement, direct mass measurement of saturated steam using (an optional) integrated temperature sensor
- Calculate steam mass by using external pressure values via HART, PROFIBUS PA or FF
- Calculate heat differences and energy by importing external temperature values via HART

Deltatop (Differential pressure):

- Volume and mass measurement via compensation using a flow computer or Memograph M
- Minimal pressure and energy losses thanks to solutions with Pitot or Venturi tubes

RMC621 (Flow computer):

- Precise compensation of differential pressure or volume using imported pressure and temperature values

Memograph M (Data manager):

- Calculate the specific energy consumption (steam quantity per kWh of fuel)
- Leak monitoring by comparing two flow measuring points
- Alarm messages
- Heat differential measurements (energy)
- Total the performance of multiple compressors
- Visualize the boiler system

Cerabar M (Pressure sensor)

Omnigrad (Temperature sensor)



② Boiler feedwater

Prosonic Flow 92F
(Ultrasonic flowmeter):

For volume measurement, especially for hot liquids with low electrical conductivity



Promag 50/53P
(Magnetometer):

For volume measurement of sufficiently conductive liquids



Prowirl 73
(Vortex flowmeter):

For volume, energy and mass measurement of feedwater



Omnigrad
(Temperature sensor):

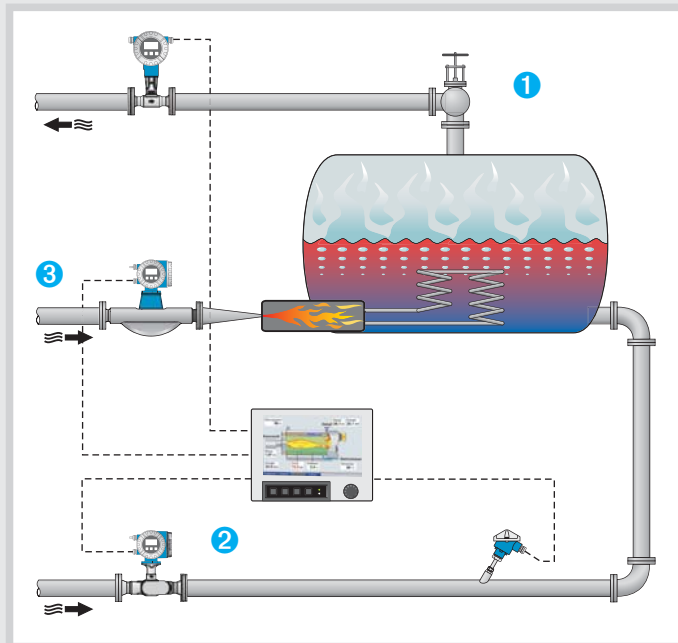
For recording heat differences where it is not possible to use a flowmeter



water levels, conductivity, pH value, temperature and pressure in the boiler. Steam systems offer numerous options for saving, re-using and reclaiming energy, whether in generation, distribution, accurate billing or in boiler efficiency.

Endress+Hauser provides you with all the measuring instruments required to obtain optimum potential improvement. Our product range also includes water analysis devices for seamless monitoring the quality of feed, boiler or condensate water, e.g. dissolved oxygen, limescale content or electrical conductivity. The benefit for you: Improved control of water evaporation in the boiler.

Put your trust in Endress+Hauser because we have a decade of experience in the steam system sector.



3 Fuel

t-mass 65F/65I

(Thermal flowmeter):

For measuring natural gas consumption (mass)

Promass 83F

(Coriolis flowmeter):

For measuring fuel consumption (oil), measuring mass and volume, direct density measurement



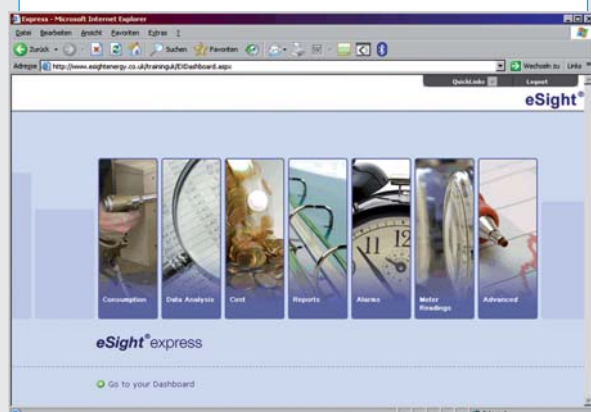
Saving made easy

- Insulate steam lines
- Minimize leaks
- Shut down unused line networks
- Service condensate separator
- Service boiler (remove deposits)
- Missing measurements can result in undetected losses of up to 30%



