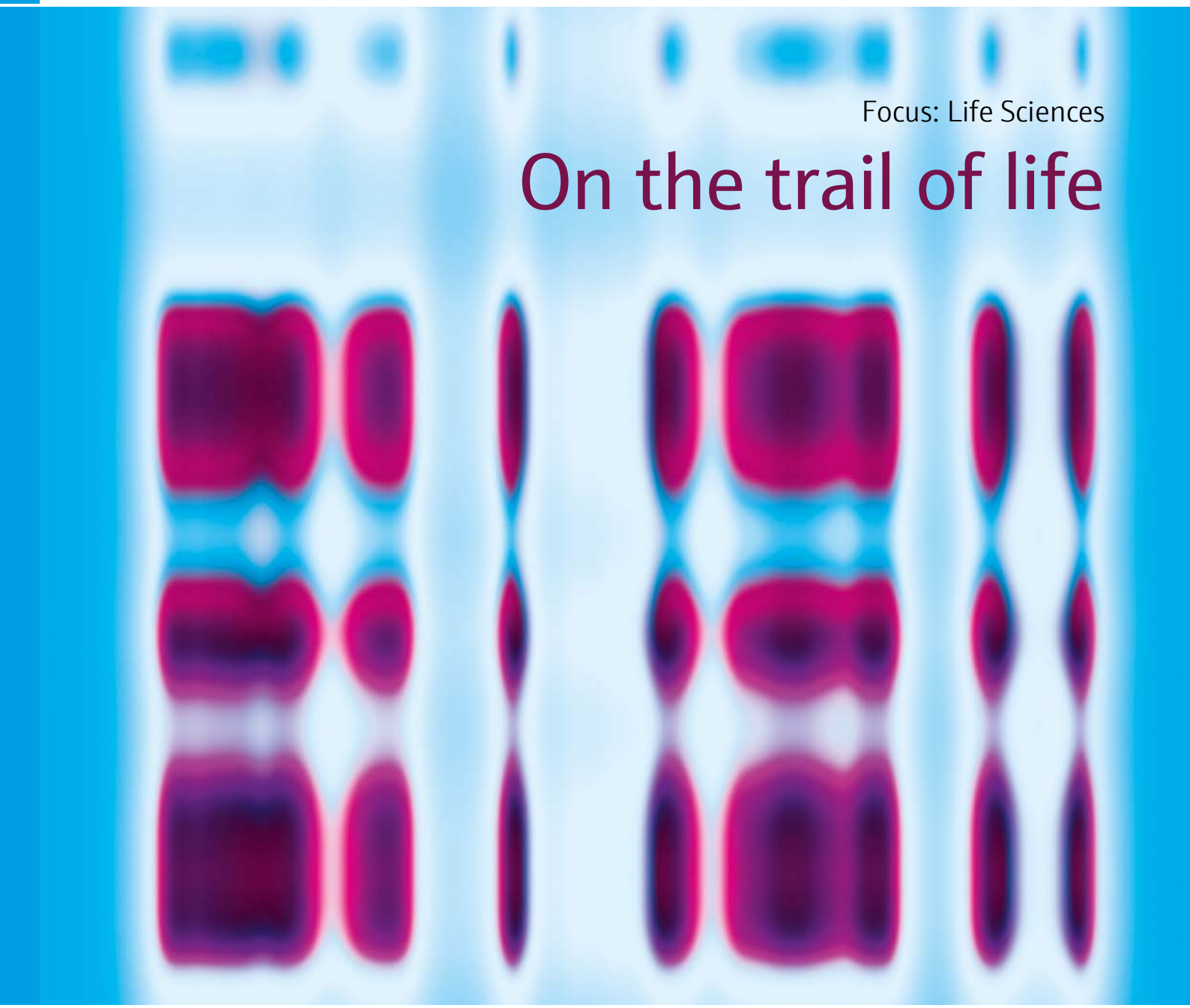
2017 edition

changes

Market: Italy The industrial heart beats strong

Know-how Where digitalization is put into practice



Focus: Life Sciences

On the trail of life

Endress+Hauser

People for Process Automation

EDITORIAL

What we can learn from the life sciences

Focus: Life Sciences
What impacts the industry and how innovation, quality and efficiency lead to continuous improvements.
Page 6

Dear reader,

This edition of ‘changes’ focuses on the topic of life sciences. Hardly any other industry is driven to such a great extent by change and innovation. The need to constantly develop new and better medications places enormous demands on the life sciences industry. But the demand for quality – spurred by stringent regulations, powerful political influence and growing global competition – is equally challenging.

What does it take to stay at the top of this industry? In an interview, Roche CEO Severin Schwan shares his opinions and insights and explains why partners such as Endress+Hauser are important to his company’s success. We’re convinced as well that close collaboration with this challenging industry moves us forward as a company – and that means all of our customers benefit. As proof, you will find a wealth of articles about the life sciences industry in this edition!

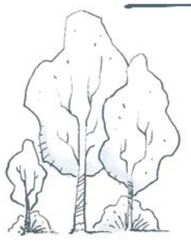
High unemployment and massive national debt is placing a heavy burden on Italy. The country nevertheless boasts a strong, highly developed export industry. Despite, or perhaps exactly because of the most recent crisis, Italian companies are competing successfully on the global stage, such as in the plant building and machinery industry. Our sales center in Italy has experienced solid growth for years by working with and supporting many of these companies. The Market section of this edition highlights this special side of Italy and illustrates just how capable Europe can be when it meets its challenges.

Our vision is to have our customers’ trust when it comes to improving their processes, and thus their products. For Endress+Hauser, this vision has both a technical and a human element. Only by understanding our customers’ applications and challenges, as well as the requirements of their industry, can we effectively develop the right products, solutions and services and provide the best possible advice on how to utilize them. The Know-how section demonstrates how we manage this issue, as illustrated in the article on digitalization.

Under the heading Insights, we once again provide a glance into the company with first-hand information. How did Endress+Hauser develop over the past year? What are we doing to fulfill our responsibilities as a company? Where is the Group headed over the mid- and long term? Here you can rely on the assessment of Klaus Endress, President of the Supervisory Board and one of the shareholders. We hope you enjoy reading the diverse selection of exciting features in this year’s edition of ‘changes’!

Market: Italy
Join us to discover Europe’s second largest industrial nation!
Page 26

Know-how
We report on technologies and applications that benefit our customers. **Page 42**



Insights
Facts, figures and opinions about the development of the Endress+Hauser Group. **Page 60**

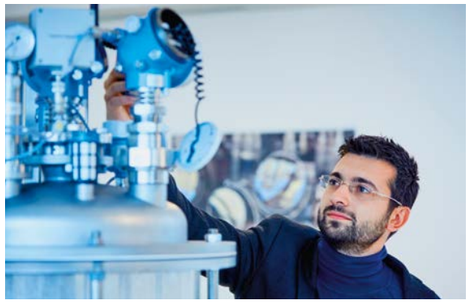
Yours

Matthias Altendorf

PS: How do you like ‘changes’ magazine?
I look forward to hearing your thoughts and suggestions!
changes@endress.com

Focus: Life Sciences

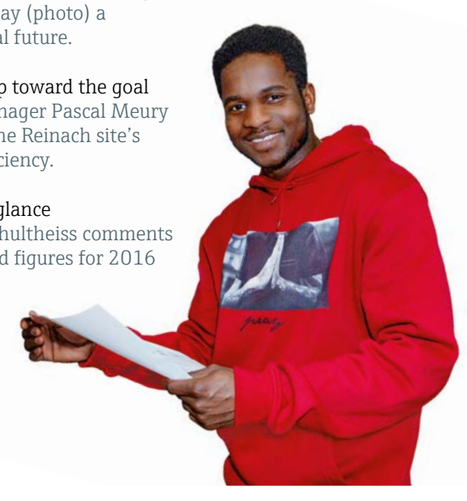
Our cover page shows an edited image of a gene sequence, a symbol of the opportunities that have unfolded in the field of life sciences thanks to biotechnology.



Market: Italy

Know-how

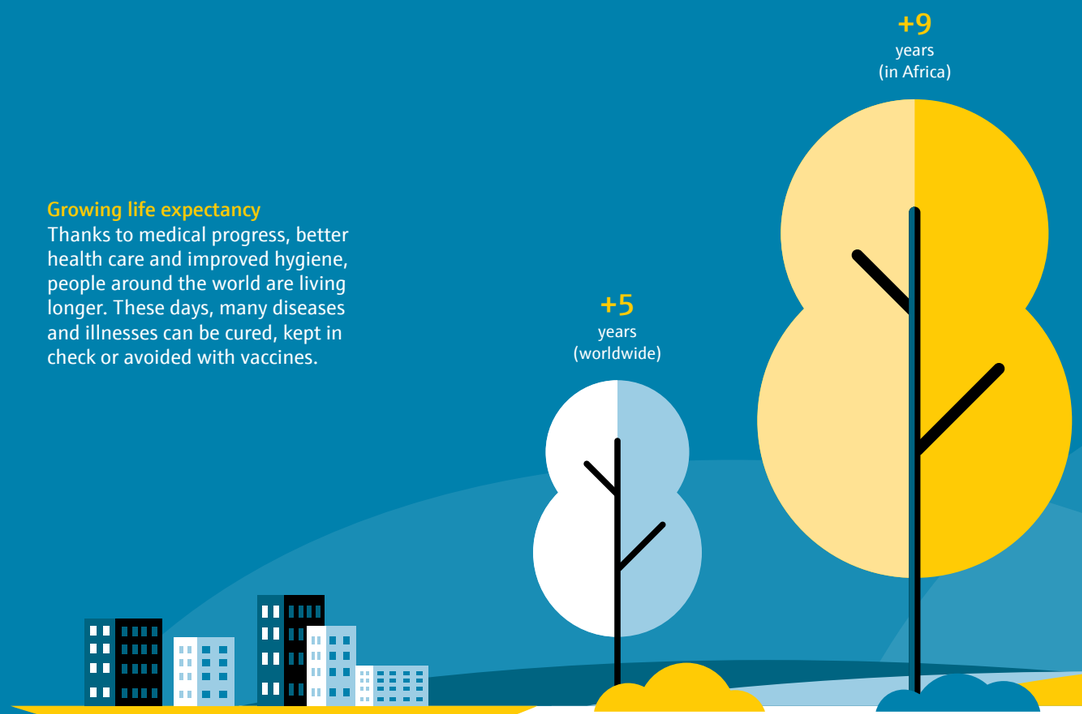
Insights



Innovations for health

The life sciences industry is focused on people. Its goal is understanding disease and illness and developing active substances used in prophylactic and therapeutic treatments.

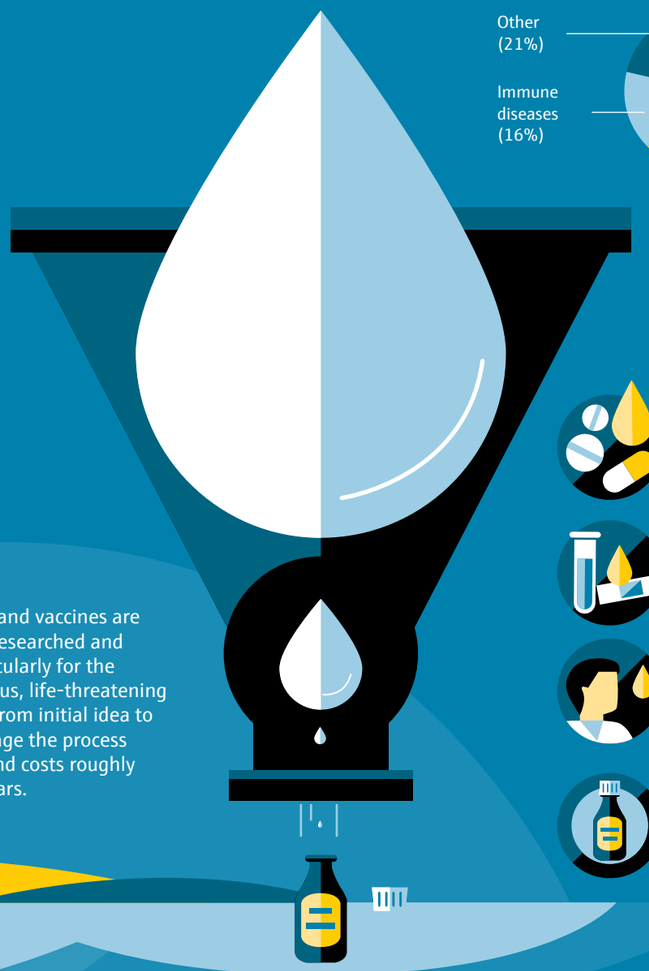
Growing life expectancy
Thanks to medical progress, better health care and improved hygiene, people around the world are living longer. These days, many diseases and illnesses can be cured, kept in check or avoided with vaccines.



Rise in average life expectancy
(2000–2015)

Long road
New medications and vaccines are constantly being researched and developed – particularly for the treatment of serious, life-threatening or rare illnesses. From initial idea to approval, on average the process lasts 13.5 years and costs roughly 2.6 billion US dollars.

>7,000
medications are being developed around the world



5,000–10,000
potentially effective substances in the initial stages of development

250
tested in the lab as active substance candidates

5
tested on humans

1
substance ends up as a medication

>500
medications have been approved since 2000

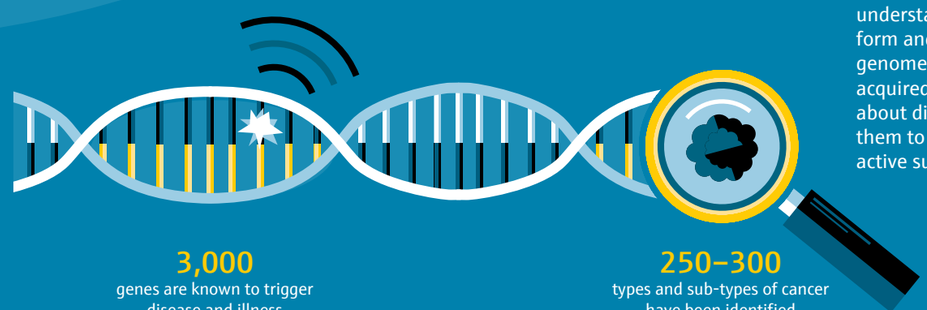
Biology instead of chemistry
More and more medications are being manufactured with the help of genetically modified cells from plant or animal organisms. Because they are so complex, biopharmaceuticals are extremely difficult, and sometimes impossible, to produce synthetically.

21
atoms

Chemically manufactured acetylsalicylic acid (pain reliever)

~20,000
atoms

Monoclonal antibodies to treat cancer, produced with biotechnology

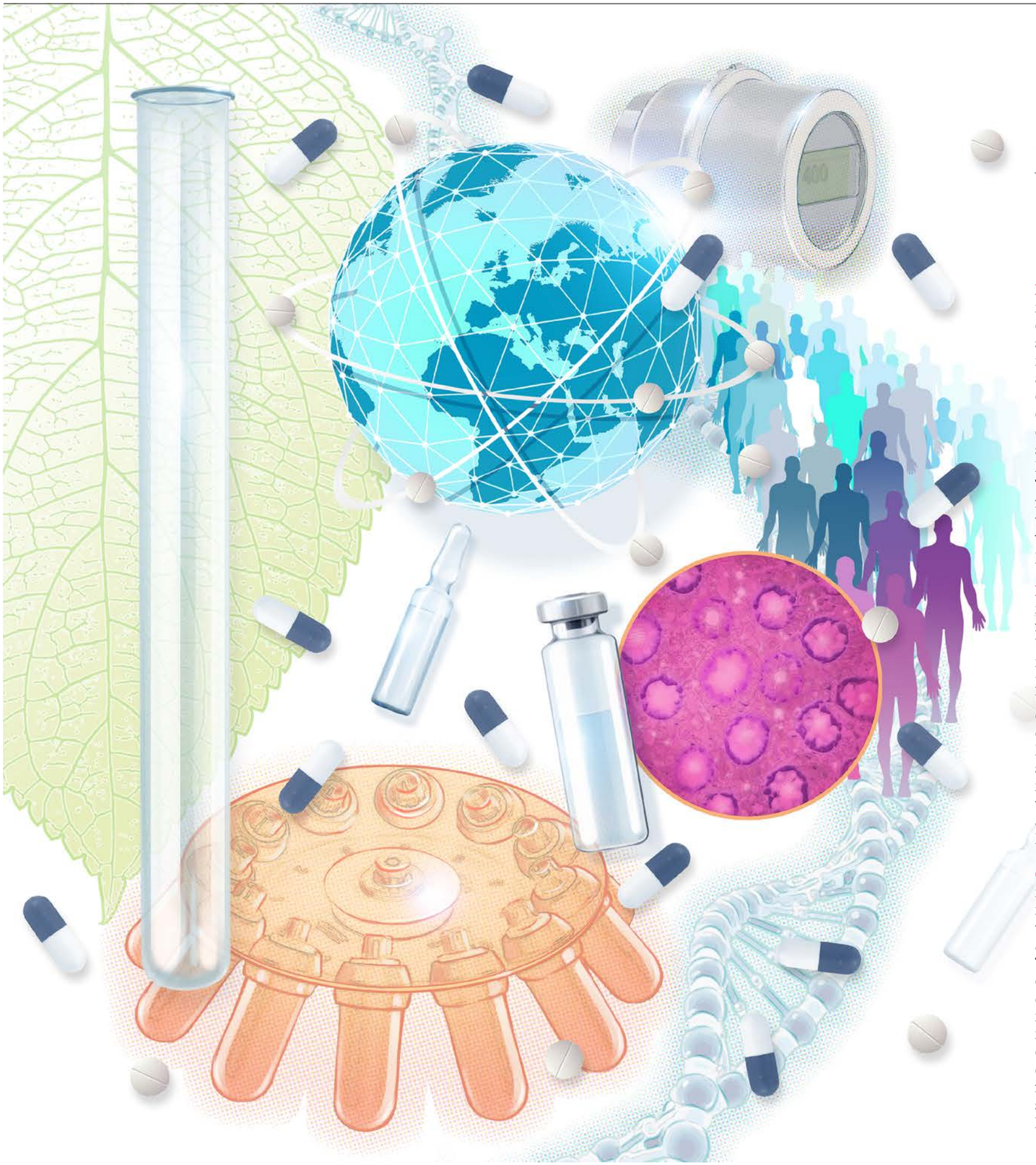


3,000
genes are known to trigger disease and illness

250–300
types and sub-types of cancer have been identified

In-depth understanding
Researchers have a growing understanding of how diseases form and run their course. Through genome decoding, they have acquired extensive knowledge about disease profiles, allowing them to more precisely develop active substances.

Infographics: Pia Bublies



In constant flux

Global demand for life sciences products is growing. Klaus Köhler knows what drives the industry and what challenges it faces.

New markets, new measures The life sciences industry is driven heavily by developments such as aging societies, growing populations and expanded access to health care services in emerging and developing countries. The result is that the overall market is experiencing steady, above-average growth. The industry has undergone major changes. Before, it was mainly blockbuster products that drove the market. Since the late 1990s, however, many of the patents for these chemically manufactured, top-selling pharmaceuticals have expired. In response, the life sciences industry has shifted its focus to research. Today, a wealth of new medications is being developed for the treatment of more rare illnesses or for more targeted therapies. Success has been achieved in particular with the innovative mechanisms of biotechnology-based pharmaceuticals.

Biotech instead of chemicals The key innovation impulse for the life sciences industry currently stems from the field of biotechnology. Today, among the world's best-selling pharmaceuticals, more active substances are manufactured with biotechnology than with chemical processes. Because production takes place in bioreactors using living cells, biotechnology is more expensive and complex than chemical synthesis. The stability, effectiveness and safety of the medication depend on hundreds of factors, from the air quality and the nutrients solution, to the design of the system. It's a process that requires around-the-clock ideal conditions, especially in the bioreactors, so that the cells will produce the desired active substances in sufficient amounts and at sufficiently high quality.

Global in every respect Today, the life sciences industry is more global than ever. Pharmaceutical production is no longer restricted by national borders and is not tied to one location. Generic drugs, biosimilars and vaccines are typically manufactured locally for regional markets. The life sciences industry is expanding its presence, especially in newly created markets in emerging and developing countries. New players are entering the market and competition is on the rise. In contrast, innovative drugs with worldwide demand are produced centrally because this is where the best combination of cost advantages, employee knowledge and yield can be found. Another factor is that product quality must meet strict regulatory requirements in the United States or Europe.

Under pressure Life sciences is one of the world's most heavily regulated industries – and regulatory requirements have increased, especially over the past few years. This trend is expected to continue. At the center are guidelines for assuring the quality of production processes and production environment. The aim is to ensure that medications are manufactured with consistent quality. At the same time, the industry is facing growing pressure from public health care systems to reduce pricing. In Western Europe, for instance, the industry has to prove the benefits of new prescription drugs in more and more cases; in emerging countries, demand for patent-free generics is growing.

Process under the microscope Process optimization plays a major role in the life sciences industry. Innovative biotechnology processes, a process analysis initiative originated by the US Food and Drug Association (FDA), plus a drive towards operational excellence, have combined to force the life sciences industry to think outside the box and utilize state-of-the-art technology and processes. Among other things, this involves acquiring a better understanding of the manufacturing processes and implementing real-time monitoring and control of quality parameters. At the end of the day, the goal is to manufacture products more efficiently and with the same quality. In this context, continuous, highly automated processes are becoming more and more established in new plants, in contrast to traditional batch manufacturing.

Text: Christine Böhringer
Illustration: Ralf Marczinczik
Photo: Christoph Fein

Close ties to the industry As Global Industry Manager, Klaus Köhler (50) is responsible for coordinating Endress+Hauser's worldwide network of life sciences experts. The chemical engineer has more than 20 years of experience in the industry. In his leisure time, the married father of two keeps fit with mountain biking.

