2020 edition

changes

Market Success in the USA

Know-how Green solutions to protect the climate

Chemical industry

Fast reactions for the future

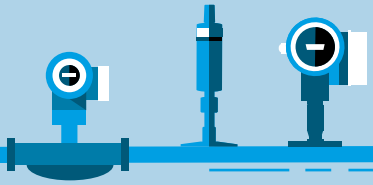
Endress+Hauser

People for Process Automation

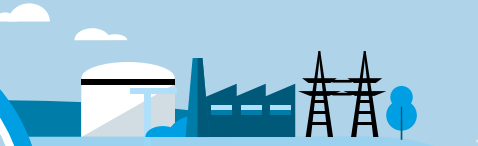
A strong partner worldwide

We are a successful family company. In **laboratory and process automation**, customers around the world trust our products, solutions and services to improve their processes, and thus their products, sustainably.

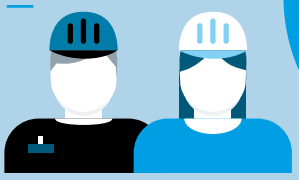
Customers around the world gain valuable knowledge from their processes by using our **products, solutions and services**.



Based on our **industry expertise** we find, in cooperation with our customers, the best solution for every application.



As a family-owned company since 1953, we are a **reliable partner** for our customers, employees and shareholders.



Watch our corporate video to learn more about the People for Process Automation.

Endress+Hauser

Infographics: Pia Bublies

Changing things for the better

Dear reader,

The coronavirus has caught us off guard and is forcing us to face major challenges – as a society, as a company and as individuals. Such a crisis demands our full attention. We must quickly recognize what is necessary, act forcefully – and then arrive at the new normality. This calls for a cool head and a warm heart. It's time to take responsibility and demonstrate solidarity.

I am convinced this crisis will have a lasting impact. By that I do not mean the economic upheavals it has triggered but its impact on the way we think and act. We have been forced to concentrate on the essential. We have learned that health, freedom, interaction with others and our standard of living are not to be taken for granted after all. We have seen what solidarity in a free society means. And we have experienced how the purpose of our work is questioned.

We will learn from this crisis – and turn increased attention to those issues that are important and sustainable. That includes protecting our environment and the climate, utilizing resources efficiently and supplying a growing population with water, food and medicine. Our products, solutions and services support all of that. They help to make processes better and safer. This ensures our customers and society progress and gives meaning to what we do.

As a family company we want to change things for the better on a sustained basis. And we are not alone here. Many other companies are traveling this path together with us, from start-ups to multinationals. After all, one thing the corona crisis has shown is that no one can solve the big problems alone. But together we make the difference! To find out how, just take a look at this issue of 'changes'.

Yours

Matthias Altendorf

PS: What do you think of this year's edition of 'changes'? I look forward to receiving your feedback and suggestions! changes@endress.com

MY READING TIPS

How sustainability impacts companies and products: My conversation with Martin Brudermüller, CEO at BASF.
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Companies around the world, such as US chemical company Chemours, are investing in eco-friendly solutions.
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Our employees are mobilizing around the goal of providing people around the world access to clean water.
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Focus: The chemical industry transforms itself for the future.

Market: Endress+Hauser's success story in the USA.

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Mover and shaker: Interview with Martin Brudermüller, BASF Chairman.

Good connections

The chemical industry creates great things from tiny molecules: substances and materials with properties that help improve our lives.

Driving force of the modern age

The chemical industry has achieved significant breakthroughs over the course of its history. Discoveries related to the reactions of elements, as well as the development of large-scale industrial synthesis processes, have changed our everyday lives in essential ways.

The pain reliever aspirin was created in **1897** by synthesizing acetylsalicylic acid; a chemist developed the active ingredients of the birth control pill in 1951

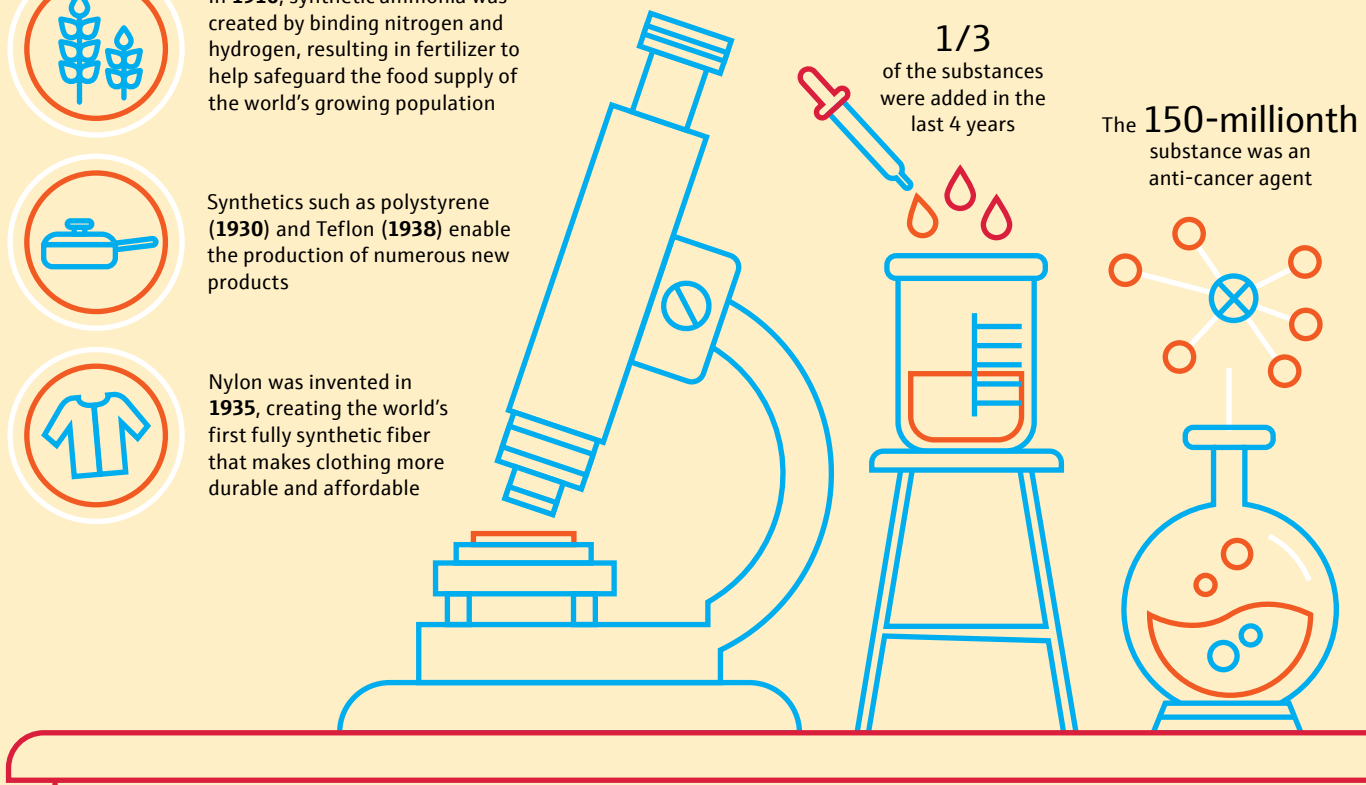
In **1910**, synthetic ammonia was created by binding nitrogen and hydrogen, resulting in fertilizer to help safeguard the food supply of the world's growing population

Synthetics such as polystyrene (**1930**) and Teflon (**1938**) enable the production of numerous new products

Nylon was invented in **1935**, creating the world's first fully synthetic fiber that makes clothing more durable and affordable

Inventions by the minute

The innovative strength of the chemical industry continues unabated. To date, more than 150 million chemical substances have been scientifically formulated, of which roughly 100,000 are currently used.



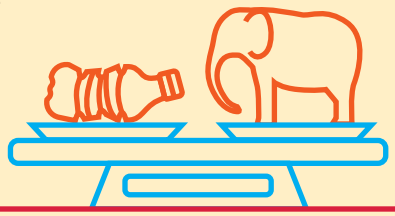
Since 1970, a new substance has been registered every
2.5 minutes

Infographics: Pia Bublies
Research: Claudia Füßler, Christine Böhringer

Green transformation

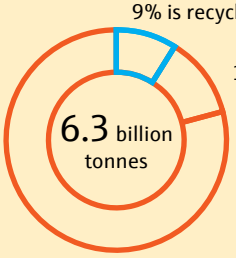
Environmental protection is the key issue for the progress of the chemical industry. The world is demanding sustainable solutions produced in a resource-saving and environmentally sound manner. The recycling of carbon-bearing waste is also becoming more important.

8.3 billion
tonnes of plastic was produced worldwide by the year 2015. This is equivalent to the weight of 1 billion elephants

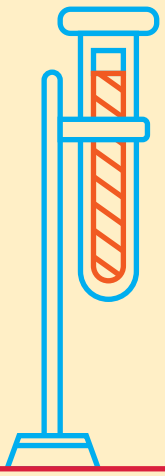


Plastic waste:

79% ends up in landfill or in the environment



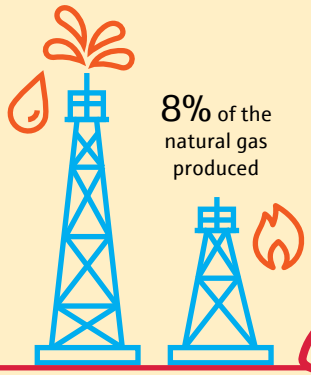
90%
of the most common base chemicals stem from crude oil and natural gas



The petrochemical industry currently uses:

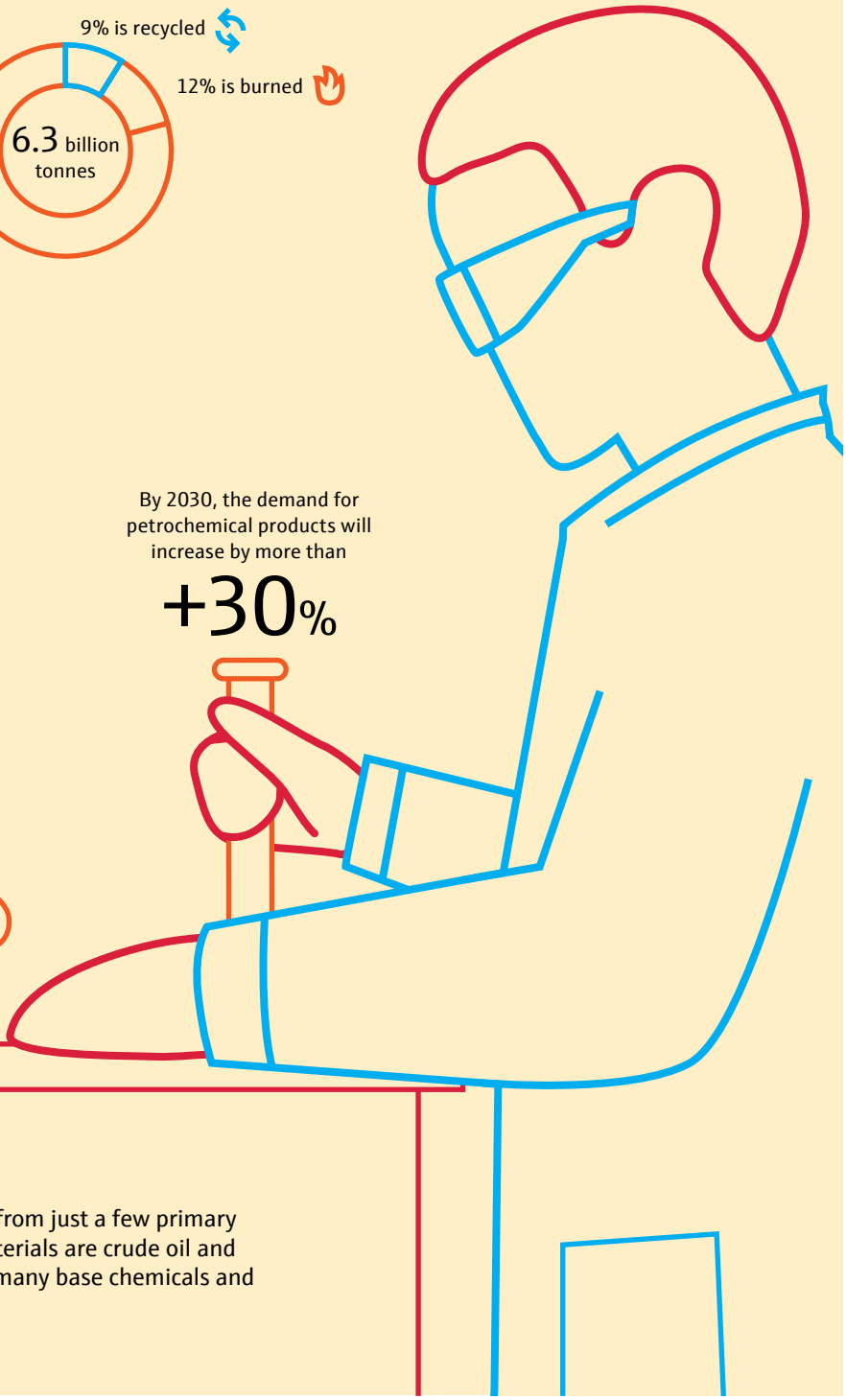
14% of the oil produced

8% of the natural gas produced



By 2030, the demand for petrochemical products will increase by more than

+30%

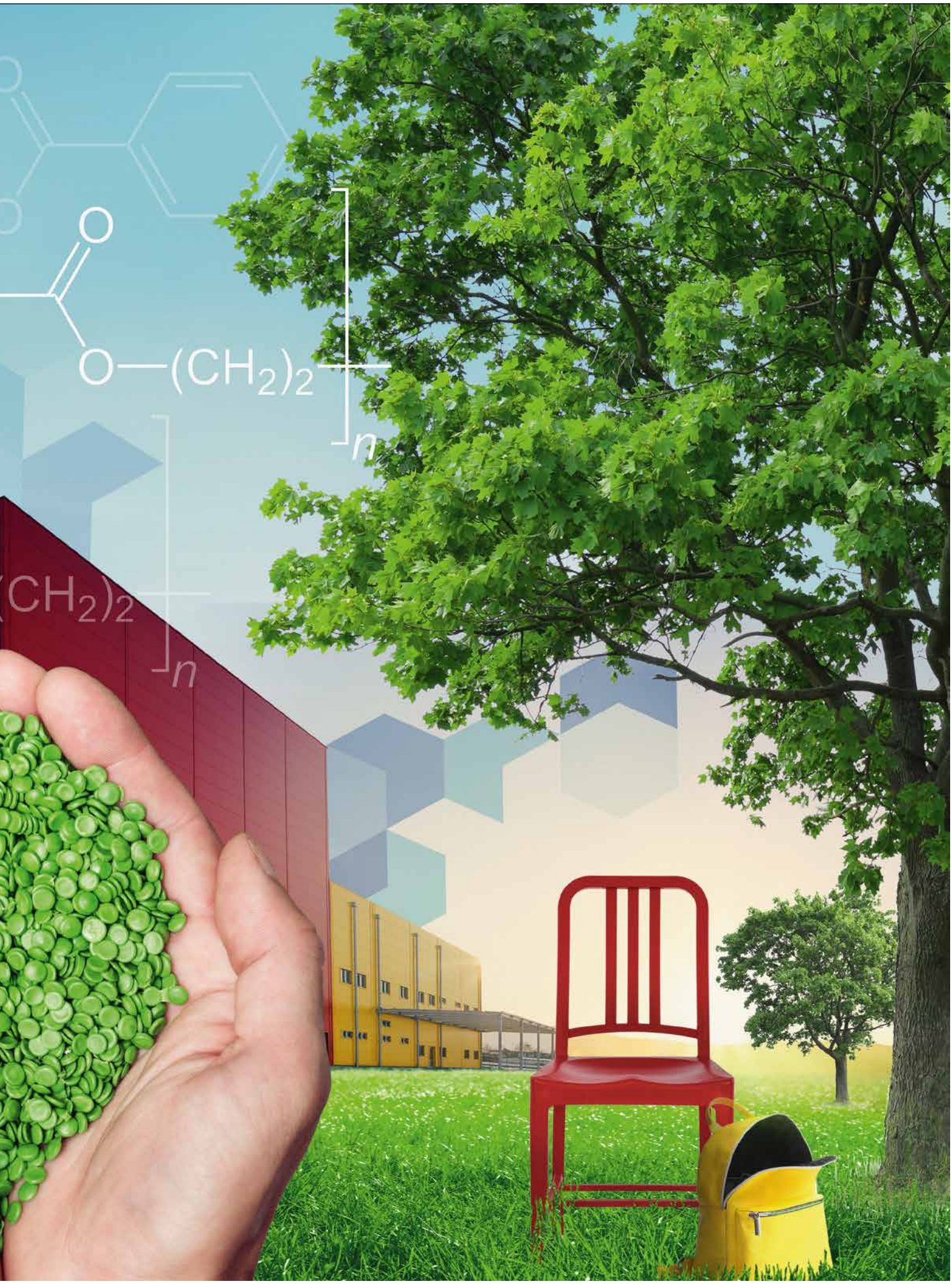


Essential raw materials

A wide range of chemical products are derived from just a few primary materials. The most important organic raw materials are crude oil and natural gas, which serve as the foundation for many base chemicals and are thus found in numerous everyday items.

Sustainable transformation

The chemical industry has transformed itself time and again since its inception. Today, this ability to renew is in demand more than ever. The world is undergoing rapid change – and climate protection is the key issue of the future.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Chemistry represents constant change. Elements bond to one another through molecule reactions, turning into substances and material until they dissipate and bond the elements into new compounds. Constant change is also an inherent part of the chemical industry, which stems from research into these processes and uses it for the well-being of mankind. “After the industrial age, the emergence of petrochemicals and globalization, the chemical industry is now entering a new phase of development driven by growing productivity pressures, digitalization and climate change,” says Philipp Conen, Global Industry Manager Chemical Industry at Endress+Hauser.

One of the biggest challenges for the chemical industry in the coming years is its fossil fuels foundation. Most of the products are manufactured from a few base chemicals, which in turn are made almost exclusively from an abundant source of carbon-based fuels: crude oil and natural gas. The manufacturing processes furthermore require enormous amounts of energy, such as heat or electricity, which are also generated from fossil fuels. “Although the chemical industry has improved when it comes to resource utilization, it remains one of the world’s largest producers of greenhouse emissions,” explains Philipp Conen.

Paradigm shift in society And the situation is expected to worsen. Experts predict that the growing demand for petrochemical products, especially in emerging countries, will increase the chemical industry’s need for raw materials by four percent a year. At the same time, governments have been pushing for a better climate balance following the signing of the United Nations Paris Climate Agreement in 2015 – among other things, the European Union aims for climate neutrality by 2050.

Even customers are demanding products with a smaller ecological footprint. As a crude oil-based, mass-market product, plastic is the subject of intense criticism around the world. Although it has become indispensable in our daily lives given its durable, lightweight, cost-effective and versatile properties, plastic has nevertheless evolved into one of today’s main concerns thanks to its steadily growing use and society’s throwaway mentality. As a result, plastic has turned into a symbol of the environmental issues the industry is facing.

Not all plastic immediately ends up in the trash, however. Some products are used for decades, especially in industrial environments, construction and transportation. Still, one-third of the plastic produced globally relates to packing material that is often used only once. After it is used, around 90 percent ends up in landfill or in nature, where it does not fully biodegrade and requires decades or even centuries to break down into minuscule parts. In the meantime, more than 60 countries have prohibited disposable and non-returnable plastics or levied taxes on them. “That can’t be the only solution. We need to develop a more responsible approach to plastics and a new mindset along the entire value chain,” says Philipp Conen.

New ideas for carbon Against the backdrop of these urgent issues, the chemical industry is on the verge of a profound transformation. “The chemical industry has to be more efficient and environmentally friendly and use fewer resources in the future,” says Philipp Conen. Under the motto ‘feedstock change,’ the industry is currently discussing expanding the raw materials basis. It must find ways to replace crude oil and natural gas with non-fossil carbons or create a carbon loop to make production, and the corresponding products, ‘greener.’

One of these alternative carbon sources could take the form of plant-based biomass. “In order to exploit this potential, there needs to be more investment in white biotechnology,” says Philipp Conen. White biotechnology uses microorganisms and enzymes to produce feedstocks and fine chemicals from renewable sources through fermentation or biocatalysis. Bioplastics based on lactic acid, starch or cellulose are already being produced today.

Is a closed-loop economy the answer? A further option is the use of chemical recycling as a new foundation for a closed-loop economy, an idea that has been gaining importance for some time now. This process involves converting plastic waste into synthetic gases or oils through pyrolysis, and then feeding them back into the chemical industry production networks at the head of the value chain.

"This method allows the reuse of mixed or contaminated plastics that are mechanically non-recyclable and therefore end up in incinerators or landfill," says Philipp Conen. "Mechanical recycling still has room for improvement, however. It has, meanwhile, reached its limits because the quality of the recycled product depends heavily on the purity of the input material."

Sustainable processes Even CO_2 emissions are gradually attracting attention as a carbon source. "Since carbon dioxide is at the end of the reaction chain from a chemical standpoint, it's inert and low energy," says Philipp Conen. That means researchers have to find a way to mobilize CO_2, such as with suitable catalyzers. In some cases, large amounts of energy are also required.

One opportunity for developing a sustainable process is referred to as Power to Gas, a technology that uses surplus wind and solar energy to create climate-neutral hydrogen from water via electrolysis. The chemical industry requires large quantities of this element as a reaction partner in the manufacture of feedstocks, for example in combination with nitrogen for ammonia synthesis. And when hydrogen reacts with CO_2, which can be filtered from the air on a large scale with new technologies, this leads to methane, which can be further processed into fuels or plastics, for instance.

Regardless of which paths the industry decides to take, "These innovations will call for large investments in process technology and basic research," says Philipp Conen. Innovative business models have to be developed and cost-effective processes have to be designed. What can help in this area is advanced process analysis, not to mention the wide range of opportunities afforded by digitalization. "In order to reach the next level of productivity and to successfully shape the transformation, both of these issues are decisive for the chemical industry," says Philipp Conen.

The global industry manager has no doubt that this transformation will be just as successful as those in the past. "Although the chemical industry has to observe numerous safety aspects, it's demonstrating a high degree of openness toward changes and new technologies."

Text: Christine Böhringer
Illustration: X-Ray AG

Industry expert Global Industry Manager Philipp Conen (42) has been coordinating the Endress+Hauser worldwide network of chemical industry experts since 2014. Conen, a trained beer brewer with a degree in bioprocess engineering, has been working for the Group for nine years. The northern Germany native enjoys crossfit training, sailing, motorcycle riding – and brewing his own beer.

“Climate change is on the minds of all generations”

Although a challenge for industry, climate change is also driving innovation. BASF Chairman Martin Brudermüller and Endress+Hauser CEO Matthias Altendorf shed light on the issue.

Mr Brudermüller, Mr Altendorf – young people are heading to the streets in many countries to demonstrate for protection of the climate and the environment. What's your view of the protests?
Brudermüller: Climate change is one of society's biggest challenges. Young people are demanding that we do more to tackle this problem, which I can fully understand. After all, it's about their future. From what I can see, however, climate change is on the minds of all generations. In our company, both young and older employees are discussing this issue. They are convinced that as a chemical company, we can make a bigger contribution to better protection of the climate.
Altendorf: The protests illustrate how much this issue is driving people. But there is also an underlying development that has been noticeable for some time now. The question of meaningful work is becoming increasingly important during interviews with job applicants. They're seeking 'good' employers, and 'good' implies how the company is contributing to our overall well-being as a society.

What does Endress+Hauser contribute exactly?
Altendorf: We help our customers improve their products and production processes in many important facets of daily life. Our customers ensure that we drink clean water and eat safe foods, that we have access to effective medications and that our infrastructures are dependable. We help customers like BASF manufacture important chemical products using less energy and fewer raw materials, but at the same high quality, while releasing fewer harmful emissions and ensuring that people and the environment are not put at risk.

How does BASF see this?
Brudermüller: We want to contribute to a world that offers everyone a livable future with a better quality of life. We're working together with our customers and partners to ensure optimal use of our existing resources. We're looking for innovations that make mobility, energy generation, transport, nutrition or living more efficient and that prevent or reduce emissions. Electromobility is one example. This will only work with high-performance batteries – and our researchers are working on the battery materials of the future.

But at the same time, the chemical industry is one of the largest emitters of greenhouse gases. Is there anything you can do here?
Brudermüller: Protection of the climate and the environment is firmly anchored in our corporate strategy. We have committed to becoming climate neutral by the year 2030. For our industry, which is very energy intense, that's a very ambitious goal. We're reducing CO_2 emissions at our production facilities at the same time. We have scaled them back by 50 percent since 1990, even though production has more than doubled. We did that by constantly improving efficiency. Given what we have achieved, further savings will be increasingly more difficult. Our researchers are therefore working at full speed on groundbreaking low-CO_2 technologies and processes. I am confident that we will come up with innovative solutions. Our ultimate goal is to avoid CO_2 emissions in the first place.

BASF wants to be a leading manufacturing operator. What does that mean?
Brudermüller: We want to be the globally leading chemical company for our customers. What's really important here is that we operate our systems in a safe, efficient and reliable manner. In order to better dovetail services such as engineering and maintenance with our production processes, we have reorganized parts of the operations-related services. The goal is to create close proximity to the operation and strong production teams. Successful production is a team effort.