Energy monitoring software

- Monitor the specific energy consumption and boiler efficiency
- Allocate generation costs across multiple cost centers
- Set and monitor target values based on historic data
- Uncover leaks
- Calculate profits due to energy-saving measures





Heating and cooling systems

“Sweating and freezing” – but not too much

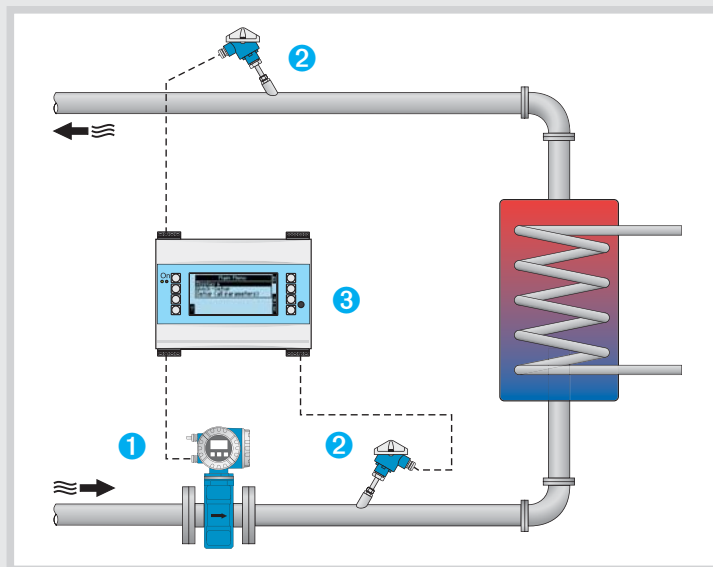
Whether in chemical reactors, utilities or for preserving food, whether for fuming wood chips or in air conditioning systems – boilers, containers and pipework systems everywhere are being either heated or cooled. The cooling and heating systems required often operate around the clock and consume a great deal of energy.

The questions system operators are confronted with here are similar to those for generating compressed air or steam: Where can I save energy? How can I improve the efficiency of cooling and heating systems? Are deposits formed in cooling or heat exchangers that need to be removed on a regular basis? How much cooling do my cooling systems really need?

With the right meter at the right location, these questions can be answered in detail. Endress+Hauser has one of the world's largest product ranges for operating consistent and effective energy monitoring.



Our measurement technology



Saving made easy



- Isolate lines
- Minimize leaks
- Avoid deposits in containers and pipelines (hot and cold sides)
- Analyse process values (e.g. density) for the prompt detection of cooling medium ageing





1 Flow measurement

Promag 53P (Magmeter):

- Standard meter for volume measurement of electrically conductive liquids, also available in a "high-temperature" version
- With optional electrode cleaning function (ECC) to prevent electrically conductive deposits in the measuring tube, e.g. for fluids that forms a coating



Alternatively, the following Endress+Hauser meters can be used for flow measurement: **Prowirl 73** (Vortex flowmeter), **Deltatop** (Differential pressure) or **Prosonic Flow 93P/91W** (Ultrasonic)



The key characteristic values can be calculated by measuring the flow and temperature in the inlets/outlets of cooling and heating circuits:

- Mass flow of liquid heat carriers
- Heat difference (energy) between inlet and outlet

2 Temperature measurement

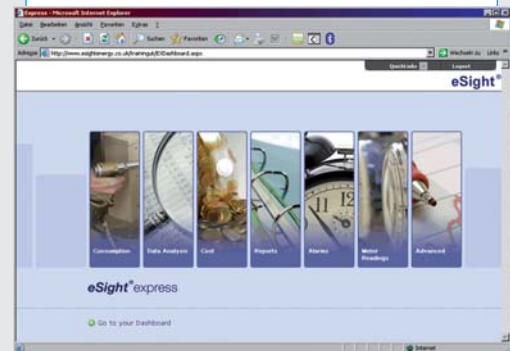
Omnigrad TST 90

Standard sensor for accurate fluid temperature measurement in the inlet/outlet. Paired PT100 sensors (Class A) should ideally be used; these are available as standard.