“Innovation occurs at the interfaces”

The life sciences industry thrives on innovation. Roche CEO Severin Schwan and Endress+Hauser CEO Matthias Altendorf talk about what it takes to maintain a leadership position – and the role partnerships play.

How do you generate a creative environment? Roche CEO Severin Schwan (right) and Endress+Hauser CEO Matthias Altendorf in discussion.

Mr Schwan, regulatory requirements are an issue for your industry, political pressure on prices is another. Global competition is growing at the same time. What do you see as the biggest challenge?
Severin Schwan: The biggest challenge involves constantly developing new drugs and diagnostic processes. Roche is completely focused on innovation. If we don't completely renew our portfolio within ten years, we can turn the lights out, because by that time the last patents will expire. Everything else stems from this one challenge. When we develop a very good drug, of course we have to manufacture it, distribute it at a fair price and succeed against competition. But the key is having that innovation in the first place.

Roche boasts one of the world's largest corporate R & D budgets. How do you create and sustain an innovative environment?
Severin Schwan: Mainly through creative freedom. Creative people need space, they need air to breathe. If you constantly tell creative people how to do their jobs, put them inside little boxes and bury them with standard operational instructions, you will never create anything new.

Mr Altendorf, how does Endress+Hauser support the life sciences industry?
Matthias Altendorf: There are various aspects to that. We can help our customers operate efficient and stable processes. We can help them to properly fulfill regulatory requirements. And we can take activities off their hands that are not part of their core business. But most of all, our products, solutions and services, which are designed for process and lab automation, help to shorten the development cycle, from initial idea to market-ready product, and to manufacture these products efficiently.

For years, Roche has focused on the link between pharmaceuticals and diagnostics and thus personalized medicine. Is Endress+Hauser's analytical strategy similarly forward-looking?
Matthias Altendorf: We're talking about completely different fields, but a similar approach. Our customers want to capture not only quantitative, but qualitative parameters – in lab, pilot plant and production. This is why we strengthened the area of process analytical technology and moved into laboratory analytical technology with the acquisition of Analytik Jena. We want to help our customers to measure, monitor and validate the right parameters as early as the R & D phase and in their quality labs, so that they don't have to re-evaluate the parameters when they transition to the next stage.
Severin Schwan: I can only confirm this. The development processes from research to the different phases of preclinical and clinical development are becoming more and more intertwined. It is a major advantage if as a partner you can support the processes beyond the value chain. If you can move seamlessly into further development, and then production, with the technologies that you began with, that translates into significant time savings.

"We could not operate our business without partners. Together you can create more value; that's the great thing about a partnership!"

Severin Schwan, CEO Roche

What is the significance of having partnerships with providers such as Endress+Hauser?
Severin Schwan: We could not operate our business without partners; it's as simple as that. If you approach cooperation from a long-term standpoint, if you work closely together along the entire value chain, if you understand each other's needs, then a pure supplier relationship will evolve into a genuine partnership. Together you can create more value; that's the great thing about a partnership!

What does Endress+Hauser do in order to be a good partner?
Matthias Altendorf: We try to stay close to our customers. We need a good understanding of their requirements and challenges. We have to know what impacts them and what challenges them. That way we can support them and help develop their business. We would not have recognized the significance of biotechnology if we hadn't remained so close to our customers.

Roche is the leading provider of biotechnology-manufactured pharmaceuticals. How did biotechnology change your company and your business?
Severin Schwan: The basic prerequisites are independent of how you create a drug. The key is that you understand biology and recognize the starting points. Then you select the right technology in order to intervene in these biological processes in the body. In other words, the business model itself has not changed. But manufacturing a biotechnology substance requires a completely different process than chemically producing a tiny molecule.
Matthias Altendorf: The production process has changed dramatically. Biotechnology requires other parameters. As a supplier we have to be creative as well. Ten years ago, we never thought we would be able to measure glucose, which fuels the metabolism in a cell.
Severin Schwan: You offer that?
Matthias Altendorf: Using Raman spectroscopy, we can determine if the cells feel healthy, if they are growing and how well, if they have sufficient glucose and oxygen, if they are producing too much carbon dioxide…

Mr Schwan, how important is expertise for production at Roche?
Severin Schwan: Extremely important! Development usually occurs in cycles here. If you have command of a technology when it is new, that represents a competitive advantage. These technologies then become standard over the years. You can see that with small molecules, where there is a lot of outsourcing today.

In the field of biotechnology, the fact that Roche had an early command of the technology was a major advantage. The manufacture of first-generation antibodies has since become a standard process. For this reason, we have begun to outsource this process as well. We are now working with second- and third-generation, heavily modified antibodies, with which we can effectively utilize our knowledge to set the company apart. That's why we're keeping this process in-house for now, although the day will come when we will have to think about whether someone else can manage the process better and more efficiently.

Right next door, Roche has erected the tallest building in Switzerland. You have your office here in the venerable old administration building. What does that say about the corporate culture?
Severin Schwan: It has a lot to do with tradition. It signifies continuity and stability. That's perhaps still more important to us than for other industries. We have extremely long product life cycles. We have to think long term. By the way, it was never our goal to create the highest building possible; that's not part of our culture. But in order to house all of our employees in Basel at a single location, the only option was to go vertical. That's why it was even more important that at least the management team keeps its feet on the ground! *(Laughter.)*
Matthias Altendorf: Architecture has an impact on people! The other is communication. It's extremely important for creativity and collaboration to have people close to one another.
Severin Schwan: Absolutely. Innovation often occurs at interfaces where different functions come together. This also applies to relationships between companies, such as our partnership. It always goes back to the same issue: How do we remain a leader when it comes to innovation? We always have to have the best medication. No one wants to be treated with the second best!

What can Endress+Hauser learn from an innovation-driven industry such as life sciences? Are there major differences?
Matthias Altendorf: The mechanisms, how creativity and innovation arise, are the same everywhere. You need the right people, and these people must feel comfortable. And you have to do everything to ensure that these people can be successful within a certain framework.
Severin Schwan: That applies not only to the business world by the way. Writers, musicians, painters and others are innovative exactly because they choose the path of creative freedom instead of following convention.
Matthias Altendorf: Interaction with the outside world is also important…
Severin Schwan: Artists inspire one another and also receive inspiration from the outside. It's the same with us, whether it involves science or measurement engineering… Sharing information and experience is important!

Interview: Martin Raab
Photos: Christoph Fein

At the top Dr Severin Schwan has been CEO of F Hoffmann-La Roche AG since 2008. The 49-year-old economist, who also holds a PhD in law, joined the Swiss pharmaceutical company in 1993. With annual sales of more than 50 billion Swiss francs (51 billion US dollars) and 94,000 employees, Roche is the number two player in the industry. Founded in 1896, the company focuses on biotechnology through its pharmaceuticals and diagnostics divisions and is considered the world leader in cancer research and therapy. The largest holdings in the company are owned by the founding family shareholders.

Successful together

The life sciences industry requires strong partners in order to safely and cost-effectively manufacture medications. Endress+Hauser supports the industry so it can focus on its core tasks.

INSTRUMENTATION

A one-stop shop

The success story of the biotech industry starts with insulin, a hormone derived from the pancreas of pigs. 30 years ago, scientists produced it for the first time using genetically modified cells. Endress+Hauser's first life sciences project involved supplying measurement technology to a plant that produced long-acting insulin. Endress+Hauser has systematically aligned its portfolio to the biotechnology industry as it has evolved over the years, expanding into analytical parameters and working on many large-scale projects as main instrumentation vendor. Endress+Hauser supports what has become a global industry with an equally global network. The subsidiaries understand the requirements and needs of local customers. All products, solutions and services are provided around the world with the same quality. Feedback from the industry network is incorporated into new products such as TrustSens, the world's first self-calibrating thermometer.

ENGINEERING

Consistent from the start

Planning a new plant for the production of active ingredients is comparable to planning a wedding: the bride and groom create a wedding gift registry and coordinate their wishes with the guests. Likewise, when designing a plant, it is useful to reduce complexity and to determine all measurement devices in an early planning phase. Endress+Hauser offers this tailored service with the help of an embedded engineer: incorporated into the project team, a specialist familiar with the life sciences industry's specific requirements ensures there is a reliable installed base of devices. The embedded engineer fine-tunes the measurement technology with the plant suppliers, answers any questions and ensures correct implementation. A high degree of standardization saves time and costs, including those associated with plant maintenance. On the operations side, this approach drives down spare parts costs while reducing training, maintenance and calibration efforts. Plant availability is increased at the same time.

HEARTBEAT TECHNOLOGY

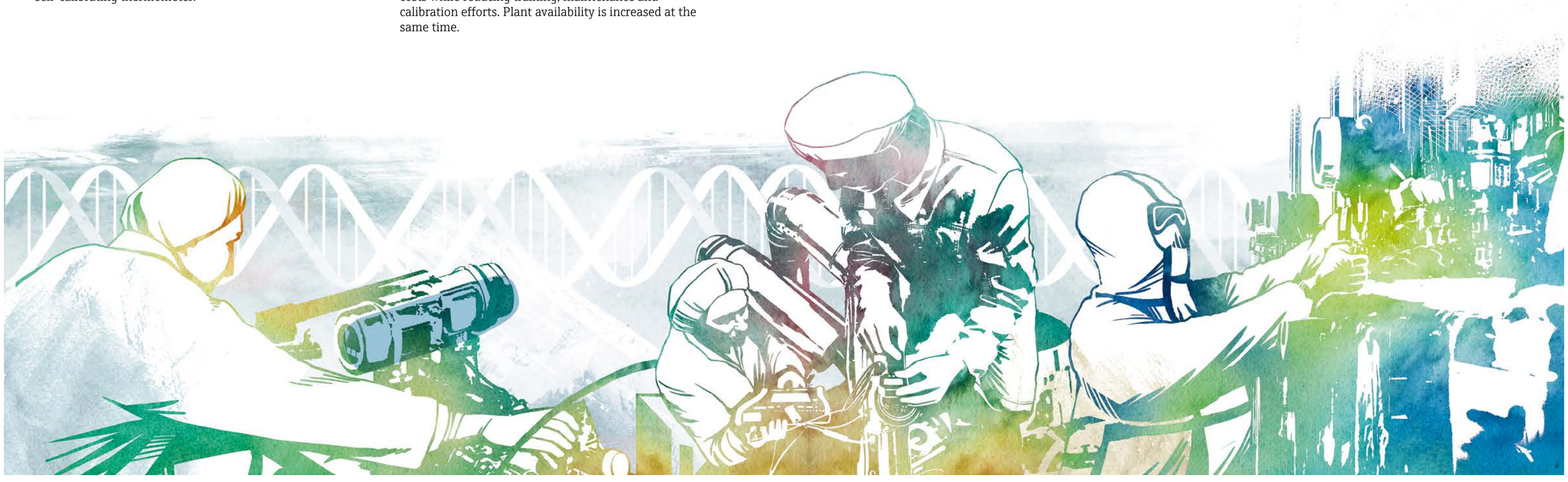
Self-test during operation

Production processes and environments in the life sciences industry are subject to strict quality management guidelines. Maximum reliability is demanded of measurement devices. Endress+Hauser has therefore equipped the latest generation of flow and level instruments, as well as liquid analysis engineering, with Heartbeat Technology for self-verification. This has a multitude of advantages. First Heartbeat enables an instrument to permanently monitor itself and the process conditions. This leads to better service planning and optimized processes. Secondly, thanks to Heartbeat, the device can perform a self-test. An automatic test can be launched by simply pressing a button on the device or clicking a mouse through a network connection. The device then carries out a self-test of all functions and generates a test report. Plant operators can thus meet their documentation requirements with ease and ensure more efficient and safer operation.

RAMAN SPECTROSCOPY

Analysis in closed systems

Even the smallest contaminant can render a batch unusable in biotechnology production. That's why bioreactors should have as few connections as possible. The Raman spectroscopy technology developed by US specialist Kaiser Optical Systems, part of the Endress+Hauser Group since 2013, offers a way to non-invasively measure critical process parameters. The innovative analytical technology is based on the interaction of a laser beam with the material under inspection. The diffusion of light creates a pattern for every substance, giving information about its composition and quality. As a result, a wealth of parameters – whether glucose, lactate and glutamate, or living and total cell count – can be reliably determined in the laboratory, during process development and later in the production bioreactors, using a non-invasive optical window. Even in single-use systems, Raman spectroscopy enables continuous quality control and process optimization.



LIQUID ANALYSIS

From lab to production

Endress+Hauser's sensors for liquid analysis can be deployed throughout the process, from the laboratories to process development to the production of active substances. It's the special Memosens technology together with the accompanying Memobase Plus software that makes this possible. The technology digitalizes the measurement values in the sensor and can store calibration, sensor and process data. Using this software, the sensors can be easily and precisely calibrated by computer under controlled conditions in the laboratory, the condition of the sensors can be evaluated and their life cycle documented. The program extracts the data and allows complete traceability of test solutions, sensors, calibrations and measurements. This method minimizes the risk of deviations between lab results and measurements in the production process. Consistent data is provided, so that liquid analysis techniques can be transferred from the laboratory to production without revalidation.

LABORATORY ANALYSIS

Safety in the quality lab

Analytik Jena covers the laboratory analysis business within the Endress+Hauser Group. The specialist for analytical instruments and bioanalytical systems offers various spectroscopic technologies for quality control in life sciences production. They enable almost all elements of the periodic table to be determined in samples. This allows laboratories to test the effectiveness and safety of medications, among other things. On the other hand, contamination of organic raw material, end products and packaging are best identified through sum parameters such as total organic carbon (TOC). Analytik Jena's fully automated analyzers do this quickly, reliably and in compliance with standards. Furthermore, the analyzers can easily determine the protein content of vaccine solutions via the nitrogen content. Compared to conventional protein testing procedures, this new method is less complex, easier to reproduce and simpler to validate.

SERVICES

Optimizing calibration

To guarantee adherence to pre-defined process values, the life sciences industry must regularly calibrate its measurement technology. Endress+Hauser offers traceable instrument calibration on accredited systems with consistent standards around the world. Endress+Hauser can also support a company with quality management throughout the entire process, from quick-response, on-site calibration in over 45 countries to fully accredited laboratory calibration services. Calibration engineers, who are specifically trained in accordance with current GMP guidelines for the life sciences industry, carry out their activities using standard operating procedures. Each result is traceable and documented in line with national standards. Endress+Hauser furthermore supports the industry with various services, the analysis of key performance indicators and modern device technologies to prolong calibration cycles and optimize calibration time. This reduces maintenance costs and increases plant safety and availability.

Texts: Christine Böhringer
Illustration: Ralf Marczinczik

Familiar with the industry: Sylvia Del Sorbo understands life sciences customers.

A WORD WITH… SYLVIA DEL SORBO

"Compliance is most important"

Ms Del Sorbo, what is the key to successfully managing life sciences projects?
The life sciences industry is subject to extremely stringent regulations. Compliance is the key issue for our customers and that requires adhering to all laws, standards and guidelines. Non-adherence brings the risk of not receiving approval for a product or losing approval at a later point.

How does Endress+Hauser help its customers to achieve compliance?
Our products have been and are being developed so that they adhere to the industry's latest requirements. We can provide the proof that our customers need for the authorities. In the biopharmaceutical sector, we have aligned our portfolio with ASME-BPE, a global standard for biotechnology manufacturing equipment and systems. We carry out software projects in accordance with the current cGAMP guide, which is the standard for validating computerized systems.

How do you ensure the quality of such validation processes?
At Endress+Hauser we have set a standard process for the validation of software projects, which all of our sales centers use. This guarantees that we meet the requirements and adhere to the standards in a consistent manner in every country. We developed a multi-tier training program for our employees in sales and production around the world that trains them on the specific requirements of the life sciences industry. We therefore speak to our customers in the same language on a global scale – and they can be certain that we understand their needs.

Questions: Christine Böhringer

Sylvia Del Sorbo works as Validation Manager in Endress+Hauser's support team for the life sciences industry.

An eye for detail

Wherever a biotechnology system is being installed around the world, chances are American manufacturer Cotter Brothers is among the suppliers. The company is one of the premier specialists in this business.

The list of customers reads like a Who's Who of the biotech industry. From A for Abbott to Z for Zymogenetics, the Cotter Brothers partner with all of the big names. The family-owned company, located outside of Boston, was one of the very first manufacturers of biopharmaceutical systems and remains a global leader. "Our customers trust us to handle even the most difficult tasks," says President Randy Cotter Jr.

The company's reputation has been built over the years on a foundation of in-depth understanding of bioprocesses and uncompromising quality of the systems made in Danvers, Massachusetts. Cotter Brothers designs, manufactures and installs process skid modules for all stages of biopharmaceutical production.

On average, two fabrications leave the manufacturing facilities located on the outskirts of Danvers each month. The process skids come in various dimensions, from refrigerator format to the size of an upright container. "We build 50-liter single-use systems as well as 12,000-liter stainless steel bioreactors," explains Randy Cotter Jr.

Many of the skids are equipped with measurement technology from Endress+Hauser. "We share the Cotter Brothers' strategy of clearly aligning with the needs of the industry," says Ravi Shankar, Industry Manager Life Sciences at Endress+Hauser, USA. "We need partners who understand the requirements of the industry," confirms Randy Cotter Jr. Last but not least, the two companies are connected through their activities within the Bioprocessing Equipment (BPE) Standards Committee of the reputable American Society of Mechanical Engineers (ASME).

"We need partners who understand the requirements of the industry."

Randy Cotter Jr., President Cotter Brothers

Active from the start The ASME-BPE guidelines developed by the committee are considered the international standard for building biopharmaceutical manufacturing systems. Many sections of the guidelines carry the handwriting of company founder Randy Cotter Sr. He gained his experience in stainless steel in both the semiconductor and nuclear industries, before he recognized an opportunity to become involved in the nascent biotech industry nearly four decades ago. In delivering his first module in 1981, in essence he was involved from the very start.

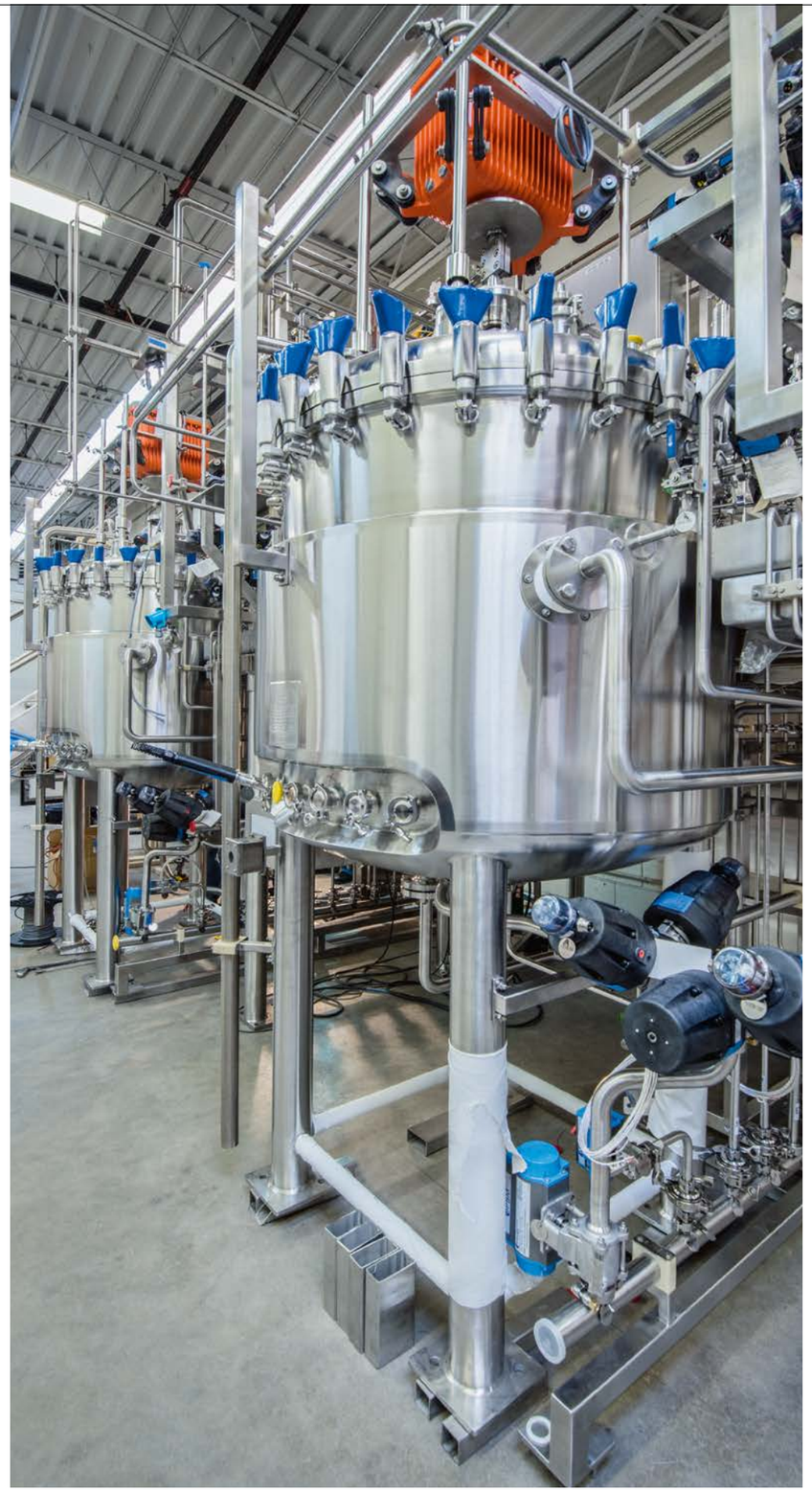
Thoroughly analyzing, understanding and acquiring a command of a subject, Randy Cotter Sr. is an engineer through and through. In the early 80s, there was no blueprint for building production modules for bioprocesses. Even where the requirements were obvious, engineers lacked the experience to implement them. "It was a painstaking learning curve," recalls the company founder.