And how can Endress+Hauser help here?
Altendorf: We have products, solutions and services tailored to the needs of the chemical industry. This allows us to help customers address their challenges. Plant availability, safety, efficiency and ecological footprint are the major issues for this industry. We have been offering life cycle management solutions for a good 20 years – and BASF was one of the first

Knows his company inside and out: Martin Brudermüller, Chairman of the Board of Executive Directors, has worked at BASF for more than 30 years.

customers. With the industrial Internet of Things, this whole area is once again acquiring a new dynamic. Today it's much easier for us to read the data from the field instruments and the process, then prepare it and link it to other information. This enables us to optimize not only the business processes within the company but even entire value chains beyond the borders of the company. We're working together with BASF on these types of solutions.

"Many innovations stem from collaboration with customers," says Matthias Altendorf, CEO of the Endress+Hauser Group.

Mr Brudermüller, as Chief Technology Officer at BASF, you are also responsible for research and development and want to make the company even more innovative. How do you want to achieve that?
Brudermüller: Our research and development area is the heart of BASF. Innovations have made us the world's leading chemical company. We can be proud of all the knowledge, experience and resources that are combined under one roof. The organizational changes we have made help us to understand the needs of our customers even better. Together with their colleagues in marketing, production and sales, many of our researchers are now working in much closer proximity to the customers. We have a clear goal: We want to develop creative solutions for our customers faster.

Altendorf: That's why customers buy from BASF, and the reason why they buy from Endress+Hauser. When we claim in our mission that we help our customers improve and manufacture their products more efficiently, we're talking exactly about this competitive aspect of innovation. Many of these innovations are created in collaboration with customers and partners. We're currently learning a lot about the needs of our large customers by working closely together with them. Our Industry 4.0 solutions are being developed through continuous dialogue with pilot customers. BASF is a pioneer in this area when it comes to Ethernet in the field and the integration of process data into the ERP system.

What significance do contractors have for you and what do you expect from them?
Brudermüller: Specialist firms and other external specialists have made a big contribution to the success of BASF for decades. We apply very high standards in the selection process. Only those companies who meet our requirements and provide high-quality, reliable services can work for us. The working relationships with proven contractors are usually long.
Altendorf: The collaboration between BASF and Endress+Hauser is one of the longest and most intense customer relationships in the chemical industry. The company is one of our largest customers worldwide. To me it's not the volume of business that is so noteworthy but the fact that a close and trustworthy relationship developed over time. During my many visits to BASF in Ludwigshafen, I had the chance to significantly expand my own knowledge in the area of process engineering. We learned a lot from one another through these joint projects. This partnership spawned a lot of good of things in the area of instrumentation and automation for the chemical industry.

Mr Brudermüller, you have spent your entire career at BASF. How do you make sure you don't get tunnel vision?
Brudermüller: I've been working for BASF for more than 30 years. I've become familiar with every aspect of the business, from the lab to marketing and production. Each new station brought with it new responsibilities and demands. Since I was constantly exposed to new things – people, responsibilities, countries – I was never at risk of getting tunnel vision. And I'm still as enthusiastic about chemistry as before. Discovering

“We want to contribute to a world that offers everyone a livable future with a better quality of life.”

Dr Martin Brudermüller, Chairman of the Board of Executive Directors at BASF SE

new things, making products better and driving innovations forward is simply an exciting thing for me!

Mr Altendorf, you’ve worked for the same company for more than 30 years as well. Where do you acquire the necessary fresh ideas?

Altendorf: What’s very important for me is external stimulus. I travel on business around the world and meet a lot of people from different cultures: customers, our own people, industry colleagues, representatives from other companies. What’s also exciting is talking with young people, such as our apprentices or university students. What’s fundamental for me is to see what’s happening outside of our industry. I deliberately take the time to learn new things and educate myself further. That helps me a lot, personally and professionally!

Questions: Martin Raab

Mover and shaker Dr Martin Brudermüller (59) has been Chairman of the Board of Executive Directors and Chief Technology Officer at BASF SE since 2018. After earning a master’s degree and doctorate in chemistry from the University of Karlsruhe, Germany, and conducting postdoctoral research at the University of California, Berkeley, he joined the chemical company in 1988. His career has taken him from positions in Ludwigshafen to Milan and Hong Kong, and from the ammonia lab to the board of directors (2006). Martin Brudermüller is described as direct, hands-on and demanding, but also as a people-oriented person. The father of grown twins and passionate hobby craftsman originally wanted to become a surgeon because he likes to work with his hands, but then he decided to study chemistry.

The chemical giant Measured in sales (59.3 billion euros in 2019), BASF is the world’s largest chemical company. The company was founded in Mannheim, Germany, in 1865; today headquarters are in Ludwigshafen. BASF has a workforce of 122,000 and operates more than 360 production facilities in more than 90 countries. Under the motto “We create chemistry for a sustainable future”, the portfolio encompasses base chemicals such as ethylene, numerous synthetics, industrial chemicals, food additives such as vitamins, cosmetic and pharmaceutical products, plant protection products and seeds. As an interesting aside, the BASF wine cellar, which is part of the gastronomy at the Ludwigshafen site, is one of the largest wine retailers in Germany.

Getting the chemistry right

Finding the right balance between safety, economy and ecology is fundamental for the chemical industry. Endress+Hauser provides support with innovative products, solutions and services that combine all industry requirements.

MEASUREMENT TECHNOLOGY

Integrated safety

Safety is crucial to the chemical industry. Plants must be fail-safe and have reliable measurement devices to monitor and control processes to prevent humans and the environment from being harmed by substance handling. Endress+Hauser offers the industry the widest range of products for **safety measurements**, which were developed with particular regard to functional safety and meet international approvals for potentially explosive atmospheres. The instruments for flow, level, temperature, pressure and liquid analysis offer further benefits in addition to their precision and robustness: They are easy to install, operate, maintain and integrate into various systems, reducing complexity and expenditure while increasing efficiency.

DIGITALIZATION

Smart data usage

Digitalization provides the chemical industry with the opportunity to make their value-added chains more efficient. Endress+Hauser's cloud-based IIoT ecosystem **Netilion** helps leverage the potential of field devices. Netilion provides a huge amount of extra data as the foundation for process optimization in addition to measured values. Over 40 million Endress+Hauser measurement devices are used across the globe, and nine out of ten devices are able to communicate digitally. They are therefore easy to connect to the IIoT via edge devices or adapters. In future, the Advanced Physical Layer will even enable high-speed two-wire ethernet in Ex-zones. The first digital services for simplified maintenance and increased plant availability are already available. Netilion Analytics, for instance, manages all the plant measurement devices and highlights the potential for improvement. Netilion Health allows operators to see the status of their field devices everywhere and at any time, enabling quick response in case of failures.

PREDICTIVE MAINTENANCE

Transparency for process trends

Many chemical industry processes are continuous and run without interruption, ideally over months or years. Endress+Hauser is integrating its **Heartbeat Technology** into new measurement devices to reduce unplanned downtime and to schedule maintenance. With this technology, devices continuously monitor themselves and report their status in plain text. Dangerous errors are therefore safely recognized, providing operators with more transparency on the status of their safety installations. SIL proof testing also allows the sensor's functionality to be verified without disassembly. Heartbeat Technology is furthermore able to detect process influences that affect measuring performance at an early stage: radar level measurement devices detect buildup on the antenna or foam on the medium, while flow measurement devices register any corrosion or abrasion in the measurement tube. Liquiline transmitters monitor analytical sensors to identify trends. New Netilion apps will calculate the ideal cleaning or servicing date, making maintenance even more efficient.

ADVANCED ANALYSIS

Real-time intelligence

The chemical industry must continue to optimize its processes in the future to even better protect the environment and resources. Advanced process analysis technology, capable of examining substances inline in a matter of seconds, provides assistance. Thanks to the precise knowledge of the compound, the process can be optimally controlled, therefore reducing the use of raw materials and energy. One of the options is Endress+Hauser's **Raman spectroscopy**. The laser-based method analyzes gases, solids and liquids in real time down to a molecular and atomic level, resulting in crucial advantages during complex chemical processes. Waste is also minimized by determining quality parameters such as polymer structures and residual monomer content during the production of synthetic rubber. The production and processing of synthetic gases to create ammonia or urea can also be monitored with Raman spectroscopy, thereby significantly increasing the output.

COOPERATION

Added-value relationship

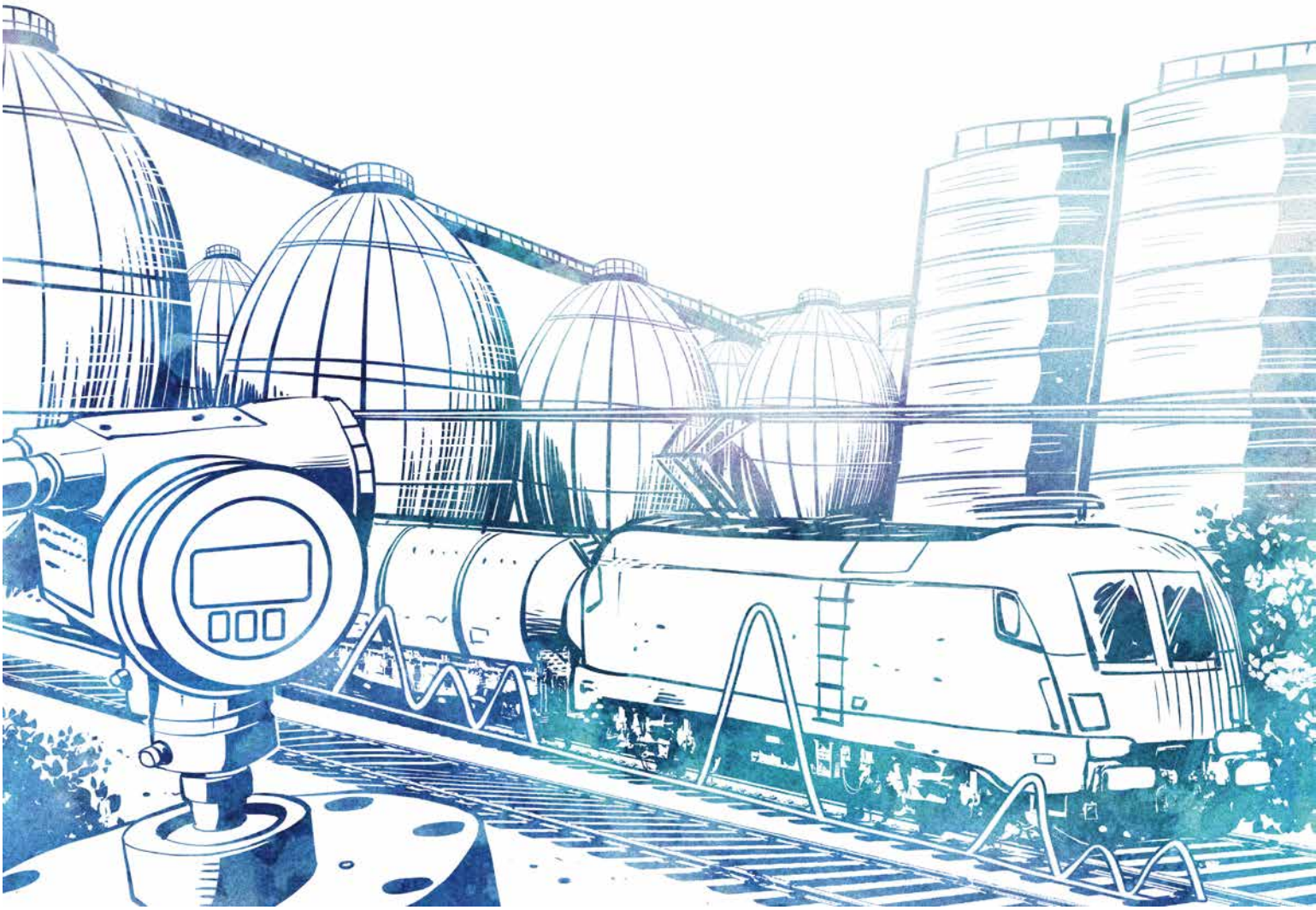
A long-term partnership connects Endress+Hauser and the chemical industry. In parallel to the industry's globalization, Endress+Hauser has become a global company with a strong network over the past 65 years. **Industry experts** in over 50 countries across the globe are familiar with the requirements and applications of the chemical industry and are skilled in areas such as functional safety or explosion protection. Numerous products have been developed in close cooperation with the industry. Endress+Hauser has the most comprehensive **two-wire portfolio** – including for Coriolis flow measurement, which is frequently used in the chemical industry. New instruments are always designed in accordance with the international standard IEC 61508 for **functional safety** – such as radar level measurement devices with 80 GHz technology. And of course there is also a version of the modern FieldXpert tablet PC that brings digital services into potentially explosive areas.

SERVICES

Single point of contact

Endress+Hauser is not just a reliable partner for designing key production processes. The company is also able to support the industry across the globe with its products, services and solutions along various parts of the value-added chain, including **inventory management, logistics, energy supply** and **water and wastewater treatment**. This pays off during large-scale investment projects in particular: As an experienced **main instrumentation vendor**, the company helps meet budgets and deadlines. State-of-the-art tools guarantee seamless data transfer throughout the entire project's engineering phase, while an Endress+Hauser engineer embedded into the on-site project team ensures that the right measurement devices are selected, configurated and commissioned. Endress+Hauser can later help optimize calibration intervals, reducing costs and increasing plant availability.

Text: Christine Böhringer
Illustration: Ralf Marczinczik



PLASTIC POLLUTION

“We need a new mindset”

Marine biologist Richard Thompson has shown how plastic contaminates the environment, but he doesn’t believe the material is necessarily bad. Rather he is calling for a more responsible approach to the way we design, use and dispose of plastic items.

I once came across a 1950s article in Time magazine describing the convenience that plastic offered a family in everyday life. At that time the world produced a mere five million tonnes of plastic annually and the price nature had to pay for this convenience was relatively small.

Today we produce approaching 400 million tonnes of plastic each year, 40 percent of which is used for packaging. It’s a short-lived convenience, and all too quickly it ends up in landfill or, worse, in the environment where it is directly harmful and can break down into microplastics. Consumers, industry, science and governments have recognized that we can no longer continue this way, and that more should have been done to avoid this problem. The calls for a plastic-free society are becoming louder.

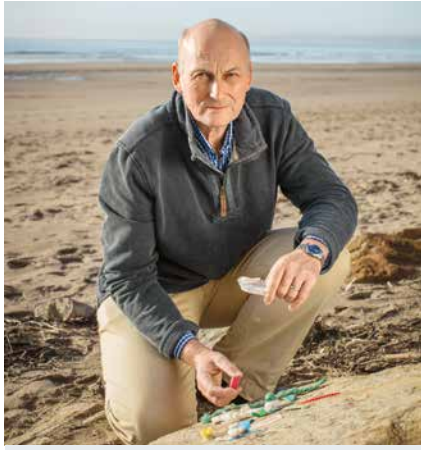
On the other hand, plastic has tremendous potential to help people. It’s not an environmental foe. It can even help to reduce our planet’s human footprint. In the end, it is all about using plastic in a responsible and efficient way. It should not end up as waste in the first place. So, while we need to reduce plastic consumption, for the benefits it brings we need to design for a more circular economy via recycling.

Thinking about the consequences

Although this requires a new way of thinking at different levels, a lot of people are not quite ready. When I ask designers if they have given any thought to what will happen with their product after it is used, the answer from many is, “No, that was not in my brief.” Then there are the pointless applications of plastic, such as the microplastics found in cosmetics. The relevant patents are some 50 years old. Didn’t anyone in the companies using microbeads ask what happens to these particles?

We cannot solve the waste problem solely with regulations, bans and taxes on products. Yes, they are part of the picture for unnecessary items like single-use shopping bags. We know, however, that people tend to circumvent regulations. The better approach is to convince them to change their behavior! What is urgently needed is closer cooperation between various fields of research, governments, consumers and industry. Only by working together can we answer questions such as, What are the current uses of plastic that should be avoided? Where does it make sense to require that a product contains a specific amount of recyclable materials? Where is plastic still the best material, and what can be done to make plastics more recyclable?

The answers lie in finding tailored solutions for each application. There is growing awareness of this issue and a real opportunity to harness that interest and focus it on more responsible design, use and disposal. Even in the short time since we proved the existence of microplastics in 2004, and the extent to which they pollute the environment, worldwide plastic production has tripled. Now is the time to finally take action – and fast!



Recognized expert Professor Dr Richard Thompson OBE (Officer of the Order of the British Empire) is Director of the Marine Institute at the University of Plymouth in England. For 20 years he has been involved in researching the impact of plastics on ocean environments and coined the term ‘microplastics’.

Invisible danger Microplastics refers to tiny particles that can be formed by the fragmentation of plastic items. Sometimes, they are intentionally added to cosmetic and hygiene products. Microplastics can be ingested by marine animals, including those we eat as seafood. Laboratory studies demonstrate that ingestion can be harmful to those organisms.

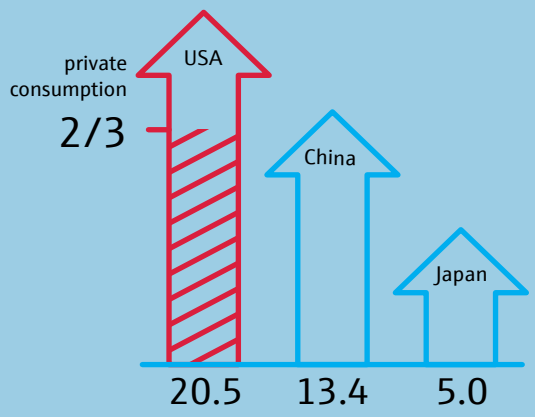
The American dream

Thanks to its economic strength, the US continues to serve as the world's benchmark – and remains a place of hope for millions of people.

Stable economic power

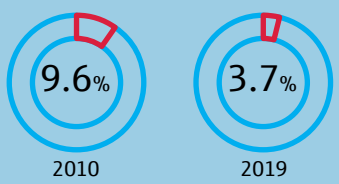
An abundance of resources, enormous labor potential and a huge domestic market define the world's largest economy. After the longest period of growth in history, the US economy began to cool off in 2019.

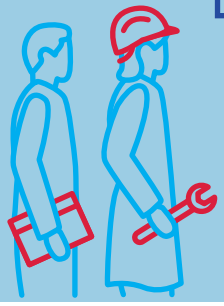
GDP in trillions of US dollars (2018)



US agricultural exports (2017)

Unemployment rate





Top lifestyle exporter

No nation has such a major influence on other societies quite like the US. Movies, music, fashion and food have been transporting the American way of life around the world for decades.

1886
Coca-Cola
is invented

1900
Jazz
emerges

1910
First Hollywood
films

1955
First
McDonald's

1997
Netflix goes
online

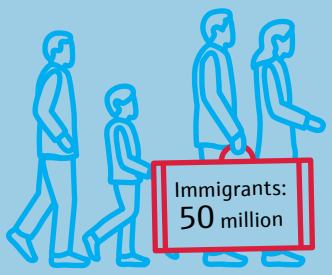
2007
First
iPhone

Powerful pull effect

Historically speaking, the US is the epitome of an immigration country with enormous multicultural diversity. To this day, the American Dream still lures millions of people in search of a better life. The US is also one of the world's most popular tourist destinations.

US population (2017)

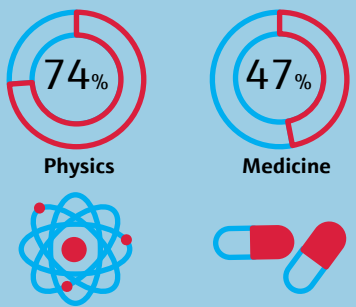
325 million



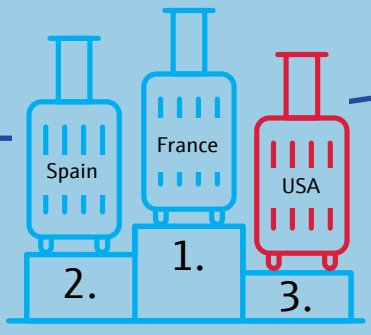
Smart minds

The country has a tremendous capacity for innovation. US researchers have made vast strides in the areas of physics, chemistry and medicine. Today there is a growing focus on future-oriented fields such as computer science and artificial intelligence (AI).

Share of Nobel Prize winners from the US



World's top tourist destinations (2017)



Share of AI patents originating from the US

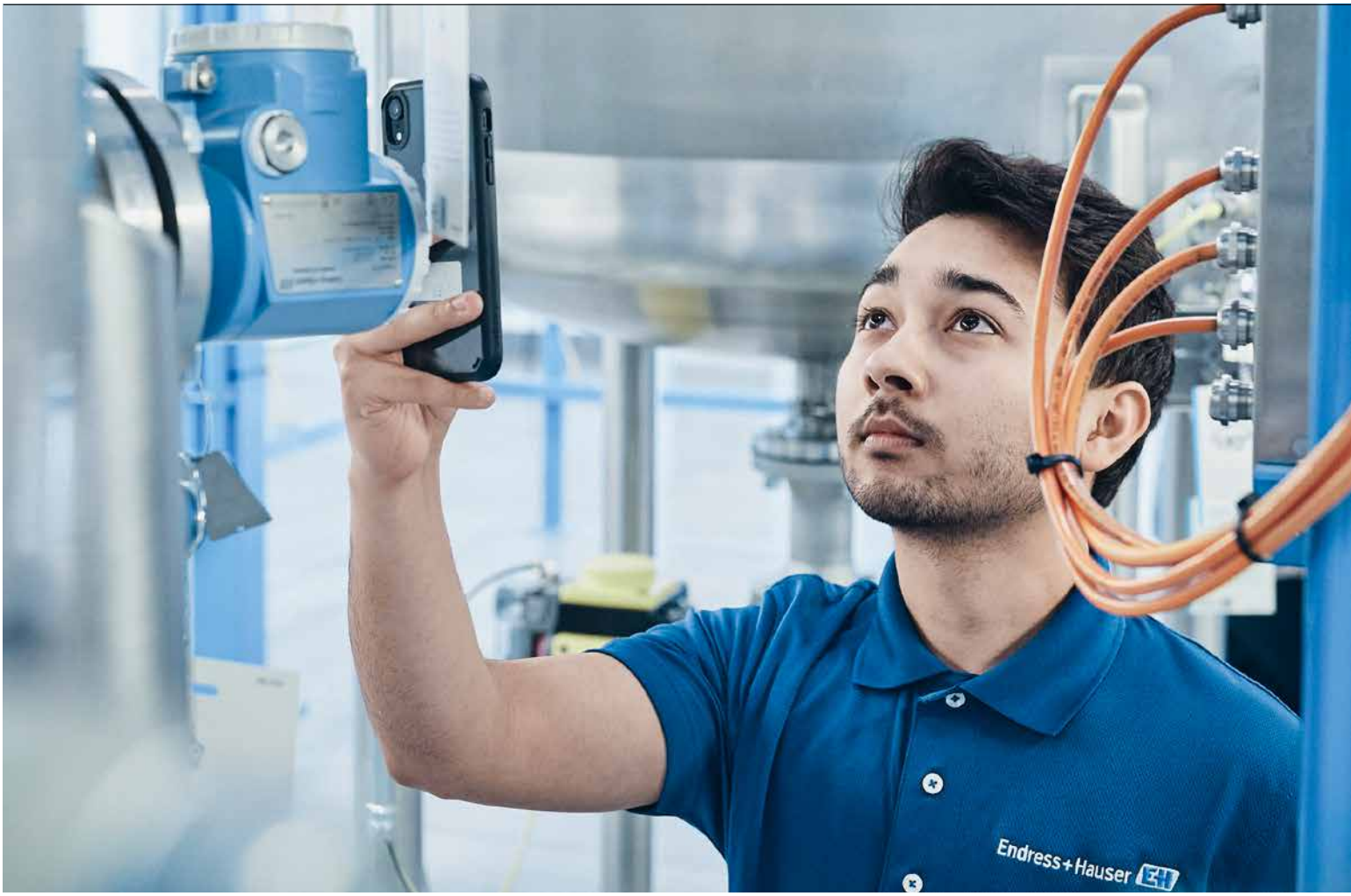
60%

Infographics: Pia Bublies · Research: Claudia Füßler


Endress+Hauser

Success made in the USA

How do you capture the market in the land of unlimited opportunities? Endress+Hauser did it with an approach that combines a European pedigree with American strength – and with a bold vision.



Knowledge transfer: Process Training Units allow customers and employees to become familiar with advanced technology.

Georg H Endress had a vision. For more than 15 years, he worked to establish his company in more and more European markets. But the company founder thought ahead. In 1970, he took a risk and branched out to other continents. The plan was to shore up the business on three strong pillars: Europe, Asia and America. Today, 50 years later, this vision is a reality, as the development in the USA impressively demonstrates.

Endress+Hauser has long since generated more than half of its sales outside of Europe. The three strongest revenue markets – China, Germany and the United States – are running neck and neck. Ultimately, however, the actual ranking is secondary. What's more important is the success that has been achieved in a market like the USA. "It was a long road to get here," reports Todd Lucey, Managing Director of Endress+Hauser USA. "And we did it with a traditional American approach built on entrepreneurship and partnership."

Independent representatives are responsible for sales and service in the USA, with a network of 15 partner companies managing process customers within the country and another 10 taking care of natural gas customers. While these representatives offer process instrumentation exclusively from Endress+Hauser, they also provide extensive support in the area of automation technology and services. This network has been streamlined over the years by merging several representatives and territories. "That strengthened our network and helped us gain more capability," says Todd Lucey. The external sales and service team is made up of more than 450 people. A clear direction is crucial for market success. "Those who represent Endress+Hauser must cultivate a similar corporate culture and operate their business in accordance with the same principles," emphasizes Todd Lucey. Just like with the Endress+Hauser Group, that means the lion's share of the profits remains within the company. "Together with our representatives, we invest in the further development of Endress+Hauser in the USA." (See interview on page 27.)