Energy monitoring software

- Monitor specific energy consumption
- Allocate costs across multiple cost centers
- Set and monitor target values based on historic data
- Uncover leaks
- Calculate profits due to energy saving measures



3 Data analysis Data preparation

RMC621 (Flow computer):

- For calculating the mass or heat energy of any liquid, gas and steam
- Up to 3 applications can be calculated simultaneously

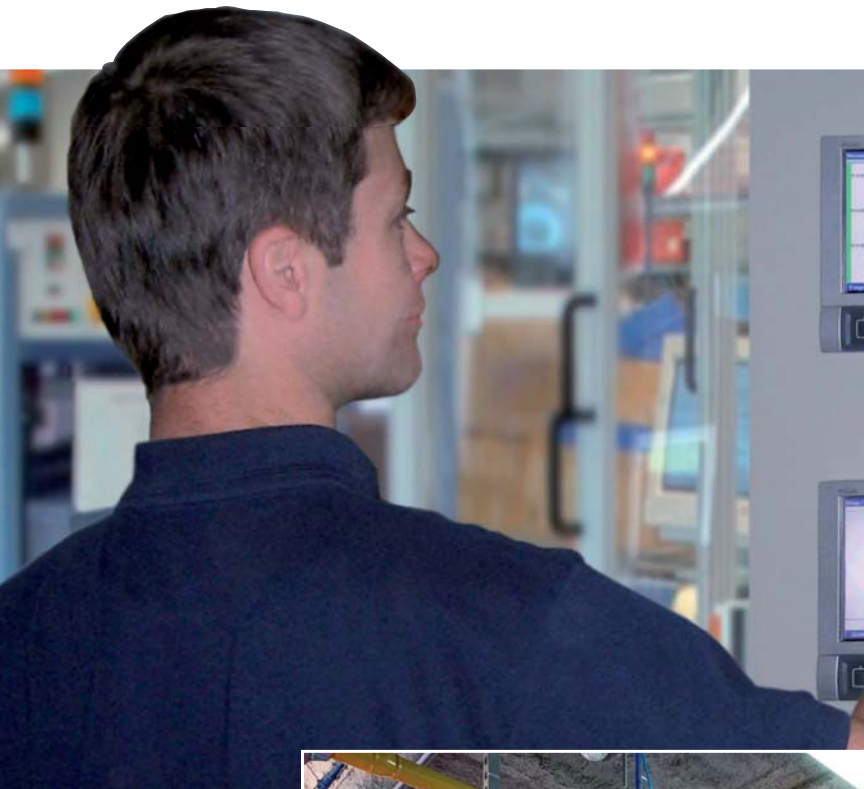
Memograph M (Data manager):

- For registering and visualizing process data, and for calculating key characteristic values, e.g. total energy consumption
- With optional functions for calculating heat differences in glycols and water (up to 8 measuring points)



Intelligent data manager in the field

Memograph M



Would you like not only recording your fuel consumption, boiler efficiency or pressure loss in a compressed air network, but also reading it directly onsite? Do you want your staff to be more conscientious when it comes to “energy efficiency”?

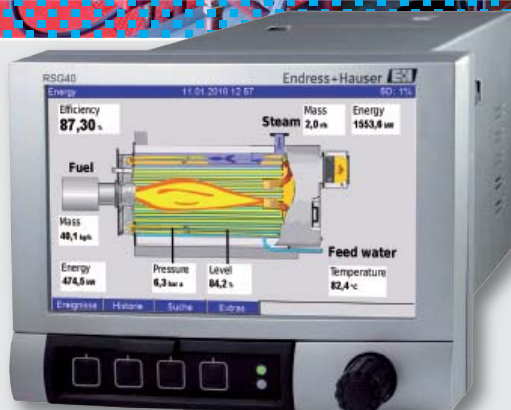
Then Memograph M is the solution for you! This cost-effective and paper-free data recording device is ideal for energy monitoring in self-contained plants. It records the required process data automatically and uses this to calculate other characteristic values. The large graphics-compatible display also permits the clear visualization of process data directly onsite.