One-of-a-kind expertise Randy Cotter Sr. tackled many of these challenges systematically. What is the optimal flow rate for liquids? What is the ideal slope for the pipes? What should a weld profile really look like? Randy Cotter Sr. worked tirelessly, in effect performing basic research to achieve technology advances. It was only a few years ago that he obtained funding and worked with industry leaders to understand dead legs in biopharmaceutical piping systems, which can lead to hygiene problems.

The knowledge developed by the family-owned company over the years is unique in the industry. "We scored points with our measurement technology expertise," reports Alan Senecal, who spent years building up the customer relationship with Cotter Brothers for industrial supplier F.W. Webb, one of the select representatives on which Endress+Hauser's US sales force is based. "We made ourselves constantly available with consulting and support services. We always delivered the right device for the respective application. And we never left Cotter Brothers high and dry when problems arose."

If the customer has no specific instrumentation requirements, Cotter Brothers recommends products from Endress+Hauser. The company integrates flow, pressure, level and temperature measurement devices into its skids, as well as liquid analysis technology. "We hear time and again that Endress+Hauser has a technological edge," explains Mark Braatz, who currently manages the relationship with Cotter Brothers for F. W. Webb. "Endress+Hauser's attention to detail," as reflected in the introduction of 1.4435-grade stainless steel instruments for life sciences applications for instance, "repeatedly serves as a persuasive selling point."

When Endress+Hauser representatives talk about Heartbeat Technology, for self-monitoring of sensors, and Raman analyzers for process control applications, Randy Cotter Sr. takes interest. "Technology transfer is important in our industry," he says. "We have to be in a position to tell



Decades of experience: Cotter Brothers is among the pioneers of skid module manufacturing for the life sciences industry.

What's behind Cotter Brothers' market success?

"We always had the ability to feel the pulse of the industry. We pay attention to our customers and give them what they need. When I started in 1979 it was like a new frontier. It was like when Ford started with the Model A. You wanted to buy a car? It had two doors, four wheels and it was black. And that's how the industry started with fermenters, bioreactors and chromatography systems. They were always packaged units. As the industry matured, clients also matured and decided they didn't want that Model A anymore. They wanted a red Model A with three doors and a retractable top. The same thing happened with bioreactors and process equipment. Customers became smarter, and we had to become smarter, too!"

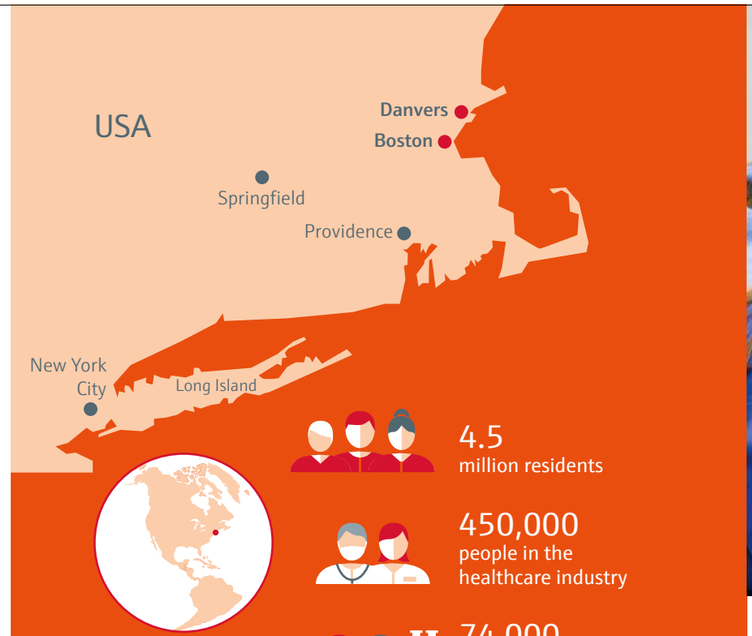
Randy Cotter Sr.,
company founder and pioneer
in the life sciences industry

our customers and employees about new innovations, and we have to convey our knowledge to the next generation of engineers," adds the company founder with confidence.

In close contact "One advantage for Endress+Hauser is that we can offer global support," says Industry Manager Ravi Shankar. Cotter Brothers generates one-third of its revenues with global customers, an area of the business that Randy Cotter Jr. wants to develop further. He knows he can rely on an experienced workforce to carry out his plans – not to mention loyal customers. "The biotech industry is not very forgiving," says Randy Cotter Jr. "The fact that our customers return to us time and again, that means something in this business!"

Text: Martin Raab
Photos: Jeremy Farrow, Martin Raab

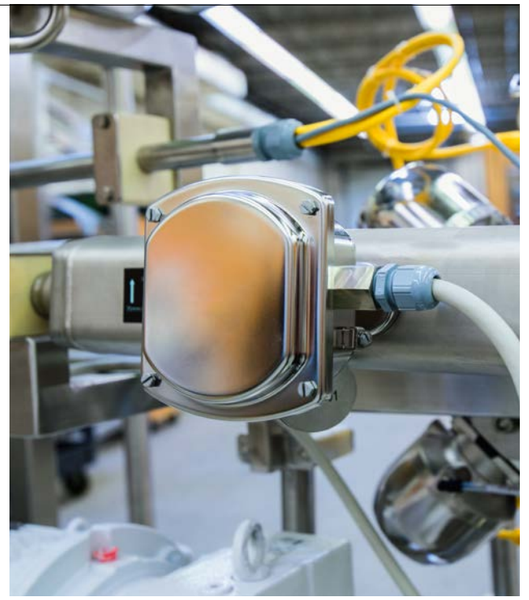
Highly specialized provider Cotter Brothers Corporation, headquartered in Danvers, Massachusetts, near Boston, is a global leader in custom-fabricated process skid systems for biotech manufacturing. The company was originally founded in 1979 by Randy Cotter Sr. and sold to global conglomerate ITT in 2001. Unhappy with the new course, the founder's three sons – Randy Jr., Tim and David – left the successor company and set up shop again on their own in 2003, bringing a large part of their former staff with them. Today, Cotter Brothers employs 60 people.



Biotech cluster Boston

Boston is a global center for biotechnology. The breeding ground is made up of several world-class universities and leading medical facilities, as well as easy access to venture capital through one of the key financial centers in the United States. The cluster's origins can be traced back nearly four decades when companies such as Biogen and Genzyme evolved from the university scene. The one-time start-ups have long grown into industry leaders. Scores of established pharmaceutical companies also have a presence in the region with their own labs. The biotechnology industry in and around Boston benefits from a constant stream of young scientists and university and clinical research work, as well as an information-sharing network and close cooperation between the companies and various institutes.

Watchful eye: an employee inspects a component.



Reliable: an Endress+Hauser flow device.

A steady hand: an experienced welder at work.

Reputable name: the Cotters have been in business for more than 30 years.

No compromises: Randy Cotter Jr. (right) relies on top quality – from receipt of materials to engineering and manufacturing. Endress+Hauser Industry Manager Ravi Shankar (left) and Account Manager Mark Braatz provide support in all aspects of process instrumentation.

Pills from the training factory

The outskirts of Strasbourg are home to a one-of-a-kind European facility. Here students and professionals can learn how to manufacture biopharmaceuticals using fully functional productions systems, including measurement technology from Endress+Hauser.

Unique training factory: students can acquire practical experience in biopharmaceutical manufacturing using state-of-the-art systems at the University of Strasbourg in France.

The Illkirch campus, south of the French city of Strasbourg, is home to various academic institutes active in the life sciences and pharmaceutical areas. Nestled among private labs, a biotechnology school and numerous startups, a new showcase project has sprouted up. The aesthetically pleasing new building with a glass facade houses an unconventional factory: the European Aseptic and Sterile Environment (EASE), a training factory belonging to the University of Strasbourg.

The construction of the training factory was funded by the French government and the EU, together with industry partners such as Endress+Hauser. Inside the three-story building, slightly more than half of the 4,000-square-meter floor space is set aside for clean rooms where sterile work can be carried out. Companies can rent space to test new systems and processes in a clean room environment.

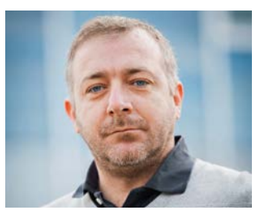
Under real conditions This is not the main purpose of the center, however. The building is used primarily for training and education in the area of biopharmaceutical manufacturing. But that doesn't mean it's simply a big laboratory. EASE is actually a factory, the only one of its kind in Europe. Year after year, 4,000 students and industry professionals can take part in hands-on training and education courses to learn how non-chemical medications are produced.

Students, apprentices or those who work in the fields of biotechnology, pharmaceuticals, engineering or process technology can supplement their theoretical knowledge with practical experience through training courses that run from one to 40 days. The bright building has very few classrooms. "There are only three, actually," says Laurent Queron, Technical Head of the University of Strasbourg. "At EASE, our goal is a little instruction, a lot of application."

The new building's architecture signals just how hands-on and comprehensive the work in the training factory is. If one glances up into the tall and open entrance foyer, the training center's building service technology is visible through a glass wall. Learning how to work with air filters, high-pressure air lines, ultrapure water loops and heating systems is just as much a part of the training as is the step-by-step preparation of the pharmaceutical production process. Ultrapure water is produced by a filtering and sterilization system within one of the rooms, for instance. In another room, you can cultivate microorganisms in five bioreactors in order to isolate the active substances needed for a medication from the biomass at a later point.

The actual pharmaceutical production occurs on the upper level. "We have three production lines: biomanufacturing with animal and plant cells and organisms, dry pharmaceuticals and liquid medications," explains Laurent Queron. Participants learn how to produce pills and capsules, as an example, in different colors, shapes or with special coatings.

Decked out head-to-foot in sterile work uniforms in the clean rooms, the participants fill bottles with liquid medications, package various pills, calibrate measurement instruments and practice how to dispose of materials in accordance with regulations. It's not only the residual substances from the manufacturing processes that have to be pre-cleaned before disposal. Even the newly manufactured medications have to be disposed of, a bitter pill to swallow for the 'plant workers,' since the training factory is not allowed to sell its products.



"Our goal is a little instruction, a lot of application."

Laurent Queron,
University of Strasbourg

State-of-the-art technology Measurement instruments from Endress+Hauser play an important role in all of these processes. This includes flow, pressure, temperature and pH sensors that are deployed in both production and utilities. Devices for energy management are distributed throughout the building as well to record and control the temperatures of the intake and exhaust air in the clean rooms and to calculate how much energy the production lines require.

Endress+Hauser donated the equipment for the state-of-the-art system, an approach that conforms well to the company's goals and culture, as Christian Knecht from the French sales center explains: "Endress+Hauser has a strong presence in the life sciences industry. This is why we want to demonstrate how important innovation and training are to us."

Text: Anita Vonmont
Photos: Loïc Chalmandrier

27 million

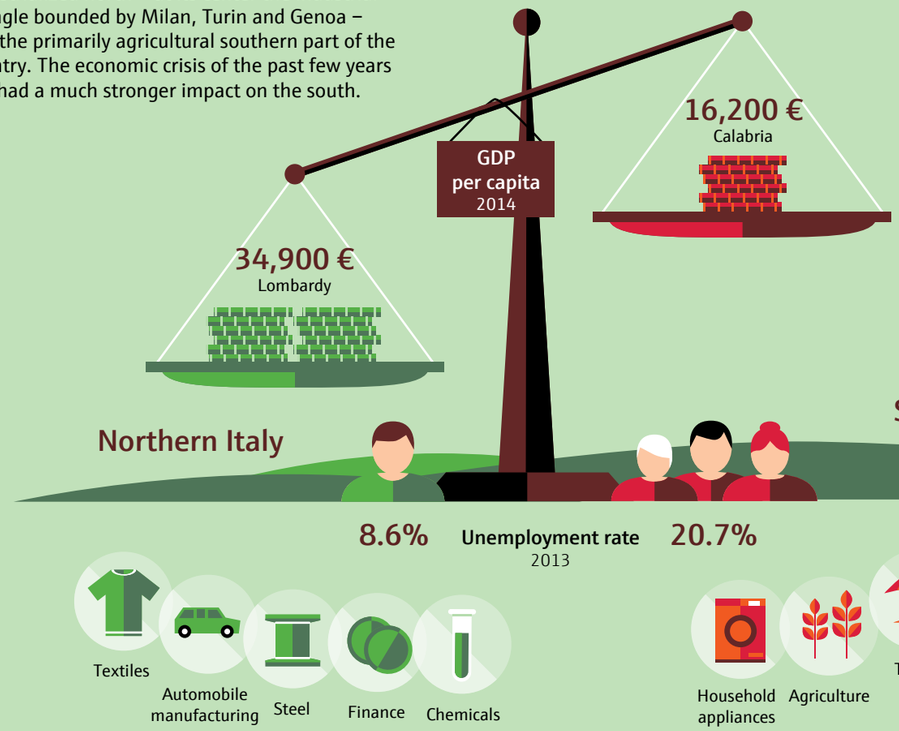
euros was invested by the University of Strasbourg in the biotechnological training factory EASE.

More than pizza and pasta

Italy: a dream destination. Fashion, soccer and art inspire people; the country attracts millions of visitors. The government and the economy nevertheless face enormous challenges.

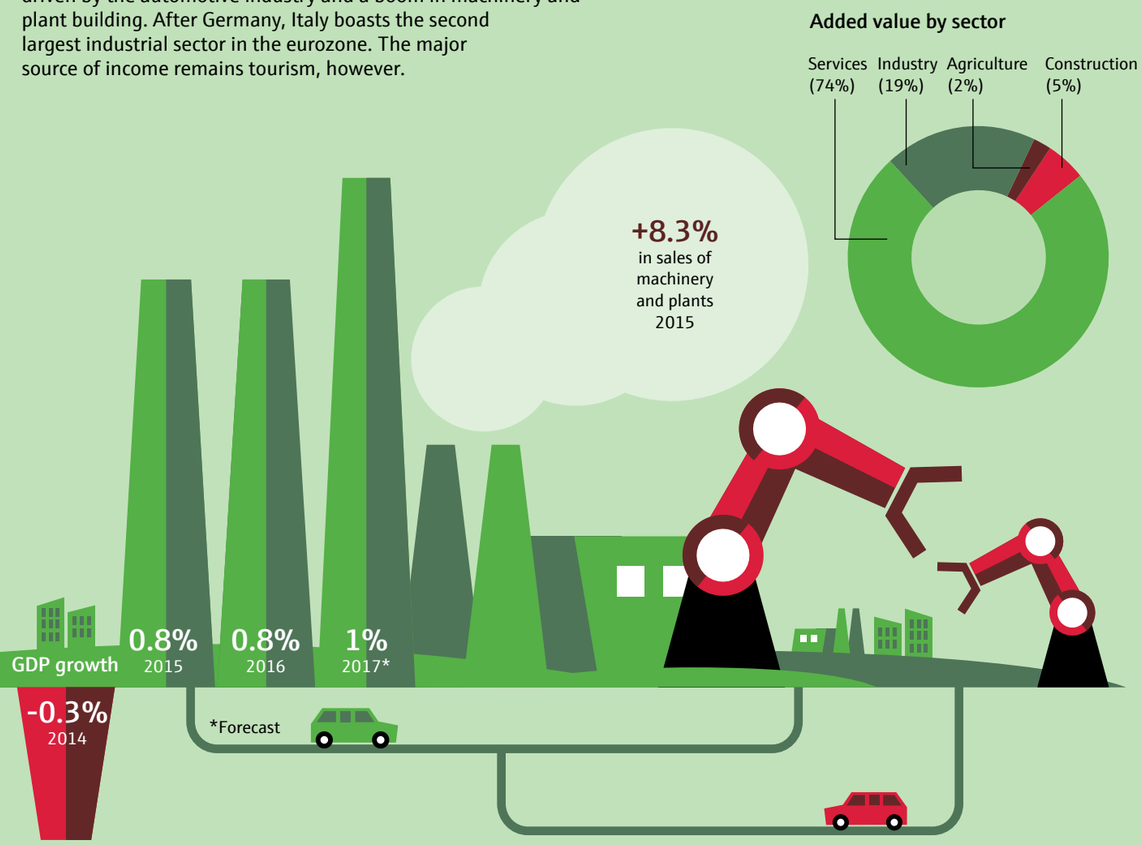
Imbalance

Wide economic disparity prevails between the heavily industrialized north – at its center the industrial triangle bounded by Milan, Turin and Genoa – and the primarily agricultural southern part of the country. The economic crisis of the past few years has had a much stronger impact on the south.



Industrial power

Domestic demand declined substantially on the heels of the 2008 financial crisis. The economy has regained momentum since 2014, driven by the automotive industry and a boom in machinery and plant building. After Germany, Italy boasts the second largest industrial sector in the eurozone. The major source of income remains tourism, however.

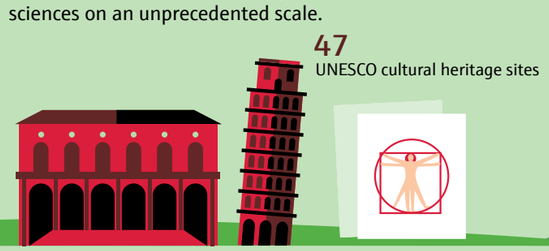


Culinary delight

Spaghetti, chianti, parmesan, salami, olive oil and tiramisu: UNESCO awarded Italian cuisine status as a cultural heritage in 2010. No wonder then that pizza is one of the few words understood around the world!

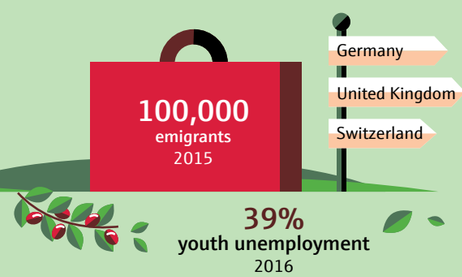
Italy's heyday

Italy's city states reaped enormous riches in the 14th and 15th centuries through mercantile and banking activities. Florence, Venice, Milan and Naples boost the arts and sciences on an unprecedented scale.



Brightest minds

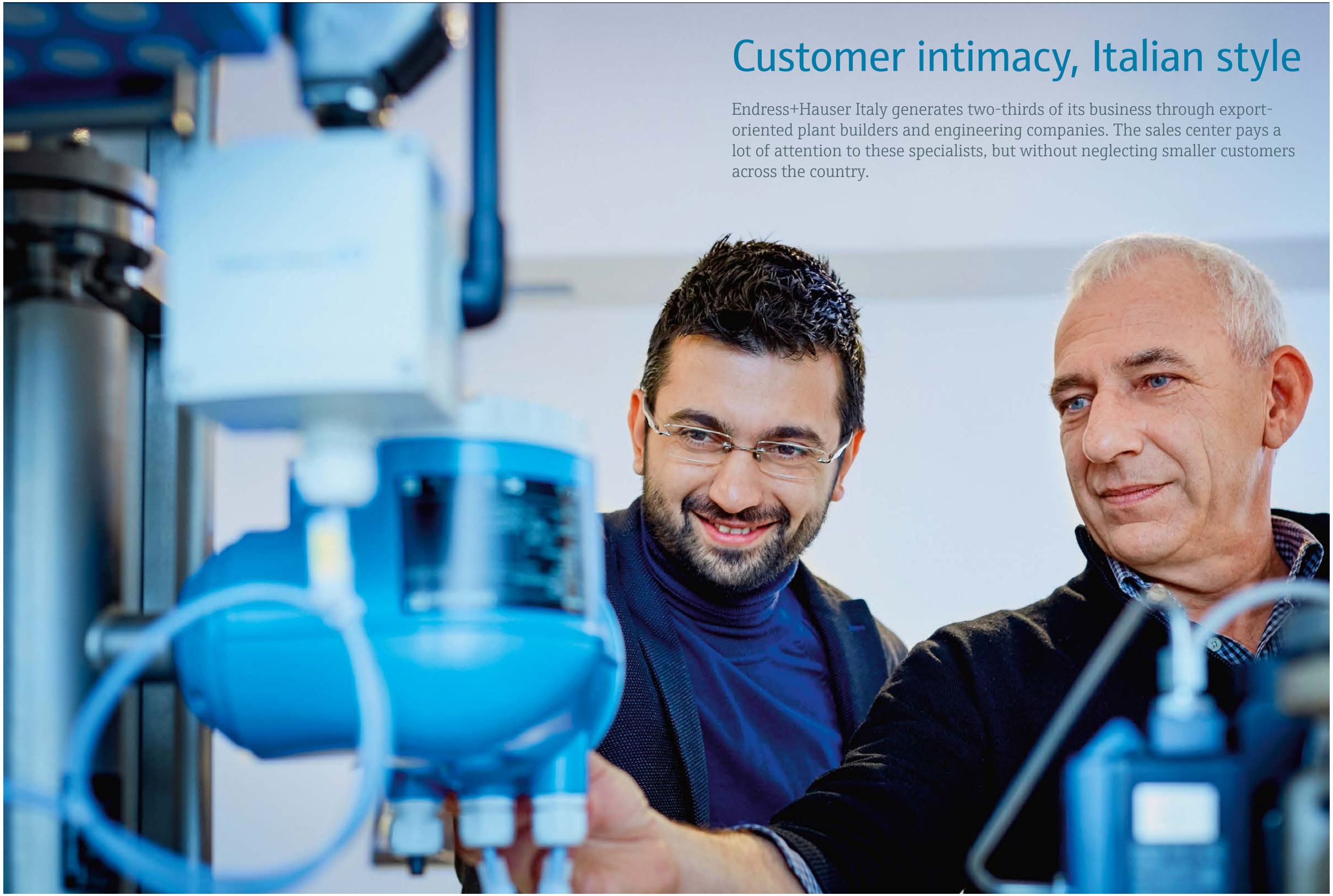
Many graduates and specialists are leaving the country to find work elsewhere. This brain drain is impacting not only southern Italy, but the north as well.