Investing in the market A new regional center for the Gulf Coast is currently being built in the Houston metropolitan area at a cost of 32 million euros. Like all of Endress+Hauser's newer buildings, it meets the highest energy efficiency standards. The Endress+Hauser regional office will move into this facility, as well as specialists for laser-based gas analysis and the lab experts from Analytik Jena, plus the local Vector Controls & Automation Group representative. A service and calibration center, as well as a Process Training Unit (PTU) will be set up under the same roof.

"These PTUs are a major asset," says Todd Lucey with confidence. Endress+Hauser and the representatives operate 10 of these systems across the entire country. Strategic alliance partner Rockwell Automation, which contributes the control technology, is always involved. The PTUs are used to provide not only customers, but also Endress+Hauser's own people, with hands-on training. The managing director underscores the importance of training both. "Our customers

Family atmosphere: The Endress+Hauser corporate culture shapes collaboration.

"We want to be the preeminent provider of measurement technology and automation solutions in the United States."

Todd Lucey, Managing Director, Endress+Hauser USA

are increasingly trying to be more resourceful and do more with less. They rely more on us to share our knowledge and expertise as well as provide innovative solutions to their challenges."

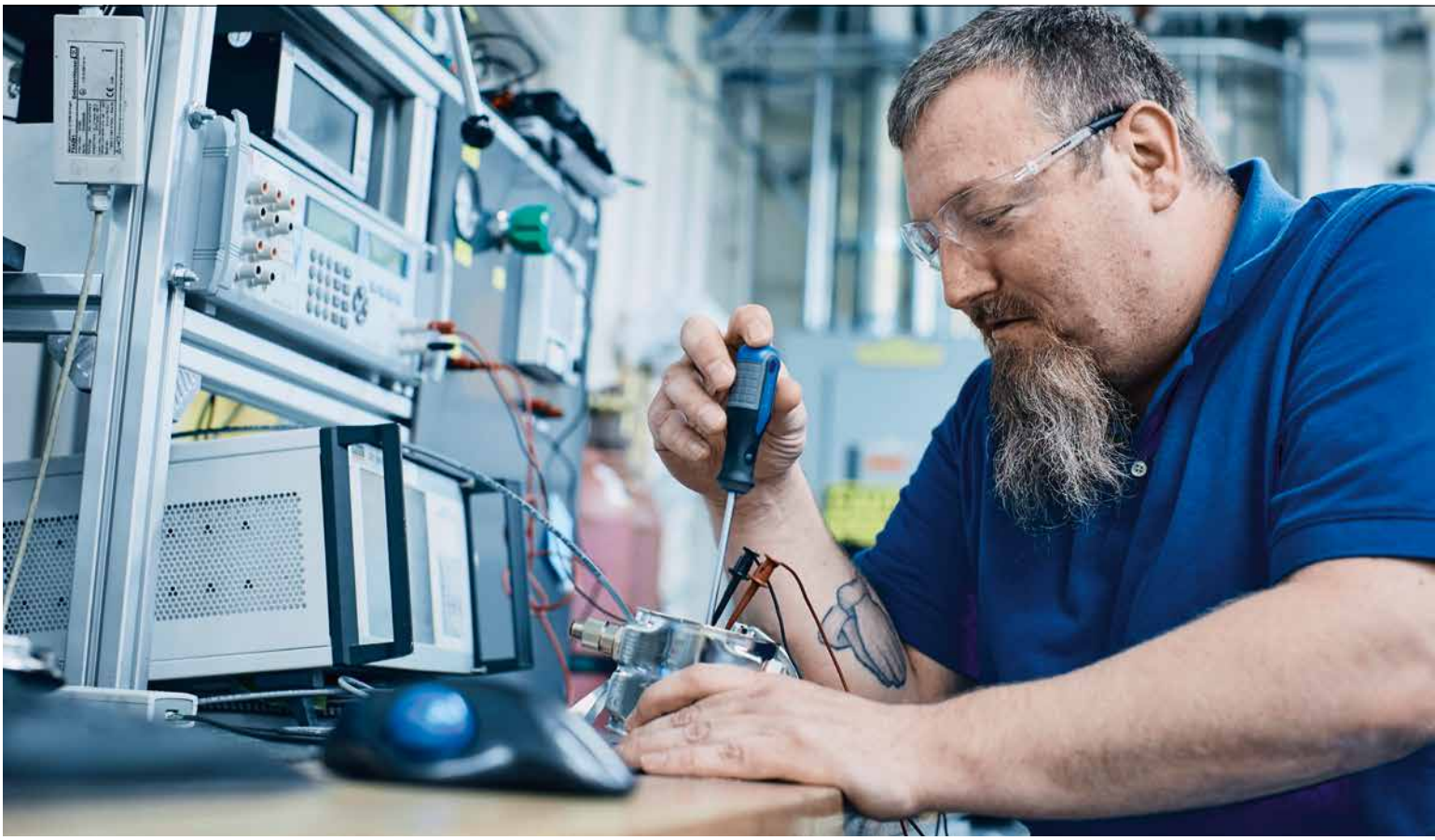
Endress+Hauser and its representatives have put in a lot of effort over the years to ensure that the cooperation runs smoothly, which is important when it comes to acting as the main instrumentation vendor. "With one of our representatives we successfully completed the largest project in the history of Endress+Hauser: 30,000 single tags, 10 percent of which were Endress+Hauser measurement instruments," reports Todd Lucey.

For Todd Lucey, one major reason for the success of Endress+Hauser in the United States is the strong manufacturing presence (see article on page 30). "The large investment in local production creates trust," says the managing director. "Once customers have toured our state-of-the-art production facilities, they are ready to purchase."

At the headquarters in Greenwood, Indiana, a genuine Endress+Hauser campus has sprouted. Todd Lucey views the proximity of the various units at the Greenwood location as a big plus, not only between sales and production, but also between the product areas. "For me, the campus is a success story in and of itself," he says. "We are well connected and we share experiences and information, utilize common resources and help each other with staffing when needed."

The borders between the individual companies and areas are transparent. That creates growth opportunities for the employees and makes the company more attractive as an employer. "It's not always easy to fill open positions," says Todd Lucey. To help attract talent, the company runs a program for engineering graduates. In collaboration with other employers, Endress+Hauser organizes career and training forums at the Greenwood site each year. In addition, an apprenticeship model has just been launched in the Unites States.

The Endress+Hauser corporate culture has special drawing power. Employee turnover is significantly lower than at other US companies. "Our culture provides stability and security for our people even when times get tough. This gives us an advantage when times get better: we don't need to ramp back up, we are already set to go," says Todd Lucey. The company managed the 2008/2009 financial crisis without mass layoffs. Todd Lucey emphasizes that "We will also withstand the Covid-19 crisis together with our customers, employees and representative partners."



Reliable partner: Customers in the United States can count on the service and support from Endress+Hauser.

As a family company, Endress+Hauser also strives to be family friendly. This helps when it comes to attracting women to the company. Endress+Hauser USA launched a program as early as 2014 in an effort to make it easier for women to join and advance within the company. Within five years, the proportion of women in management positions doubled to nearly one-third.

A vision for the future Todd Lucey has no doubt the company will remain stable and well positioned for the long term in the large US market. The country's independence from energy imports, thanks to newly developed oil and gas deposits, has allowed the industry to flourish. Many industries still offer large growth potential. The utilization of new process analysis technology, digitalization of production and demand from customers for value-added services is creating a wealth of opportunities for new business. "Our customers are solving the world's biggest challenges – and we're at their side."

Todd Lucey is thus developing a vision that appears no less bold than the one created by the company founder. "We want to be the preeminent provider of measurement technology and automation solutions in the Unites States." Generating more revenue than the market leader isn't the priority. "More important is the value our work brings to customers. First and foremost, we want to be the preeminent provider in the minds of our customers."

That's not necessarily an easy task. "Our customers have high standards and expectations. We must be ready and willing to adapt to their needs," says Todd Lucey. "We have a great team, innovative products and the right spirit." How long might it take to turn this vision into reality? "We don't have the exact answer, but we will continue to do everything in our power to make it happen for our customers." The success story of Endress+Hauser in the Unites States is far from over.

Text: Martin Raab
Photos: Christoph Fein

Entrepreneurial spirit
Todd Lucey joined Endress+Hauser in 1993 and has been head of Endress+Hauser USA since 2004. He has also headed up the North American sales region at Group level since 2016. The 57-year-old chemical engineer lives up to what he expects from others. He is considered a doer with a great deal of entrepreneurial spirit and the courage to innovate. Customers, employees and partners value his openness and accessibility. Todd Lucey is married and the father of two grown children.

“We are one team to the market”

Jared Boudreaux heads Vector Controls & Automation Group, one of Endress+Hauser’s largest representative partners in the US – making him a familiar face to the customers.

Mr Boudreaux, what makes the partnership with Endress+Hauser special to you?
How Endress+Hauser supports customers with closely aligned and linked representatives is a strong differentiator and our customers feel this. True project pursuit and main instrumentation vendor value propositions can only be successfully executed in a partnership. We act on the market as one team!

But still you work for your own company…
We wear the Endress+Hauser badge, but at the same time, we hand out a Vector business card. We have our own identity as a company. But being successful as a representative can’t be a standalone goal. We win together, and we lose together. To succeed, we must be closely aligned, understand Endress+Hauser’s goals and know how to use the resources in our network effectively. We all work hard to make sure that we are on the same page!

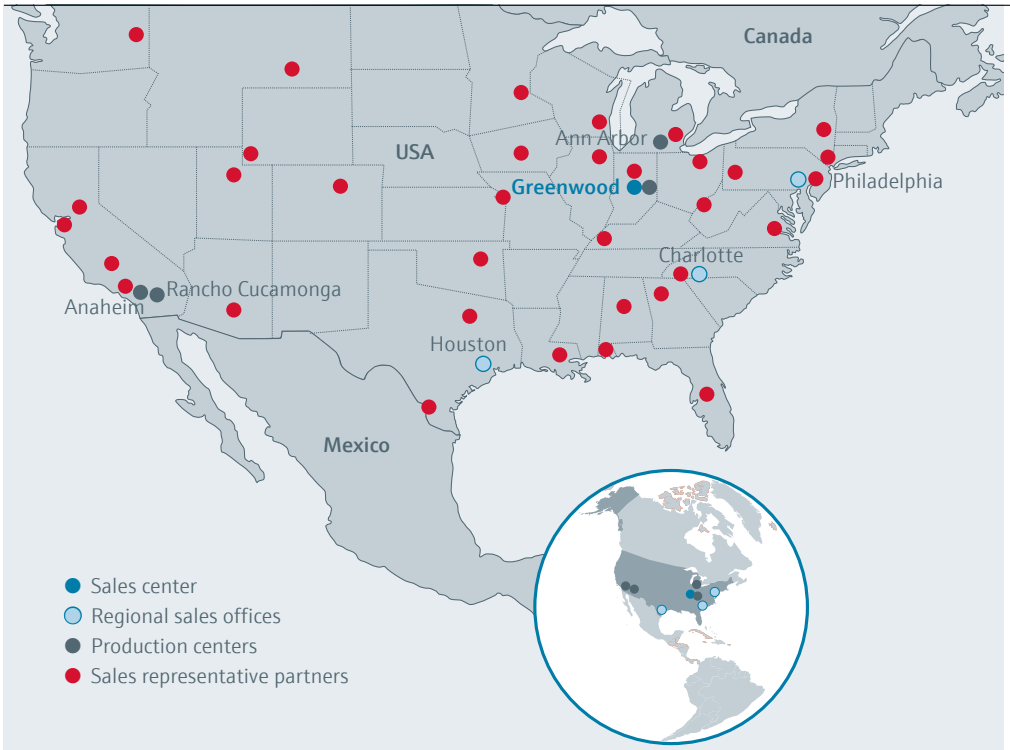
How do Vector and Endress+Hauser benefit from their partnership?
Endress+Hauser is a top-tier company for instrumentation. This makes us an attractive partner for other companies as well. On the other hand, we provide great resources to grow sales. When it comes to investments, we join forces. Both companies add people, support solutions and projects and help to create efficient processes. We challenge each other on how to be better partners for our customers.

And how do customers benefit from the partnership?
Customers are looking to reduce the number of vendors to save money and reduce risk. They want to align with select added-value partners who can solve their problems – minor and major. As a representative, we can be a total solutions provider for our customers.

How do you think the partnership will develop in future?
The only limitation is us. It’s up to us to continuously improve our collaboration. The new Gulf Coast campus is a good example for Endress+Hauser and Vector of how to bundle resources, pursue common goals and align strategies. We will have Endress+Hauser’s regional sales, the calibration and service center, gas analyzer specialists and our offices under the same roof, including a huge, state-of-the-art Process Training Unit. And who wins in the end? The customer!

Questions: Martin Raab

At home in both worlds
Jared Boudreaux (44) is President and Managing Partner of Vector Controls & Automation Group, one of the major representatives of Endress+Hauser in the USA. The company generates around two-thirds of its sales with Endress+Hauser products. It covers Texas, New Mexico, Oklahoma, Arkansas, Kansas and Missouri, and has 100 employees working at six locations. Jared Boudreaux holds a bachelor’s degree in business administration and marketing. Before founding Vector Controls & Automation Group in 2013, he worked for Endress+Hauser for 10 years in various positions, including outside sales, international strategic account management in the chemical industry and Area Vice President of the Gulf Coast region.



Will, the local barista, brings coffee culture to the employee restaurant.

Five decades of success

The history of Endress+Hauser in the United States began on the East Coast. The first location was established in Beverly, Massachusetts. Three years later, the company moved to Greenwood, Indiana, in the Midwest, which bills itself as the Crossroads of America where key traffic and transportation routes intersect. Today, Greenwood is one of the Group's largest locations. The sales center maintains its headquarters there with office facilities, a modern customer center, a service and calibration lab and a large-scale process training unit. The campus is also home to Endress+Hauser production facilities for flow, level, pressure and temperature measurement technology as well as system products. Analytical devices are manufactured in Anaheim, California; Ann Arbor, Michigan; and Rancho Cucamonga, California. 15 representatives with branches across the entire country manage sales and service; their network is supported by regional Endress+Hauser offices in Charlotte, North Carolina; Houston, Texas; and Philadelphia, Pennsylvania.

1970
Endress+Hauser USA is established.

90%
of all instruments sold in the US are manufactured in the country.

912
people were employed by Endress+Hauser in the US at the beginning of 2020.

29%
of all sales center management positions are held by women.

$82,000,000
has been invested by Endress+Hauser in the US since 2013.

An exhibition in the customer center illustrates the company's history.

Close connections: At the Greenwood site, sales and production work next to and with one another. Employees collaborate closely to ensure knowledge and experiences are shared.

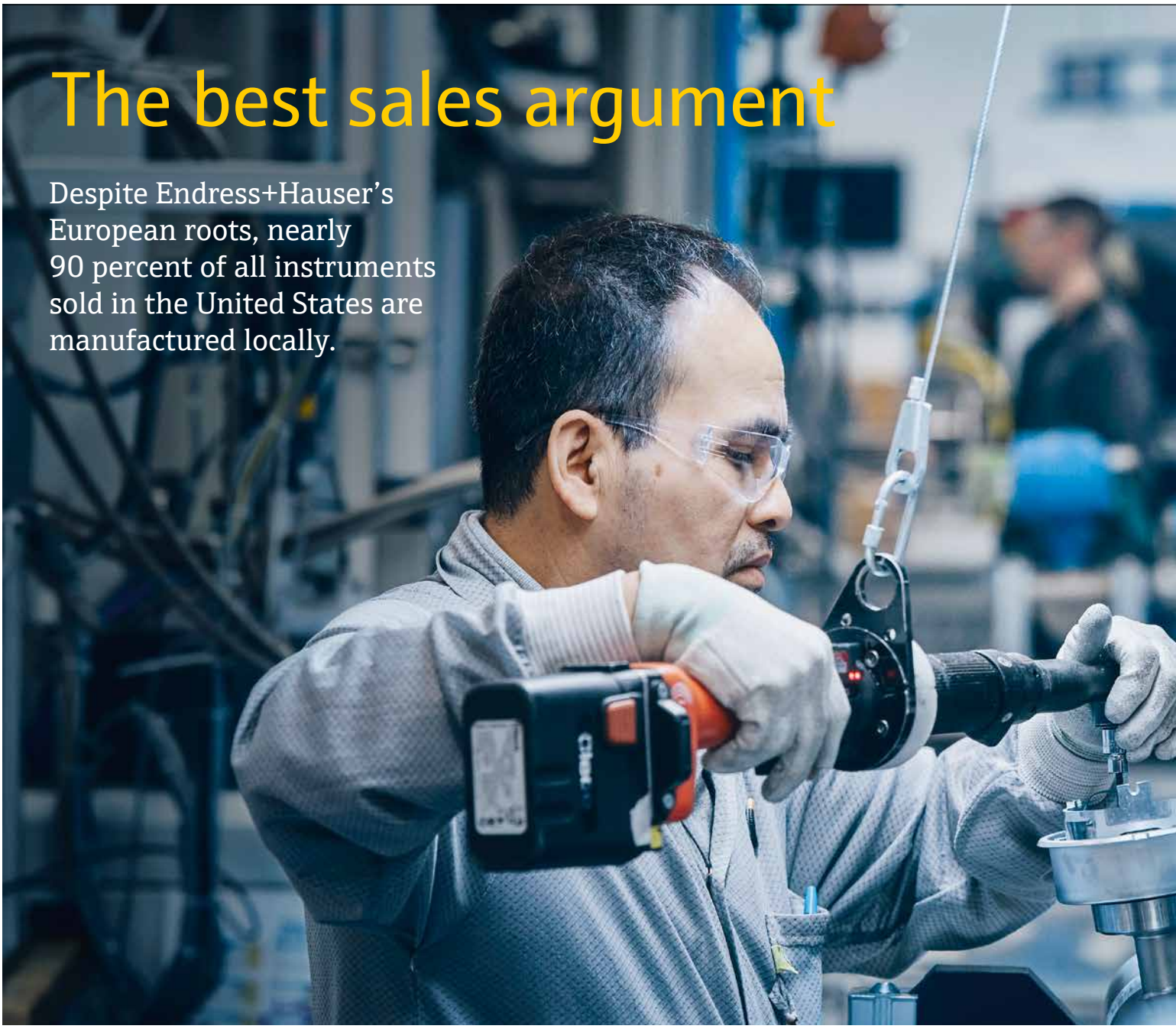
Talent wanted: Endress+Hauser offers young engineers in the USA an entry-level program. Graduates have the opportunity to become familiar with different areas of the company.

Everyone is welcome to play a chess move in the restaurant.

The Loyalty and Responsibility sculpture at the headquarters in Greenwood.

The best sales argument

Despite Endress+Hauser's European roots, nearly 90 percent of all instruments sold in the United States are manufactured locally.



Domestic production: Endress+Hauser manufactures most of the instruments sold in the US within the country.

One of the largest manufacturers of process instrumentation in the USA is a Swiss company. Endress+Hauser produces at four locations in the country. Flow, level, pressure and temperature measurement technology as well as system products are produced in Greenwood, Indiana, while analytical instruments are manufactured in Anaheim, California; Ann Arbor, Michigan; and Rancho Cucamonga, California. The various production facilities employ almost 600 people. The plants primarily supply the North American market, while South American customers are for the most part served from Brazil.

"Local manufacturing is one of the strongest sales arguments in our market," says Stefan Grotzer, head of flowmeter manufacturing. After all, wherever Endress+Hauser produces in the world, the same products are manufactured with the same quality. Over the years, the level of in-house production in the US has been continuously expanded and the number of product families constantly increased. "All of our customers are impressed at how clean, well-kept and bright it is at our production centers," says Jason Baker, who is responsible for level and pressure device production. "That influences work attitude, increases safety and improves the quality of our products."

Market knowledge drives new products

Regional production makes it possible to quickly and flexibly incorporate the customers' wishes. "Our global production network is extremely agile. We can react very quickly," emphasizes Patrick McGlothlen, head of temperature instruments and system products manufacturing. The proximity to sales and customers helps to understand the needs of the North American market. This knowledge has been flowing into the development of new products for several years now. Various teams in the US are working on new flow, level and pressure measurement engineering. And in the field of analytical

Product variety: The level of in-house production is constantly expanding.

Expertise: When it comes to flow calibration, Endress+Hauser offers the highest precision.

technology, a wealth of R&D expertise has been gathered in the country for years.

Specialists in California are working on sensors for liquid analysis, as well as laser spectroscopy analyzers for gases. In Michigan, Endress+Hauser is manufacturing Raman analyzers that examine liquids, gases and solids with laser technology as well. “These highly sophisticated analytical methods boast huge potential,” says John Schnake, who heads up this area within the Endress+Hauser Group. “We’re currently building global sales and support structures to drive this business forward” – a development that will also boost production in the United States.

Text: Martin Raab
Photos: Christoph Fein

Market experience: Specialists are developing new measurement instruments in the United States.

A clean operation

Within just two years, chemical company Chemours built a new plant for climate-friendly refrigerants in Texas – from initial planning to commissioning. Close collaboration ensured the project ran quickly and smoothly.

Ready at the push of a button: Patrick White led the Endress+Hauser project team.

The roads to Ingleside are bounded on either side by cotton fields as far as the eye can see. It can be oppressively hot in southern Texas. Between May and September, average temperatures soar above 30 degrees Celsius (86 degrees Fahrenheit). And then the humid air from the Gulf of Mexico sweeps in. It may just be a coincidence that chemical company Chemours produces refrigerants in this region, just a stone's throw from the port city Corpus Christi, but anyone who travels around in a car here will certainly value the comfort of an air conditioning system.

But refrigerants used widely for many years needed to be improved relative to their environmental footprint. A new refrigerant marketed by Chemours under the trade name Opteon boasts significantly lower global warming and ozone depletion potential than legacy refrigerants. With the new plant in Ingleside, the company tripled its production capacity in one fell swoop, putting it in a position to address the growing demand from manufacturers around the world who are striving to make vehicle, residential and commercial air conditioning systems more eco-friendly.

Market pressure Opteon is a key product for Chemours, one that serves as a main pillar of the company's sustainability strategy. "We knew that if we produced HFO-1234yf, we would sell it," explains Robert K Endres while sitting in his office on the grounds of the plant. The electrical engineer was one of the first members of the project team, responsible for power distribution, process control, safety systems and process instrumentation. But hardly anyone knows him under this name. Instead, everyone calls him by his first-name initials, which is why his business card is adorned with Arkey.

Chemours invested 300 million US dollars in the new production facility. Rapid construction of the plant was a top priority. There was little more than two years between the decision to build the plant and its commissioning. "In our world, that's really fast," emphasizes Arkey Endres. As with every project, his job was to keep an eye on time, quality and costs. "However, our main focus in this project was clearly on the timeline and the quality issues."

Arkey Endres incorporated process engineering requirements into the early stages of the project. As if it wasn't enough to build a world-scale plant within an unusually short period of time, Chemours is producing the compound in Ingleside for the first time using a modified process. The chemical reactions are complex, and the process contains moving parts, all of which places high demands on the materials and technologies. The company had also made a long-term investment. As Arkey Endres puts it, "The plant is supposed to run for 50 years, not just five." For that reason, Chemours opted for the higher-performance technology, the higher-quality material. "But we wanted added value for our money."

Experienced newcomer Chemours is a US chemical company that was spun off from DuPont in 2015, meaning the young company can build on 200 years of history and experience. The portfolio encompasses fluoroproducts (including climate-friendly refrigerants), titanium dioxide technologies (coatings, plastics, laminates and paper) and chemical solutions (e.g. for mining applications). With customers in 120 countries, Chemours generated revenues of 5.5 billion US dollars in 2019. The company employs some 7,000 people at 58 locations worldwide.

Close support The added value that was offered was a critical factor in the decision to award the instrumentation contract to Endress+Hauser. "We suggested embedding one of our engineers at an early stage," explains Patrick White, who led Endress+Hauser's project acquisition and execution team. As Strategic Account Manager, for years he was the point of contact for DuPont, and then later for Chemours. He currently serves as the Group's Head of Strategic Account Management for the Chemical Industry.

Embedded engineers have long been common practice in many sections of a new production plant – "but not when measurement technology is involved," as Patrick White points out. "That's why we need our customers' trust." But a long and solid working relationship helps, which was the case with Chemours. "Endress+Hauser has been on our supplier list for more than 10 years," says Arkey Endres. "That's quite an achievement, because it never just happens by itself. Our suppliers have to work for that time and again."

High-tech and know-how The new Chemours Opteon production facility contains more than 2,000 Endress+Hauser devices. Apart from instruments for measuring flow, level, pressure and temperature, Endress+Hauser also supplied the liquid analysis technology, which had been mainly provided by a competitor in the past. "Since we're talking about critical measurements here, Chemours was persuaded by our digital Memosens technology," says Howard Siew, Chemical Industry Manager, Endress+Hauser USA.

"Without the support of Endress+ Hauser, operation of the new plant would have been delayed."

Arkey Endres, Manufacturing Technology Fellow at Chemours

Endress+Hauser has gained experience with embedded engineers through a wide range of large-scale projects. "Embedded engineers bring their instrumentation skills and knowledge into the important planning phases and they maintain contact with the core of the project team," explains Howard Siew of the concept. In the case of the new Opteon plant, the Endress+Hauser engineer worked at an engineering, procurement and construction company on the US East Coast. He identified the right measurement technology for each task, provided recommendations based on experience with similar applications and configured the instruments accordingly.