And data transfer is just as easy:

- Via SD card or USB memory stick, e.g. on the laptop or PC for processing in Windows programs.
- Via fieldbus communication using MODBUS, PROFIBUS or FOUNDATION Fieldbus

The Memograph M allrounder has numerous functionalities:

- Data visualization in real time
- Clear, graphics-compatible display (145 mm diagonal)
- Display curves, tables, digital values and signal evaluations
- Calculate characteristic values, e.g. energy consumption, boiler efficiency, system pressure, water level in boilers or characteristic values for leaks
- Record and analyze energy data: e.g. Steam mass, specific energy consumption, standard cubic meter compressed air per kWh of electricity
- Data transfer, e.g. via analog and digital outputs, Ethernet, OPC server or MODBUS
- Alarms issued automatically if limit values are not reached or are exceeded



Data transfer made easy

Hardware and software that fits everywhere



Automatic data acquisition

Acquiring and evaluating data – the critical link between these two activities is always secure data transfer between the field and process control levels. The open energy monitoring system from Endress+Hauser has all the hardware and software components. This means that measurements can be automatically queried and imported in freely selectable time intervals.

For data transfer, our devices are equipped with numerous interfaces, e.g. current output (4–20 mA), pulse output (e.g. for meter), HART, M-Bus (building control technology), MODBUS, PROFIBUS DP/PA, FOUNDATION Fieldbus, Ethernet, OPC Server or XML. For hard-to-access measuring points, there are also solutions for wireless data transfer.

Fieldgate – the bridge to the network

Our Fieldgate FXA320, FXA520 and FXA720 system components ensure secure data transfer between field devices and higher level process control systems at all times.

Fieldgates permit world-wide data querying, remote diagnostics and remote configuration of HART and PROFIBUS devices via Ethernet (TCP/IP protocol), telephone lines (analog) or via mobile communication systems (GSM). This means that measurements are also available world-wide via an intranet or the Internet and can be analyzed in a standard web browser without any additional software.

Fieldgate Data Access (DA) Scheduler

The Fieldgate DA Scheduler is software that can be used for the cyclical querying of process data collected by Fieldgate. Various interfaces for this purpose are included as standard, such as for importing measured values into databases or exporting measured values into different file formats (*.csv, *.mdb, OPC server, SQL, etc.). This also permits data evaluation in other programs as well:

- Energy monitoring programs
- Microsoft® Office programs (Excel, Access)
- Supervisory Control and Data Acquisition (SCADA), e.g. Wonderware
- iFIX Intellution
- WinCC
- Endress+Hauser programs (e.g. PView, FieldCare)





Evaluate energy data Highlight potential savings

One piece of software does it all

Visualization and evaluation of process data, however, are the real keys to benefit fully from measurement technology. The web-based energy monitoring software we use permits access to the entire monitoring system in your plant from anywhere via an intranet or the Internet. In addition, this software can be used to analyze measurement data and to create energy reports. This software solution is used in many different industries.

- Fully web-based software solution
- World-wide or local usage via intranet or Internet
- Simple operation
- Easy-to-use interface with drop-down menus
- Automatic data import from data loggers, SCADA systems, production systems or building management systems
- Simple integration into any existing operating data recording system
- Modular software design, customization possible at all times

Energy analysis

- Monitor energy consumption (electricity, water, fuel)
- Assess the efficiency of compressors, steam boilers, refrigeration systems or pumps (regression analysis)
- Target/actual comparison of energy data
- Identify peak values during energy consumption

Cost analysis

- Create diagrams and displays:
 - Costs for energy consumption
 - Costs for generating steam, compressed air, etc.
 - Time-based comparisons
- Create and monitor budget plans (target/actual)
- Cost comparisons with different price changes for energy sources
- Profitability calculations (ROI, Return on Investment)

Reporting

- Produce cumulative curves or comparative displays with predefined tables and graphical formats
- Automatic sending of energy reports (PDF files) via e-mail or via storage on a central server

Deviation analysis

- Trigger warning messages via e-mail or SMS
- Set limit values
- Prioritize warning messages in accordance with process criticality