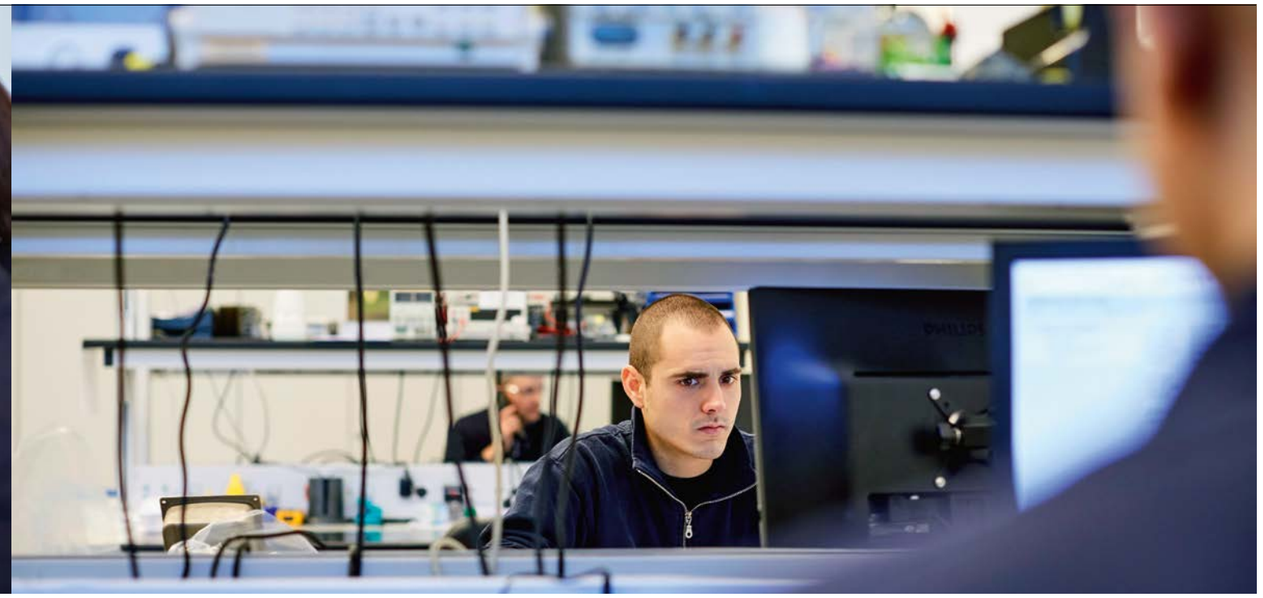
Infographics: Pia Bublies · Research: Ute Kohlstruk

Customer intimacy, Italian style

Endress+Hauser Italy generates two-thirds of its business through export-oriented plant builders and engineering companies. The sales center pays a lot of attention to these specialists, but without neglecting smaller customers across the country.



Extensive expertise under one roof: the Italian sales center understands the special needs of the various industries and sectors.



Growth segment: the solutions and services business is becoming increasingly important.

Europe's economy has experienced tough times. The southern part of the continent in particular is still feeling the repercussions of the 2008 financial crisis. Endress+Hauser Italy can look back on years of success, however. What at first glance appears to be a contradiction has much to do with the special structure of the Italian economy: Italy boasts a strong industrial sector, where vigorous exports more than compensate for the weak performance of the domestic market.

The growth of the Italian sales center is nevertheless extraordinary. "The reasons for our success? The people, the people – and once more the people," says Ivano Mazzoletti, Managing Director of Endress+Hauser Italy. "With extensive expertise, a clear strategy and an excellent culture, our people make the difference."

The sales center has a broad customer base across various industries, with an emphasis on companies from the food & beverage, water & wastewater, chemicals and life sciences industries. While aligned with specific industries, the sales organization boasts supplemental expertise that allows it to address the needs of engineering, procurement and construction contractors, as well as plant and equipment manufacturers, which account for two-thirds of the business. Sales offices and representatives manage regional customers all over the country.

"It will always be people that make the difference."

Ivano Mazzoletti, Managing Director Endress+Hauser Italy

Consultative approach Endress+Hauser grew into the market leader in Italy over four decades. "We stay close to our customers and try to maintain a constant dialogue with them," explains General Director Roberto Gusulfino. This is a key aspect, especially in the solutions and services business, an area that depends heavily on consulting expertise and whose growth is a major contributor to the success of the sales center. Customers value the fact that they can receive everything from a single source, whether engineering, configuration, commissioning, maintenance and calibration support, or complete automation or energy monitoring systems. This business simultaneously bolsters and secures Endress+Hauser's position as a leading provider of process instrumentation.

The sales center is located in Cernusco sul Naviglio, just outside Milan. The prestigious new building is assimilated into a park-like campus, where old, majestic trees offer a contrast to the modern architecture. "The building belongs to the people – our visitors and our employees," says Ivano Mazzoletti. With conference, training and exhibit space, an entire floor is dedicated to customer contact. The 190 employees enjoy an open office landscape and a wealth of meeting zones. A restaurant, as well as a fitness and break area, offer opportunities for rest and relaxation.

Not visible at first glance is the energy-efficient building technology. A wide range of concepts improves the ecobalance, from heavy duty insulation, special window glazing, extensive solar protection, geothermal probes for the cooling and heating and automated lighting and ventilation systems, to roof-mounted photovoltaic panels and the use of rain water for the irrigation and fire protection systems. "The technology also provides a pleasant indoor climate," says Roberto Gusulfino.

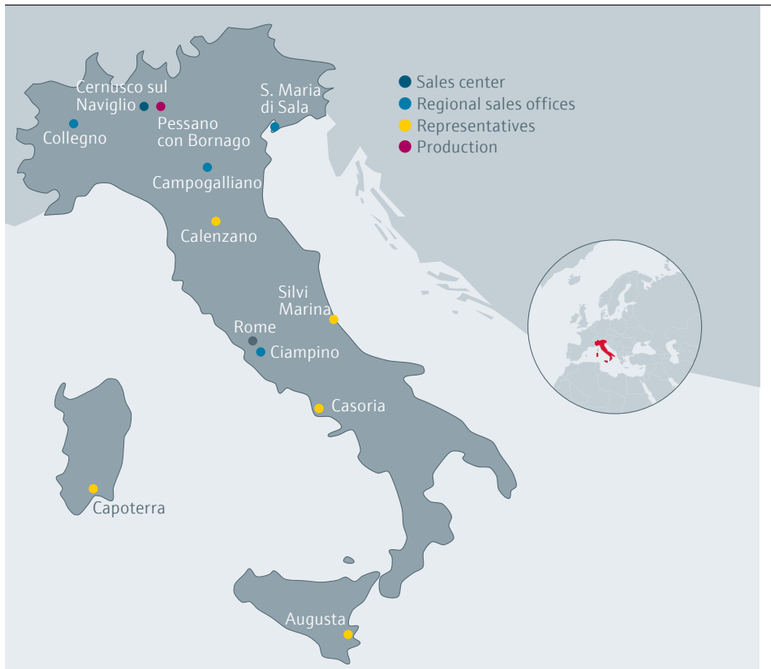
The building is large enough for further expansion as the sales center is committed to continuing its current path of strong growth. "Overall expectations for the Italian economy are restrained," says Ivano Mazzoletti. "Although we have to deal with a volatile and uncertain business environment, we're confident given our alignment with markets strong in export." EPC companies as well as plant builders are benefitting from the excellent reputation of products made in Italy, which stand not only for quality and reliability, but also flexibility.

Exceptional flexibility "If there is such a thing as national traits, then we Italians distinguish ourselves through flexibility, agility and creativity," reckons Ivano Mazzoletti. These characteristics will help the sales center tackle the biggest challenge of the future: digitalization. The managing director emphasizes that this involves both technical and social aspects. "We need new skill sets. That means attracting young talent, but it also requires bringing the older generation along. And we have to help our customers manage this digital transformation."

How well this will be managed is also a cultural issue for Ivano Mazzoletti. "Our goal is maintaining a special level of customer intimacy in a digital world." The managing director is convinced that this intimacy will always depend on personal connections, despite new digital points of contact. "Italians are very communicative. We love encounters and we love personal discussions. People value this, and that includes the younger generation. They sense that it will always be people that make the difference!"

Text: Martin Raab
Photos: Christoph Fein

Networker
Ivano Mazzoletti joined Endress+Hauser Italy in 2000 as director of sales and took over the reins as managing director in 2008. In 2016, the manager, who has an extensive business network, also assumed responsibility for the Central Europe sales region. Ivano Mazzoletti is 55 years old, married and the father of two grown children. In his spare time, he enjoys traveling and sports. He is an active tennis player and skier and an enthusiastic soccer fan.



In Italy's industrial heartland

The sales center and a production site for temperature measurement engineering are both located on the outskirts of the industrial center of Milan. Endress+Hauser Italia S.p.A. manages customers from its headquarters in Cernusco sul Naviglio, as well as from four regional offices. Five sales representatives cover other parts of the country and other business areas. Endress+Hauser Sicestherm S.r.l. designs and manufactures temperature measurement technology in Pessano con Bornago. The company is a division of the Endress+Hauser competence center for temperature measurement technology, system components and data management headquartered in Nesselwang, Germany.

1974
Endress+Hauser Italia S.p.A. is founded as a sales center.

4
regional offices are operated by Endress+Hauser Italy. Five representatives cover further parts of the country.

1997
Temperature measurement specialist Endress+Hauser Sicestherm S.r.l. joins the Group.

380
people work for Endress+Hauser Italy, evenly divided between sales and production.

2/3
of the business generated by Endress+Hauser Italy involves indirect customer sales (often from abroad) and ranges from planners to plant builders.

Buon appetito! Lunchtime at the restaurant.

Relaxing, shooting the breeze, networking: the meeting zones provide numerous opportunities for interacting with colleagues.

Photovoltaic system: the new facility has been designed with energy efficiency in mind.

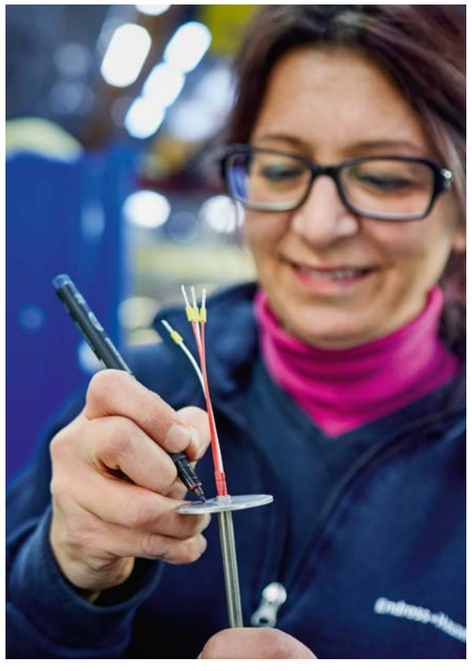
Modern architecture: the Italian sales center building

Communicative atmosphere: visitors and employees enjoy informal discussions in the break area.

Welcome! Visitors feel right at home as soon as they enter the reception area.

Quality and quantity

Endress+Hauser has assembled a wealth of expertise in the field of temperature measurement technology in Pessano, where sensors are produced in high volumes and custom systems are delivered.



Regardless if it involves blistering heat or freezing cold, sensitive food or aggressive chemicals, sterile applications or harsh environments, in Pessano con Bornago, Endress+Hauser manufactures temperature measurement technology for nearly any requirement. 190 people work in the state-of-the-art production facilities located near Milan. Tens of thousands of sensors leave the plant each year, which also supplies locations in the US, China, India and South Africa.

"We manufacture the sensor technology, the core of our temperature instruments, in high volumes," reports Managing Director Martin Benoliel. A modular system makes it possible to build a wide range of products to meet the needs of different industries and applications. This standard business accounts for more than 80 percent of the production volume, although standard is a fairly loose term. "Some of our thermometers are available in more than 1,000 models!"

Tailored solutions Still, what Endress+Hauser really specializes in is the engineered solutions business. "This calls for extensive knowledge and custom engineering. Although the technology is standard, the systems are tailored to the individual needs of the customer," explains the managing director. These solutions include multipoint thermometers that capture temperatures in two or three dimensions at various points, such as in a reactor, as well as individual measurement points for extremely challenging applications.

"The solutions and services business has taken on much more significance for us over the past few years," emphasizes Martin Benoliel. At the same time, closer collaboration with international partners is leading to growing requirements. "The project business is becoming increasingly important for us," says the managing director. "Thanks to the quality of our products and our expertise in the solutions business, we're setting ourselves apart from the global competition."

Text: Martin Raab
Photos: Christoph Fein

Temperature measurement technology for the global market: Managing Director Martin Benoliel can rely on a pool of skilled, dedicated employees.

Insatiable thirst

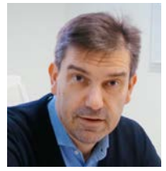
San Benedetto outpaced some of its competitors thanks to modern process engineering. Together with Endress+Hauser, the beverage producer is now stepping into the era of the Industrial Internet of Things.

Technological edge: a high level of automation ensures San Benedetto's quality and allows for flexibility in production.

Innovation and tradition go hand-in-hand at mineral water producer San Benedetto. Originally at home in the sales of household appliances, the company founder had the idea that the refrigerator's success could have a positive impact on the consumption of mineral water. He turned out to be right. The company recently celebrated its 60th anniversary. As the name suggests, the company's water promised beneficial effects. Known as Acqua della salute ('healthy water'), it quickly made a local name for itself, but obstacles to the national market remained.

"Revenues grew, but distribution was only regional. Building a new production line required a significant investment," recalls Enrico Zoppas, who took over the company together with partners following the death of the founder in 1971. "The company was losing money and no one wanted it," remembers the Chairman of the Board. Enrico Zoppas was nevertheless convinced of the potential. He entered the business and not long after landed a coup with the introduction of returnable bottles. Practically overnight, consumer acceptance catapulted the regional player to the national stage.

Key milestones Less than ten years later, the introduction of recyclable PET bottles led to the next revolution. In 1983, San Benedetto became the first company in Italy to sell mineral water in plastic bottles. For the first time, vertical process integration enabled full automation of the production line. A further innovation followed in 1993 when the company put a complete, aseptic bottling system for non-carbonated beverages into operation. More than just a milestone in quality assurance, it also opened the door to emerging lifestyle products such as iced tea and energy drinks.



"The ability to constantly improve our operation turns Endress+Hauser from a supplier into a partner."

Rosario De Marchi, Plant Manager, San Benedetto

The bold and foresighted moves paid off. Today, San Benedetto is successful in every segment of the soft drink industry, from mineral water and sweetened drinks, to children's drinks and tonic water. While the company relies on a modern sales distribution network that stretches from vending machines to restaurants, the production chain, from manufacturing to bottling, remains under its own control. "We utilize state-of-the-art process plants and continuous improvement processes to guarantee quality," says San Benedetto Plant Manager Dr Rosario De Marchi. "The pursuit of a good balance between quality, safety and efficiency spurs continuous technical innovation."

Strong partner A key factor here is process automation. "With Endress+Hauser, we found a strong partner with whom we have a lot in common, particularly a vision to constantly improve things," says Rosario De Marchi. The vision is not just about reliably monitoring the process and quality parameters in-line. It also involves the optimal use of resources and energy. "Precise and reliable flow measurements during batch dosing and preparation allow us to reduce the use of raw materials and process water and minimize the volume of waste," adds Rosario De Marchi.

"Thanks to Endress+Hauser's technology and knowledge, we have reached a level of automation that provides a great deal of production flexibility," says the plant manager. Behind this flexibility is not only technology, but also people. Endress+Hauser offers training to help the plant operators make the right decision in any situation. "Rather than performing their tasks blindly, our employees should assume responsibility. That calls for easy-to-use interfaces that permit a direct diagnosis of the process," explains Rosario De Marchi.

"A well-interconnected device landscape doesn't supply data, but information," says the plant manager. And it offers a perspective for the future. With regards to the Industrial Internet of Things, integration of the automation technology into the company's ERP system is becoming increasingly important. "Endress+Hauser has already implemented this requirement with fieldbus technology, the W@M portal and an asset management solution," says Rosario De Marchi in praising Endress+Hauser's approach. "The bottom line is, the partnership allows us to keep our processes lean and our attention focused on what our customers need!"

This technological edge did not go unnoticed by the industry. International beverage companies eventually began to show interest in San Benedetto, a development that culminated in joint projects. "We're agile and boast a high rate of innovation. That allows us to act quickly, flexibly and boldly," underlines Enrico Zoppas. The entire product and process development system was recently oriented toward environmental sustainability, another important aspect of the company's culture. "San Benedetto has always maintained a close relationship with nature and the environment," recaps Enrico Zoppas. "From nature we learned to create prosperity. This principle summarizes our philosophy and charts a course for the future. Everything revolves around a product that is not the work of people, but a gift from nature!"

Text: Alexander Marzahn, Tiziana Perchiazzi
Photos: San Benedetto, Christoph Fein

1,800

employees work in San Benedetto's 11 production facilities (6 in Italy)

20

million bottles are filled each day using 44 systems

730

million euros in net sales was generated by the company based in Scorzè (near Venice) in 2015

Success through quality and service

A strong industrial sector is the backbone of the Italian economy. Highly specialized, globally oriented companies operate successfully on an international scale. Endress+Hauser supports many of these market leaders.

Reliable teamwork

Tecnimont is active on a global scale. The engineering, procurement and construction company is part of the Maire Tecnimont Group, an international player operating in the hydrocarbons value chain with about 4,900 employees, of whom over half work abroad. Tecnimont is among the industry leaders in plant engineering for oil & gas processing, petrochemicals and fertilizers.

“Our business is experiencing a return to quality, which we are profiting from in Europe,” reports Claudio Montresor, Head of Instrumentation at Tecnimont. Alongside cost and delivery reliability, quality is also a crucial factor for him when selecting process measurement engineering: “We have never had a complaint with Endress+Hauser devices.” The engineer praises the support provided during the selection of suitable instruments for specific applications. “Endress+Hauser has a complete fit-for-purpose product portfolio,” emphasizes Claudio Montresor. In addition, Endress+Hauser can offer high-level project management.

Of course, the long-term partnership has seen ups as well as downs: “In 2006 we worked on a chemicals project together with Endress+Hauser. After six months, the customer called it off,” says the Head of Instrumentation. But Tecnimont didn’t let the project go – and finally received the contract. Claudio Montresor: “We didn’t give up. This is what we have in common with Endress+Hauser!”

Competent contact

Plant builder Elettracqua is all about water – pure and ultrapure water as well as water for injection. With headquarters in Milan and production in Genoa, the company has developed into a global player over the past 50 years. Its reverse osmosis, ultrafiltration, electro deionization, distillation and pure steam generation systems are used in pharmaceutical and biopharmaceutical production in particular.

When it comes to process automation, the company relies on Endress+Hauser. A good reputation, international presence and high quality were deciding factors for Managing Director Marco Minuto. Pressure, flow, temperature, conductivity and pH values are important measured values in Elettracqua’s systems. “For our applications Endress+Hauser offers a broad selection of products, which are fully tailored to the requirements of life sciences.”

Elettracqua’s water treatment systems are exported across the globe. Endress+Hauser is able to provide technical documentation for its measuring devices in most languages. As Marco Minuto says: “We find a competent contact person in every country and can fully rely on the on-site service.”

Strategic partnership

The Finnish Kemira group of companies focuses on water treatment, providing relevant chemicals and services. Customers come from the pulp & paper, oil & gas and mining industries as well as communal and industrial wastewater treatment. The company is internationally successful: 80 percent of production goes overseas.

In 2016, Kemira put the world’s largest production facility for bioacrylamide into operation in San Giorgio di Nogaro, northern Italy. The company invested 30 million euros into the expansion and refurbishment of the plant. Kemira consciously counted on Endress+Hauser as its single-source supplier for process measurement technology – “a strategic decision,” as emphasized by Plant Manager Stefano Tapparelli. “We are now better able to fulfill regulatory requirements thanks to standardization. Furthermore, we are reducing the expenses for maintenance and spare parts logistics.”

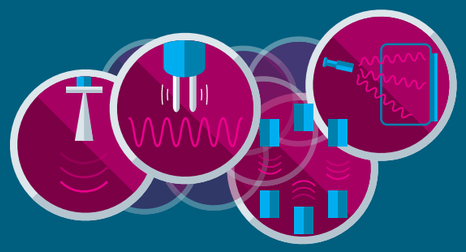
Kemira does not chemically produce acrylamide, which serves as a flocculant, instead producing it biotechnologically. Endress+Hauser’s devices measure flow, level, pressure and temperature and analyze liquids. “Our plants are characterized by flexibility, quality and efficiency, without compromising safety and the environment,” emphasizes Stefano Tapparelli.