Smooth teamwork Apart from the expertise, Arkey Endres was also impressed by Endress+Hauser's presence. "Right at the beginning, I said: I know you have other customers. But in this project, you have to act as if you only have us." Project managers oversaw every phase and coordinated the work of all parties involved on the East Coast and in the Gulf Coast region, including the representatives Vector Controls and Automation Group and Eastern Controls. "The customer," says Patrick White, "didn't realize that so many people and teams were involved."

"The excellent and close collaboration took a lot of pressure off us," emphasizes Arkey Endres. "And that during a time in which other things demanded our attention." Because a supplier unexpectedly dropped out, the production of a primary product was integrated into the plant at short notice. "All at once, the project volume increased by 20 percent," says the Chemours engineer. Endress+Hauser also provided the instrumentation and support.

Valuable support The overall package included the inspection of all instruments at Endress+Hauser's facilities in Greenwood, Indiana. Every single device was checked to ensure that it met specifications, functioned correctly and was properly configured. "This step saved us an enormous amount of time during commissioning," says Arkey Endres with conviction. Service technicians helped with the commissioning of the instruments and the system integration. In addition, Chemours' plant personnel were trained by Endress+Hauser in a Process Training Unit (PTU) located in Houston, which offered the same communication protocol installed at Ingleside.

Arkey Endres is sure of one thing: "Without the comprehensive support of Endress+Hauser – the embedded engineer, the inspection of the instruments, the training program – operation of the new plant would probably have been delayed. All of this support was extremely valuable to us. Even if I can't put the benefits into numbers – if I had to do another project like this, my recommendation would be: get an embedded engineer to work with us!"

Text: Martin Raab
Photos: Tom Callins

Mission accomplished: Arkey Endres and his team completed the project on time.

Under control: 2,000 installed Endress+Hauser instruments support Chemours' operation.

Technology and expertise: Howard Siew knows the needs of the chemical industry.

Established site: Chemours has been manufacturing in Ingleside, Texas, since 1971.

Eco-friendly solution Under the trade name Opteon, Chemours markets refrigerants for use in automotive air conditioning, as well as refrigerant blends used in a wide range of applications. Opteon YF (HFO-1234yf or – chemically precise – 2,3,3,3-Tetrafluoropropene) is a compound from the hydrofluoroolefins class of substances. In contrast to chlorinated hydrocarbons, Opteon does not harm the ozone layer. The global warming potential is roughly equivalent to that of carbon dioxide, 99.9 percent lower than the conventional refrigerant it replaces.

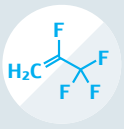
MR

Willis Haviland Carrier (1876–1950) is considered the inventor of modern air conditioning systems

In 1938, US manufacturer Nash introduced the world's first automotive air conditioning to the market

Today, there are 3.6 billion cooling devices and systems in operation around the world, a number expected to rise to 14 billion by 2050

The global warming potential (GWP) of typical legacy hydrofluorocarbons refrigerants is 1,500 to 4,000 times higher than that of CO_2



The GWP of 2,3,3,3-Tetrafluoropropene is below 1

Quantum leap

Relying on its engineering expertise, Endress+Hauser helps plant operators take exactly the right steps into the future, making processes simpler – and safer.

Crystal clear: Wastewater treatment operators must adhere to strict phosphorus limits.

Lab-quality online measurements

The Mountain View Wastewater Treatment Facility in the township of Wayne, New Jersey treats roughly 51,000 cubic meters of wastewater daily. As the operator of the facility, in 2017 the township was facing tighter limits on the total phosphorus content in the treated wastewater. During the warmer months, the township is required to keep the total phosphorus discharge at 0.76 milligrams per liter or lower. The goal is to prevent algae from growing excessively in the downstream waters.

The new regulations had a significant impact on the plant's processes: previously, the phosphorus had been removed from the wastewater biologically, and now it had to be eliminated chemically. In order to ensure optimal flocculent dosing and avoid excessive costs, the responsible managers wanted to eventually determine the total phosphorus content with an online analyzer. After conducting several tests, they decided on the Liquiline CA80TP total phosphorus analyzer from Endress+Hauser.

The analyzer made an impression thanks to its precise and reliable measurements. An innovative Y-strainer enables representative and homogenous samples to be analyzed without taking excessively large solids directly out of a bypass line. To determine the total phosphorus content, the analyzer uses a standard colorimetric method that provides measurements comparable to the lab.

"If the phosphorus content begins to rise, we can detect this trend almost in real time since the samples are taken nearly every 45 minutes," says Howard Breder, the township's lab manager. The dosing of the flocculent can then be adapted accordingly. The plant managers are also planning to set up

remote access to the analyzer via an integrated web server, thus taking advantage of the opportunity to carry out advanced diagnostics and create comprehensive process documentation.

Texts: Christine Böhringer

Pure enjoyment: Accurate temperature measurements are important when it comes to brewing beer.

Streamlined calibrations

Temperature is the most frequently measured process parameter in the food & beverage industry. That is certainly the case at New Belgium Brewing, an American company that has been brewing craft beer for around 30 years in traditional Belgian beer styles. There are around 100 RTD thermometers installed at the company's site in Asheville, North Carolina alone.

In the past the brewery had relied on portable micro-baths, and other methods, to calibrate the thermometers. The micro-bath single-point calibrations involve the use of hot oil and a reference thermometer, which takes on average 45 minutes per sensor to complete. This prompted the brewery to look for a more efficient solution, which it found in the iTHERM TrustSens, the world's first self-calibrating thermometer from Endress+Hauser.

TrustSens is typically used for inline calibration in systems that rely on regular steam sterilization. The self-calibration process is triggered when the temperature rises above 118 degrees Celsius. But since the brewery does not utilize steam, Kyle Boughner, lead instrumentation specialist, chose another path. He removes the TrustSens probe from the thermowell and places it inside a ceramic block heater, which is then heated. This calibration step takes only 15 minutes.

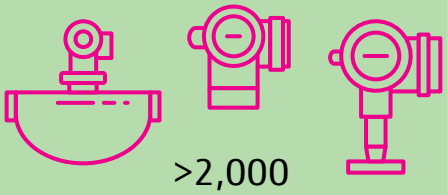
"TrustSens has the capability to turn a very tedious task into an easy process," says Boughner. He then adds: "We're not only happy with the ease of calibrations but also with the accuracy and response times we're seeing from this thermometer."

On-time customer delivery

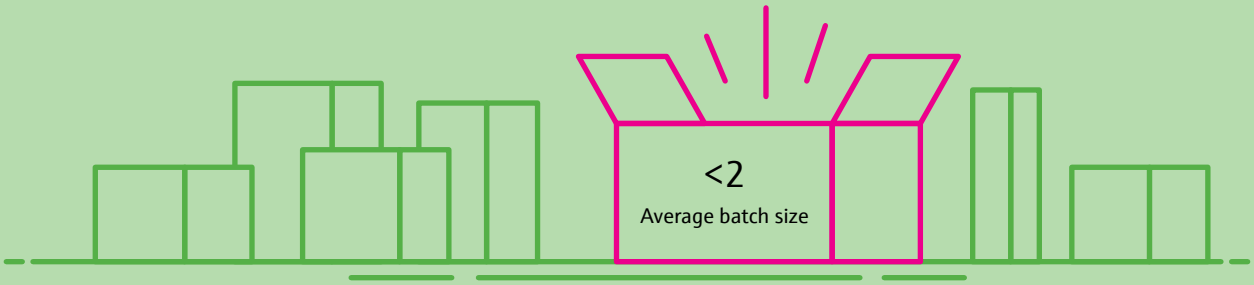
Endress+Hauser ships 2.5 million sensors and systems each year. A tight-knit order and supply chain ensures fast and reliable delivery of the products to customers around the globe.

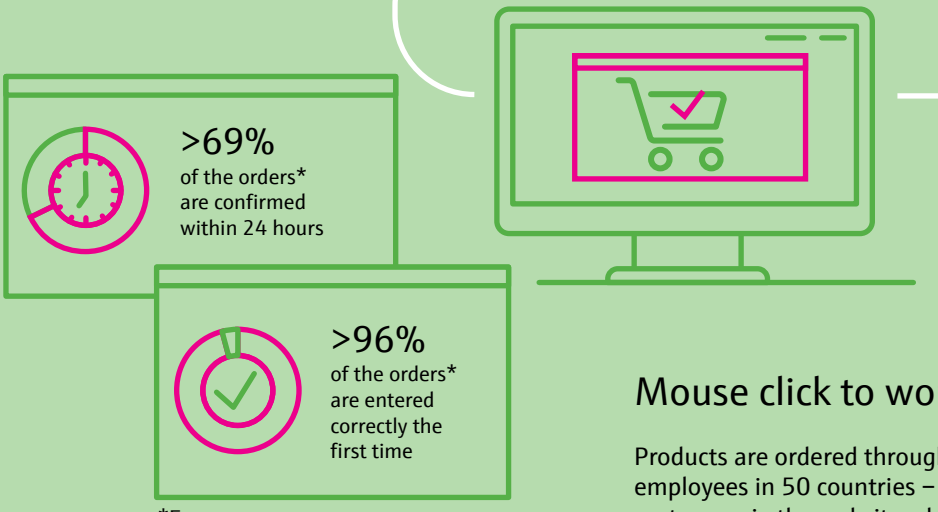
Products made to measure

Endress+Hauser instruments are made to order in 12 countries. The vast number of variants means that nearly every instrument is unique. Only specific standard products are held in stock.



>2,000
products in billions of variants





*Europe

Mouse click to workbench

Products are ordered through Endress+Hauser employees in 50 countries – or directly by the customer via the website where they can be individually configured. Standard processes ensure fast and flawless quotation generation and order processing.

Logistics hub

When a product is ready for shipment, in Europe and North America the Endress+Hauser Global Transportation Network takes over, transporting the products to a logistics hub, and from there to the customer. Intelligent algorithms guarantee a high level of delivery reliability. Similar regional concepts are being planned for China, India and Brazil.

Shipping methods from Europe (2019)

4,242 tonnes
by air

582 tonnes
by water

6,029 tonnes
by ground

...to 75 countries around the world

Full transparency

Customers know the status of their orders at all times. All orders can be viewed through their personal account on the website – regardless of how they were submitted. Customers can track each step in real time, from quotation generation and order confirmation, to delivery status and documentation download.

93.8%
of all orders* were delivered on time in 2019

Value*
>1.1 billion euros

European shipments in 2019:
598,246 packages

58,460 pallets

14,748 wooden boxes

70%
of the instruments reach customers within 6 to 8 working days*

*Europe

Delivery quality*

0.027%
lost

0.024%
incorrect delivery

0.013%
damaged

Infographics: Pia Bublies
Research: Christine Böhringer

A true digital native

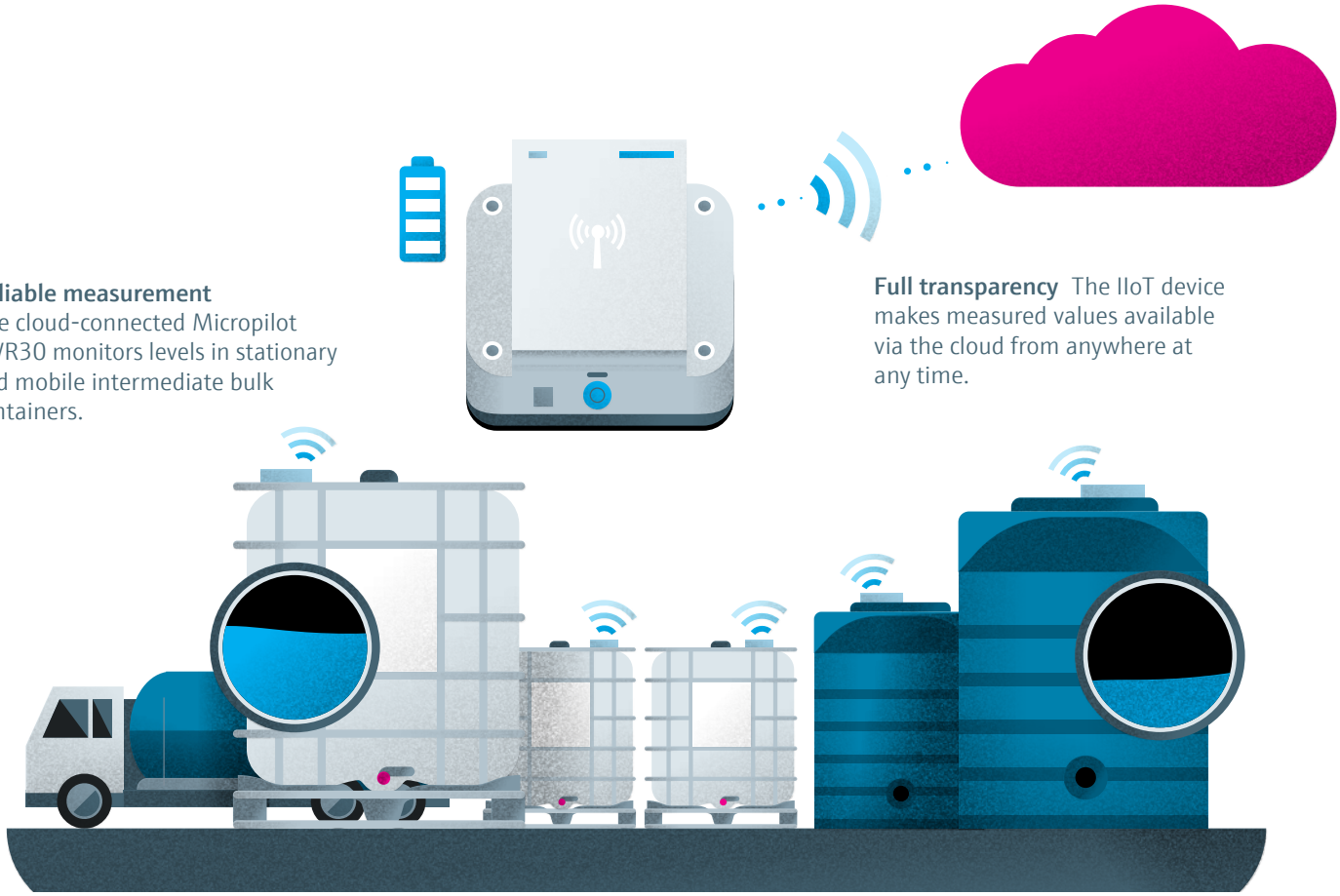
The Industrial Internet of Things makes it possible: The Micropilot FWR30 is the world's first cloud-connected 80 gigahertz radar level sensor that measures and monitors both stationary and mobile intermediate bulk containers.

Intermediate bulk containers (IBCs) are used in every industry, where they are filled with coolants, liquid foods, chemicals, pharmaceuticals and much more. One of the major advantages is that they can be used in a flexible way, which also presents a disadvantage, however, as classic inventory monitoring solutions are often too complex for mobile tanks that are frequently spread over a wide area. Empty tanks that need replenishing often go unnoticed until it is too late: when the container is empty.

To prevent unpleasant surprises, Endress+Hauser now offers a new solution for remote level monitoring for mobile tanks. At the heart of the solution lies a precise, cloud-connected measurement device that was developed for exactly this type of application. The Micropilot FWR30 is the world's first wireless 80 gigahertz radar level sensor that communicates exclusively via the IIoT. The battery-powered device requires neither data nor electrical cables and instead transmits its measured values to the Netilion Cloud using a battery-powered mobile connection. "The IIoT sensor delivers facts, whereas customers relied on assumptions for their applications up until now," explains Janina Meng, Product Manager at Endress+Hauser.

Easy to use The cost-effective and compact device is installed and operational in just a few steps. The sensor can also be attached using the bracket provided so the IBCs can still be stacked. It is quickly and easily set up via an app. Users don't have to do anything until the solution signals that the tank needs refilling. The inbuilt lithium battery does not require constant replacement and has a battery life of up to ten years depending on the preset measurement interval.

Customers can make a flexible choice from a broad range of digital products to meet the requirements of their application. The Netilion Value starter pack provides an overview of current measured values, historical data and device status. Based on this, Netilion Inventory additionally



Reliable measurement
The cloud-connected Micropilot FWR30 monitors levels in stationary and mobile intermediate bulk containers.

Full transparency The IIoT device makes measured values available via the cloud from anywhere at any time.

allows for simple and clear management of inventories, while SupplyCare Hosting offers an all-encompassing inventory management solution with a diverse range of functions. The digital services can be accessed via smartphone and tablet in addition to desktop PCs, while the data transmission fulfills the highest safety and data protection requirements.

Texts: Reinhard Huschke
Illustrations: Pia Bublies

Simple overview Digital services offer tailored and flexible customer support.

Effective management
Easy access to inventory information helps optimize the supply chain.

Flexible labs, flexible processes

Different measurement technologies in laboratory and process can lead to deviations in liquid analysis. A new multiparameter handheld by Endress+Hauser is bridging the gap between these two fields: The Liquiline CML18 is an all-rounder for measured value monitoring. The pocket-sized transmitter uses Memosens sensors and can reliably determine pH, ORP, conductivity and dissolved oxygen in addition to temperature. The device immediately recognizes which sensor has been connected and automatically loads any stored sensor data while displaying the correct measured value. This allows users to apply the same sensors used at set measurement points in processes for sample analysis in laboratories.

A finger on the pulse of measurement

Endress+Hauser is rolling out its Heartbeat Technology to a growing number of measuring principles and devices. The latest newcomers include the Liquiphant FTL51 point level switch for liquids as well as the Prosonic Flow G for gas flow measurement. New Cerabar and Deltabar device families for pressure and differential pressure measurement will soon be launched and will also feature the technology. Devices with Heartbeat functions offer major advantages when it comes to applications relevant to safety: They continuously monitor themselves, can be verified at the touch of a button without removing the device and recognize influences that negatively affect their measuring performance. This makes processes safer, increases system availability and enables predictive maintenance.

Still in tune with the times

The Liquiphant revolutionized level measurement. The latest generation of the point level switch is now on the market and, according to product managers Martin Pfändler and Artur Jede, it sets new benchmarks in the digital era.

Mr Pfändler, you codeveloped the Liquiphant in the early 80s. Did you ever believe it would become an industry classic?
Pfändler: Not really. We conservatively estimated we would sell 500 in the first year, but then demand for the instrument exploded right after the trade fair introduction. We ended up producing 5,000 units. Today, it's more than 300,000 a year.

What was the development phase like? Georg H Endress had a clear vision…
Pfändler: The company founder wanted a 100 percent metal, permanently waterproof sensor with a rod that could detect if a liquid was present in a tank. When we realized that the single-rod solution couldn't deliver the required physical performance, we pursued a double-rod approach in the form of a tuning fork. This led us to create and patent the vibronic measurement principle, which uses piezoelectricity to oscillate the fork. When submerged in liquid, the frequency changes and this change is converted into a switching signal.

To what do you attribute the success?
Pfändler: Before Liquiphant was introduced, users lacked a way to safely and reliably detect liquid levels. Back then the industry primarily used float switches, which are extremely susceptible to incrustation caused by the build-up of deposits. The maintenance effort was accordingly extensive.
Jede: Unlike conductive and capacitive sensors, with Liquiphant the measurement results are not influenced by the physical properties of the media. Even foam and build-up do not interfere with the measurements. That means it can be universally deployed in all types of liquids and essentially solves any application scenario without adjustment.

How do you go about finding ways to further improve such a top seller?
Pfändler: We spend a lot of time on-site with users and closely share information with them. The only way to find out what they really need is to have an understanding of their processes.
Jede: Liquiphant has been optimized several times in the past. The fork was shortened, for instance, which allows it be used in narrow pipes. Digitalization now offers completely different opportunities to enhance the tried-and-tested product with new innovations.

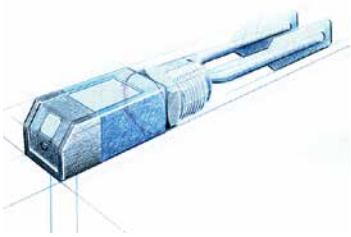
Two for one Martin Pfändler (63) has worked at Endress+Hauser since 1981. The trained electronics specialist and technician, who codeveloped the Liquiphant, has served as the responsible product manager since 2006. He has been supported by Artur Jede (29) since January 2019. After an electronics apprenticeship at Endress+Hauser, which was followed by a degree in electronics engineering and computer science, he initially worked in the technical support team.

What characterizes the latest generation?
Jede: The new instruments are equipped to support the requirements of digitalization. To date, we have lacked a way to acquire other information about the sensor and the process beyond the state of operation. With completely new electronics and integrated software, we can use Heartbeat Technology to monitor, process and utilize all relevant sensor information, such as the oscillation frequency or the temperature of the electronics.

What concrete benefits does the new Liquiphant offer?
Pfändler: It offers additional safety because it constantly monitors itself in the background thanks to Heartbeat Technology. It also displays its status in real time with an LED module that is visible from a distance, or in the SmartBlue app via Bluetooth technology.
Jede: Heartbeat monitoring also detects changes such as the onset of tuning fork corrosion. By analyzing this information, operators can calculate the optimal timeframe for maintenance and service and increase the availability of the plant.
Pfändler: Additionally, the functional safety metrics have been significantly improved and are now unique in the market! Since Liquiphant was developed in line with IEC 61508, it can be used directly in SIL applications without further certification.

Will Liquiphant still have the same significance in 20 years as it has today?
Jede, Pfändler: *(simultaneously)* Absolutely!
Jede: The overall package of this instrument is just right, and it precisely meets the customers' requirements. Liquiphant simplifies their lives and helps them increase productivity and optimize processes.

Questions: Christine Böhringer
Photo: Christoph Fein



Liquiwhat? A contest was initiated by Georg H Endress to find a name for the new vibronic point level switch. Liquiphant recalls the image of an elephant with its tusks dipped into the water (liquid).

Top seller Six million Liquiphant instruments have been installed around the world for point level detection, leakage detection and overfill prevention applications. The name has become synonymous with vibronic point level switches.

The road to energy transition

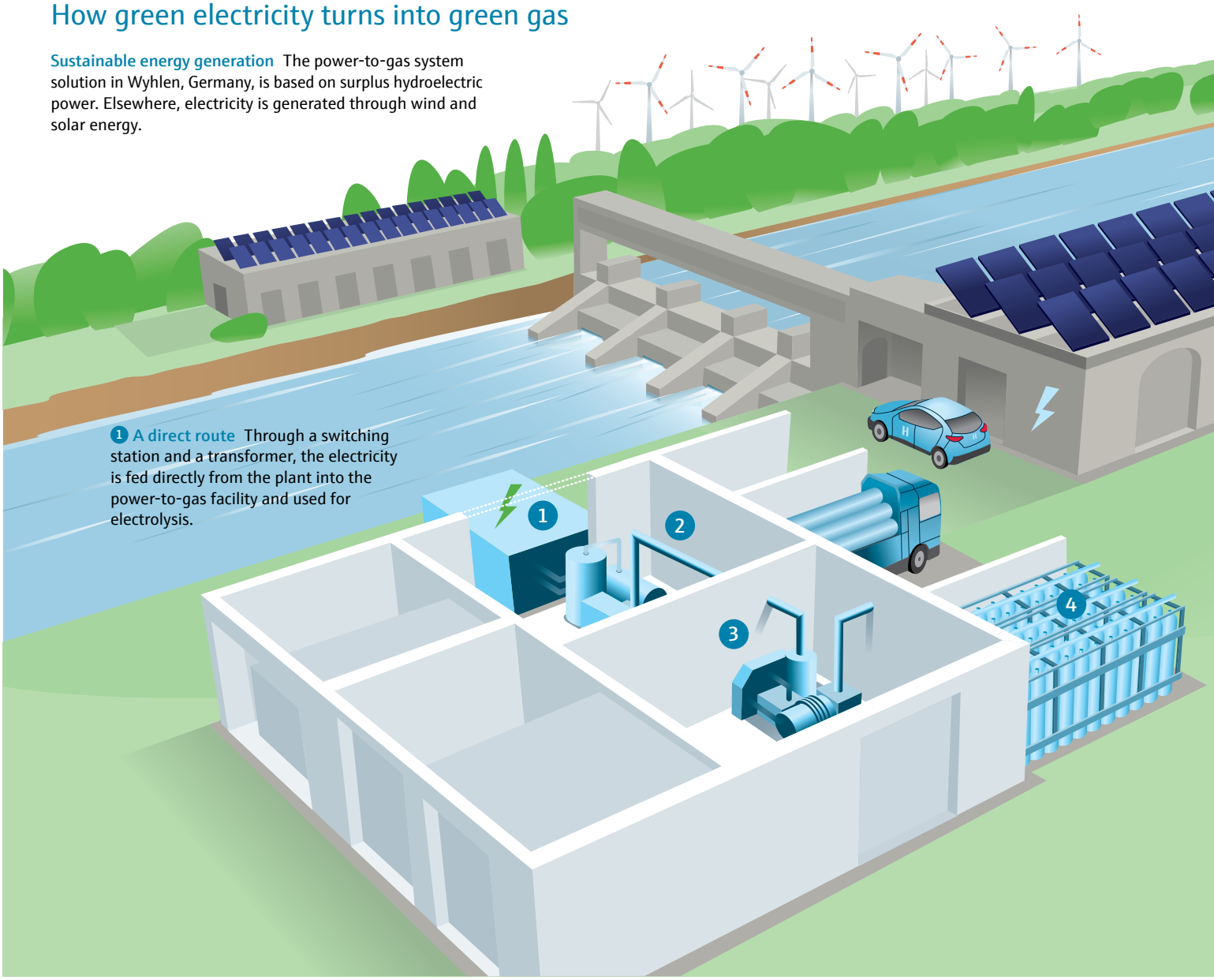
Power-to-gas plants use surplus green electricity to produce hydrogen, allowing large quantities of renewable energy to be stored and further utilized.