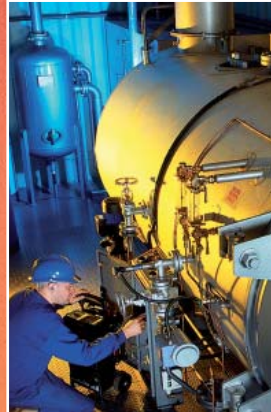
Simulation/calculation

- Calculate characteristic values using mathematical functions.
Example: $\text{Emission} = \text{mass} \times \text{heat value} \times \text{emissions factor} \times \text{oxidation factor}$

Billing verification*

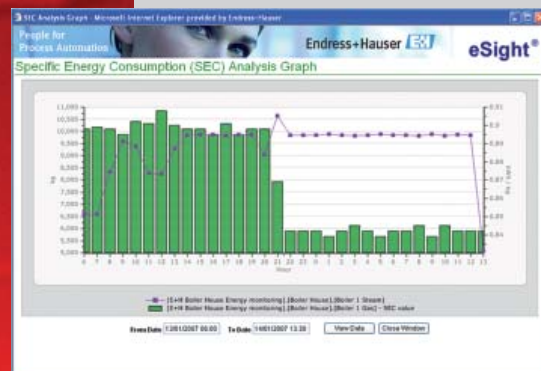
- Automatic import of supplier invoices
- Comparative functions (validation) between the requested amount and the amount calculated based on measurement data

* not available in all regions / or country specific





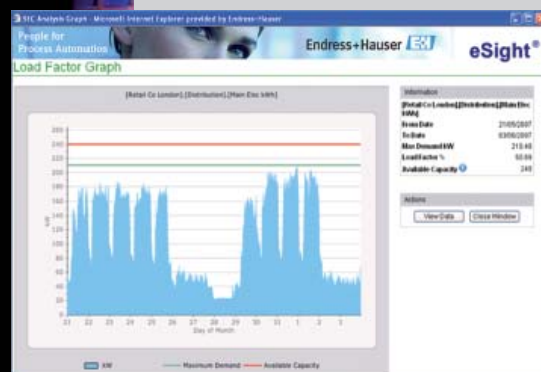
Courtesy Byworth



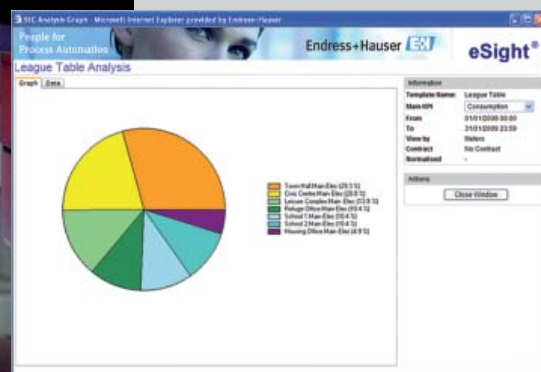
Monitor the specific energy consumption



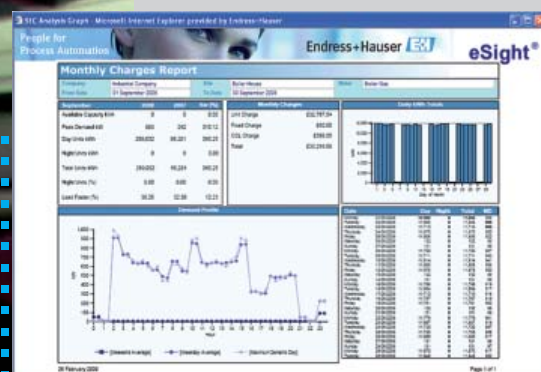
Benchmark and budget analysis indicate deviations from default values



Consumption profile of a measuring point accross various days of the week



Allocate energy consumption to cost centers



Simple reporting provides transparency



Observe standards – Reduce CO₂ emissions

Thanks to precisely calibrated meters

Efficient prevention of energy losses

Reducing world-wide carbon dioxide (CO₂) emissions is one of the most important challenges in preventing climate change and the greenhouse effect. The CO₂ released when burning fossil fuels equates directly to the quantity of fuel used. It is therefore in every system operator's interest to use energy more efficiently and thus reduce costs.