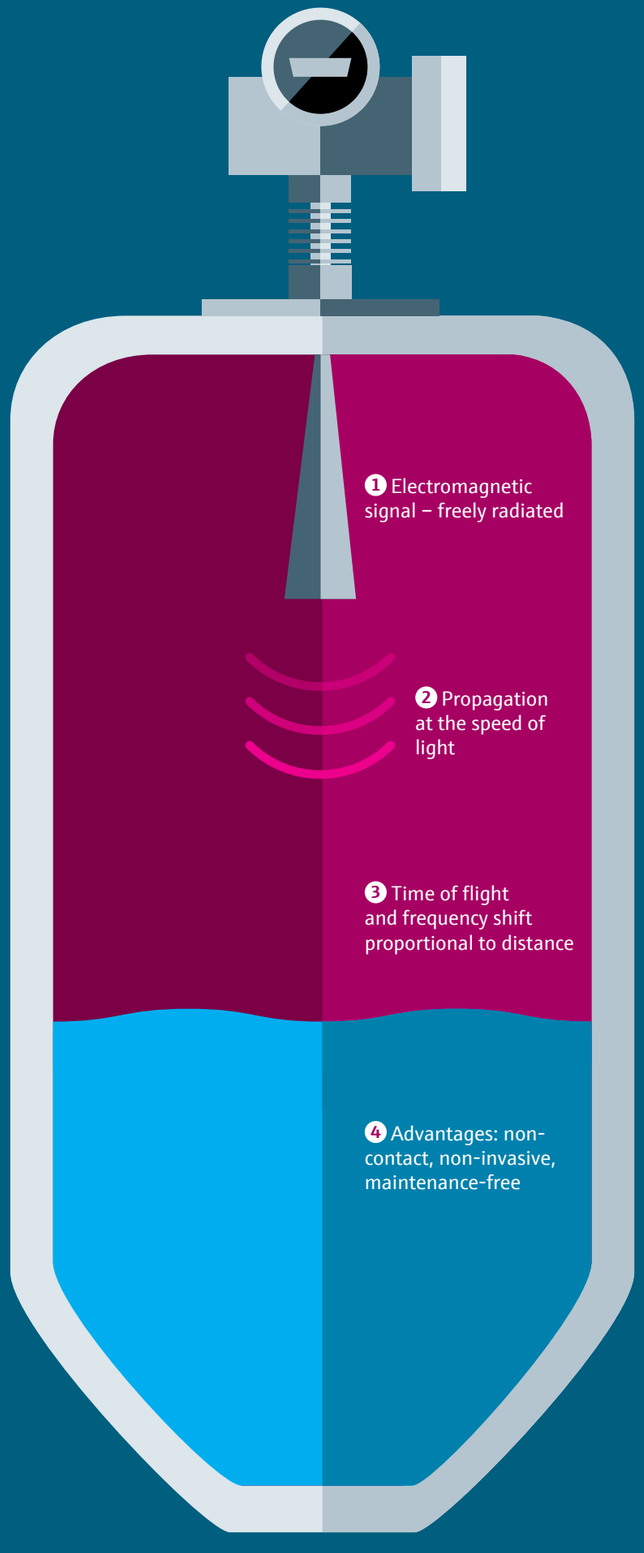
Texts: Anna Kürzinger, Tiziana Perchiazzi

On the right wavelength

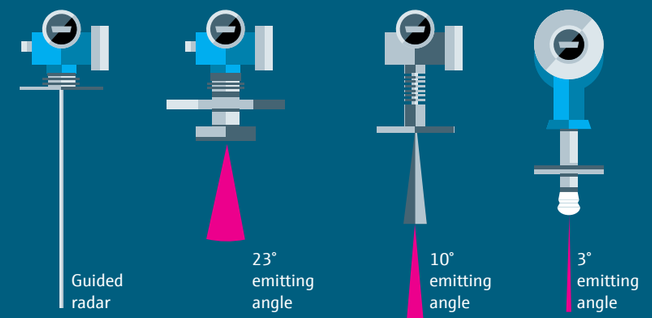
Endress+Hauser is a pioneer in the field of level measurement using radar. The technology now solves a variety of level measurement tasks, even under difficult conditions.

The whole spectrum
For Endress+Hauser, radar is just one of no less than twelve measuring principles that can reliably monitor levels, interface, density and level limits. This allows the correct solution to be found for any requirement – regardless of the application. More information: www.yourlevelexperts.com





From 1 to 80 gigahertz
Radar is often the method of choice for the continuous monitoring of levels. Similar technologies are used in the adaptive cruise control systems of modern cars. The breakthrough of these assistance systems has given a boost to the development of radar sensor technology and opened up new opportunities in measurement engineering.

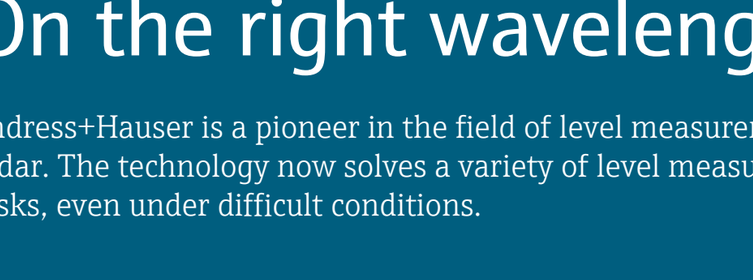


1 GHz
Ideal for difficult media, for example involving foam

6 GHz
Low influence of turbulence or strong condensate

26 GHz
For 90% of all applications; best price-performance ratio

80 GHz
Focused beam, long range, high precision, easy commissioning



The key to the solution
Inventory management systems work precisely and reliably – if necessary across sites, while integrating into the company's IT. The precision of radar engineering literally pays for itself.

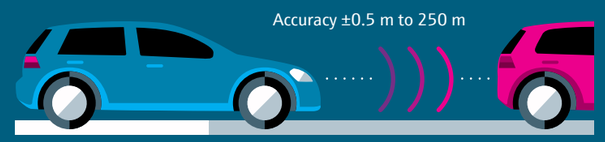
1 A 15-meter high, 30-meter diameter tank holds oil valued at around $4 million.

2 Usual level measurement accuracy of ±4 mm leads to an uncertainty of $4,200 above or below the actual tank inventory.

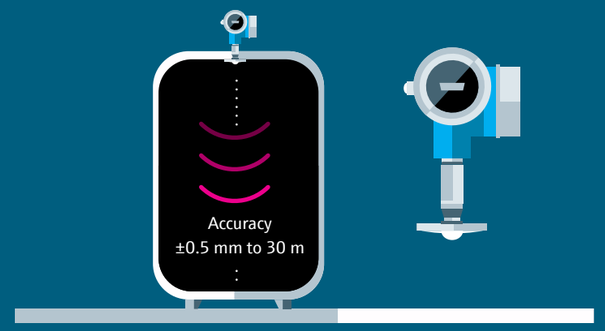
3 Accuracy of ±0.5 mm lowers the uncertainty to $520. This means that for 100 tanks it removes $368,000 of uncertainty.

Inherently reliable
The newest devices are developed according to IEC 61508 and are therefore suitable for safety-critical applications. The sensor monitors itself thanks to Heartbeat Technology. Testing at the push of a button is now possible; the sensor data allows for predictive maintenance.

Adaptive cruise control: optimized for speed



Micropilot NMR81: optimized for accuracy



Infographics: Pia Bublies · Research: Martin Raab

Environmentally friendly route: one of 90 Mærsk Line container ships sailing with blue measurement technology.

Economical on the high seas

Endress+Hauser's measurement engineering solutions make the world reliable, safe, efficient and environmentally friendly – on land as well as at sea.

Mærsk Line is putting sustainability first. The world's largest container shipping company aims to reduce carbon dioxide emissions by no less than 40 percent per container between 2007 and 2020. In order to reach this objective, Mærsk Line is putting the focus on a state-of-the-art fleet – and on energy monitoring systems that capture consumption and emission.

Highly accurate mass flowmeters from Endress+Hauser measure consumption, thus enabling CO_2 emissions to be calculated. "The implementation of our measurement technology actively contributes to environmental protection," emphasizes Merten Traulsen, head of the global support center for marine applications. He knows: "Measuring consumption alone doesn't save money. But it enables Mærsk Line to take appropriate action. The shipping company can therefore improve the efficiency of their ships, reduce consumption and hence reduce the impact on the environment."

Complex project The energy monitoring systems can only be installed when the ships dock for maintenance. Within a timeframe of just 20 to 30 hours, up to nine flow measurement devices have to be installed and put into operation. "That sounds manageable, but it's a real challenge," emphasizes Merten Traulsen. "The installation sites often span several decks, and it's often over 40 degrees Celsius in the engine rooms." All this makes work time-consuming and strenuous.

In addition, the ships from Mærsk Line mainly dock in ports in southern Europe and Asia – so the teams installing the energy monitoring systems have to travel to the ports. By 2018 Endress+Hauser will have fitted about 90 ships in line with a well-thought-out timetable.

Text: Anna Kürzinger

Digitized brewery: Rothaus has integrated process measurement technology in the company's IT system.

Reliable measurement technology: pH sensors from Endress+Hauser help to precisely control processes in the gold mine in Kittilä.

Tradition with innovation

Using the best ingredients and drawing on years of experience, the Badische Staatsbrauerei Rothaus in the Black Forest has been brewing flavorful beer for over 200 years. However, tradition does not have to exclude innovation: with the installation of Endress+Hauser's plant asset management system, Rothaus has already taken steps towards the Industrial Internet of Things. Endress+Hauser has been a reliable partner for the beverage producer since as far back as 1970. This relationship of trust provided the foundation for a farsighted concept: a universal IT solution on the basis of a bus system. The first project was implemented in 1995 and integrated into the fermentation and conditioning cellar, leading to a vision for a complete solution from malting right through to the wastewater treatment plant. With Fieldcare from Endress+Hauser, Rothaus has a software solution in place in which a module for condition monitoring supports the maintenance of the field instrumentation – a successful collaboration of IT and process automation.

KA

Technology – worth its weight in gold

Reliable, user-friendly and precise – those were the specifications of the Agnico Eagle mining company for the new liquid analysis technology for its gold mine in Kittilä. Over four tons of gold per year are extracted from the earth there, in the far north of Finland, using sophisticated processes – and liquid analysis plays an important role in this. Agnico Eagle is now putting its faith in pH sensors with Memosens technology from Endress+Hauser. "This has drastically reduced the time and effort spent on calibrating the pH measurement devices. We have been able to reduce the time taken from 2,200 to 240 hours per year," reports Reijo Mämmioja, Senior Instrumentation Engineer in Kittilä. The processes can also be controlled better. One primary chemical used in separation is highly toxic cyanide. Reliable measurements with pH sensors from Endress+Hauser allow precise dosage of the chemical, significantly saving costs.

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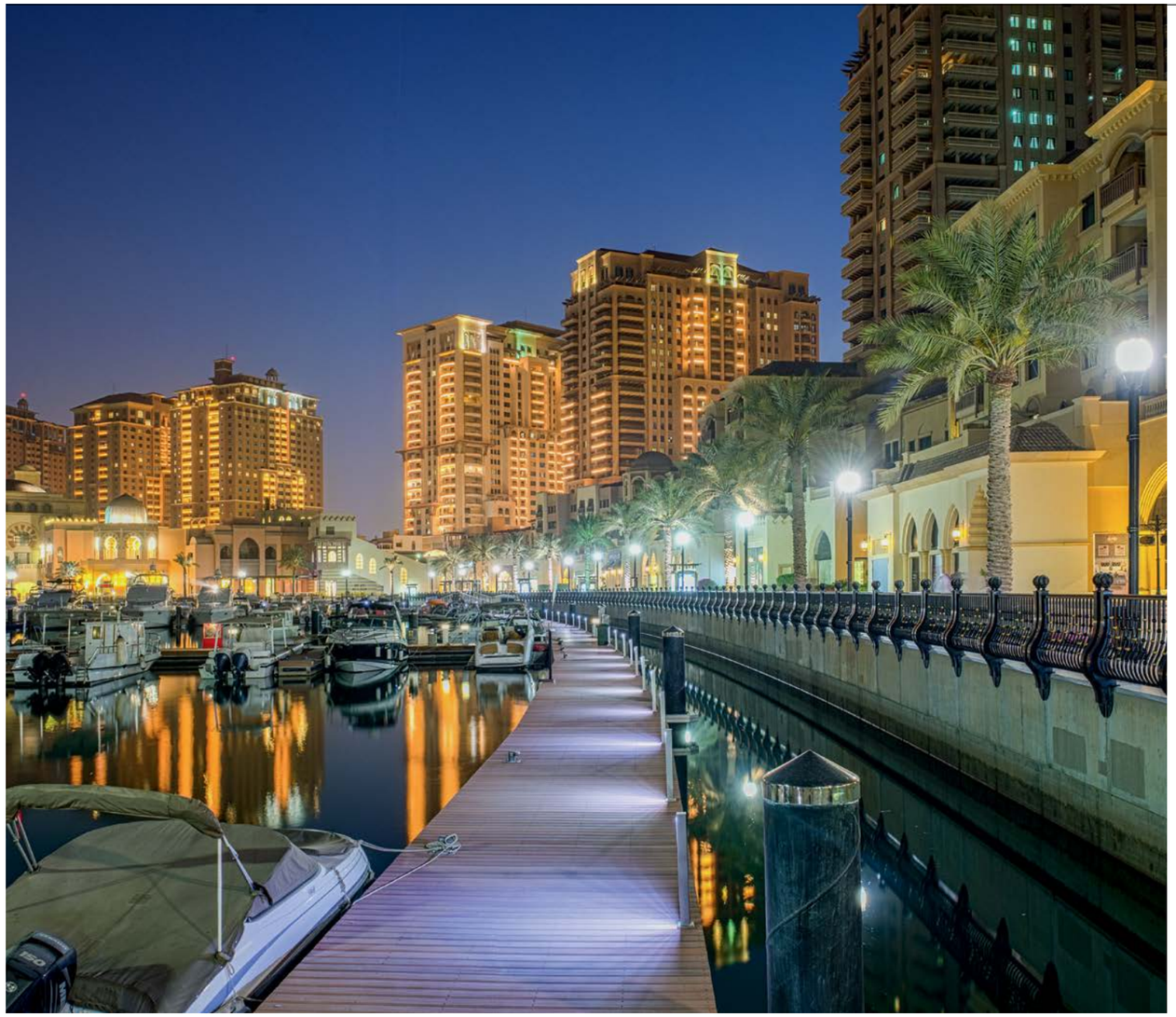

Pleasant climate: Qatar Cool ensures reliable and efficient district cooling on the man-made island The Pearl.

A cool head with ‘blue’ technology

The Pearl is a man-made island on the east coast of the emirate of Qatar. Throughout the year its climate is humid, subtropical and hot. Qatar Cool therefore provides an invaluable feature of the island’s advanced infrastructure. The company is a leading provider of district cooling services in the emirate. With a capacity of more than 450 megawatts, Qatar Cool’s integrated district cooling plant is the largest in the world.

Endress+Hauser’s flow measurement technology assists with the reliable and efficient operation of the plant, including environmental protection and energy efficiency. 78 Promag 50L electromagnetic flowmeters have helped to precisely determine water volumes and monitor chiller system performance since 2014. Head of Operations and Services Nahar Al Mutawah remarks: “The devices supplied by Endress+Hauser have proven their reliability. We have instruments in the open air that have worked for years without any failure.”

Once fully developed, the 3.9 million square meter island will be occupied by over 45,000 residents living in approximately 15,000 apartments and 700 villas. It will also have luxury hotels, schools, kindergartens, shops, numerous restaurants and mosques for its inhabitants and visitors.

KA

Understanding without many words

Remat Chemie is a renowned Dutch solvent manufacturer. The company had already had good experiences with Endress+Hauser in 2008 while constructing a modern new plant at the company’s headquarters in Helmond – which is why the Dutch subsidiary was there from the start of the current project, a new distillation column. “Safety stood at the forefront in the explosion protection areas,” says Managing Director Ben van Bockel. He was particularly enthusiastic about the uncomplicated cooperation with the employees of Endress+Hauser: “Because we know our own field of work like nobody else we carried out the technical and constructional engineering of our new fractionating column ourselves.” Endress+Hauser planned the instrumentation and controls required for the project, installing and commissioning them. Once again, the customer found the cooperation to be perfect. “The Endress+Hauser people know what they are talking about,” emphasizes Ben van Bockel. “And because we have known each other well for years we understand one another without many words.”

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The solvent manufacturer Remat Chemie plays it safe and relies on Endress+Hauser when it comes to measurement technology.

A cleaner drive: filling up with hydrogen only produces heat and steam, but no carbon dioxide.

Into an emission-free future

The first cars around Paris, Lyon and Valence have recently started running on green energy: “France is beginning to invest in hydrogen infrastructure – and we are there from the start by equipping petrol stations,” reports Thierry Graeff. He takes care of customers from this sector in the competence center for flow measurement technology in Reinach, Switzerland. The Proline Promass A is perfectly suited for this application. It measures the mass flow of liquid gases in the smallest of spaces. Thierry Graeff provides support to the plant builders of AJC and even carries out commissioning on site. The extremely high precision of Promass A has convinced the customer, as have Endress+Hauser’s service and consultation. Alongside electro mobility, hydrogen mobility has proven to be a sustainable concept in order to reduce CO_2 emissions – in the best case scenario the gas can be produced emission-free with electricity from renewable energies. 20 industry partners, from Air Liquide to Shell and Volkswagen, are advancing development. Car manufacturers such as Toyota and Hyundai are selling their first serial models. A full tank can last for 400 to 800 kilometers; a car can be fully refueled in just five minutes.

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Water for the mega city

Water is a rare commodity in the metropolis of Mexico City, which has a population of more than 20 million. The government has been investing in the infrastructure since 2014 in order to secure drinking water supply and wastewater treatment for the future: a 62-kilometer-long tunnel is being built in order to renew the sewage system. Wastewater runs into the world's largest wastewater treatment plant in Atotonilco, which is designed for a capacity of 10.5 million people. The drinking water supply from deep wells has also been optimized.

Endress+Hauser first became involved with the deep wells, then with the wastewater treatment plant: the specialists from the Mexican sales center provided a customized data transfer solution for plant builder ICH, which specializes in projects in the water & wastewater industry. Measured data including level, pressure and flow can be transferred wirelessly via GPRS modules. This allows remote control to prevent the deep wells from drying out; the population's access to water is improving.

"Approximately 90 percent of the instrumentation at the Atotonilco wastewater treatment plant comes from Endress+Hauser," reports Heidrun Tippe, Global Industry Manager for Water & Wastewater. More than 500 measuring points carry the Endress+Hauser label; in addition service features were sold. "The water & wastewater industry in Central and South America offers huge potential, because Europe is regarded as a role model with its strict guidelines. And our sales centers convince the customers with their detailed knowledge of the industry and good after-sales support.