"I don't like it when energy is wasted," Stefan Ficht says. The electrical engineer manages production development for the Energiedienst Group, which supplies green hydropower energy to over 270,000 customers in Germany and Switzerland. In times of increased power generation through renewable energy, it can happen that more energy is produced than is currently needed, leading to an imbalance between supply and demand. Hydropower plants must then reduce their production by allowing water to flow that is partially unused. "We therefore came up with the idea to do something else with this electricity and store the surplus renewable energy," Stefan Ficht says.

This is made possible by a power-to-gas plant. It is one of Germany's 35 plants and has been operating on the site of the run-of-the-river power plant in Wyhlen am Rhein since December 2019. Green electricity is used for electrolysis in the plant, in other words to split water into oxygen and the energy carrier hydrogen. Endress+Hauser not only supplied measurement devices for the electrolyzer but also for all of the upstream and downstream processes in addition to an

How green electricity turns into green gas

Sustainable energy generation The power-to-gas system solution in Wyhlen, Germany, is based on surplus hydroelectric power. Elsewhere, electricity is generated through wind and solar energy.



1 A direct route Through a switching station and a transformer, the electricity is fed directly from the plant into the power-to-gas facility and used for electrolysis.

attached research electrolyzer. “It is important to us that everything works,” Stefan Ficht says. “I know from my own experience that Endress+Hauser pays for itself – I have been building process plants in the energy sector for 25 years.”

The facility, which produces approximately 200 cubic meters of hydrogen per hour with an output of one megawatt, is considered to be a flagship project in energy transition in southern Germany. To begin with, the gas is being used by a nearby chemical company. It replaces hydrogen from fossil fuels in their production process. “The aim is to run fuel cell vehicles with it in future,” says Energiedienst Project Engineer Dagmar Kaiser. The process can also be linked to other industry sectors: When combined with carbon dioxide, hydrogen creates synthetic fuels for conventional combustion engines or methane that can be fed directly into the natural gas grid.

Texts: Christine Böhringer
Illustration: Ulrich Birtel

2 **Electrolytic splitting** During alkaline electrolysis, purified water (H_2O) is split into oxygen (O) and high-purity hydrogen (H_2) with the help of electricity.

3 **Effective compression** The hydrogen is then compressed, increasing the pressure from 30 to approximately 300 bar, allowing the gas to be transported more efficiently.

4 **Many opportunities** The hydrogen can now be used for mobility, heating or industrial processes. It is stored in tanks until it is collected by truck.

Development at full speed

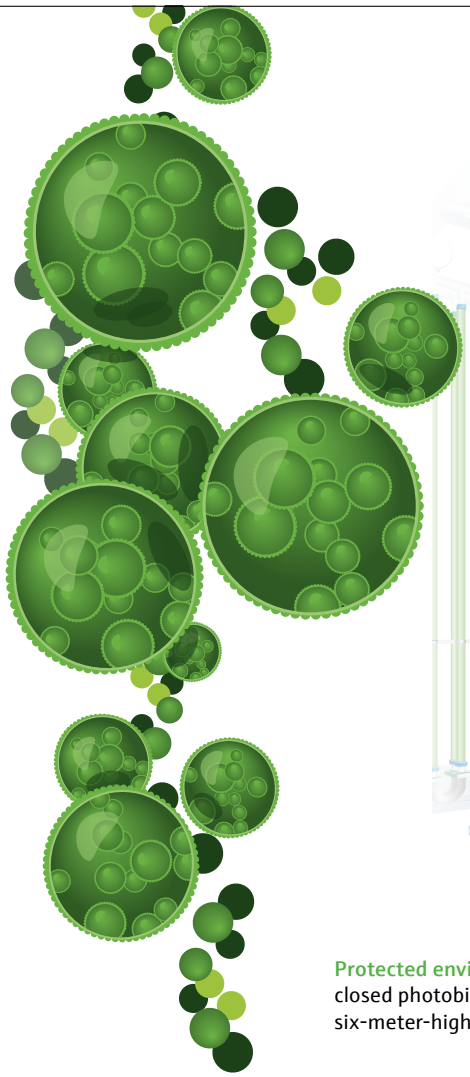
The key technology of the power-to-gas system is water electrolysis. As far back as 1874, novelist Jules Verne had the idea of splitting water into its elements and using the hydrogen as a source of energy. “It wasn’t until recently that the concept really took off thanks to the energy transition, and with it the construction of electrolyzers,” says Jens Hundrieser, European Industry Manager for the energy and metal industries at Endress+Hauser.

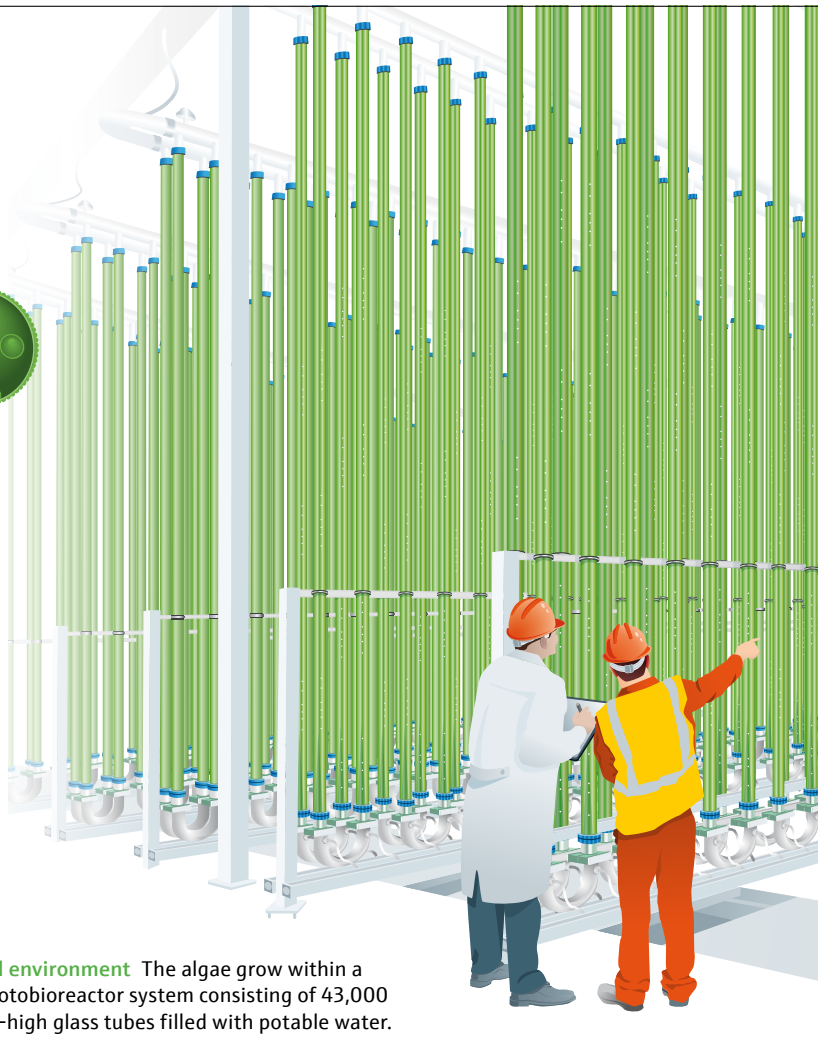
Today there are two main industrial processes: alkaline electrolysis, a proven process, and systems featuring innovative proton exchange membranes (PEMs). PEMs can be rapidly powered up and down and are thus well suited to unpredictable yields from wind and solar energy sources. “We have closely followed the development of electrolyzers over the years,” says Jens Hundrieser. “At the moment manufacturers and researchers are trying to increase the capacity of the systems and make them more effective and cost-effective to manufacture.”

Endress+Hauser works closely with large specialists for hydrogen energy solutions. “Our measurement solutions help them to better understand and monitor the process,” says Farrukh Quraishi, OEM Business Manager at Endress+Hauser United Kingdom.

Adopting natural processes

Green all-rounders
Microalgae are one of the world's oldest microorganisms. Invisible to the naked eye, they offer an abundance of valuable substances.





Protected environment The algae grow within a closed photobioreactor system consisting of 43,000 six-meter-high glass tubes filled with potable water.

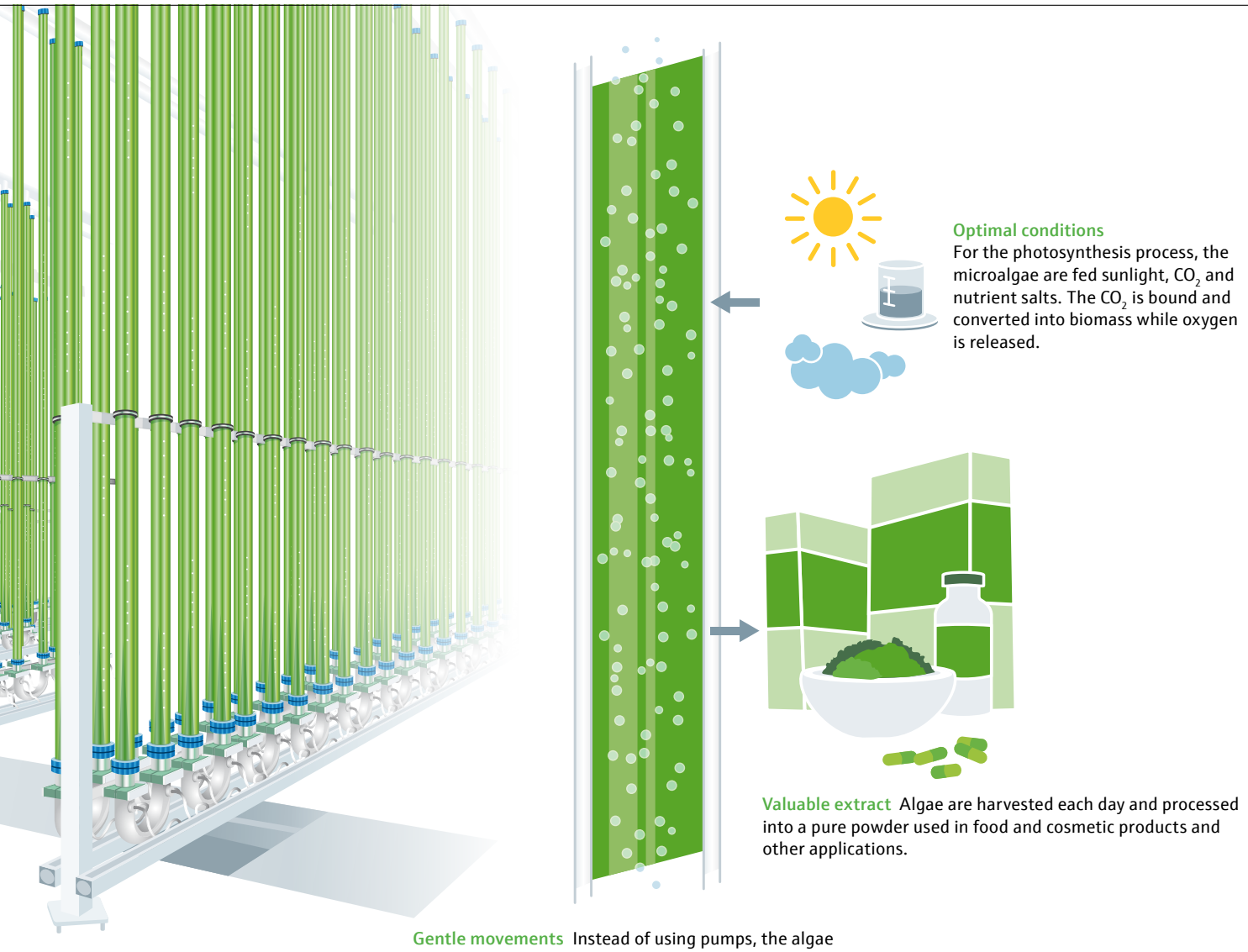
Raw material of the future

Nutrient, natural remedy, crude oil alternative: Algae have the potential to help solve some of the many issues facing humanity. In Austria, an innovative system is being used to cultivate them.

The huge sunlit hall is filled with a constant rush of noise, as air bubbles rise through thousands of vertical tubes of deep green liquid. What appears to be the set of a science fiction movie is in reality the world's first continuously producing microalgae plant. After years of research and development, the facility was opened in 2018 by Ecoduna AG in the Austrian community of Bruck an der Leitha.

Why algae? "Algae are a highly sustainable and eco-friendly source of raw materials for the future," explains Dr Johann Binder, Chairman of the Ecoduna management board. Among other things, these single-cell organisms supply valuable fatty acids, vitamins, proteins and pigments used in food, cosmetics and pharmaceutical products. Chlorella algae, for instance, contain vitamin B12, an important component of vegetarian and vegan diets, while an active ingredient in spirulina algae promotes cell renewal. Other algae families contain certain oils and could one day serve as an alternative to crude oil in the production of fuels and plastics.

Algae find optimum conditions for growth in the subdued lighting of the photoactive zone, a few centimeters under the surface of the water. The carbon dioxide and nutrition supply have to be correct as well. "None of this can be accomplished without sophisticated analysis technology," says Johann Binder. Ecoduna found the process engineering expertise and analysis technology needed for all of the key parameters at Endress+Hauser. "We appreciate the high-quality compact sensors, as well as the competent and dedicated support that we receive from Endress+Hauser," adds the chairman.



Optimal conditions
For the photosynthesis process, the microalgae are fed sunlight, CO_2 and nutrient salts. The CO_2 is bound and converted into biomass while oxygen is released.

Valuable extract Algae are harvested each day and processed into a pure powder used in food and cosmetic products and other applications.

Gentle movements Instead of using pumps, the algae suspension is mixed with a flow of air bubbles, which at the same time distributes the nutrients, removes the oxygen and cleans the glass.

Vertical flow production The closed photobioreactor system covers an entire hectare of production space. If the conditions are right, the microalgae cells divide each day. The system can produce up to 100 tonnes of pure algae powder annually. Once there is a sufficient crop, it is harvested by means of cross-flow filtration, separated in centrifuges and spray-dried.

"Continuous monitoring of the relevant parameters enables Ecoduna to maintain reproduction of the algae within the optimal range and determine the right harvest point," explains Roswitha Schützner, Product Manager Analysis Technology at Endress+Hauser Austria. The algae concentration level can be identified by analyzing the water turbidity, which is determined by measuring the optical density. A pH measurement provides information regarding the CO_2 content.

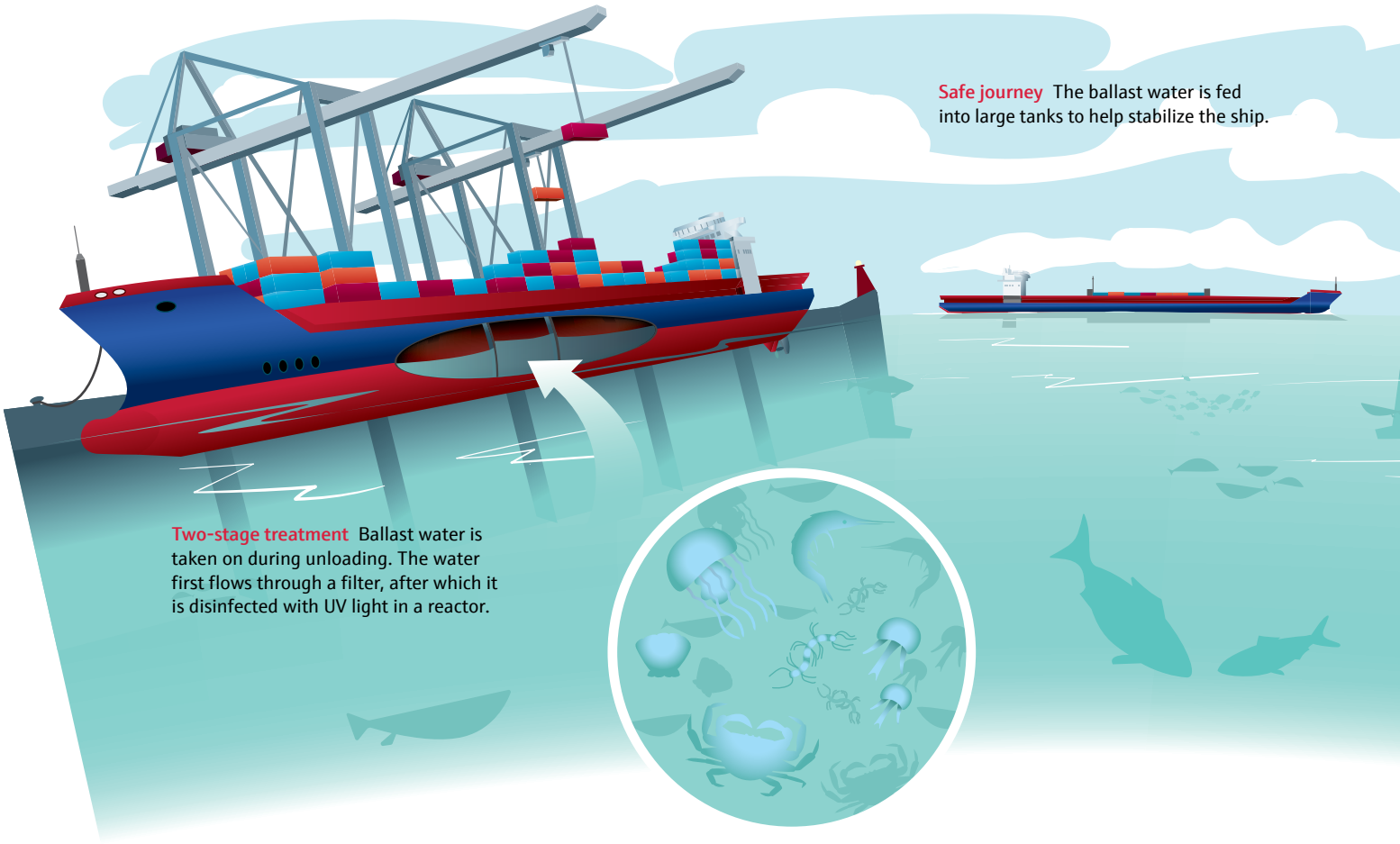
Ecoduna and Endress+Hauser collaborated on a wide range of tests to define the suitable sensor technology for the process. This led to the decision to go with robust glass electrodes featuring Memosens technology for the pH measurements, as well as absorption sensors that measure the optical density in the near-infrared range without being influenced by the different colors of the algae. A digital four-electrode conductivity sensor monitors the water concentration in the filtrate during the harvest filtration and processing.

Ecoduna has constantly enhanced the technology since commissioning of the plant. "In the next step, we want to further optimize the mixture ratio between used and fresh water with a TOC measurement," reports Johann Binder. The algae powder from Bruck is in high demand. Plans are in place to expand the facility to three hectares by 2025 to triple the production capacity.

Text: Reinhard Huschke
Illustration: Ulrich Birtel

Systematic treatment

Controlled exchange Ships must treat the ballast water with approved systems to prevent organisms from being transported from one ecosystem to another.



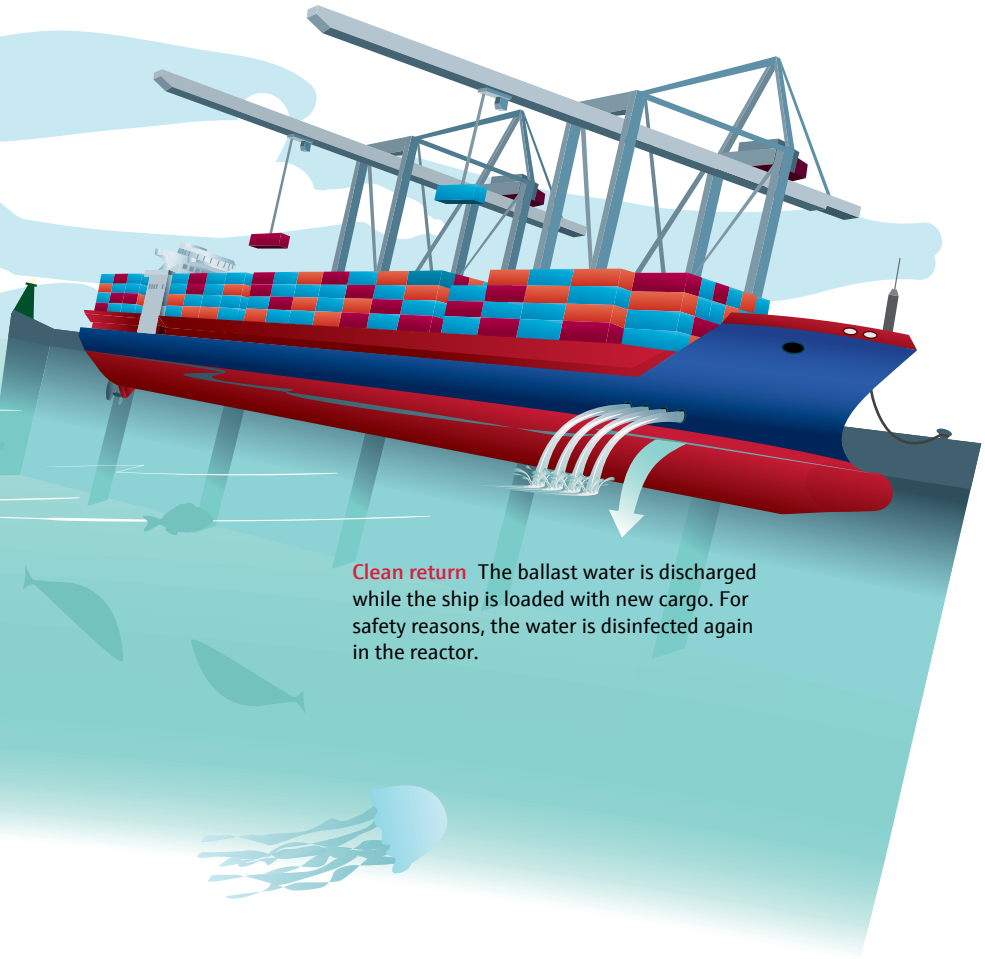
Clear sailing

The maritime shipping industry is on course toward better environmental protection. Measurement technology is helping to reduce the burden on our oceans.

Increasing numbers of ever-larger ships are crossing the oceans to distribute goods around the world. Each year, these vessels take on roughly 10 billion tonnes of ballast water to improve stability if the cargo holds are empty or only partially loaded. The water is taken in from the coasts, fed into ballast tanks and then discharged when the ship reaches its destination. The problem is that organisms use the water to board the ship as stowaways, making the journey from one corner of the world to another, where they can threaten the balance of the foreign ecosystem.

That's why ships travelling in international waters have had to be equipped with ballast water treatment systems since September 2017. One of the pioneers in this field is Alfa Laval, a leading Swedish provider of key technologies in the areas of heat transfer and separation and processing of fluids. "In addition to being one of the first to meet current International Maritime Organization standards as well as the revised that enter into force at the end of October 2020, our systems also fulfill US Coast Guard guidelines," explains Peter Nordström, who is responsible at Alfa Laval for developing PureBallast, a family of ballast water treatment systems.

Reliable partner Endress+Hauser supplies the measurement technology. "Our ties to Alfa Laval stem from a long partnership cultivated through food & beverage industry solutions," says Virpi Varjonen, who manages sales support for the customer. This positive experience opened the door to the shipbuilding business. "We needed robust instruments that carry out highly precise flow and conductivity measurements and possess all of the necessary maritime



Clean return The ballast water is discharged while the ship is loaded with new cargo. For safety reasons, the water is disinfected again in the reactor.

approvals. Endress+Hauser met all of these requirements," says Peter Nordström.

Endress+Hauser's delivery capabilities also worked in its favor. "The market for treatment systems gained momentum after ratification of the IMO Ballast Water Management Convention," says Virpi Varjonen. This prompted close cooperation on the logistics side with Alfa Laval. "Our instruments are available as soon as they are needed – and in the required quantities." For the electromagnetic flow measurements alone, around 600 instruments were delivered in 2018, growing to 1,200 in 2019. The new Proline Promag W300 recently came into play. Designed especially for water and wastewater measurements under harsh conditions, this instrument passed the elaborate tests for use on the high seas with flying colors. "Our colleagues did everything in their power to make sure the required approvals were available in time," says Damien Spenlehauer, OEM Account Manager at Endress+Hauser.

Text: Reinhard Huschke
Illustration: Ulrich Birtel

Solutions for marine shipping

Marine shipping handles more than 80 percent of the world's trade. This industry's growth has also led to an increase in maritime traffic, at the expense of the ocean environment. A new mindset has been adopted, however. "Ship owners are being confronted with increasingly tougher environmental requirements from the International Maritime Organization," says Damien Spenlehauer, OEM Account Manager at Endress+Hauser.

The turn of the year 2019/2020 marked the beginning of a new era for shipping companies. In an effort to reduce the harmful emission of sulfur oxides, the maximum sulfur content of ship fuels is now set at a mere 0.5 percent. The cost of low-sulfur fuels such as marine diesel oil or liquid natural gas is significantly higher, however. "We help keep the financial burden as low as possible," says Damien Spenlehauer. Endress+Hauser supplies solutions that precisely track fueling of the ships or monitor the fuel consumption of the engines to help improve efficiency.

Shipping companies that want to continue using cheaper diesel oil with higher sulfur content are required to install special exhaust gas cleaning systems on their ships. Leading OEMs rely on Endress+Hauser. "Our measurement technology can be found in several of the largest scrubber systems in the world. The instruments make sure that almost all of the sulfur is removed and only minimal particulates are generated," reports Damien Spenlehauer.