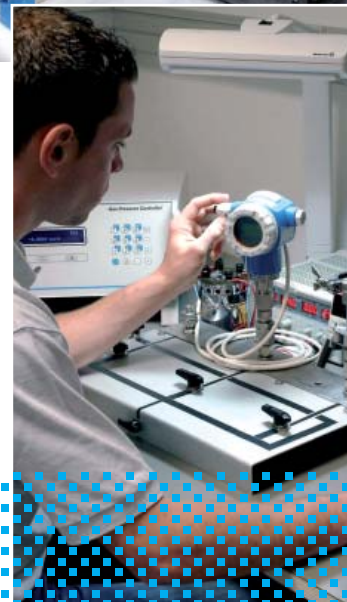
For sectors with energy-intensive processes in particular – such as the metal, chemical, cement, food and petrochemical industries – an energy monitoring system pays for itself within a short space of time. Companies are already offered tax incentives for using these systems and reducing their emissions using proven methods. This is why standards such as EMAS, ISO 14001 or EN 16001:2009 are becoming increasingly important and binding. Energy monitoring software also offers considerable opportunities in emissions trading.



Consistently high measurement quality world-wide

Energy figures are only as good as the meters used to obtain them. For this reason, the relevant ISO standards also outline technical requirements for measurements. For example, the meters used for energy monitoring must be calibrated and the measurement data obtained must demonstrate a minimum level of accuracy and reproducibility. And this is precisely where Endress+Hauser has been the leader for decades:

- Every meter is tested and calibrated in conformity with ISO/IEC 17025 on the world's latest calibration rigs
- All our calibration rigs are accredited by national authorities and are fully traceable
- Our meters are robust, tried and tested in practice with proven long-term stability
- We offer a world-wide calibration service in over 40 countries
- Commissioning and test measurements onsite are conducted by experienced specialists



Always at your service

It is our aim that all devices manufactured by Endress+Hauser guarantee high measuring accuracy and operational safety – around the clock, seven days a week, throughout the entire life cycle of your plant. Our sales and service centers in over 40 countries ensure that everything runs smoothly for you, anywhere in the world, and that you make perfect decisions when it comes to energy monitoring. Whether you are based in Europe, America, Asia, Africa or Australia – we are always by your side!



How Endress+Hauser can help you

- First-class field measurement technology for all process variables (flow, pressure, temperature, etc.)
- Planning and delivery of all common control, visualization and process control systems
- Planning and advice from consultants, engineers and expert technicians onsite
- Professional management of national and international projects
- Consulting, design, engineering
- Installation, commissioning and configuration
- Inspection and maintenance (maintenance contracts)
- Onsite calibration, control measurements
- Repair service, spare parts, conversion kits
- Individual maintenance concepts (Installed Base Audit)
- Training courses and qualifications
- World-wide service





Installed Base Audit

Installed Base Audit is a service which consists of auditing and analysing an installed base of process instrumentation. The main aim in this is to use appropriate recommendations to develop a maintenance plan that increases system reliability and saves costs. Installed Base Audit allows you to track the following objectives:

- Specify the top priorities for maintenance, according to the available resources and your production requirements
- Reduce the complexity of older systems, for example by using devices from different manufacturers and a wide range of instrument types
- Identify outdated system documentation that does not conform to current standards
- Define the measures required to increase production quality and system availability
- Meet the highest safety requirements

W@M

Life cycle management from Endress+Hauser is an open information system which provides technical and operative management with complete data flow and archival – from commissioning through to maintenance and service within a plant, at any time or location. This is attained within an open system based on Internet/intranet technology, and incorporating all software programs, products and services from Endress+Hauser.



Energy monitoring from Endress+Hauser

Applications

- Measuring operating equipment and energy sources: Steam, compressed air, oil, gas, water, electricity, heating and cooling
- Monitoring energy consumption and the efficiency of steam boilers, compressors, cooling and heating systems, pumps and heat exchangers

Benefits

- Uncover unexploited potential energy savings
- Automatic tracking of specific energy figures
- Creates energy forecasts

Features

- Solutions for every budget, from local energy consumption monitoring through to global solutions
- World-wide online access to data
- User-friendly software with easy-to-use interface

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