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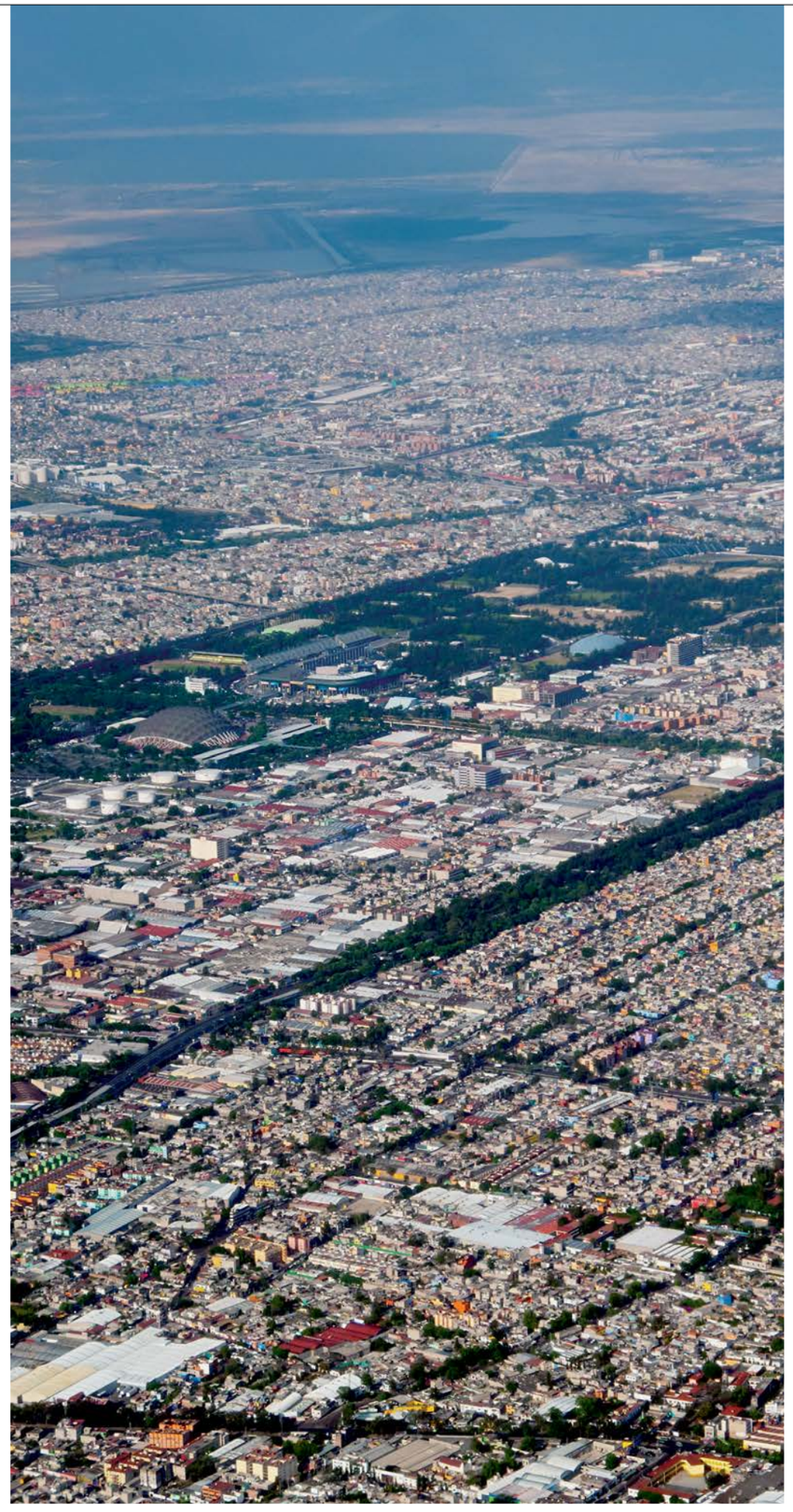
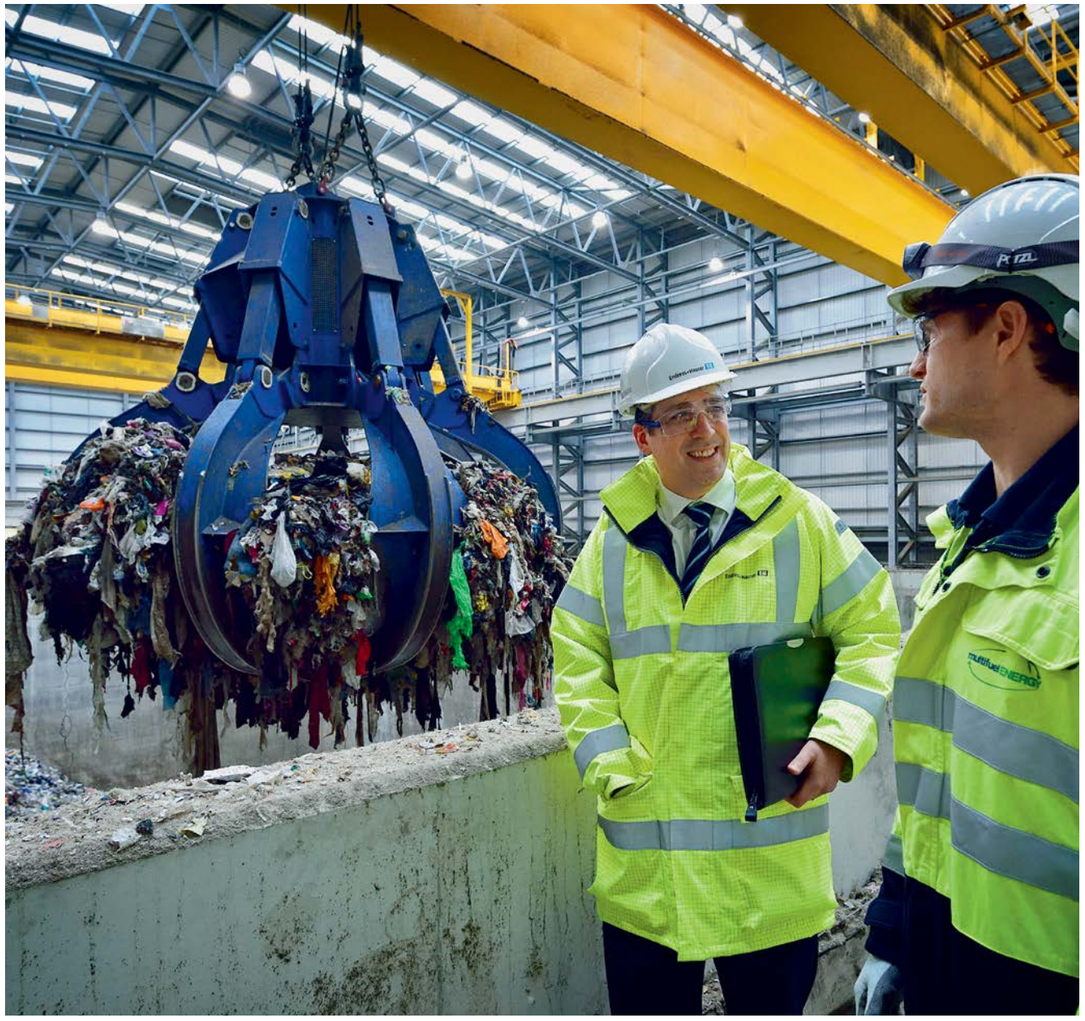


High-performance infrastructure: Mexico City invests heavily in drinking water supply and wastewater treatment.



On-site support: precise measurement technology and perfect service help operations at the waste processing plant in Ferrybridge, England.

Where waste becomes energy

Energy from waste: this is the concept of the multi-fuel plant in Ferrybridge, northern England – one of the biggest facilities of its type in Europe. In just three years of construction, the Swiss general contractor Hitachi Zosen Inova set up Ferrybridge Multifuel 1. Since 2015 the plant has been able to make thermal use of an average of 570,000 tonnes of municipal, commercial and industrial waste and waste wood annually, supplying 170,000 homes. Endress+Hauser was the partner for measurement engineering. The range of products and services as well as the project management capabilities won over the general contractor. And the success story continues: Ferrybridge Multifuel 2, a facility of similar dimensions, has been under construction since 2016. Over 700 measurement instruments are again being installed and put into operation. "Hitachi Zosen Inova were so impressed by our work on the first major project that we have also received the contract for the second phase," says Project Manager Jochen Hees, who takes care of the key customer from the Swiss sales center. Last but not least he praises the performance of his colleagues at Endress+Hauser UK: "Our people convinced the customer with perfect service."

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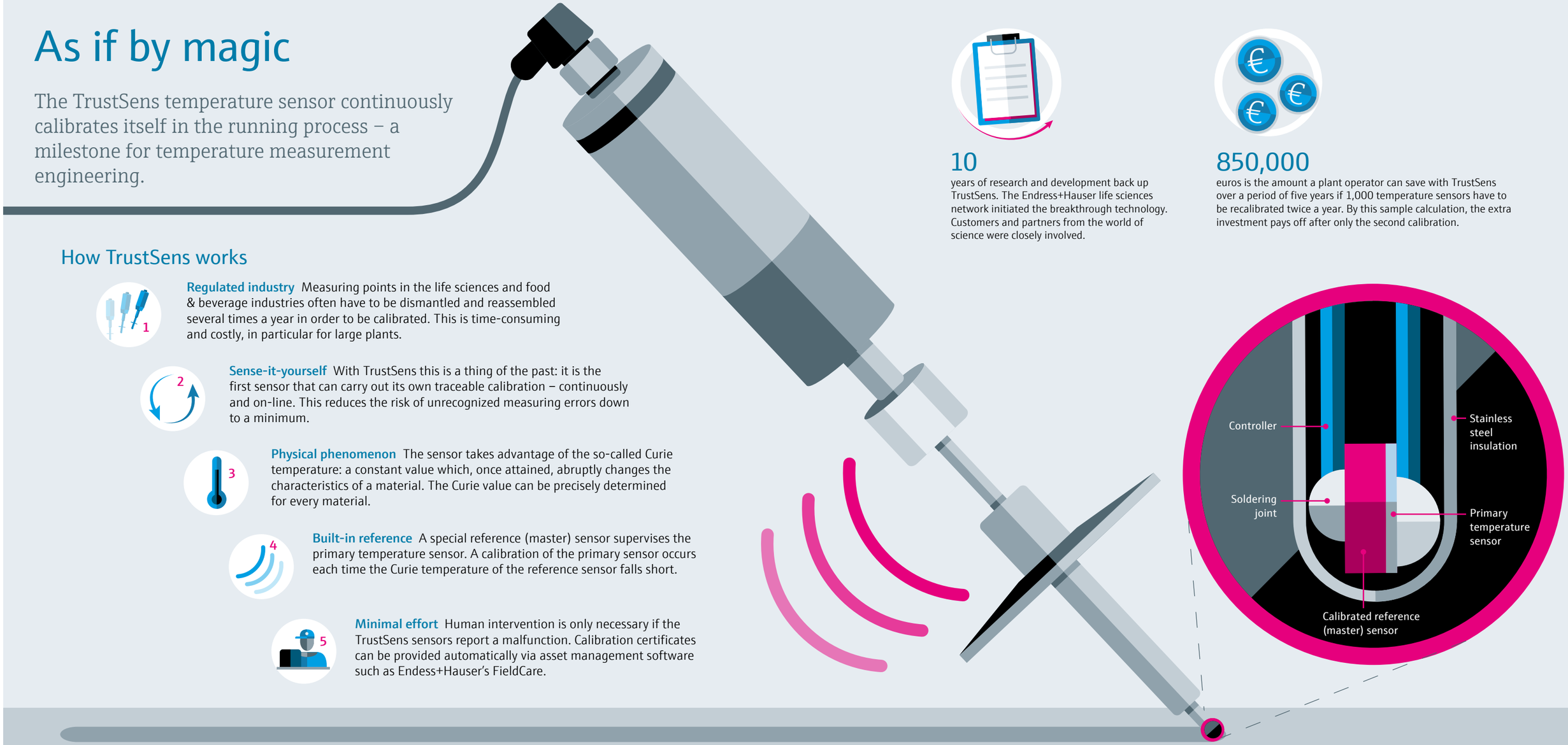
As if by magic

The TrustSens temperature sensor continuously calibrates itself in the running process – a milestone for temperature measurement engineering.



How TrustSens works

Regulated industry Measuring points in the life sciences and food & beverage industries often have to be dismantled and reassembled several times a year in order to be calibrated. This is time-consuming and costly, in particular for large plants.

Sense-it-yourself With TrustSens this is a thing of the past: it is the first sensor that can carry out its own traceable calibration – continuously and on-line. This reduces the risk of unrecognized measuring errors down to a minimum.

Physical phenomenon The sensor takes advantage of the so-called Curie temperature: a constant value which, once attained, abruptly changes the characteristics of a material. The Curie value can be precisely determined for every material.

Built-in reference A special reference (master) sensor supervises the primary temperature sensor. A calibration of the primary sensor occurs each time the Curie temperature of the reference sensor falls short.

Minimal effort Human intervention is only necessary if the TrustSens sensors report a malfunction. Calibration certificates can be provided automatically via asset management software such as Endess+Hauser's FieldCare.

10

years of research and development back up TrustSens. The Endress+Hauser life sciences network initiated the breakthrough technology. Customers and partners from the world of science were closely involved.

850,000

euros is the amount a plant operator can save with TrustSens over a period of five years if 1,000 temperature sensors have to be recalibrated twice a year. By this sample calculation, the extra investment pays off after only the second calibration.

Conventional recalibration

Disassembly Depending on the industry and criticality of the measuring point, a sensor must be calibrated on a biannual to weekly basis. The process has to be stopped.

Calibration Qualified staff have to disassemble the sensor and calibrate it in a mobile block calibrator with a traceable reference (master).

Documentation Authorities and customers alike demand valid certificates. These have to be manually prepared by the calibration specialist before being filed by the customer.

Reassembly, cleaning Following the reassembly of the sensors the plant often requires sterilization. Only now can production begin again.

Recalibration with TrustSens

Self-monitoring A special reference sensor – the master – allows for a one-point calibration of the primary temperature sensor in the ongoing process.

Reference measurement The master utilizes the Curie temperature principle. Falling short of this value – such as after cleaning with steam – initiates calibration.

Operation The process is not interrupted; the system is not opened up. Staff need only intervene if TrustSens reports a malfunction.

Documentation The calibration data is saved in the field device. With Endress+Hauser's FieldCare software, a valid calibration certificate is always available.

Infographics: Pia Bublies · Research: Alexander Marzahn

Unparalleled measurement precision: Proline Promass Q measures mass flow and density with the highest accuracy.

Highest precision
Proline Promass Q achieves ±0.2 kg/m³ maximum deviation from the measured value of density and ±0.1% (PremiumCal: ±0.05%) of mass flow.

Oscillating measurement tubes
Coriolis flow measurement directly measures the mass flow of liquids and gases. A video explains the technology clearly:

https://www.youtube.com/watch?v=XIIViaNITIw

Specialist for extraordinary tasks

Entrained gases and changing pressures and temperatures make precise flow and density measurements a challenge. There is only one device that will not be deterred: Promass Q.

What do soft ice cream and heavy crude oil have in common? Both are viscous fluids that often contain small air or gas bubbles trapped inside. These gas pockets, as well as sudden changes in pressure and temperature during processing, can impair the accuracy of flow measurement. The consequence is either a fluctuation in product quality – one batch of ice cream is softer, the next is thicker – or the customer is incorrectly billed. Custody transfer transactions are often calculated according to volume, requiring precise measurement of not just flow, but also of (temperature-sensitive) density.

The development team at the Endress+Hauser competence center for flow measurement technology searched for a solution for these specialized measurement tasks – and completely re-thought the renowned Coriolis method of measurement. “We wanted to develop a measurement instrument that is able to cope better with demanding processes,” says Paul Ceglia, Head of Coriolis Product Management at Endress+Hauser Flowtec in Reinach, Switzerland. “A true specialist that, even under adverse conditions, delivers precise measurements for density and mass flow that can otherwise only be achieved under controlled laboratory conditions,” adds Product Manager Kyle Kergen.

This specialist has been on the market since the end of last year. Promass Q stands out even from its external appearance with the bulbous shape of its measurement tubes. The shape is the result of extensive mathematical simulations. The developers went through every scenario imaginable until the ideal shape was found. “The sensor delivers high-precision measurement values even during process fluctuations while simultaneously featuring the lowest pressure losses of all current Coriolis devices,” says Kyle Kergen.

Double oscillation However, the problem with entrained gases remains. Micro bubbles locked tightly into the medium are particularly critical. Unlike free-moving bubbles that are easily eliminated via air separators or a sufficiently high fluid pressure, these bubbles are persistent and distort measurement. The Endress+Hauser developers found a completely new solution to this: multi-frequency technology, MFT for short. “The measurement tubes don’t oscillate at one frequency as usual; instead they oscillate at two differing frequencies,” explains Paul Ceglia. The additional measurement information allows the error to be eliminated.

The result is hitherto unprecedented measurement precision – “note that this does not take place in the laboratory, but rather during the process, and without the need for recalibration in the field,” emphasizes Kyle Kergen. Users can convince themselves at any time that Promass Q really does provide the promised precision by using an inline verification: patented Heartbeat Technology makes that possible.

Text: Reinhard Huschke
Photo: Endress+Hauser, Christoph Fein

Specialists together: Kyle Kergen (left) and Paul Ceglia with Proline Promass Q.

A WORD WITH… PAUL CEGLIA

“Immune to process influences”

Mr Ceglia, what sets Promass Q apart from other Coriolis instruments?
Above all, its extensive immunity against process influences – meaning fluctuating process and ambient conditions as well as non-homogenous, two-phase fluids. The sensor provides high-precision measurements regardless.

Other instruments promise equal precision…
Everything always works perfectly on paper; it often works out differently in the field. We know from our customers’ feedback which specific conditions cause problems in practice. It is for these cases that we developed Promass Q.

What are the main applications?
We see a lot of applications in the oil & gas and food & beverage industries. High-precision density measurements are key in these industries, and entrained air and gases are often a problem. Consistency is a quality characteristic in food production, so consistent density or concentration is crucial.

Are there any further features?
Aside from the extraordinarily high measurement precision we were able to minimize loss of pressure while simultaneously attaining stable zero point values. Of all the current Coriolis flow measurement devices, Promass Q demonstrates the highest usable measurement dynamics.

How were these results achieved?
Development is based on years of fundamental research in physics, which we will continue in order to better understand the behavior of complex liquids, and in order to be able to build even better measurement instruments in future.

Questions: Reinhard Huschke

As Head of Product Management for Coriolis flow measurement, **Paul Ceglia** oversaw the development of the Proline Promass Q until its market launch.

Ready for the digital journey

Whether it's about choosing the perfect device, the optimum maintenance cycle or evaluating process and sensor data – custom-made digital tools open the gateway to the Industrial Internet of Things.

1 Endress+Hauser's conventional and digital sales are becoming one.

2 With digital tools, product selection and configuration become child's play.

1 A voyage of discovery

For Peter, an automation engineer for a large company in the food & beverage industry, there are many different ways to contact Endress+Hauser. At 45 he is not a digital native, and he values the familiar contact with a sales engineer. He also uses the Internet in various ways: simple contact and information options via online shops, forums, blogs or social media have complemented existing channels such as customer events, technical magazines, trade fairs or training sessions.

At Endress+Hauser traditional sales and offers via **online platforms** go hand in hand. No matter through which channel, on which continent and with what issues Peter contacts Endress+Hauser, he can do so quickly and directly. The entire portfolio is available on the Endress+Hauser **Online Shop**. Ordering process and fulfillment are quick, easy and transparent. Peter gets all the information on new trends and offerings on Endress+Hauser's **website**, which allows him to learn everything about the latest products, solutions and services in measurement and automation engineering.

2 A good choice

The entire range of Endress+Hauser's products and services is available at the click of a mouse: In the **Online Shop**, Peter can search for products, compare and configure them. Suitable spare parts and installation guides can also be accessed quickly and easily. He has saved his standard products in his favorites list for restocking, which he can select at any time with delivery times updated on a daily basis. He never loses track thanks to the fully documented ordering process, while the **delivery status request** gives him a constant overview of current orders.

Peter uses **Applicator**, a high-capacity engineering tool, in order to find the right product for his application. He simply enters the parameters in order to receive a custom offer. As an experienced user, Peter also uses the modules for device configuration and project management. His personalized shopping cart contains useful features such as spare parts lists, product status and a spreadsheet export function.

Peter has quickly found the product that suits his requirements. He can now design his plant on his computer using 2D drawings and 3D data models to ensure that everything fits perfectly when installed. He gains security during planning and saves valuable time, as he is able to directly import the data into his company's CAx system. The device's master data is included – Peter is perfectly equipped!

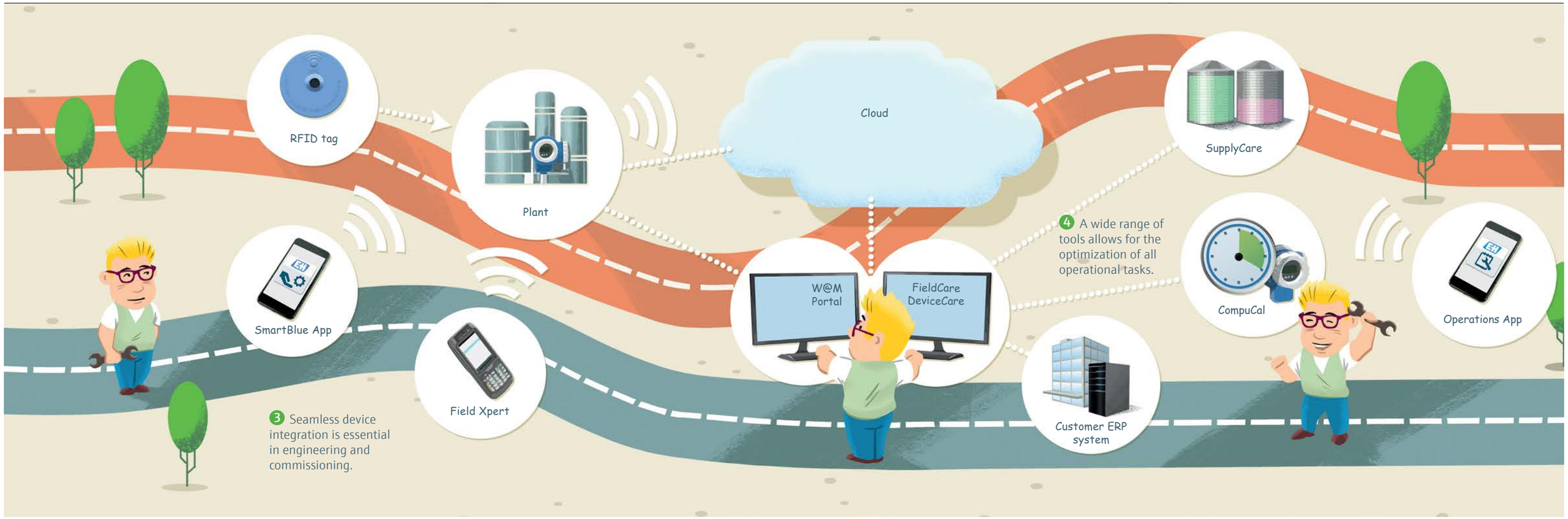
For less complex products Peter uses **E-direct**: the little brother of Endress+Hauser's Online Shop enables the quick purchasing of standard products. The portal contains a pre-configured portfolio of simple high-quality products at affordable prices. Selecting is just as easy as ordering: delivery usually takes just two to five working days.

Peter's manager wants to make the process even more efficient and place orders directly from the company's own SAP system. Endress+Hauser provides its own customized procurement solutions. With **B2B integration**, the ERP systems independently exchange all transaction data via standardized shopping cart interfaces – from the order confirmation to the electronic invoice. This allows Peter to further reduce **costs** and save time, especially since all data is continuously imported directly into Endress+Hauser's **W@M** Plant Asset Management.

3 All data on hand

Peter has chosen the right products from the enormous portfolio using Applicator. In order to be able to make the right decisions when it comes to engineering, he requires constant access to current product information. With **W@M Engineering** Endress+Hauser enables the seamless integration of relevant device data into the engineering process – saving time and money and reducing error rates. The **W@M Device Viewer** gives Peter online access to any information on the new instrument. He can also easily identify and localize all measuring points during later operation with the **Operations App** on an mobile device. The asset data is generated from the very beginning of the engineering phase. **W@M Life Cycle Management** offers comprehensive device information and is designed to transfer the defined instrument parameters into the subsequent phases and processes. This enables complete traceability of the instruments throughout the entire life cycle.

Even the complete and correct measurement point documentation, which takes up a lot of time when designing a plant, requires little effort. Until now, the parameters had to be drawn out of the technical documentation manually. The digital **Spec Sheets** compiled by Endress+Hauser clearly group all characteristics of the fully configured product.