CHB

Breathing space for the climate

Using new technologies, the greenhouse gas carbon dioxide can be captured after it is released – even from the air – and then utilized as a raw material for a variety of purposes.

Mankind has been discharging more and more carbon dioxide into the atmosphere since the beginning of the industrial era – currently more than 35 million tonnes a year – thus causing the earth to warm up. For this reason, the global community is working to prevent CO_2 from being emitted in the first place. The question is, What if that's unavoidable? Swiss company Climeworks offers a solution that filters the greenhouse gas from the air with a direct air-capture system and then sells it for the manufacture of various products.

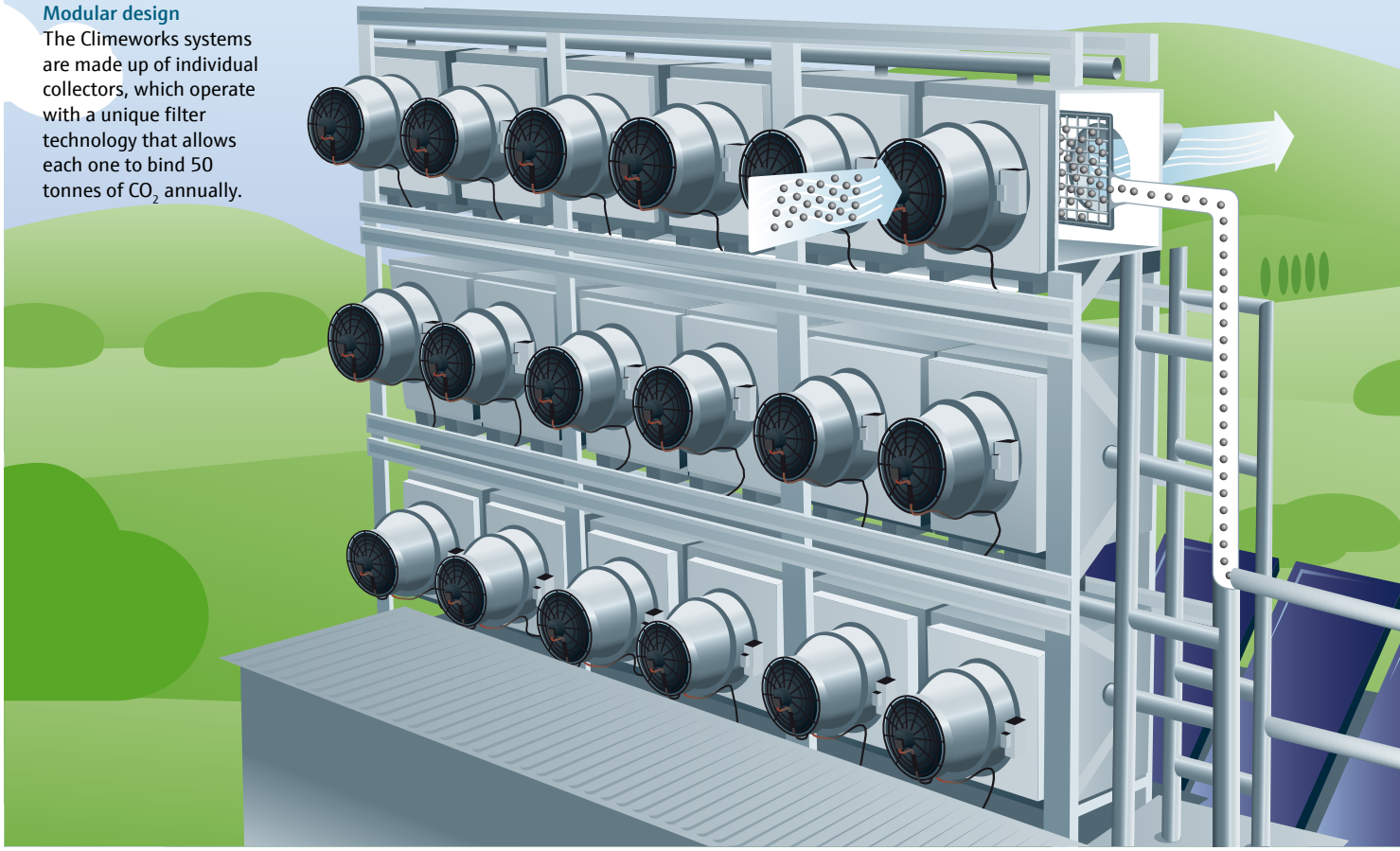
This green key technology was developed by two engineers from ETH Zurich, a Swiss university for science and technology. Christoph Gebald and Jan Wurzbacher met in 2003 while studying mechanical engineering and, during their first encounter, asked one another what they wanted to achieve in life. Both had the same notion: leading a company that helps to preserve the planet. They began to research in 2007, starting with a couple of milligrams of CO_2 filtered out of the air in a university lab.

Fifteen Climeworks systems in five countries now capture thousands of tonnes of CO_2 from the atmosphere every year – and all of them are packed with measurement technology from Endress+Hauser. "Climeworks was persuaded by our portfolio and the accuracy and reliability of the measurements," says Endress+Hauser sales engineer Francesco Cali, who has supported the company for many years.

Out of thin air

Rapid enrichment Ventilators draw ambient air into the collectors during the adsorption phase. The CO_2 chemically collects on the surface of the filter and the remaining air is expelled.

Modular design
The Climeworks systems are made up of individual collectors, which operate with a unique filter technology that allows each one to bind 50 tonnes of CO_2 annually.



The systems feature a modular design consisting of individual collectors that draw in the air, then bind, filter and collect the CO_2. The gas is then used by the agriculture, food and energy industries as a growth accelerator for greenhouse plants, for carbonated beverages or, together with hydrogen, to manufacture CO_2-neutral synthetic fuels. In Iceland, Climeworks pumps the gas, bonded with water, 700 meters deep into the ground where it mineralizes to completely neutralize the emissions.

"Climeworks works constantly to more precisely understand and improve the process," says Francesco Cali. The goal is to increase the capacity of the collectors, make the systems operate more economically and produce them in series. The two young entrepreneurs have an even bigger goal: chemically binding one percent of the world's CO_2 emissions by 2025 with their technology.

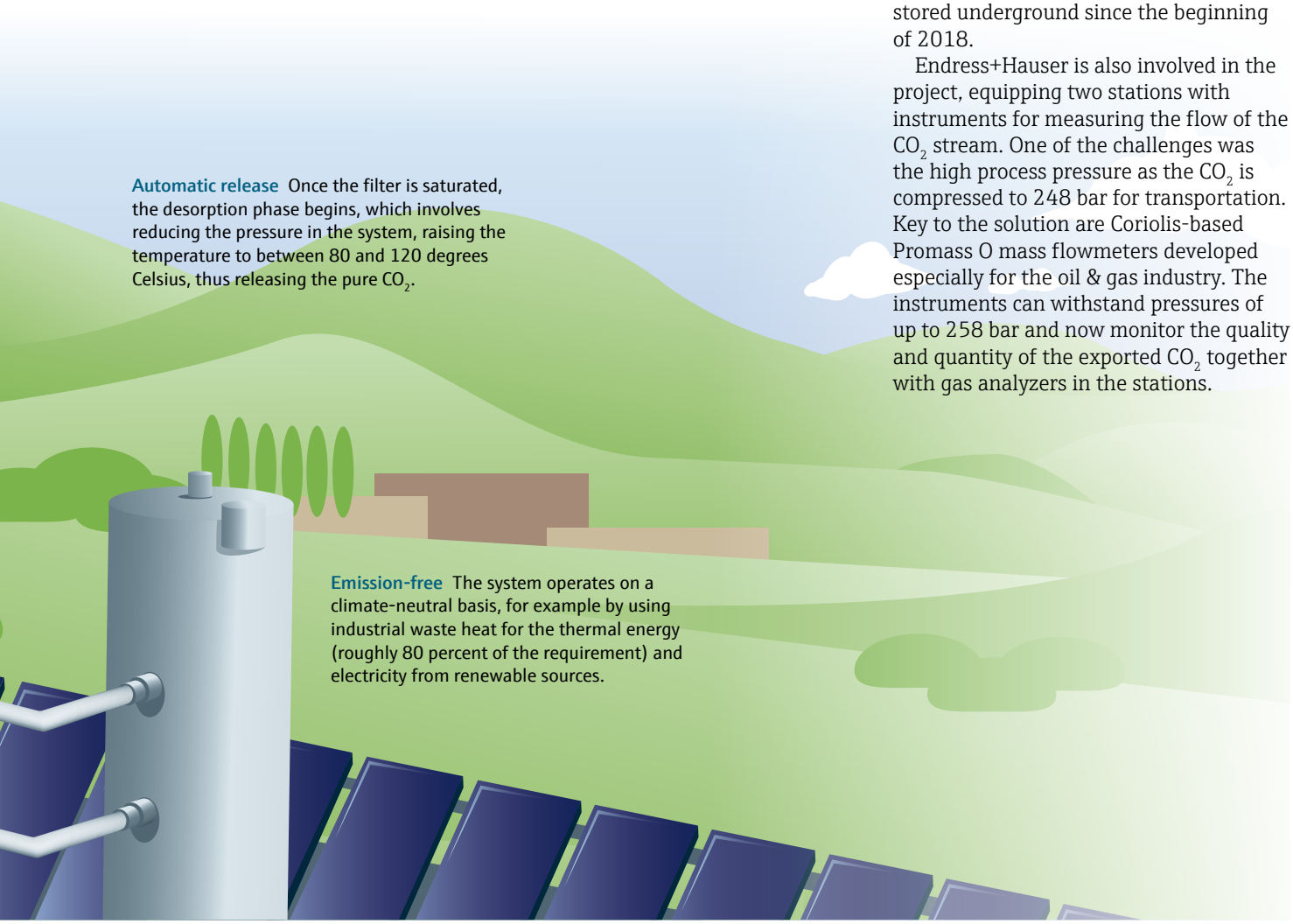
Texts: Christine Böhringer
Illustration: Ulrich Birtel

Lower emissions, higher energy yield

Researchers and companies around the world are working on technologies aimed at capturing, utilizing or storing carbon dioxide before it ends up in the environment. One of the pioneers in the field of carbon capture and storage is the Abu Dhabi National Oil Company (ADNOC) in the United Arab Emirates. A leading global energy provider, the company has been operating the region's first commercial-scale plant since 2016.

CO_2 is emitted in a steelworks as a by-product of iron smelting. In the plant the gas is separated and humidity is removed before it is compressed and transported along an almost 50-kilometer-long pipeline to ADNOC's oil fields. There it is injected into nearly depleted reservoirs, where it helps to extract remaining oil resources. In the past the company used natural gas instead, which now covers part of the Emirates' energy demands. As a consequence, CO_2 emissions have been lowered as well, with 240,000 tonnes stored underground since the beginning of 2018.

Endress+Hauser is also involved in the project, equipping two stations with instruments for measuring the flow of the CO_2 stream. One of the challenges was the high process pressure as the CO_2 is compressed to 248 bar for transportation. Key to the solution are Coriolis-based Promass O mass flowmeters developed especially for the oil & gas industry. The instruments can withstand pressures of up to 258 bar and now monitor the quality and quantity of the exported CO_2 together with gas analyzers in the stations.



Automatic release Once the filter is saturated, the desorption phase begins, which involves reducing the pressure in the system, raising the temperature to between 80 and 120 degrees Celsius, thus releasing the pure CO_2.

Emission-free The system operates on a climate-neutral basis, for example by using industrial waste heat for the thermal energy (roughly 80 percent of the requirement) and electricity from renewable sources.

Eye-openers for the process industry

For a long time, Industry 4.0 was little more than a vision. Now applications are beginning to breathe life into the idea. The benefits of digital services are becoming apparent in real environments. And solutions based completely on internet technologies are opening up brand new fields of applications.

"My smartphone has been serving as a sort of control center for my daily life for a long time," says Julia Grether. The 29-year-old uses her smart companion to communicate with others, check the weather, book train tickets, track the number of steps she takes and control the lights at home. After studying international management, the young woman has her eye on the benefits of digital connectivity in her professional life as well. In her role as a business development manager, she has been working for the past year on Netilion, the IIoT ecosystem from Endress+Hauser.

"My goal is to use Netilion to bring the convenience and simplicity that digitalization provides our private lives to the process industry as well," explains Julia Grether. "That makes processes more efficient and reliable." The heart of the platform is Netilion services, web-based applications that make all field instruments and their data accessible from anywhere. The apps help users carry out tasks such as capturing and managing all instruments in a plant, organizing device documentation or monitoring the instrument status and responding correctly in case of a malfunction.

Keeping an eye on all instruments

"The Netilion apps are easy to use and immediately provide added value," says Julia Grether. And sometimes they prove to be real eye-openers, such as at Salzgitter Flachstahl GmbH, a Netilion pilot customer located in Germany. While digitally capturing the installed base of measurement devices at the steel mill, more instruments sur faced than the plant had anticipated. Furthermore, some of these devices were found to be in need of replacement.

With Netilion, there is a complete overview of the installed base at hand. Digital twins of the actual field instruments, which are often difficult to access, are made available in the cloud where they can be seen from various devices – from the office PC, the industrial tablet and even from the technician's smartphone. Prior to the service call, the technician already has the troubleshooting guide at hand. "The plant operator can save costs with the knowledge generated by the Netilion system, such as through streamlined maintenance and higher system availability," says Julia Grether.

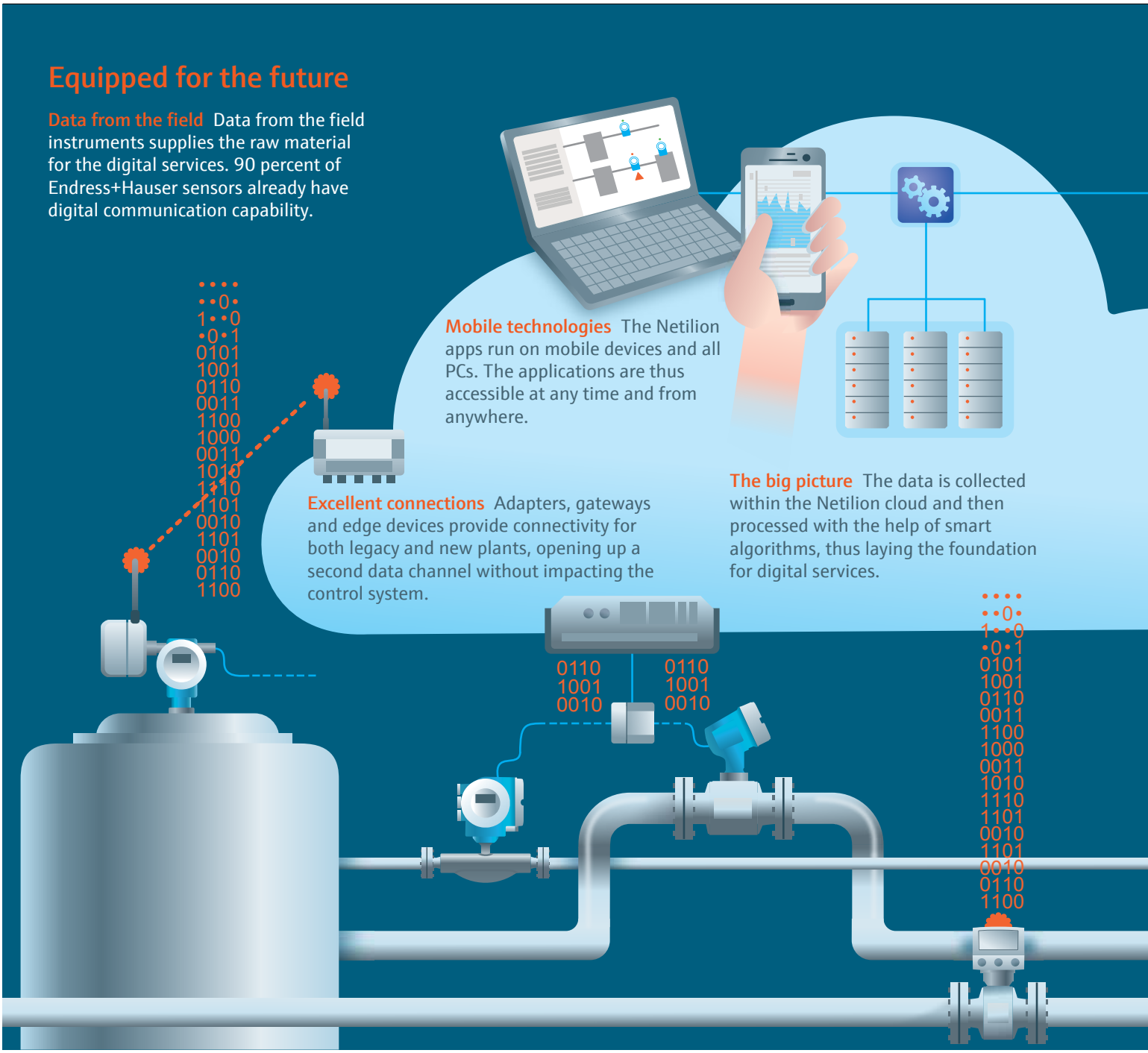
Security around-the-clock

Netilion also opens up access to new applications beyond conventional process engineering. Endress+Hauser offers cost-effective packages that include IIoT-enabled measurement technology and digital applications designed to solve simple measurement tasks. Set-up is uncomplicated. The complete preconfigured packages contain the sensors, including installation material and the transmitter, plus a subscription to the digital service. One example is Netilion Smart Systems for analyzing bodies of water, which are currently in pilot operation in two communities in Switzerland.

In Giebenach, near Basel, Netilion is being used to monitor a salmon farm. In the past, the water was checked intermittently. Now it is possible to continuously monitor the oxygen, nitrate and ammonia values. The community of Baltschiederbach, Switzerland uses a similar system to analyze the quality of the water in a stream by measuring turbidity, conductivity and pH. Employees have constant access to the measurement values on their smartphones. If the values deviate from the target, the

"The Netilion apps are easy to use and immediately provide added value."

Julia Grether,
Business Development Manager



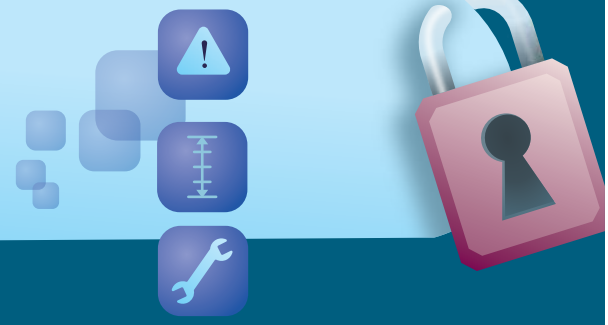
system sends out an alarm notification. In addition, it provides information regarding the status of the sensor. "The smart system gives us a sense of security in our daily activities," says Daniel Zopfi, who oversees the fishery. "We're always aware of the breeding conditions and can improve them with targeted interventions."

Endress+Hauser offers an additional bundled solution for remotely monitoring the levels in portable or remotely located plastic tanks with wireless technology. The solution comes with the new battery-operated, radar-based Micropilot FWR30 level instrument, which transmits the measurement results via an integrated mobile wireless interface. The data is displayed and monitored with the Netilion Value cloud-based monitoring system. "With the FWR30, we have finally created a process engineering solution based totally on IIoT technology," says Julia Grether.

On the path to predictive maintenance Additional new applications will also be available for conventional process plants. The Netilion Predict app, which is currently under development, is engineered to continuously analyze process and instrument parameters to optimize calibration and maintenance intervals and increase plant availability. "Our goal is to be able to tell the plant operator, in plain language, how much longer the measurement point is expected to operate reliably," adds Julia Grether.

Technical development is also progressing. "We plan on expanding the communications capability of the field instruments in parallel," says Julia Grether. In order to cover the wide range of common fieldbus standards, further data interfaces will be added to the field instruments and a new adapter will make HART devices Bluetooth capable. Further sensors are being planned, modeled after the Micropilot

Tailored solutions Netilion smart systems bundle everything needed for specific measurement tasks, from sensors and connectivity, to the digital service.



Initial applications The growing family of Netilion services increases process availability, safety, cost-effectiveness and reliability.

FWR30, which will be 'Netilion-ready' straight from the factory – in other words, capable of sending data direct to the Netilion cloud without the need for separate interface modules.

Text: Reinhard Huschke
Photos: Christoph Fein, Pino Covino
Illustration: Ulrich Birtel

A WORD WITH... BRUNO KÖGLER

"Netilion offers added value without additional risks"

Mr Kögler, Endress+Hauser is pursuing a strategy of small steps with the Netilion IIoT ecosystem. Why is that?
Digitalization of the process industry is a mammoth task that cannot be completed overnight. That's why we are focusing on iterative development. That means we are moving Netilion forward in short, recurring cycles while constantly gathering feedback from users. This approach leads to short time-to-market and enables us to quickly respond to customer needs.

What concrete benefits does Netilion provide?
Netilion allows our customers to easily optimize their workflows and flows of information, particularly in areas that are important to them, such as maintenance. With the Netilion apps, you can begin working immediately. There is no complicated installation required and the basic services are free of charge. In order to make it even easier for our customers, we have also developed complete bundled solutions for analyzing water. These systems are easy to order and commission and deliver precisely the information our customers need.

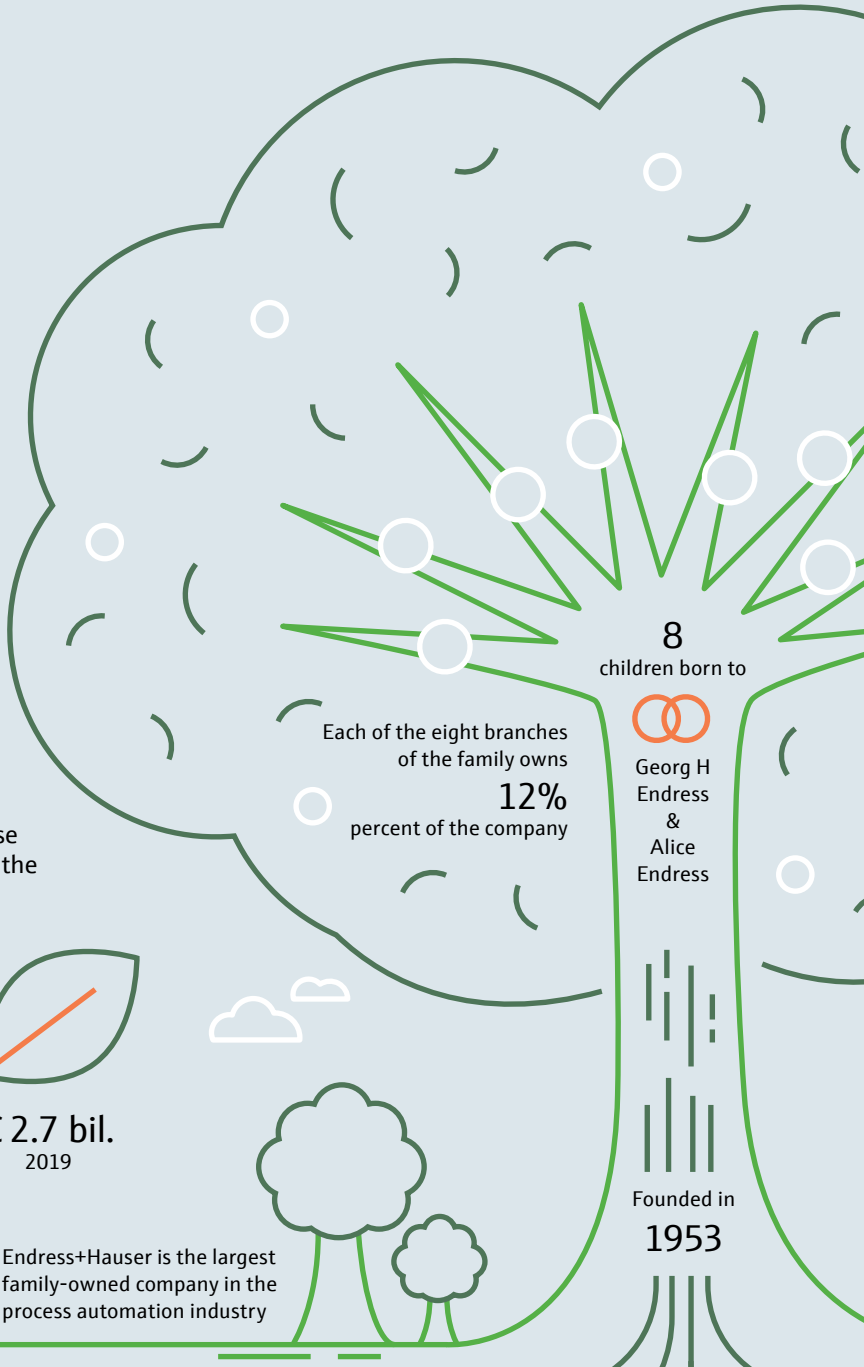
How do you see process control developing further? How quickly will digitalization progress?
The process industry has always been rather conservative and concerned about security, but increasing cost pressures are forcing it to become more efficient. That's why the new opportunities that digitalization opens up will be increasingly rolled out. And of course we have considered the high need for security. With our IIoT ecosystem, we are the first industrial company to receive four out of a possible five stars during the EuroCloud audit. Parallel to automation technology, information flows via our edge devices in one direction only: from the field to the cloud. In this sense, Netilion offers real added value without additional risks.

Questions: Reinhard Huschke
Photo: Pino Covino

Solutions seeker Bruno Kögler (40) is head of product management at Endress+Hauser Digital Solutions in Reinach, Switzerland. Working closely with the customers, he uncovers optimization potential that is then integrated into the further development of the Netilion IIoT ecosystem.

