changes

A change for the better

How the circular economy is gaining momentum

What's driving the process industry

#1/25

Endress+Hauser

The luminous swirl shown on the magazine cover is steel and may previously have been part of a washing machine, a tool or even a bridge. Steel is an alloy with immense circular economy potential, having a long lifespan and being recyclable without loss of quality. But perhaps most significantly, it features in the value chains of practically all everyday goods on the planet – whether in the products themselves or in their production processes.

Industry in transition

Companies are facing major challenges. They are under pressure to adapt to an increasingly dynamic economic and political environment. On top of that, they are grappling with global existential imperatives of ever-greater urgency. Sustainability is one such imperative: Humanity must safeguard the climate and the environment if the Earth is to remain comfortably habitable.

Piecemeal measures clearly won't be enough. If our planet is to remain livable, we must ultimately transition to a circular economy – a system that decouples economic growth from resource consumption by reducing and improving resource use and avoiding waste wherever possible. In other words, a huge change!

This transition to circular economics calls for a coordinated, phased approach and innovation at all levels. Why? Because developing the necessary products and processes and changing entire value chains over to circularity will require new technologies, greater digitalization and close collaboration. The only way to the best solutions is through working together – uniting in pursuit of the same goal and learning from each other.

Our research for this edition of the magazine led us to conclude that the process industry is well aware of its sustainability responsibilities. Many companies in this sector see the challenges involved as opportunities. They are exploring the possibilities of circularity and working on specific solutions. There are innovative approaches out there that give me courage for the future because they show that it is possible for environmental and economic advancement to proceed hand in hand.

An enjoyable read awaits!

Dr Peter Selders
CEO of the Endress+Hauser Group

It is possible for environmental and economic advancement to proceed hand in hand.

Read more *changes* stories online at **changes.endress.com**

Rethinking the linear economy

Embracing the circular economy requires a mindset makeover. **Page 8**

Dump it!

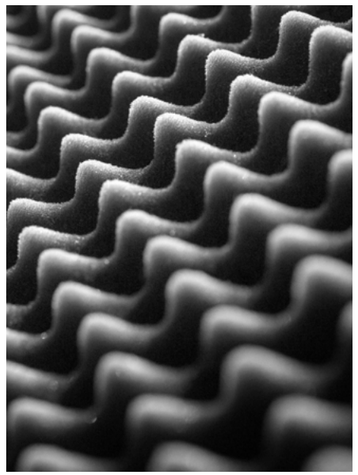
Avoiding waste: What did we achieve until now? **Page 4**

Pulling in unison

Covestro Chief Technology Officer Thorsten Dreier in conversation with Peter Selders. **Page 22**

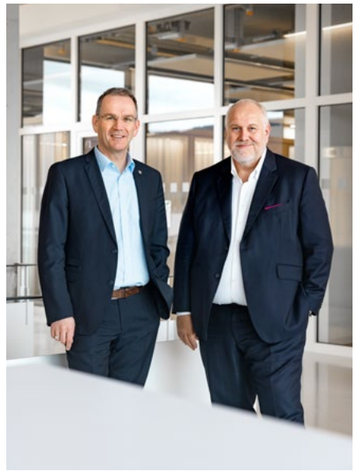
Staying ahead of the curve

How Endress+Hauser supports the transition to a circular economy. **Page 26**



Covestro makes plastics more sustainable. **Page 14**

Circular polymers



Peter Selders and Matthias Altendorf talking about the path to the future. **Page 44**

Strong together

Contents

Dump it!

Over time, humans have forgotten how to operate resource-efficient economies. But the path to a circular economy is still there. As proof, we needn't just look back to the past. Positive approaches exist in the present, too – although there is still much to accomplish.

Text: Marlene Etschmann, Roman Scherer, Robert Habi
Photography and illustration: 3st kommunikation, Strandperle, Unsplash

Time for change

Today economies operate in linear fashion: extraction of natural resources on an ever grander scale, manufacturing them into products with the heavy emissions that entails, and consumption of those products, which then end up being discarded. But this means humans are overexploiting the Earth. And it has consequences: climate change, environmental pollution, species extinction, raw materials shortages, water scarcity. The circular economy, on the other hand, aims to keep products and materials in use for as long as possible, and to close material and energy cycles. Circularity conserves resources and avoids impacts on nature, so it can regenerate.

Circularity Gap

The annual Circularity Gap Report examines the extent to which raw material cycles are already closed. Spoiler alert: it's not as good as you'd hope. And there is a big gap between talking about it and taking concrete action. In the past five years the number of published articles and discussions about the circular economy has tripled. Meanwhile, just seven percent of raw materials consumed worldwide came from recycling in 2023, down from nine percent in 2019. This is due, in part, to increasing general demand for materials. Which is to say that right now, the gap between the circular and the linear economy is widening rather than narrowing.