The seamless integration of the field devices into the existing process control system is of crucial importance to Peter. He knows that Endress+Hauser promotes itself as the pioneer of fieldbus technology for open standards across multiple manufacturers. Using **DeviceCare** and **FieldCare** he is able to independently configure all field devices regardless of the manufacturer, easily incorporating them into existing networks. The adaptable software tools guarantee quick diagnosis and simple documentation, from device parameter settings to customized status monitoring.

If Peter is on the go within the plant, he makes use of **Field Xpert**, a mobile platform for Endress+Hauser's Plant Asset Management applications: a robust touchscreen handheld device for start-up and maintenance. Communication occurs wirelessly via Bluetooth or WiFi interfaces, allowing the efficient configuration of Foundation Fieldbus, HART and WirelessHART devices.

4 Maintenance made easy

The web-based **W@M Portal** is the centerpiece of Endress+Hauser's Plant Asset Management, connected to the comprehensive Endress+Hauser product database. The information is automatically updated throughout the entire life cycle and can easily be accessed by Peter through mobile devices. Through automatic document handling he can continuously optimize the maintenance of his facility – be it spare part or calibration management, maintenance cycles or criticality monitoring.

The free **Operations App** allows Peter to retrieve all the required device data directly and on-site. He enters the device's serial number or scans the QR code and is given access to a world of spare parts, successor models and technical instructions. If nameplates are illegible or disadvantageous installation obstructs the view, the **RFID tag**, a type of digital nameplate, can remedy the situation by reliably identifying any device. In situations where locations are difficult to access or in hazardous areas, Peter can communicate from a safe distance with the first generation of Endress+Hauser devices to have a Bluetooth connection thanks to the **SmartBlue App**.

Endress+Hauser has also recently begun offering a **Cloud solution**, which allows the dynamic data from the process to be continuously recorded and analyzed alongside the device data. The Endress+Hauser Cloud forms the foundation of a variety of possible applications regarding the Industrial Internet of Things, providing Peter with whole new opportunities for the improvement of his processes.

Peter's colleague has already optimized the inventory management: **SupplyCare** supports him through the intelligent planning of requirements, scheduling and restocking. Because the suppliers are also involved, he always has an overview of the entire supply chain through his personalized dashboard. Peter also uses a high-capacity tool for calibration and maintenance: with **CompuCal** he has automated all calibration processes. The seamless data exchange with Peter's ERP system and Endress+Hauser tools such as W@M or FieldCare renders maintenance efficient and safe.

With **Heartbeat Technology**, field device verification, as required by some industries for safety reasons, is reduced to a minimum right from the start: comprehensive diagnosis and testing functions are already firmly integrated into the newest generations of flow and level measurement devices as well as transmitters for liquid analysis. This guarantees the continuous verification of the device without interrupting the process. The data can be read using W@M and transferred to the electronic document management.

The revolutionary **Memosens Technology** also makes maintenance and process optimization a lot easier thanks to the digital transmission of measurements. Calibration, sensor and process data is stored directly in the sensor head and errors are automatically reported, significantly increasing the availability of measuring points.

The best automation solutions are of limited use if operators do not know how to tap the potential of digital tools. For training the production and maintenance personnel, Peter can again count on Endress+Hauser's support: thanks to tailored **online webinars** on important topics many problems can be solved without external support. If a device ever does need to be sent in for **repair**, Peter can look up the device-specific services directly online. The task is thereby processed faster and more safely; urgent repairs and calibrations can be carried out in one day.

Text: Alexander Marzahn
Illustration: Ralf Marczinczik

Holding its own

Measured against the industry, Endress+Hauser performed well in 2016. Earnings can be described as robust. The Group is continuing to invest heavily in the future while relying on a highly dedicated and qualified workforce.

Sustainable future

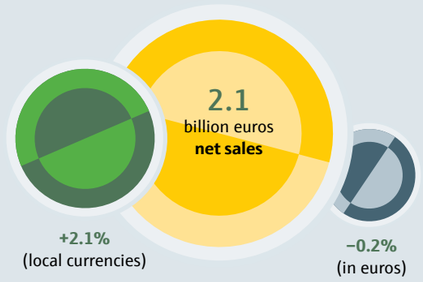
Family-owned businesses think in generations. In order to keep growth on a sustainable course, Endress+Hauser takes into account economic, ecological and social aspects. One measure of success for these considerations is the regular EcoVadis audit, a benchmark for sustainable suppliers.

58
points in the 2016 **EcoVadis Benchmark**

average:
42 points

Affected by currencies

Based on euros, Group sales fell slightly due to the impact of foreign exchange rates. Sales grew on a local currency basis, however. Solid profitability permits further large-scale investments by the Group.



153
million euros
net income

149
million euros of
investments

72.2%
equity ratio

A focus on people

Endress+Hauser gives its employees the freedom to develop, both personally and professionally. The Group promotes continued workforce training and education and offers vocational apprenticeships within the company and in cooperation with universities.

13,003
employees (+51)

306
apprentices

Training and education

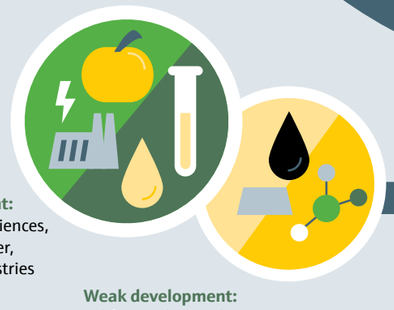
1,500
internal programs

49,000
registrations

29.4%
ratio of female employees

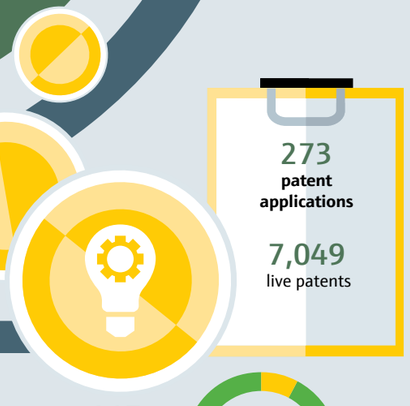
Unequal development

Declining growth rates and economic turmoil, low commodity prices and political uncertainties – despite this difficult business environment, the majority of the sales centers achieved solid growth. Suffering the most were markets that depend on individual industries or those struggling to adapt to structural changes.



Solid development:
food & beverage, life sciences, water & wastewater, power & energy industries

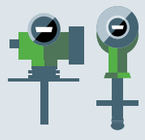
Weak development:
oil & gas, chemicals, primaries & metals industries



273
patent applications

7,049
live patents

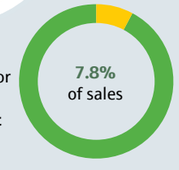
64
new products



Constant innovation

Endress+Hauser introduced a wealth of product innovations and improvements to the market in 2016, the foundation of which is in-house research & development. A comprehensive portfolio of patents protects the company's intellectual property.

167
million euros for
research & development



Infografik: Pia Bublies · Research: Martin Raab

“Our people’s spirit makes the difference”

CEO Matthias Altendorf and Supervisory Board President Klaus Endress discuss the development of the Endress+Hauser Group. Their conclusion is that an atmosphere of trust leads to better results, regardless of the economic environment.

Looking forward with confidence: Matthias Altendorf (left), CEO of the Endress+Hauser Group, and Supervisory Board President Klaus Endress.

Mr Altendorf, 2016 wasn't a good year for the company and neither was the year before. Is Endress+Hauser experiencing a crisis?
Matthias Altendorf: We lagged behind our goals and we're not satisfied with what we achieved, but Endress+Hauser is certainly not experiencing a crisis. That net sales failed to grow is the result of slower global economic development and fundamental structural changes in the worldwide economy. Every company in the process automation business felt the effects. Measured against the growth of the industry, we held our own. Measured in local currencies, we even grew a bit. In 2015 currency rates provided us a tailwind, but in 2016 we ran into severe headwinds.
Klaus Endress: When we look at the Group as a whole, some of the companies performed very well, in terms of sales as well as profit. But individual companies also struggled with internal issues – structural things such as dependency on oil & gas in some countries. We could have done better in these areas, but all in all we didn't end the year badly. Even net income was at a respectable level like before.

Many of these factors already had an impact in 2015. What measures did you take to counter these issues?
Matthias Altendorf: We're in the process of positioning ourselves better from an organization standpoint to address the changing conditions. But that requires time, because we want to make these adjustments together with our employees. In 2016 we tried to concentrate on those opportunities that were presented to us, in other words growth markets and industries. Firstly, we worked to adapt our sales structures accordingly. Secondly, we invested in new products, strengthened our services offerings and expanded our automation solutions portfolio.

Why didn't the turnaround occur in 2016?
Matthias Altendorf: Let's put it this way: we didn't manage to turn everything around, but the fact is, compared to the competition two-thirds of our sales units experienced above-average growth and were profitable. In those areas where we should have done our homework, either there was an over-reliance on specific industries, an over-reliance on exports or we didn't adapt our structures quickly enough to serve those markets and customers that continued to offer opportunities for growth.

What was positive about the past year then?
Matthias Altendorf: One positive aspect is that we introduced many new products to the markets and our customers. These are products that can offer a difference. We were successful in areas in which we were previously not present, such as Raman spectroscopy or water analyzers. I'm pleased that we experienced overall strong growth with analytical products.

Mr Endress, how did you and the Supervisory Board react?
Klaus Endress: The Supervisory Board observed the situation matter-of-factly. We saw what was happening in the world around us. We stood by the Executive Board at all times.

Were there periods during your time as CEO when growth was similarly tough?
Klaus Endress: Every CEO experiences such phases! The world is not always perfect and you just have to persevere. 2001 and 2002 were difficult years, not only with the economy, but also with the insolvency of our PPE subsidiary, which was active in the printed circuit board business. And then there was the 2009 crisis of course. But when you explain things to people well enough, they will pull their own weight. Everyone pitched in to keep costs under control, and that helped us overcome the difficult period. Sure, sales declined and profit fell, but overall the mood was positive and that was the most important thing, because our people's spirit makes the difference. When your people are truly committed and show trust, this will lead to better results, even when things aren't going well!

How has the mood been the past year?
Matthias Altendorf: The commitment of our employees was exemplary. As long as people know why the company has to change and in what direction, then you're not going to have any problems. It just takes time. Our new Strategy 2020+ created a framework around which the employees could orient themselves.

How do you intend to put Endress+Hauser back on the path to growth?
Matthias Altendorf: We can't influence market dynamics and economic cycles. But we can try to deal with them intelligently. In segments where we have a large market

"We can't influence market dynamics and economic cycles. But we can try to deal with them intelligently."

Matthias Altendorf, CEO of the Endress+Hauser Group

share, we want to create new growth opportunities by providing our customers added value through new products, solutions and services. In markets where our share is low, we have to acquire new customers in the right industries. In the background we have improved our internal processes so that our employees have more time to take care of customers. And we're sticking with our strategy of continuing to jointly develop process and laboratory automation.

You already mentioned Strategy 2020+... How do you pursue long-term goals when you need to act in the short term?
Matthias Altendorf: As always, you have to find a balance. Although we have to adapt to changing conditions, we must keep a careful eye on the pace. If an operational unit is struggling to acquire enough orders, it doesn't make sense to concentrate on long-term issues. In this case, you have to put the short-term focus on winning customers and orders to stabilize the company.
Klaus Endress: A company needs a good strategy. We have to know where we are headed long term, but of course along the way you can't perish. Whenever things get tough, you have to look where you are driving, but not lose sight of the distant goal.

When you glance at the future, where do you see the biggest challenge?
Matthias Altendorf: Two key elements will help us to generate growth. First, we are in the process of enhancing our sales approach. We want to improve our electronic sales channels in order to serve our customers better and more efficiently and to reach new customer segments. And in areas where we rely strongly on individual industries, we are looking for ways to address customers in other industries. Secondly, we will broaden our foundation with our solutions portfolio.
Klaus Endress: We have fantastic new products. But we see even greater potential in automation solutions. Original wort in beer is an example... It's a topic that is extremely difficult to wrap your head around – and we can provide a measurement solution for it. We've had such solutions for a long time, but they remain a challenge for our sales people. We have to keep working at it, because the solutions business is much more reliable than the large-scale projects that come and go!

How confident are you about 2017?
Matthias Altendorf: The people in our company have an in-depth understanding of how we must change and improve in order to exploit opportunities for growth. I'm confident that we are on the right track. We sensed it over the last four months of the past year and we are seeing it in the first months of the new year.
Klaus Endress: Business has picked up and that didn't just happen by chance. A lot of effort was involved. But with a good team, you can even manage difficult situations. For that reason, I'm very confident about 2017!

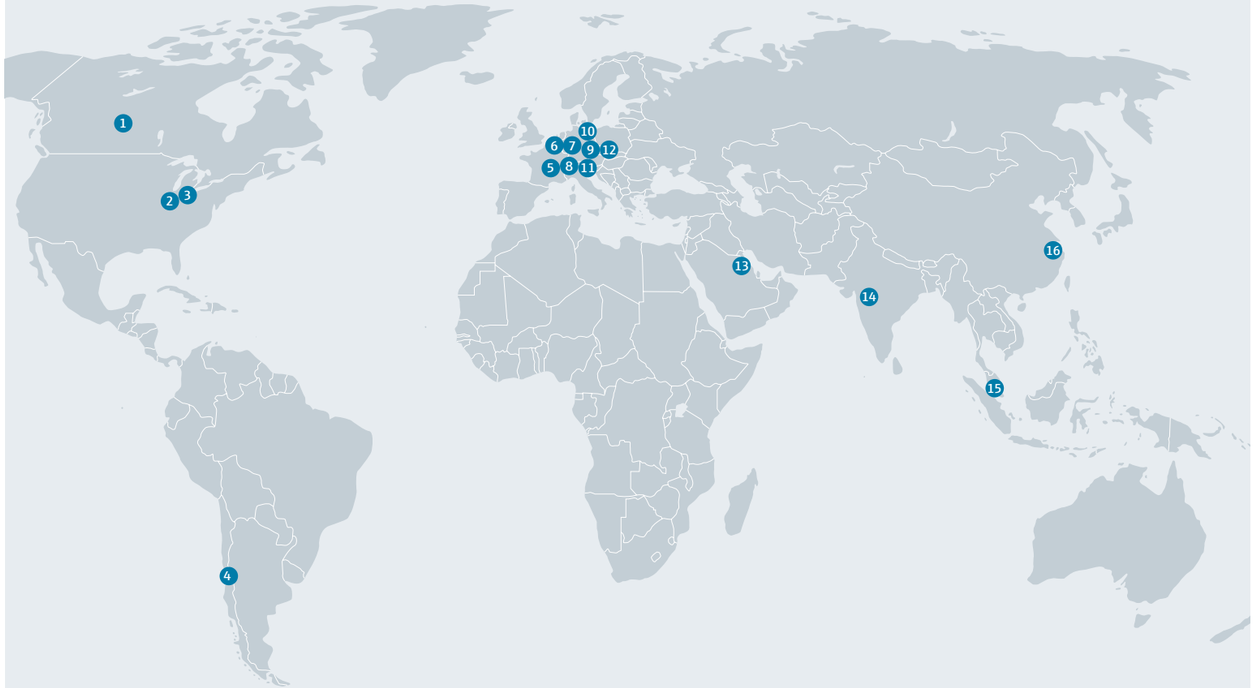
Questions: Martin Raab, Alexander Marzahn
Photos: Christoph Fein

Guardian of corporate culture Klaus Endress (1948) graduated from the Technical University Berlin with a degree in industrial engineering. He joined his father's company in 1979 and took over Group management in 1995. He became President of the Supervisory Board in 2014. Klaus Endress is married and the father of two grown children.

Deep ties to the company Matthias Altendorf (1967) started his career at Endress+Hauser with vocational training as a technician, followed by studies, stays abroad and further education. He was promoted to the Executive Board in 2009 and became the Group's CEO in 2014. Matthias Altendorf is married and has one son.

Markets and customers in mind

Endress+Hauser has further strengthened its sales and production network around the world. Many investment projects bear witness to this.



1 Edmonton, Canada
New customer training center
4.0 million euros
Opened in 2017

2 Greenwood, Indiana, USA
New production facilities for temperature measurement engineering
7.8 million US dollars
Opened in 2017

3 Ann Arbor, Michigan, USA
Expansion of production facilities for analytical engineering
8.6 million US dollars
Opened in 2017

4 Santiago, Chile
New facilities for sales center
5.4 million euros
Opened in 2017

5 Lyon, France
New facilities for sales center
3.3 million euros
Opened in 2017

6 Brussels, Belgium
New facilities for sales center
6.0 million euros
Opened in 2017

7 Weil am Rhein, Germany
Expansion of sales center facilities
4.8 million euros
Opened in 2017

8 Reinach, Switzerland
Expansion of offices and production facilities for flow measurement engineering
49.5 million Swiss francs
Opened in 2017

9 Maulburg, Germany
New multi-level car park; expansion of production facilities for level and pressure measurement engineering
40.5 million euros
Construction to begin in 2017

10 Stahnsdorf, Germany
Expansion of production facilities for silicon pressure sensors; purchase of additional land
12.4 million euros
Construction to begin in 2017

11 Ebnat-Kappel, Switzerland
Expansion of sensor production facilities
13.2 million Swiss francs
Construction to begin in 2017

12 Nesselwang, Germany
Expansion of production facilities for temperature measurement engineering
10.0 million euros
Scheduled for completion in 2017

13 Al-Jubail, Saudi Arabia
New calibration and service center
2.7 million euros
Scheduled for completion in 2017

14 Aurangabad, India
Expansion of production facilities for level and pressure measurement engineering
1.9 million euros
Opened in 2017

15 Kuala Lumpur, Malaysia
New facilities for sales center
4.5 million euros
Opened in 2017

16 Suzhou, China
New production facilities for flow measurement engineering
26.9 million euros
Scheduled for completion in 2017

Remembrance: Alice Endress died peacefully in her sleep after a long and fulfilling life.

Mourning Alice Endress

All her life Alice Endress has been present in the company. Last year, the widow of the company founder died after a brief illness at the age of 97.

It was a significant encounter in many respects. It was more than 70 years ago in Tessin, in southern Switzerland, that fate brought Georg H Endress, who was performing his military service at the time, together with Alice Vogt. After attending a trade and hotel management school, the young woman was dipping her toe into the world of work beyond the Alps. Then she took over the management of a cafeteria for Swiss soldiers.

Alice Vogt and Georg H Endress became a couple and married on 15 June 1946. One year later their first child, a son, was born. Three more sons and four daughters followed. Alice Endress, born on 14 May 1919 in Schwyz in central Switzerland, always yearned for a big family. That was an important incentive for her husband in his quest to build his own business. Georg H Endress liked to tell the story in his later years in a witty style: “After the third child, my wife said to me: you have to do something. So I became an entrepreneur!”

Center of the family While Georg H Endress built the company from the ground up and led it to success, his wife managed the growing family. She insisted that dining table discussions about the business remain positive, even though things were not always easy. Her gospel nevertheless proved to be a blessing for the family-owned company, as the patriarch verified in later years: “We didn’t have to talk the children into entering the business. They wanted to.”

Although she deliberately kept her distance from business throughout her life, Alice Endress always maintained a presence at Endress+Hauser. She attended company events until the last months of her life and was noticeably at home in the midst of things, despite some aches and pains. Alice Endress always blossomed in the presence of her children, grandchildren and great-grandchildren (the shareholder family today has more than 70 members across all generations). She even traveled to Berlin for the annual Endress Family Day as recently as May 2016.

After a long and fulfilling life, Alice Endress died peacefully in her sleep on 6 July 2016 in the presence of her loved ones after suffering a brief illness. She was laid to rest in Arlesheim, Switzerland next to her husband, who passed away in 2008.

Text: Martin Raab
Photo: Axel Hupfer

Highly versatile: SensAction's LiquidSens systems determine the concentration of liquids in process and laboratory applications.

Focus on quality measurements

Endress+Hauser has acquired SensAction AG, a German manufacturer of innovative systems for measuring the concentration of liquids. This move further strengthens the Group's quality measurement portfolio.

SensAction will operate as a division of the Endress+Hauser center of competence for flow measurement technology headquartered in Reinach, Switzerland. "This innovative technology is an excellent fit with our modern flow measurement portfolio," says Dr Bernd-Josef Schäfer, Managing Director of Endress+Hauser Flowtec AG. "It allows us to further expand our range of products for measuring quality parameters."

Coriolis flow measurement devices from Endress+ Hauser can already determine not only mass flow, but density as well. Electromagnetic instruments are capable of measuring conductivity parallel to the volume flow. "These physical analysis parameters create direct value-add for the customer," emphasizes Bernd-Josef Schäfer. Endress+Hauser plans to integrate the SensAction instruments into its own program and open up new markets via the Group's international sales structures. In addition, plans are in place to eventually combine the technology direct with Endress+Hauser flow instruments.

Apart from developing and manufacturing concentration measurement systems, SensAction also offers supplementary services, such as software products that rely on a laboratory measurement to provide a high degree of accuracy and user-friendliness for the customers' applications. The key fields of application for the SensAction instruments include concentration measurements for liquid process media.

The acquisition of SensAction was effective retroactively from 1 January 2017. The company will remain headquartered in Coburg, Germany and keep the current staff of 13 employees. Stefan Rothballer and Michael Münch, two of SensAction's founders, will continue to manage the innovative company's business.