Sustainability as a principle

Family companies such as Endress+Hauser form the backbone of many economies. Their strength lies in their desire to be successful for generations to come.



Strong foundations

From a global standpoint, family-owned enterprises make up roughly two-thirds of all companies – in Germany, Switzerland and the US this number is around 90 percent. These companies often contribute more than half of the GDP and create up to 80 percent of all jobs.

Endress+Hauser Group net sales

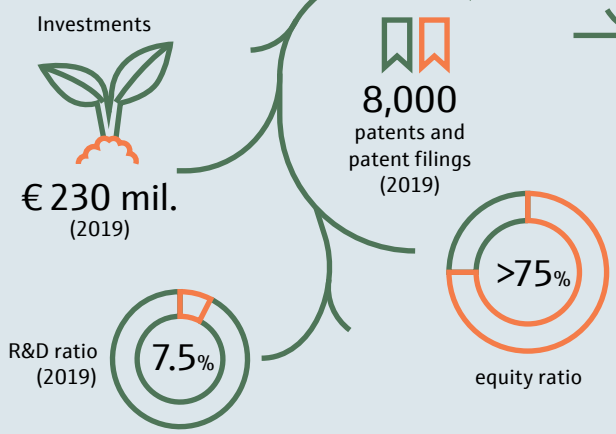
€ 675 mil.
1999

€ 1.1 bil.
2009

€ 2.7 bil.
2019

Solid growth

Family companies think in generations, not quarters. They run their businesses with foresight and follow their goals over the long term. The reinvestment of profits pays off, and innovative strength and financial stability fuel above-average growth.



Clear relationships

Only two-thirds of all family enterprises are successful in handing the company over to the next generation. The older and larger the company becomes, the greater the complexity. Shareholders must find ways to ensure solidarity, promote identification with the company and manage the succession.

76
members of the second, third and fourth generations

2 representatives of the family have seats on the Supervisory Board

A Family Charter governs the relationship between the company and the family

Family members have voting rights within the Family General Assembly when they turn 16

4%
of the shares are held by the non-profit Georg H Endress Foundation

Sustainability audits by EcoVadis since 2015

Endress+Hauser Group workforce

5,700	8,400	14,300
1999	2009	2019

400
apprentices

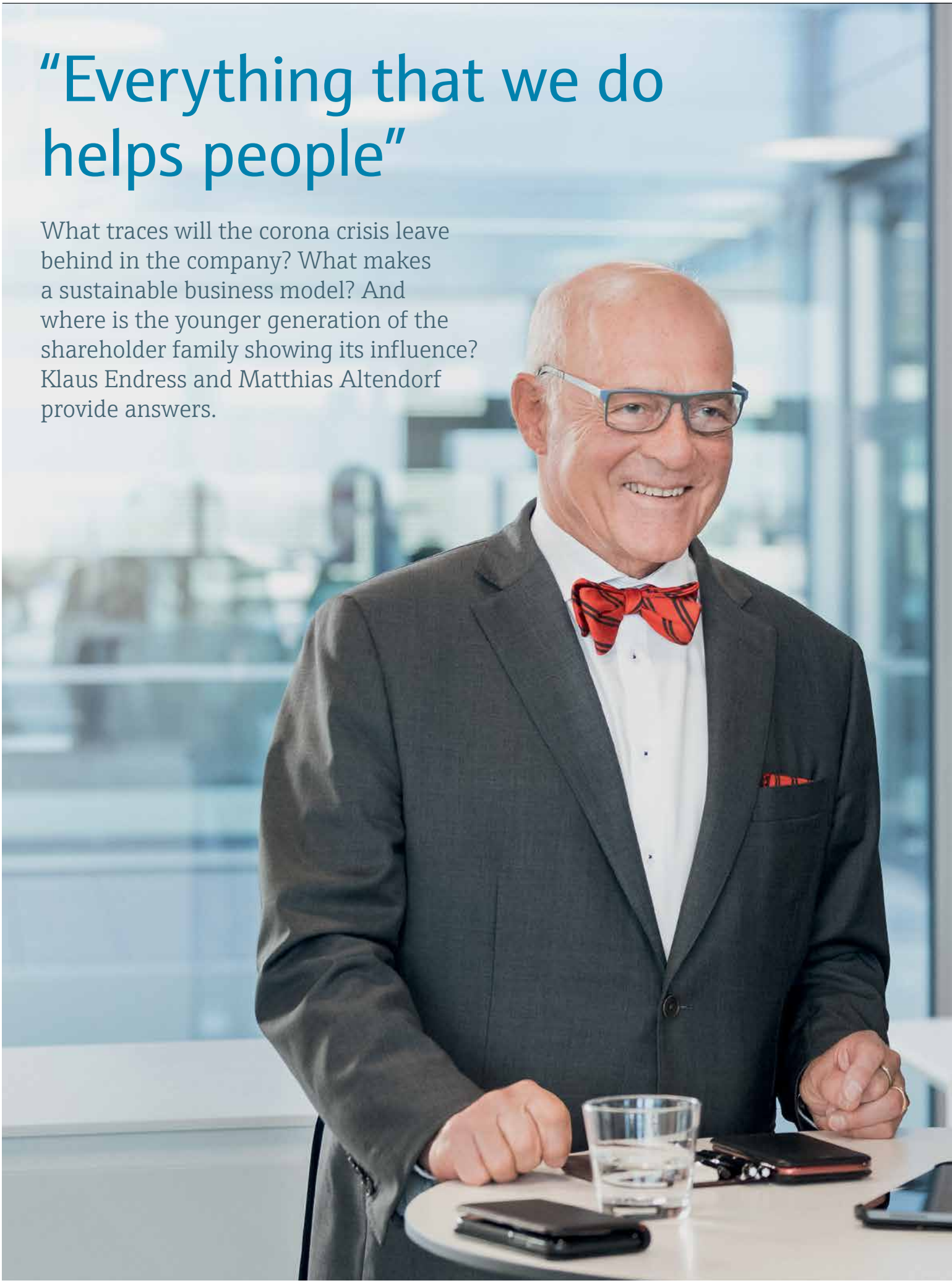
Comprehensive responsibility

The shareholders' strong identification with the company is reflected in the way the company carries out its activities in a responsible manner. As a result, people, the environment and society as a whole all benefit, from secure jobs to extraordinary social engagement.

Infographics: Pia Bublies · Research: Christine Böhringer

“Everything that we do helps people”

What traces will the corona crisis leave behind in the company? What makes a sustainable business model? And where is the younger generation of the shareholder family showing its influence? Klaus Endress and Matthias Altendorf provide answers.



Mr Altendorf, what does the corona pandemic mean for Endress+Hauser?
Altendorf: The corona crisis has confronted our customers and us with immense challenges. When the virus spread, we took action immediately – first we issued travel restrictions, then ever more extensive measures. Our employees' and customers' health took priority at all times. At the same time, we wanted to support our customers in the best possible way, given a situation like that: how can we remain operational and keep up delivery, how can we assist our customers to keep their plants up and running?

How will the crisis affect the economy?
Altendorf: Today, we cannot tell exactly how. We made a good start into 2020, with a considerable order backlog… but the crisis will leave its mark, with our customers and with us. But what counts, after all, is this: what we do is important for our customers. We can assist them in getting better and making their processes, products and manufacturing facilities even more efficient. And this applies to all aspects, so that they can further improve quality, raise productivity and reduce their use of resources. That is what takes our customers forward, in fair weather and all the more in challenging times. We have a sustainable business model!
Endress: We will never run out of work, not in a hundred years – not as long as we don't lose sight of the customers and markets. The world population is growing, life expectancy and standards of living are on the rise. All of these people need water, food, energy, medications, all types of goods. At the same time, we have to manage our resources efficiently and take account of the environment. All these things will lead to more demand for measurement technology. Besides, we maintain a global presence, in many industries. Of course, a worldwide crisis affects us, but not full on and not digitally, just because the world and the industries are developing in different ways. That gives room to attract business and keep people in work.

Are there any parallels to the financial crisis of 2008/09?
Endress: The events that triggered the financial crisis were completely different. Things took off in the world of banking and spread to the real economy, which meant a sharp fall for many at the time. It felt as if the customers just weren't coming back from their holidays. Others felt the blow with some delay. Back then we said, we have to think the unthinkable, and think it through to whatever end – and then get it going or dismiss it after all. Much of the experience we gathered, and we did learn many positive things, has been helpful recently: how to deal with black swans, the unexpected events that might have major effects, and how to successfully survive in a fragile world.
Altendorf: Today, like then, the Endress family stands up for the company. The family is placing full trust in us to keep the company on course even in heavy weather. We want to retain our employees in this current crisis. Endress+Hauser shows solidarity and assumes responsibility. Since 2009, we have been consistently working towards increasing the economic soundness and resilience of the Group, to have the staying power for a situation like this.

"The family solidarity provides tremendous support. We have now for a long time a stable framework that allows the company to successfully develop."

Matthias Altendorf, CEO of the Endress+Hauser Group

In the current situation, last year is almost out of sight… why was 2019 a good year for Endress+Hauser?
Altendorf: We experienced growth across all fields of activity, industries and regions, albeit with varying dynamics. But it is fair to say that it wasn't a bad year for many of our competitors in process automation either. Factory automation suffered more from the economic situation. But behind our numbers there is also a lot of work. Although we had no large-scale projects, we did business with many individual customers and carried out small and medium-sized projects. The foundation for this was laid over the past several years. Perhaps we also had the good fortune of the brave!

Before the corona crisis, climate policy largely dominated public debate. What does that mean for Endress+Hauser?
Altendorf: On the one hand, we can help our customers drive down energy consumption, resource utilization and polluting emissions. This is our core business. It's what we do every day. On the other hand, we have to manage resources responsibly on our own. We do a lot here, although we are certainly not using our full capabilities so far. But we've always been a little ahead of our time – and it should stay that way!
Endress: Those are issues that we have been addressing for decades! We were active in protecting the environment before others had even talked about it, just because it was important for us.

Then what is Endress+Hauser doing exactly?
Altendorf: From the perspective of a manufacturer, we have the advantage that we don't operate an energy-intensive business. Building and office infrastructure, commuting, business travel and material transport account for most of our ecological footprint. This is where we can start, by constructing highly energy-efficient buildings everywhere in the world. In Canada we are taking this a step further by building a facility that is 100 percent energy self-sufficient. We even accept higher costs because we believe it sends all the right signals.

That doesn't change the fact that many Endress+Hauser customers don't have very sustainable business models.
Altendorf: It's a complex issue. Take food & beverage, our biggest industry, which ensures that we're able to feed the world. At the same time, livestock farming in the dairy industry, to cite one example, is one of the biggest sources of methane emissions. Are we supposed to discontinue this business abruptly? That's certainly not the answer. What we can do is help our customers limit the amount of methane

"Our work has an impact"

Mr Altendorf, what motivated you over the past year?
"When, early this year, the corona epidemic spread in China, the colleagues of our laboratory analysis specialist Analytik Jena were of service right away. For the detection of an infection, the genetic material of the virus has to be prepared and examined. Analytik Jena supplied the necessary equipment: reliable devices that provide rapid and accurate results. We supplied hospitals in China with relevant laboratory technology, including the emergency field hospital in Wuhan that was erected in just ten days. It's a good feeling to know that we touch the lives of many people through our activities and have a positive impact. That gives meaning to our work!"

Roots in the company Matthias Altendorf, born in 1967, began 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 the father of a grown son.

"Recognition inspires"

Mr Endress, what motivated you over the past year?
"I recently enjoyed a lot of recognition. I became an honorary senator at the University of Freiburg and received the German Federal Order of Merit. My commitment to the Basel region was also honored. Lastly, the University of Basel awarded me an honorary doctorate. With many things in life, it's all about finding the right measure or dimension. When it comes to recognition, though, too much never hurts, because it has a tremendous effect on you as a person. The brain releases dopamine and oxytocin, two chemical messengers, and produces endogenous opioids, a completely legal cocktail that triggers a natural high, which strengthens trust and increases performance. We should therefore always be conscious of the fact that recognition inspires. It transforms a good thing into something better – both privately and professionally!"

Link to the family Klaus Endress, born in 1948, obtained a degree in industrial engineering from the Technical University Berlin. He joined his father's company in 1979, took over Group management in 1995 as CEO and moved to the Supervisory Board in 2014 as President. Klaus Endress is married and the father of two grown children.

released into the environment – or, at best, completely eliminate it. I believe there is broad consensus that we have to change course. But what we need for this transformation are solid technical solutions and an accelerated approach. We are able to say in good conscience that we are on the right track here. Everything that we do at Endress+Hauser helps people. That's something very positive!

Is the climate debate a topic within the Endress family?
Endress: The family is sensitive to these issues. It's also about corporate social responsibility. For me that was always the driving force – continually developing the company, creating jobs, making a contribution to society and protecting the environment. All of that belongs together in my opinion. That's why I believe it is good that our young people are already giving this some thought.

The young generation has gained more influence within the Family Council, which governs the relationship between the family and the company…
Altendorf: …it's not only become younger. It also has more female representation!

Is that noticeable in any way?
Endress: So far, we've had two meetings under this new arrangement. Women and the younger generation now form a majority within the council. Both meetings were very relaxed and constructive. The institutions we created years ago through the Family Charter are proving their worth. The young members of the family have the opportunity to get to know one another and are brought closer to the company. Today they get along well with one another. They know what the others are doing, they take an interest in the company's activities and they share a deep sense of solidarity. This has been an extremely positive development over the past few years!

Last year at the Annual General Meeting, a member of the younger generation was elected to the Supervisory Board for the first time. Sandra Genge will replace Hans-Peter Endress effective 2022. What significance does this step have?
Endress: The Supervisory Board serves an important role. For this reason we need good people on this committee – generally speaking, but also from the family's side. Sandra Genge is an excellent choice. She has achieved a lot in her professional and private life. She is well connected, in addition to being well respected within the family. She is thoroughly preparing for her mandate at the moment, regularly attending the Supervisory Board meetings. She also participated in the strategy meeting involving management and the family. She's doing an excellent job of finding her way in her new role. And the good thing is, we have even more young members of the family with similar potential!

To strengthen the bonds between the family and the company, you have opened up career opportunities to members of the family at all levels of the company. Why is that?
Endress: We have not been very successful in bringing young members of the family into the company. To date, this was only possible in the long term if someone headed up one of the Group companies or the entire Group. At this level, however, the hurdles are extremely high. That's why we made the decision to give family members the same chance as anyone else. They should also be able to grow and develop a career within Endress+Hauser. This is the right mindset. But given that this can create difficult arrangements, the Family Council and the Supervisory Board will keep a close eye on them.

Have young members of the family already used this opportunity?
Endress: Not yet, but I know the young members of the family will eventually come. And that's a good thing!
Altendorf: That will take some time.

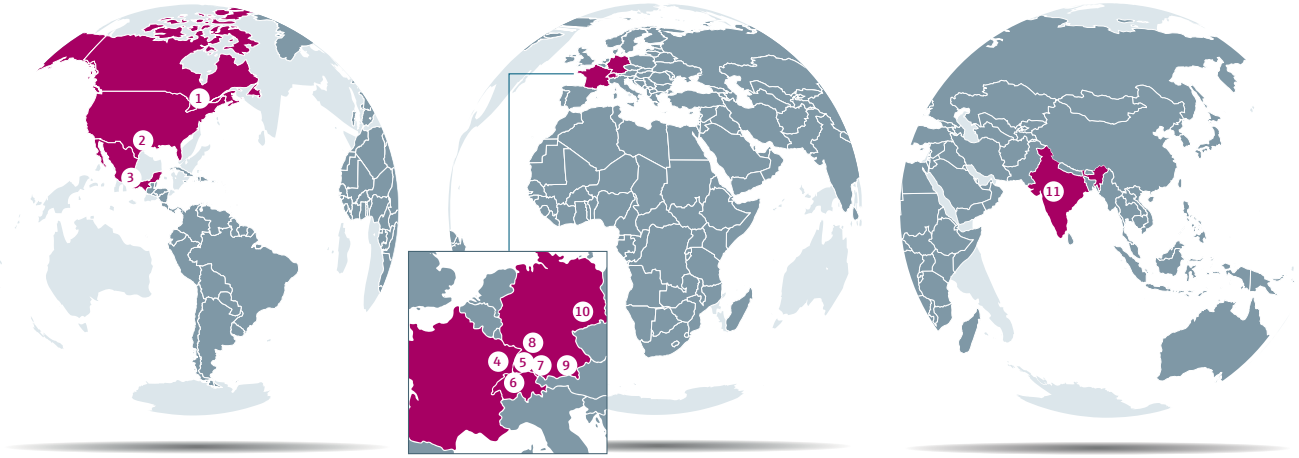
Mr Altendorf, you supported the family with the revision of the Family Charter and the shareholders' agreement. What does that mean for you as CEO?
Altendorf: I am pleased that the family is so united when it comes to all of the important issues. This solidarity provides tremendous support. We have now for a long time a stable framework that allows the company to successfully develop. These are the ideal conditions for any executive. A lot of other CEOs can only dream of such an environment!
Endress: As far as the shareholder family is concerned, overall we're in a solid situation. But it took a lot of hard work before we could get to this point!

So, what's next?
Endress: The subject of succession is always an issue. I only have to look in the mirror. I will have to give up my responsibilities at some point – that's something I want to do, when the time is right. And anything can happen – it wasn't just the corona crisis that showed us that. It applies to every key person in the company. The position of Supervisory Board President is important, because a good boss can only work effectively under a good boss. For that reason, we're in the process of thinking this through, together with the family. We want to do an especially good job with this task!

Questions: Martin Raab
Photos: Andreas Zimmermann

Investments around the globe

The worldwide network continues to grow. Endress+Hauser is investing in modern office buildings, training centers and production facilities across the globe.



1 Burlington, Ontario, Canada
New sales office building; customer and training center
13 million euros
Completion expected in 2020

2 Houston, Texas, USA
New sales office building; calibration and training center
32 million euros
Completion expected in 2020

3 Mexico City
New sales office building
14 million euros
Construction started in 2019

4 Cernay, France
Expansion of flow facilities
13 million euros
Completion expected in 2020

5 Weil am Rhein, Germany
Modernization of the sales office building
12 million euros
Completion expected in 2020

6 Reinach, Switzerland
Expansion of flow facilities
56 million euros
Construction started in 2018

7 Maulburg, Germany
Expansion of level and pressure facilities
46 million euros
Completion expected in 2020

8 Gerlingen, Germany
New office building for liquid analysis
12 million euros
Completion expected in 2020

9 Nesselwang, Germany
Expansion of temperature facilities
8 million euros
Construction started in 2020

10 Waldheim, Germany
Expansion of analytical sensor production
19 million euros
Construction started in 2020

11 Aurangabad, India
Expansion of flow facilities
7 million euros
Construction started in 2020

Bundled expertise: A team in Lyon, France provides support when advanced analyzers are employed.

Analysis expertise under one roof

Endress+Hauser has established a support organization for process analysis in Lyon, France. The regional sales office was expanded at a cost of roughly 2 million euros to accommodate the team. The 20 employees based in Lyon support customers and sales centers throughout Europe in the use of highly sophisticated analyzers. These systems provide direct information regarding the composition of substances, material characteristics or product quality. Endress+Hauser has continually broadened its analytical portfolio over recent years, for example in the area of spectroscopic processes. This portfolio helps customers to optimize their processes and bring their products to market more quickly.

Pioneers: Angelika Andres, Marisol Sanchez, Sandra Rubart, Judith Wenger, Dr Monika Heisterkamp (from left to right) and Maria Delaney (not pictured) are coordinating the global Women's Integrated Network activities.

A network for diversity

Diversity makes enterprises sustainably successful. One key to this is to encourage more women to join the company. A global Endress+Hauser initiative is working on a solution.

The higher up a company's career ladder you get, the fewer women you'll find there. The same goes for Endress+Hauser: While three in ten members of staff are women, not even one in 14 managers is female. The Women's Integrated Network aims to change this: The company wants to make greater use of professional women's potential through the global initiative, thereby increasing their numbers in management and expert positions in the long term.

Multiple women in leadership positions at the Endress+Hauser Group launched the initiative together with the Executive Board. In a model project in the US, Endress+Hauser doubled the proportion of women in management to almost a third within four years. "Diversity is crucial to companies," explains co-initiator Sandra Rubart, Corporate Director of Brand Management and Communications. "The more people with different perspectives get involved, the more robust, agile and innovative organizations become."

There are no specific guidelines for single companies and locations. "Individual solutions are required because the conditions are different everywhere you go," says Judith Wenger, who is the Director of Human Resources for various sales companies. The topics are diverse and range from new ways of recruiting female employees and internal mentoring programs to external networking activities such as collaboration with universities.

"We also want to create awareness of this issue," says Monika Heisterkamp, Marketing Director for Endress+Hauser Liquid Analysis. When she started working for the company 15 years ago, she was the first woman in product management; today, 40 percent of these roles are held by women. With a doctorate in chemistry, she knows what she is talking about: "It is important to have also female role models in the workplace. This encourages other women and makes the company more appealing to female applicants."

The Women's Integrated Network, which was launched throughout the Group in October 2019, can look back at a successful start: representatives have been appointed across all sites, local teams have been set up and initial activities have commenced. "This has resulted in energy that is tangible across the entire company, and which will be decisive to the success of our network," Sandra Rubart states. The corporate culture has already been positively affected: "The initiative has further expanded our internal network," Judith Wenger explains. "Being able to see how many fantastic women we already have at all levels, and the passion and joy with which they work for Endress+Hauser, is truly inspiring. It shows us how much diversity already exists!"

Text: Christine Böhringer
Photo: Pino Covino

Eco power plant for the city: The wind tree supplies the e-vehicle charging station with electricity.

The turbines work even in light winds.

Energy from the wind tree

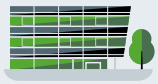
From a distance it looks like a tree, but on closer inspection it turns out to be an innovative small-scale power plant: a wind tree that delivers sustainable electricity at Endress+Hauser in Gerlingen, Germany.

The wind tree is nothing more than a small wind power station, 9.9 meters high with a metal trunk and branches, adorned with vertical, green-colored plastic turbines that resemble large leaves from afar. Driven only by wind, the 54 approximately 85-centimeter-high mini turbines rotate to generate electricity. With an electrical power of 4,000 watts, the turbines produce around 3,200 kilowatt hours of electricity per year, enough to supply a one-person household.

Compared to a large wind turbine, that doesn't seem like much. But this small power plant offers key advantages. The small dimensions make it suitable for installation in urban environments, for example. The leaf-shaped turbines can also utilize any form of wind, even turbulent air flows that often occur in built-up areas. And they are nearly silent. Jérôme Michaud-Larivière, the inventor, estimates that his micro power station can operate 320 days a year in normal wind conditions, with a life cycle of 25 years.

"The wind tree is a visible sign of our commitment to handle our

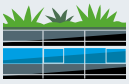
Sustainably smart



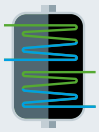
The Gerlingen site is designed for energy efficiency, from the foundations to the roof. The building is modular.

A natural gas cogeneration plant supplies 223 kilowatts of electrical power. At 335 kilowatts, the thermal output covers the entire demand. During the summer, the heat output is converted into cooling.

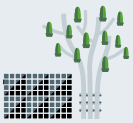
Fresh air is fed into the building via six ground collectors. Pipes integrated into the foundations warm the outside air passing through them in the winter and cool it in the summer.



The glass facade has a special coating for sun protection and a high degree of insulation. The grass roof improves the building's climate and relieves the sewage and drainage system by absorbing the rainwater.



Heat exchangers installed on the roof use the night-time temperatures to chill the building's cooling medium, which is stored in buffer tanks until the next day.



A photovoltaic system and the wind tree generate electricity that flows into the redox flow battery, which feeds the e-vehicle charging station in front of the building.

environment and natural resources in a responsible manner," says Manfred Jagiella, Managing Director at Endress+Hauser Liquid Analysis. The company has implemented a sustainable energy concept for years. As part of the expansion and modification of the facility in Gerlingen, the building systems were designed for energy efficiency from the ground up, and are optimized on a continual basis.

Electric driving is now a beneficiary of the wind power station as the electricity flows directly into an innovative redox flow battery, which in turn supplies power to a charging station located in front of the building. "That means our own vehicles, as well as our visitors' vehicles, can now operate with climate-friendly, autonomously generated energy," says Manfred Jagiella.

Text: Marion Fünfgeld
Photos: Cira Moro

High claims: The new building in Canada is designed to be carbon-neutral.

Canada goes green

The Endress+Hauser Group is investing 19 million euros in a new customer experience and process training center in Canada that sets itself apart by a new, completely sustainable design. The roughly 4,400-square-meter building in Burlington, Ontario is designed to draw all of its energy needs from local regenerative sources for carbon-neutral operations.

"Our goal is to create an exceptional facility in all respects that will not only be sustainable on the day it opens but will still be considered as such decades from now," explains Anthony Varga, Managing Director, Endress+Hauser Canada. Double-sided solar panels on the roof generate electricity, while a ground source heat pump supplies geothermal heat. In addition, the building is not connected to the local water supply network and the facade will be triple-glazed. The aim is to receive gold LEED (leadership in energy and environmental design) certification for sustainable building construction. The new center is scheduled to open in early 2021.

KW

Running for a good cause

An idea is mobilizing employees around the world. With the Endress+Hauser Water Challenge, the company is transferring its commitment to clean water to the non-profit sector.

As the beautiful fall day comes to an end, the Endress+Hauser headquarters in Reinach is bustling with unusual activity. More and more employees gather in front of the office complex, all of them decked out in sportswear and running shoes. It's not long before the crowd is in motion. The 250 participants jog or walk Nordic style to the Birs river, where they will line up for the starting signal of the inaugural Endress+Hauser Water Challenge charity run.