The value of things

Today's throwaway, consumer society only came into existence just over 150 years ago with the start of the industrial revolution. Crafts were displaced by mechanized production. Goods could now be made quickly, cheaply and in high quantity. Low-cost oil in the 1950s fueled the trend towards short-lived products. Yet throughout the preceding millennia it was scarcity and shortages that governed humanity's relationship with objects and materials. So in order to preserve their value for as long as possible, things were repaired, reused or recycled.

Our predecessors of 500,000 years ago, the Neanderthals, were already adept at turning their broken **flint axes** into new, smaller tools.

The **Colossus of Rhodes** is one of the seven wonders of the ancient world. An earthquake destroyed the 30-meter-high bronze statue around 226 BC. Word has it that 900 years later, a merchant bought the fragments and had them melted down.

Prior to the industrial revolution, **clothing** was always mended. Irretrievably worn-out textiles went into papermaking, or were picked apart and their threads re-woven into fabric for new garments.

84%

of the steel ever produced worldwide is still in use due to its longevity and continuous recycling.

<1%

of the clothing produced worldwide is processed into new fibers for the textile industry. Two out of three manufactured garments end up directly in the trash. Just around one tenth of waste clothing goes into producing rags and thermal insulation materials.

Endless loop

'Hit recycling' has long been an established practice in the music business. Tried-and-tested tunes are revived time and again, with each iteration finding completely new fans. But wait: Which song is actually the most covered in the world?*

A) Yesterday – The Beatles

B) Satisfaction – The Rolling Stones

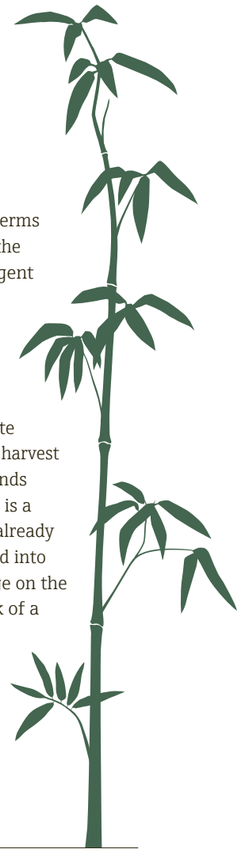
C) Love Me Tender – Elvis Presley

D) Last Christmas – Wham!

E) Hallelujah – Leonard Cohen

* Yesterday – more than 2,200 times.

On the up and up



It is hard to top the construction industry in terms of how much carbon dioxide is released from the production of its materials. So there is an urgent need for climate-friendly alternatives to concrete. Bamboo is one such candidate as a building material in many Asian and South American countries. The fastest-growing plant in the world has many advantages: It combines the compressive strength of concrete with the tensile strength of steel. It is ready to harvest after just four years. One tonne of bamboo binds around 450 kilograms of CO_2. And because it is a grass, cut stalks will sprout again. There are already industrial processes where bamboo is whittled into small strips and glued together. One challenge on the way to a sustainable cycle is the current lack of a bio-based adhesive. Prominent examples of bamboo construction include the roof cladding at Madrid Airport, the Hotel Jakarta in Amsterdam and the Green School, an international school in Bali.

"Earth's nature is a circular system. The only way forward for the human race is to emulate nature and pursue a circular economy."

Prof. Seeram Ramakrishna, materials scientist and circular economy researcher

Out of this world

Lost in space? Not at all! The International Space Station (ISS) cannot afford to lose water, given the extreme cost of transporting fresh water into space. This is why 98 percent of the water that the crew consumes on board, sweats out or excretes as urine is recovered and treated to produce drinking water. A dehumidifier captures the airborne water vapor from breath and sweat and feeds it into a complex filtration system. Urine goes through a special distillation process. Developers recently succeeded in removing the water from the remaining urine brine, raising the recovery rate from 93 to 98 percent. Fun fact: according to the engineer in charge, the purified water up on the ISS is cleaner than the water we drink down on Earth.

98%

of water on the ISS is captured and reused.

Rethinking the linear economy

It’s time to rethink our linear economic model: the consequences of all that taking, making and wasting are getting harder and harder to ignore. But as yet we seem to lack that initial impetus, that spark, needed to set the circular economy in motion.