Text: Martin Raab
Photo: Uli Präcklein

Innovative technology
The systems from SensAction measure the concentration of liquids with the help of surface acoustic waves, which are high frequency sound waves whose behavior can be compared to seismic waves created by earthquakes. By analyzing the transmission time and amplitude, the acoustic parameters of the liquid, such as sound wave velocity, impedance and density, can be measured in order to quickly and precisely determine the concentration. Because they contain no moving parts, the systems are maintenance-free and do not suffer from wear-and-tear.

View of the first joint test plant of Endress+ Hauser and Rockwell Automation in Europe.

Simulation on a grand scale

Endress+Hauser and Rockwell Automation, an expert for automation solutions in industrial production, have inaugurated their first joint test plant for validation purposes in Europe. Core elements of the installation at Endress+Hauser's competence center for level and pressure measurement engineering in Maulburg, Germany are three massive tanks, each one containing between 2,000 and 26,000 liters of oil. More than 20 instruments from Endress+Hauser with different measuring principles, all of them communicating with Rockwell Automation's control system, have been installed on the tanks.

The original idea for the joint equipment of the tank system came from training centers established by Endress+Hauser with the support of Rockwell Automation in recent years. At 10 so-called Process Training Units worldwide, sales representatives and product specialists from both companies host practical training sessions for their customers. The first joint test center for Europe takes this concept a few steps further and establishes new standards: It focuses on product validation. Research & development take center stage to align new products to customer requirements at an early phase under real application and environmental conditions.

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Better future: Paboy Ceesay came to Germany as a young refugee. Now he's part of a vocational training program at Endress+Hauser.

A bridge to the world of work

Endress+Hauser offers refugees the chance of a career. Training them requires considerable effort, both from the company and the young people themselves.

The competence center for level and pressure measurement in Maulburg, Germany is one of the region's largest employers. Endress+Hauser has long supported the integration of asylum seekers into the world of work through internships. In September 2016, the first two young refugees began working at the company's state-of-the-art apprentice training facility.

One of them is 20-year-old Paboy Ceesay. He's from Gambia, one of Africa's poorest countries, whose former dictator forced thousands of people to flee the country each year. At the age of 17, Paboy Ceesay set off on a risky solo journey through Africa and across the Mediterranean Sea to Germany in the hope of building a secure future for himself and eventually supporting his family in Gambia.

The talkative young man with the soft smile is now one step closer to his goal. He not only acquired a compulsory school diploma as part of a special class at a vocational school, but last fall he was also given the chance to prepare for his dream profession in Maulburg as an electrician for devices and systems. He's about to complete a one-year entry qualification program at Endress+Hauser that could lead to an apprenticeship at the company.

"We coordinated this new program with the employment office and a social welfare organization, which helped us recruit the young refugees," explains Jens Kröger, Head of Human Resource Development at Endress+Hauser Maulburg. The direct path to an apprenticeship is difficult for most young refugees. The German language is but one of several hurdles. Many refugees have educational deficits, for example in physics or math. Due to their school experience, they are often accustomed to rote learning. That means they must first learn to apply abstract and theoretical knowledge.

A path with stumbling blocks "You can't rely on a quick test to ascertain how easily refugees are able to make up for missing skills," says Jens Kröger. With this in mind, an Endress+Hauser team put a great deal of time and effort into developing a corresponding training program. The first year of the apprenticeship is preceded by the entry qualification program, which offers the apprentices tutoring courses when needed. Paboy Ceesay, for example, receives six hours of German each week to supplement his school courses, in addition to tutoring in technology and math.

The high degree of individual supervision makes the new training program complex. The apprentices are equally challenged, however. Paboy Ceesay gets up every day at 5:00 am and travels an hour by public transport from his remote residence in order to be at the training facility on time. He says he hardly has time for soccer, his favorite pastime, but he can chuckle about it knowing that the entry qualification program is an opportunity well worth strenuous studying and early rising.

The first two apprentices have a good chance of getting accepted into the regular apprentice program. The training contract is extremely important to them, because it offers the young men a chance to stay in Germany, even if their reason for asylum is not accepted. The Head of Human Resources Development is all the more pleased to see the company's commitment bear fruit: "We think we have found a good mix in order to build a bridge for refugees into the world of work." Endress+Hauser intends to continue the entry qualification program despite the extensive effort it takes. Jens Kröger: "Two more refugees have already been accepted for the 2017 program!"

Text: Anita Vonmont
Photo: Jürgen Weisheitinger

Practicing responsibility There was widespread concern in 2015 as hundreds of thousands of weary and destitute people arrived in Central Europe during the global refugee crisis. At Endress+Hauser, where employees come from more than 40 nations, many people were asking themselves what could be done. Spontaneous relief campaigns were started, from money, food and clothing donations to employee-sponsored projects such as a bicycle repair shop for refugees. "When young people come here, we must offer them a future," says Matthias Altendorf, CEO of the Endress+Hauser Group. This led the German and Swiss sites to develop different activities. Until now, about 15 interns have been employed. At least three refugees are to begin a training program in 2017 in Germany; another one has been given a regular employment contract. In Switzerland, a young man will complete his vocational training this year and plans to subsequently start studying.

AVO

Improved opportunities: the Youth Initiative launched by Nestlé helps young people transition to the world of work.

Giving young people a chance

Nestlé is more than just a long-standing customer. The world's largest food producer has also been successfully collaborating with Endress+Hauser in the area of sustainability and social responsibility since August 2016. The companies combat youth unemployment together.

The partnership has its origins in Chile. The youth unemployment rate is especially high in Latin America. For this reason, Endress+Hauser Chile is participating in the Youth Initiative, a global campaign from Nestlé for young adults. The program aims to ease the transition into the world of work and help develop the next generation of talents.

More than 6,000 young people in Chile alone have participated in the program so far. Depending on age and experience, the Youth Initiative helps young people with career orientation, initial entry into the job market, access to training and education or permanent position searches. Participation by the companies involves, among other things, internships, advice and career networking.

Cooperative effort To strengthen and empower local young professionals, Nestlé and Endress+Hauser in Chile have joined forces. An instrumentation training rig with state-of-the-art measurement devices will be built with support from Endress+Hauser's production centers. The equipment was designed by engineers from the sales center; a similar rig is used by a Chilean mining company for training purposes.

KA

Step by step toward the goal

Energy efficiency is in a production center's DNA, so to speak. But only a systematic approach helps realize the whole potential. This is reflected by the progress made at the Reinach site.

The competence center for flow measurement technology in Reinach, Switzerland is one of the Group's largest sites. Endress+Hauser Flowtec employs more than 1,000 people here; the annual electricity consumption alone amounts to almost 9,000 megawatt hours. The company aims to reduce relative energy consumption by a fifth and carbon dioxide emissions by almost a half by 2020. "We will only achieve this through a variety of measures," Energy Manager Pascal Meury is convinced.

Endress+Hauser Flowtec has been working on increasing energy efficiency for many years, in particular in the production and infrastructure area, but also in the offices and R&D laboratories. Pascal Meury, who has been the company's energy manager since 2015, brought a systematic approach to these endeavors. "My first assignment was certification according to the international energy management standard ISO 50001," he reports. The task was to combine activities on site and to make them visible – externally as well as internally.

Reliable foundation Aside from the new proposals, Pascal Meury's work also targets the optimization of existing installations in particular. He can rely on data from the energy monitoring system, which observes the main consumers of electricity at the site. "The measurement technology that we install for our customers also helps us with our own operations," says the energy manager. The system helps him to quickly identify deviations, to follow up on their causes and to take corrective action.

Special opportunities always arise when expansion or modernization takes place. The company now uses the waste heat from the production facilities in many places – for example in the over 1,000-degree Celsius soldering furnaces. "Our newest buildings, which make up a quarter of the entire energy supply area, can mostly be heated with waste heat," reports Pascal Meury. The new wood pellet facility is used if more heat output is required. Fossil fuels are only used in exceptional cases.

Efficient engineering A further measure concerns the 60-degree Celsius process water that is required for production. It used to be centrally heated using an electro boiler; nowadays heat pump boilers are used. The new equipment uses waste heat from production – saving 80 percent of the electricity that was required thus far. Pascal Meury has LED lamps installed during every modernization. "If maintenance costs are taken into the equation as well as energy, they pay for themselves after just two and a half years."

"Last but not least it's about raising people's awareness of the efficient use of energy," Pascal Meury is convinced. Employees have to attend a training course every two years. Using descriptive examples, the energy manager demonstrates that even the smallest contributions add up: "If all computers and monitors were switched off completely instead of being put on standby at the end of the day, we could save 200,000 kilowatt hours of electricity per year at the Reinach site alone – enough to supply 40 houses."

Text: Anna Kürzinger
Photo: Christoph Fein

500

instruments record energy consumption at the competence center for flow measurement technology in Reinach. The company monitors the power supply, heating and cooling cycles, ventilation and use of the industry gases nitrogen and argon. This data helps to increase energy efficiency using targeted measures. Endress+Hauser Flowtec now offers its own guided tours focusing on the energy monitoring system.

Every kilowatt hour counts: Energy Manager Pascal Meury wants to systematically improve energy efficiency at the Reinach site.

At second glance

For Luc Schultheiss, negative growth in the 2016 fiscal year doesn't show the whole picture. When he takes a closer look at the figures, the Group's Chief Financial Officer sees many positive indicators.

When we look at the consolidated figures for the Endress+Hauser Group, one thing is clear: we failed to reach our objectives last year. With net sales shrinking by 0.2 percent, 2016 will go down in history as one of the few years in which the company experienced negative growth.

Although we cannot be satisfied with what we achieved, we have to view the results comparatively in order to put them into perspective. Doing that yields a different and somewhat more positive picture. Measured against the competition, we held our own in 2016 in a difficult business environment. In addition, when we look at sales in local currencies, we even grew the business by roughly 2.1 percent, around a two-fold increase over the prior year.

While foreign exchange rates added around 115 million euros to our sales in 2015, the impact in 2016 was a decline by nearly 50 million euros. Like all global companies, we have to deal with and work around such currency fluctuations. Still, we're well advised to take them into account in our analysis to avoid drawing false conclusions.

An examination of the individual markets thus shows a nuanced picture. Non-cyclical industries such as food & beverage, life sciences, water & wastewater and power & energy showed positive trends. However, the moderate growth in these consumer-related segments was obviously not enough to offset declines in cyclical industries such as oil & gas, chemicals and primaries & metals. We are still feeling the impact of slower growth rates in China and at least to some extent the resulting low commodity and energy prices and cutbacks in large-scale customer projects. We lost a lot of business in recent years in these areas

Two-thirds of our sales centers nonetheless achieved solid growth in 2016, even though Germany and the United States, our two largest markets, were part of the group of countries where we experienced less success. In places where the business did not do well, either we relied too heavily on individual industries or businesses, or we had a situation where we didn't align our sales organization quickly enough with customer segments that offered further growth potential. In China, our third largest market, as well as in other countries, we managed this turnaround over the course of the year.

One thing we did have under control the entire year was costs. Although we clearly failed to reach our growth objectives, profitability fell only slightly and thus remained within the framework of our expectations. While we are lagging behind our strategic objectives with respect to return on sales and productivity, we are still performing at a high level for our industry. As a result, we were not forced to curb any of our large investment projects. We kept the number of employees constant. The equity ratio also declined slightly, but as before exceeded our strategic target.

A confident start to the new year Looking forward, one of the issues that concerns us is the rise of protectionism. For more than two decades, the global economy has profited from open markets and the free movement of goods, services, capital and people, leading to a higher standard of living around the world. If barriers to open trade are erected again, a development we are observing in various countries, it will not occur without negative consequences.

We are nevertheless confident about the future – more confident than a year ago. Over the last few months of 2016, we sensed that business was picking up. December was even a record month for Endress+Hauser with respect to net sales and this positive trend continued into the new year. Given that most of the economic indicators are positive, and despite the continuing political and business uncertainties, we expect moderate growth and an improved earnings situation in 2017.

Illustration: Ralf Marczinczik

A knack for numbers After graduating in business and subsequently achieving a doctorate, Dr Luc Schultheiss (55) worked as an associate professor and consultant. He joined Endress+Hauser in 1999. In 2011, he was appointed CFO of the Group and became a member of the Executive Board. Luc Schultheiss is married and the father of three grown children. He is a passionate sailor and is also active in the Basel carnival.

2016 HIGHLIGHTS

World leader in liquid analysis

US consulting firm Frost & Sullivan concluded that Endress+Hauser supports its customers better than any other provider in the area of liquid analysis. Endress+Hauser clearly set itself apart from the competition and received the 2016 Global Company of the Year Award. "A robust product portfolio, coupled with strong acumen for innovation and focused customer centricity, has been instrumental in strongly positioning Endress+Hauser amidst competition in the global water analysis instrumentation market," said Frost & Sullivan Industry Analyst Krishnan Ramanath.

Concentrated expertise for the IIoT

Endress+Hauser has bundled activities for the Industrial Internet of Things (IIoT) into a start-up. The subsidiary of the competence center for automation solutions is based in Freiburg, Germany. It is tasked with developing new offerings for the IIoT. Based on specific customer requirements and market potentials, digital applications are to utilize networking opportunities in order to convert sensor information into valuable knowledge and advantages for the customer.

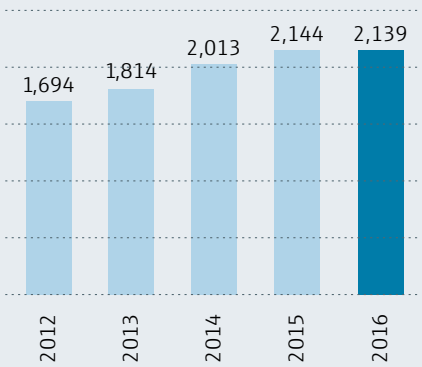
New partners for Open Integration

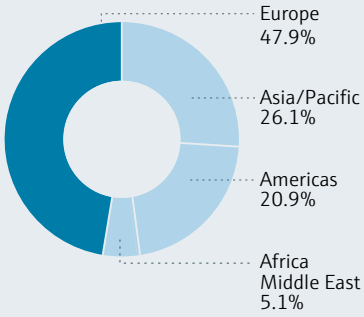
With the Open Integration Partner Program, Endress+Hauser strives to ensure the easy integration of devices and components into automation systems and to mitigate risks when commissioning new plants. The program partners go well beyond traditional testing methodologies by verifying the functionality of specific system architectures in a laboratory environment. After AUMA Riester, HIMA Paul Hildebrandt, Honeywell Process Solutions, Mitsubishi Electric, Pepperl+Fuchs, Rockwell Automation, R Stahl and Schneider Electric, Phoenix Contact and Flowserve recently joined the program.

MR

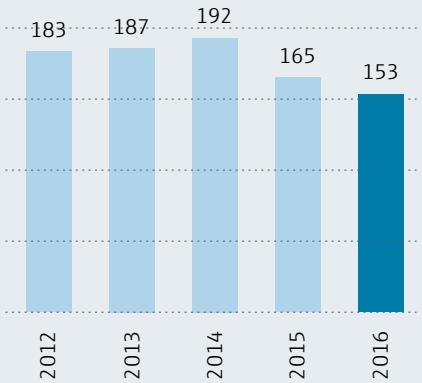
Fiscal year 2016 at a glance

Net sales and net sales by regions
(in million euros)

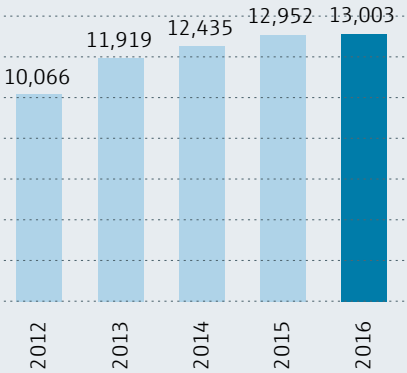




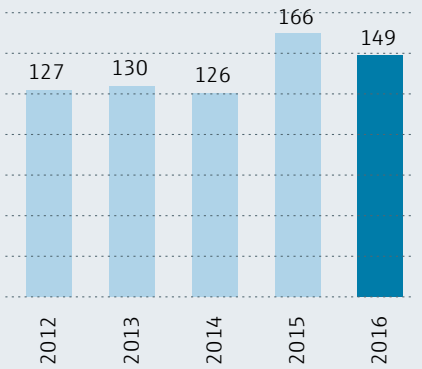
Net income
(in million euros)



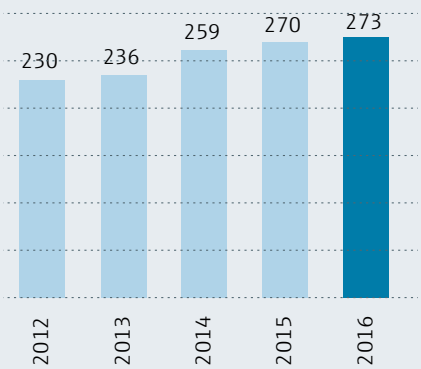
Employees
of the Endress+Hauser Group



Capital expenditures
(in million euros)



Patent applications
of the Endress+Hauser Group



Financial highlights 2016

	(in million euros)					
	2012	**2013**	**2014**	**2015**	**2016**	Change
Net sales	1,694	1,814	2,013	2,144	**2,139**	–0.2%
Operating profit (EBIT)	273	277	268	251	**216**	–14.2%
Profit before taxes (EBT)	263	270	274	234	**217**	–7.2%
Net income	183	187	192	165	**153**	–6.8%
Return on sales (ROS)	15.5%	14.9%	13.6%	10.9%	**10.2%**	
Productivity	1.45	1.42	1.37	1.30	**1.26**	
Equity	1,174	1,310	1,465	1,718	**1,840**	7.1%
Equity ratio	70.1%	67.8%	68.3%	73.0%	**72.2%**	
Total capital employed	1,674	1,932	2,146	2,353	**2,549**	8.3%
Capital expenditures	127	130	126	166	**149**	–10.5%
Depreciation and amortization	74	74	85	99	**100**	1.4%
Cash flow	257	261	277	264	**254**	–3.8%
Number of employees	10,066	11,919	12,435	12,952	**13,003**	0.4%

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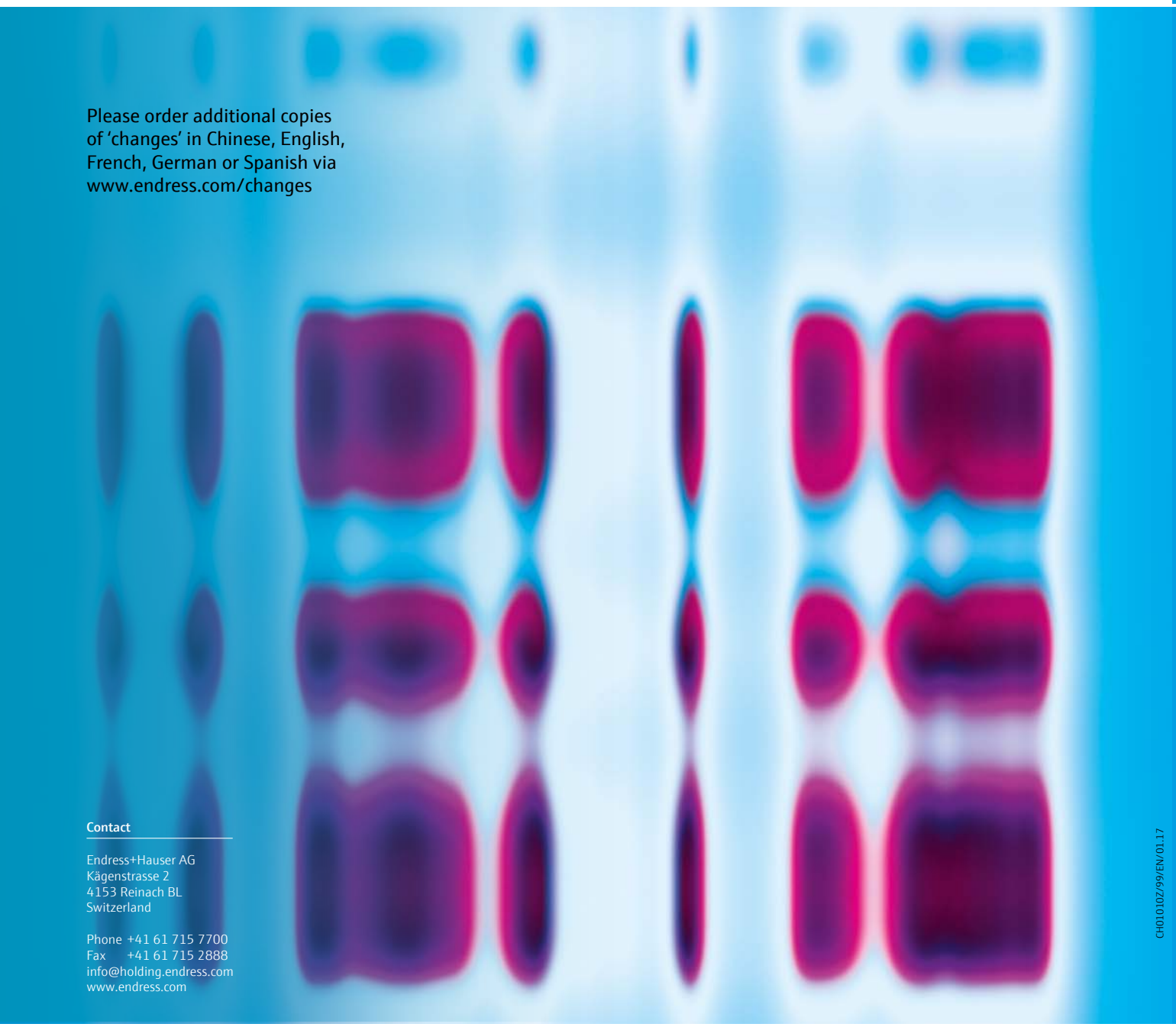

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People for Process Automation