The idea behind the campaign is simple. Employees jog or walk, Nordic style, a specific distance and make a small contribution for each kilometer they complete. The company then matches the final amount. The money is set aside for select aid projects in Asia, South America or Africa that focus on improving access to clean drinking water. Through personal contacts and presence, Endress+Hauser ensures that none of the donated money drains away.

"The Endress+Hauser Water Challenge is open to all employees who enjoy being active and have the desire to do something good for other people," explains CEO Matthias Altendorf, who is participating in the first charity run as a Nordic walker. The company has been involved in safe, efficient and eco-friendly water supply and treatment for decades. "We're now exploiting this business activity for use in the non-profit sector," says Matthias Altendorf. "There are many people in the world who don't take safe drinking water for granted. For them it's a valuable and scarce resource."

It's the taking part that counts

Matthias Altendorf is excited about how the initiative is encouraging involvement. Employees in many countries are organizing their own events, including Argentina, Australia, Austria, Germany and Mexico. Other locations want to follow these examples. The type of activity plays a secondary role. Whether walking, skiing or cycling, or on land, water or ice, the most important thing is that the participants get involved in a physical activity together. It's not about achieving the best times or about competing. "The common experience is more important than the pace," emphasizes the CEO.

After reaching their goal, the participants hang around together a while longer, quenching their thirst with beverages, enjoying bratwurst from the grill and topping it off with cake. The proceeds from the Reinach charity run amount to 10,000 Swiss francs. The first of the aid projects is successfully completed a mere three months later in Vietnam. Up next are Endress+Hauser Water Challenge projects in Brazil, India and Cameroon. And a new Reinach charity run is already on the calendar.

Text: Joel Bedetti
Photos: Pino Covino, Rolf Leber

At the finish line: 250 people participated in the first charity run.

The employees are moved by the idea of the Endress+Hauser Water Challenge.

Refreshment, anyone?

Jointly active for a good cause.

In operation: The new water house in Kon Bdeh.

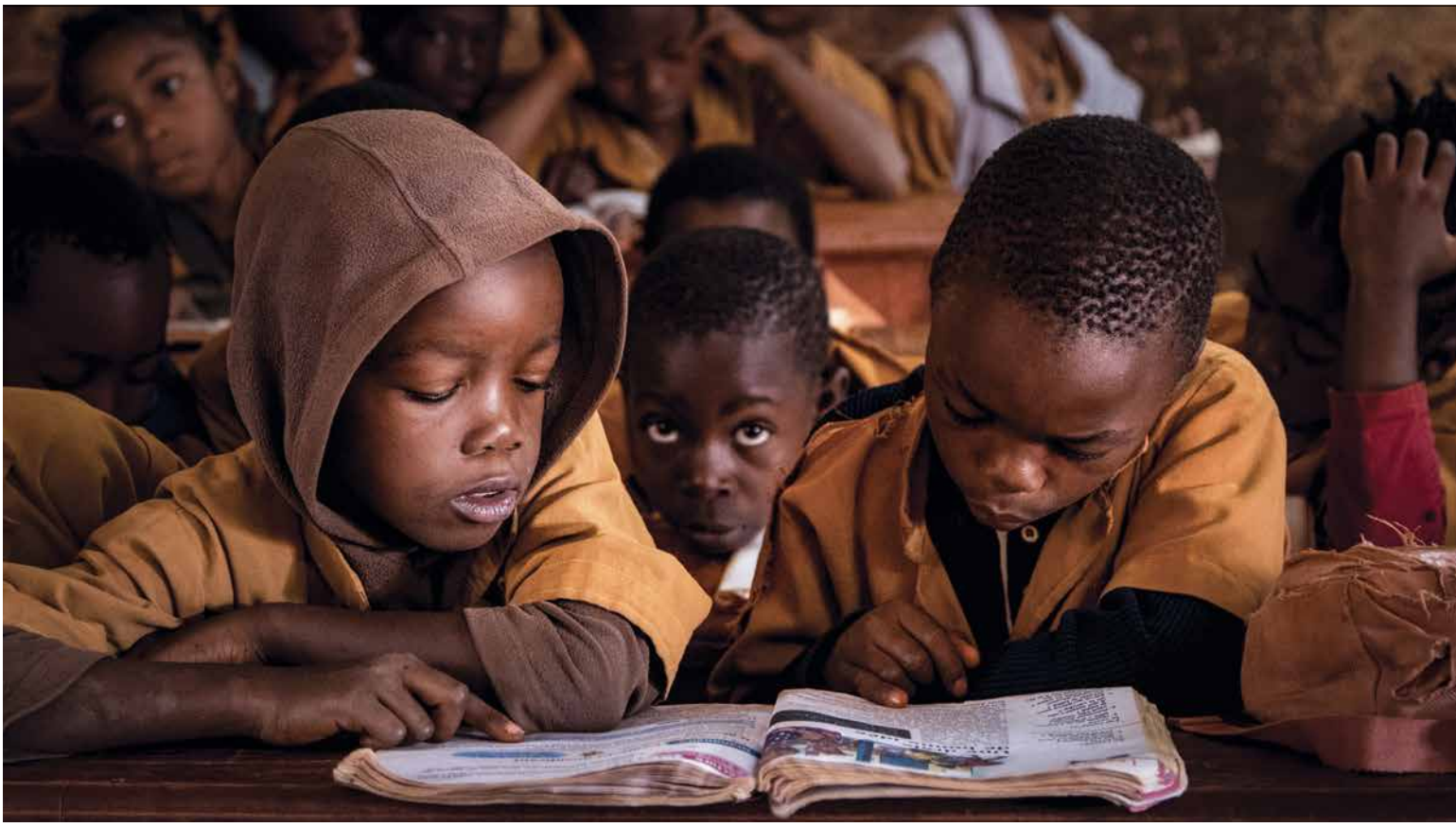
AID PROJECTS

Every drop counts

Every year during the drought period, the old well in the central Vietnamese village of Kon Bdeh dries up. The 800 residents then struggle with a lack of water for up to six months. The Endress+Hauser Water Challenge has improved the situation for the people of Kon Bdeh for the long term. Donations were used to drill a 100-meter-deep well, tap the spring, install a pump and build a water house. Before it flows out of the tap, the water is filtered and cleaned with a reverse osmosis process. Solar panels supply the system with electricity. Rolf Leber, who works for Endress+Hauser in Southeast Asia, served as the on-site project manager, calling it a “terrific experience”, adding that “together we changed the lives of 800 people for the better!”

Initiative encourages involvement

After successful completion of the first aid project, the Endress+Hauser Water Challenge will now shift to Brazil, where it will support a program to improve the water supply in the northeast part of the country, a region that suffers from partial drought conditions. In India, a purification plant in the village of Donwada is scheduled to be built, where Endress+Hauser had already helped some years ago by improving the water supply with a rainwater collection system. And in Cameroon, in the village of Lobongie, plans are in place to drill a well and create a pipeline network. The 1,500 residents of the village are currently dependent on various water holes and a small polluted river.



Start of a better life: In Bandrefam, the children no longer have to learn on an empty stomach.

Offering new perspectives

For three years, Endress+Hauser family shareholder Urs Endress has been involved in an aid project in a village in Cameroon. He has since found many supporters for the project – both inside and outside the company.

Urs Endress will never forget his first journey to Cameroon at the age of 21. Driving an off-road vehicle, he and a friend ventured across Africa – from Algeria, through the Sahara and down to Cameroon where they happened upon a village. "The residents invited us to eat with them," he recalls. "They refused to accept money from us, although they couldn't be sure what they would have on their plates the next day."

This generous hospitality had an impact on the young Urs Endress, compelling him to return to Cameroon time and again over the years, including in his role as managing director of Endress+Hauser France for two decades where he was responsible for the francophone African market. At the age of 66, Urs Endress still travels to Cameroon twice a year in a private capacity. Working together with like-minded people, his ambitious goal is to improve the lives of the 3,500 residents of the village of Bandrefam.

His engagement resulted from a chance meeting with a former karate professional from Bandrefam who had started a development project in his home village. Urs Endress accompanied him to Cameroon, where he quickly discovered that, apart from money, the project lacked a professional structure. "I managed projects and led people during my entire Endress+Hauser career. My thought was, why not put this experience to use here as well?" No sooner had this idea entered his mind, than he became president of the aid project.

Getting to the root of the problem

Urs Endress has a business mindset even when it comes to charitable activities. The first thing he did was take stock of the situation in Bandrefam. "We originally planned to build a carpenter's workshop but realized that it made more sense to focus our efforts on farming." Although the ground is exceptionally fertile, a lack of knowledge and technology means it's not being used efficiently.

"Even though the farmers work 12-hour days, they can't afford new shoes," explains Urs Endress. It's no surprise that younger people are leaving for the cities – or immediately undertaking the dangerous voyage across the Mediterranean Sea to Europe. "These young people deserve to have good prospects at home."

Leveling the playing field: The project gives village residents the knowledge to help themselves.

In Switzerland, the 66-year-old uses his network inside and outside the company to raise money – and to find others interested in joining his efforts in Cameroon. The project family has meanwhile grown to more than 30 members. "Besides acquaintances, my children and other members of the family, former and current Endress+Hauser employees get involved and give up their spare time and vacation," says Urs Endress.

A group of volunteers travels to Bandrefam every six months to drive the project forward. A former school principal trains the village teachers in didactics and an electrician runs courses for young people. An agriculture engineer instructs the farmers in permaculture. A finance specialist helps local businesspeople with microcredit programs. An engineer oversees improvements to the water supply system and an architect coordinates the construction of various structures such as an innovation center and a school cafeteria. Endress+Hauser donates computers and mobile phones that were taken out of service.

Returning home from the city

Urs Endress serves as the local project manager. "My job is to remove the roadblocks and clear the way for others," he adds. In these situations, the intercultural skills he acquired during his Endress+Hauser career have proven very useful. "We don't show up with preconceived notions. We ask people what they need."

For Urs Endress, this mindset fits well with the Endress+Hauser corporate culture. "Education is the key to everything. The best way to help someone is to give them the knowledge they need to help themselves." There are already visible signs of success. "Grades have improved among the schoolchildren, plus fewer younger people are leaving the village," reports the entrepreneur. "And some people are even starting to return to Bandrefam."

Text: Joel Bedetti
Photos: Claire Endress

Diverse engagement
After obtaining a degree in mechanical engineering, Urs Endress (born 1953) worked for his father's company for 34 years. He influenced the development of the Endress+Hauser flow technology and provided significant impetus to the Asian business. He led Endress+Hauser France until 2016. Today he manages key customers for the Group as an ambassador and oversees the global apprenticeship program. He is also involved in many private endeavors, including a landmine removal project sponsored by his own foundation.

A work that binds: Artist Bruno Guthauser and Klaus Endress, President of the Supervisory Board, in front of the sculpture in Reinach.

Sculpture with symbolic power

At the core of the Endress+Hauser corporate culture is the strong relationship between customers, employees and shareholders. The sculpture Loyalty and Responsibility illustrates what holds the innermost parts of the company together.

What does a technology company have to do with art? At first glance, not much. On one side you have the world of highly precise measurements, the laws of physics and indisputable metrics. And on the other, the sphere of aesthetes, where is there no right or wrong and where personal taste matters much more than expert analyses.

Still, Endress+Hauser is not just a high-tech company. It's also a family company. And family companies, which are marked by a strong focus on values and a deeply rooted corporate culture, are different. There is good reason why the Endress+Hauser claim – People for Process Automation – puts the emphasis on people. "People are what make the difference and what lead to excellence in a company," says Klaus Endress, President of the Supervisory Board, with conviction.

Customers, employees and shareholders all have different roles in this corporate fabric. But they all carry the company and they all depend on one another. "All three feel and do their best when they conduct themselves loyally and responsibly," explains Klaus Endress. When shareholders put the bulk of the profits back into the company, better products can be developed, for instance. This leads to satisfied customers, generates more business and creates new jobs. At the end of the day, everyone benefits.

The language of art When Klaus Endress was serving as CEO of the Group, nurturing and cultivating this corporate culture was an important issue for him – and it still is. For many years now, he has also been relying on the communicative power of art. With the sculpture Loyalty and Responsibility, which he commissioned Swiss artist Bruno Guthauser to create, he has conceived a work of art that gives form to the idea of a "good company".

"It comes down to the issue of holding and being held. That happens in every family and in every company."

Bruno Guthauser

As so often happens, the idea came to Klaus Endress during a nature excursion. While on one of his daily bicycle rides with his dog, he chanced upon the artist who frequented the same section of woods. It wasn't long before the two were having discussions that often revolved around the subject of loyalty and responsibility. "As an iron sculptor, I knew he had the means to implement such an idea. So one day I asked if he could imagine transforming these thoughts into an artistic form," explains Klaus Endress.

"For me, the discussions were wonderful," recalls Bruno Guthauser. He approached the initial design with a great deal of respect, choosing a ring as the basic form. "The simpler the form, the more powerful the impact," says the artist. What evolved was a 84-centimeter bronze ring with three equally large, intertwined segments symbolizing customers, employees and shareholders. "It comes down to the issue of holding and being held. That happens in every family and in every company. No one rises above the others. Together, they give the ring momentum," explains Bruno Guthauser. Klaus Endress views the sculpture as a type of "wedding ring" that binds the customer-employee-shareholder alliance.

Symbol of the corporate culture Today, the original version of the sculpture – a 30-centimeter ironwork – has its home in the office of CEO Matthias Altendorf, a gift from Klaus Endress when he handed over the reins of the family company in 2014. Matthias Altendorf is well aware of the symbolism – and the fact that it represents his own responsibility, as well as what the corporate culture means for a company that becomes more global each day.

"Endress+Hauser has experienced strong growth over the past several years. Today we have more than 14,000 employees. Each one serves as an ambassador for our brand and makes sure that our customers are always served with the same high quality standards," explains the CEO. In order to promote this self-image and the cohesion in the company, we have to cultivate and live up to our values. The sculpture carries this message around the world."

Whenever Endress+Hauser opens a new building or location, a replica of the sculpture is unveiled, not as some decorative accessory, but as a strong plea for a corporate culture that has pertinence across the globe. From Shanghai, to Madrid, to Abu Dhabi, the head-height artwork greets customers and employees at 37 locations around the world, a number that grows every year.

Locally anchored Minus the pedestal, the sculpture weighs a solid 120 kilograms. The pedestal, which is always carved from local stone, embodies how the sculpture is locally anchored and also embedded in the environment and society in which the company operates. "Just as customers, employees and shareholders assume responsibility, the company as a whole has an obligation to society and the environment," explains Klaus Endress. "The sculpture is thus an expression of the company's full and all-encompassing responsibility."

Text: Alexander Marzahn
Photos: Christoph Fein, Klaus Reinelt

Cast from the same mold The sculpture Loyalty and Responsibility is produced in small series by Swiss company Fischer JRG AG using a hollow casting process. Even for a company that prides itself on manufacturing special parts, hollow casting in a dimension like this presents a major challenge.

1. The foundry utilizes a Styrofoam model created by the artist as a template. A hardwood replica is used to manufacture the molds.
2. The casting mold, which is destroyed after each use, is made from hardened quartz sand. The two halves of the mold are heated with a gas flame to prevent humidity from reacting with the metal.
3. Before the halves are bolted together, the core is set in place. It defines the inner cavity and wall thickness of the sculpture.
4. In the meantime, 230 kilograms of bronze is smelted at temperatures of up to 1,350 degrees Centigrade. Small amounts of tin and phosphorus are then added to fine-tune the mixture.
5. The hot bronze is transported to the mold and the sculpture is cast in less than 22 seconds.
6. As a final step, the object is ground, sandblasted and patinated and then anchored to a pedestal made from stone.

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Martin Raab (editorial management), Christine Böhringer, David Bosshard, Olivia Feldheim, Alexander Marzahn, Sandra Rubart, Susi Teichmann

Editorial cooperation
Thomas Adolph, Joel Bedetti, Marion Fünfgeld, Claudia Füßler, Reinhard Huschke, Jan Rübel, Kirsten Wörnle

Language adaption
Helen White

Translation
Daniel Hawpe, Johanna Späth

Illustration
Ulrich Birtel, Pia Bublies, Ralf Marczinczik, X-Ray

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Contact
Endress+Hauser AG
Kägenstrasse 2
4153 Reinach BL
Switzerland

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Well prepared for the future

A glance back at 2019 shows a successful year. But when times get tough, it is the future that is of most interest. Despite the corona crisis, CFO Luc Schultheiss looks ahead with confidence.

Higher sales, more profit, increased headcounts: our key financials for 2019 reflect a successful business year. Endress+Hauser performed well compared to the industry overall, achieving higher growth than most of our competitors. Consolidated in euros, we grew by roughly 8 percent. Almost one and a half percentage points of this growth is due to currency exchange effects. But even discounting this influence, our business experienced solid growth.

We grew across all fields of activity, industries and regions. Strong impetus came from Asia, particularly China and India. Europe, the Americas, Africa and the Middle East developed positively. Calculated in euros, China overtook Germany in terms of sales and is now just behind the USA, which continues to be our top-selling market. The extent to which our business has become global is also reflected in the growing share of sales generated outside of Europe, which rose again and now surpasses 55 percent.

Earnings failed to keep pace with the sales growth. Our margin declined due to the changed regional and product composition of our revenues. In addition, depreciation and amortization increased disproportionately due to the investments of recent years. The financial result showed significant improvement in 2019 thanks to the successful management of our financial assets. Profits before and after taxes both experienced above-average growth. Return on sales exceeded our strategic goal of 13 percent, while productivity was also outstanding at 1.34.

Solid finances Our equity ratio rose to more than 75 percent. This is, among other things, due to the transfer of our German pension obligations to an independent fund, which reduced our provisions. Without this effect, cash flow from operating activities also developed above average. With over 230 million euros, we invested more in buildings, equipment and machinery than ever before in the company's history.

We thus headed into the current year with considerable momentum, a situation also driven by a significantly higher order backlog than the prior year. This initially exceeded our relatively conservative expectations. Although we were counting on slower growth, we never anticipated an event such as the coronavirus pandemic. It remains to be seen what kind of impact this crisis will have. But the effects of a weeks-long lockdown of public life and economic activity in many countries across the globe will undoubtedly be felt by our customers and us.

Our company is well prepared for difficult times. We did a solid job of running the business during the good years and constantly kept our eye on current expenses. Today, there are essentially no bank loans we have to serve, and we enjoy enough liquidity to be able to settle the Group's liabilities. This provides stability and security. Furthermore, we know that we are well positioned, strategically and operationally. We have a broad base of business activities across various regions, industries and products. And we are helping our customers address important issues.

Securing jobs As always in uncertain situations, we sort of operate 'on sight' and adapt as needed. Our experience during the 2008/2009 financial crisis will help us here. We have an entire package of measures at our disposal to compensate for underemployment, for example by driving working time accounts into the red or using vacation days. We are reviewing each expense to determine if it is necessary in the current environment and we have postponed some smaller projects. When it comes to the large investments, however, we are staying the course and completing them as planned.

As with the last crisis, our goal is to retain our employees. In return, we are accepting a decline in profits. We are thus exemplifying the loyalty and responsibility that marks our corporate culture, the Spirit of Endress+Hauser. We are pleased and grateful to have the full backing of the Endress shareholder family. They trust that we will overcome this crisis together and continue to successfully develop the company over the long term.

Photos: Andreas Pohlmann, Christoph Fein

A knack for numbers
Dr Luc Schultheiss (58), who holds a doctorate in business administration, worked as a university lecturer and consultant before joining Endress+Hauser in 1999. He was appointed Chief Financial Officer and member of the Executive Board in 2011. Luc Schultheiss is married and the father of three grown children. He is an avid fan of FC Basel and enthusiastically involved in the Carnival of Basel.

2019 HIGHLIGHTS

Paving the way for generational change

The young generation of the shareholder family is assuming more responsibility. Sandra Genge was elected to the Supervisory Board by the Endress+Hauser AG shareholders' General Assembly. She will join the board in 2022, replacing Hans-Peter Endress, who is retiring. A granddaughter of the family founder, the 42-year-old is managing partner in a Switzerland-based advertising agency and is married and the mother of three children. Since 2006 she has represented the younger generation on the Family Council, which serves as an important link between the family and the company.

Sustainable progress

For the fourth year in a row, Endress+Hauser reached Gold Recognition Level in the EcoVadis sustainability audit in 2019. With 72 out of a possible 100 points – four more than the year before – the Group placed in the top two percent of the companies in the comparison group. EcoVadis operates a global platform for assessing suppliers in accordance with environmental, social and ethical criteria. Endress+Hauser achieved above-average results in the categories of environmental protection, work conditions, business practices and procurement.

Patented innovation spirit

Endress+Hauser filed 318 patents in 2019, an increase of 31 over 2018. This brings the number of active patents and patent applications to just over 8,000. More than one-third of the new applications involve Industry 4.0, digital communications and instrument diagnostics. Analysis technology and quality measurements also represent a growing focus. Another testament to the Group's ongoing innovation spirit is the number of new developments in the pipeline. Employees within the Group submitted nearly 400 innovations for internal patent review in 2019.

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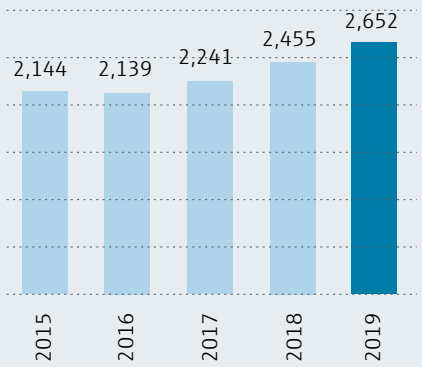
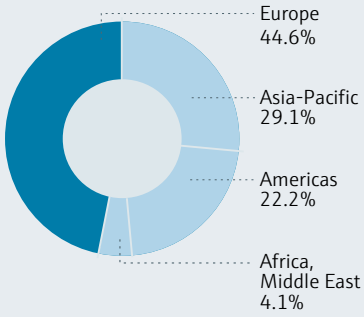
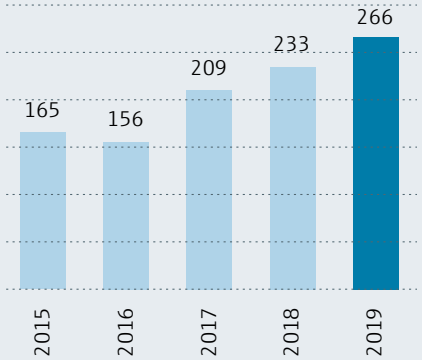
Fiscal year 2019 at a glance

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

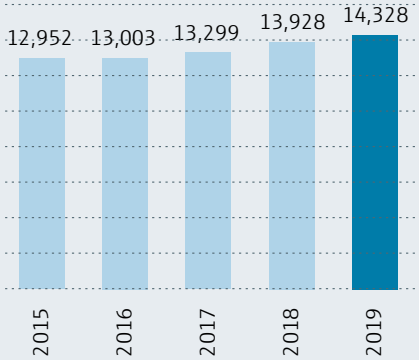




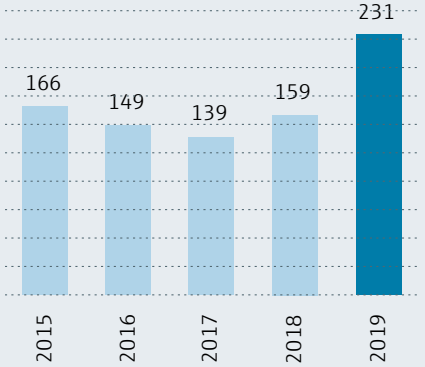
Net income
(in million euros)



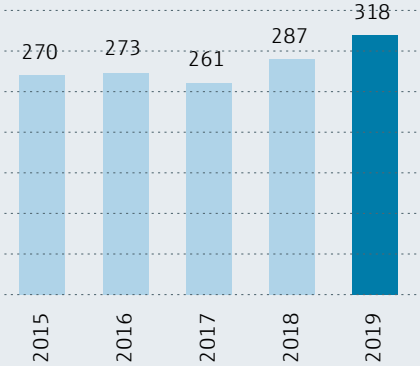
Employees
of the Endress+Hauser Group



Capital expenditures
(in million euros)



Patent applications
of the Endress+Hauser Group



Financial highlights 2019

(in million euros)

	2015	2016	2017	2018	2019	Change
Net sales	2,144	2,139	2,241	2,455	**2,652**	8.0%
Operating profit (EBIT)	251	219	252	331	**343**	3.9%
Profit before taxes (EBT)	234	221	276	316	**347**	9.9%
Net income	165	156	209	233	**266**	14.3%
Return on sales (ROS)	10.9%	10.3%	12.3%	12.9%	**13.1%**	
Productivity	1.30	1.27	1.31	1.34	**1.34**	
Equity	1,718	1,779	1,820	2,067	**2,286**	10.6%
Equity ratio	73.0%	70.5%	70.2%	71.0%	**75.6%**	
Total capital employed	2,353	2,524	2,593	2,913	**3,025**	3.8%
Capital expenditures	166	149	139	159	**231**	45.8%
Cash flow from operating activities*)	260	237	237	304	**347**	14.2%
Number of employees	12,952	13,003	13,299	13,928	**14,328**	2.9%

*) 2019 without effects from transfer of German pension liabilities

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Contact

Endress+Hauser AG
Kägenstrasse 2
4153 Reinach BL
Switzerland

Phone +41 61 715 7700
Fax +41 61 715 2888
info@endress.com
www.endress.com

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Endress+Hauser

People for Process Automation