Text: Armin Scheuermann
Illustration: Kathrin Rodegast

The spark plugs used in our cars epitomize the dilemma we’re facing with our linear economy: they’re throw-away items, but the engine won’t work without them. Every year, over a billion of these critical ignition system components are swapped out worldwide and wind up in the trash. And increasingly, they feature a special iridium coating. Spark plugs with iridium – an extremely temperature-resistant metal – offer improved combustion efficiency and last three times longer than their conventional nickel counterparts.

On the plus side, each of these high-tech spark plugs contains only a minute quantity of iridium. But demand for them is growing – with the result that around 100 kilograms of this rare metal ends up in landfills or is melted down as scrap every year. The problem here is that global iridium production is only about 8 tonnes annually, so it’s becoming harder to meet this growing demand. The transition to cleaner energy is exacerbating this situation because iridium is also a vital catalyst in the production of hydrogen using PEM electrolysis.

Our economy is currently based on the ‘take-make-waste’ model and, exceptions like PET bottle and waste paper collections aside, global recycling rates are decidedly modest. This is mainly due to commercial considerations: using virgin materials is cheaper than collecting and processing used materials. But price does not reflect the true value of the resources used. That’s clear from Earth Overshoot Day, the date each year by which humanity is estimated to have consumed all the biological resources the Earth can regenerate in a year. In 2024, that date was 1 August.

106 billion tonnes

That's the volume of resources that humanity consumes every year, according to the *Global Resources Outlook* report for 2024. In other words, consumption is three times as much as in the 1970s, or about 39 kilograms per person per day.

FROM COWBOY ECONOMY TO SPACESHIP ECONOMY

According to World Economic Forum estimates, humanity consumes 70 percent more resources than Earth's ecosystems can regenerate. Yet recycling still accounts for only seven percent of material inputs in production processes. As long ago as 1966, the economist Kenneth Ewart Boulding described this propensity for reckless exploitation in open societies as the 'cowboy economy'. He called for a shift to a 'spaceship economy' – a closed, cyclical ecological system capable of continuously reproducing its materials. And so the concept of the circular economy was born.

Circular economics, it should be noted, extends beyond recycling. It calls for the efficient stewardship of natural resources, materials and energy through closed cycles of constant reuse. Here, recycling happens only after repair, reuse and remanufacturing are no longer possible. This keeps products and materials circulating through the economy for much longer, drastically reducing the demand for virgin materials.

In the chemical industry, with its integrated production complexes, circularity of energy, heat and materials has been the norm worldwide for decades. In these cycles, by-products and waste heat from one process are used as raw materials and process heat in the next. But that's the extent of it: the circularity ends once the finished products leave the factory gates. This needs to change.

Change is needed because without circularity the chemical industry and all others will not achieve sustainability nor climate neutrality. To put that in context: Management consultancy Roland Berger calculates that raw materials extraction and processing are responsible for 90 percent of global biodiversity loss and water shortages as well as about a third of negative health impacts. Meanwhile, the Ellen MacArthur Foundation estimates that circularity has the potential to reduce global greenhouse gas emissions from goods and materials production by 45 percent.

THE R-STRATEGIES FOR A CIRCULAR ECONOMY

To help bring about a circular economy, experts in the field have developed the 'R-strategies', so called because each strategy is headlined by a word starting with 're'. They show that circularity involves more than just recycling. For a long time, there were only three such strategies: *reuse*, *reduce* and *recycle*. Now there are as many as 12, depending on the publication you're looking at. Some are aimed at extending the lifespan of products and their components. Hence *reuse*, *repair*, *refurbish*, *remanufacture* and *repurpose*. Others are designed to help decrease resource use in production and lower environmental impacts. For example, *rethink* and *reduce* urge us to consider making products using secondary raw materials, to design them for end-of-life circularity, and to make their production more energy and resource efficient.

"We need to start thinking about how to reduce, reuse and repair products at the design stage."

Julia Binder, professor of sustainable innovation and business transformation at IMD Lausanne

RELEARNING CIRCULAR ECONOMICS

While the principles of circularity have been well known for a long time, companies have so far struggled to implement them. Why? Because, to go circular, they first need to rethink their business models. For example, they need to make their products circular by design and develop them based on alternative materials. "If we are to truly capture value and move away from the entrenched thinking that keeps us locked in a take-make-waste economic model, we need to start thinking about how to reduce, reuse and repair products at the design stage," writes Julia Binder, professor of sustainable innovation and business transformation at IMD Lausanne and co-author of *The Circular Business Revolution*.

Other barriers to going circular include the high initial capital investment required, complex and opaque supply chains, a lack of standards and regulations for take-back, reuse and recycling, and a lack of technologies to make these processes effective and efficient. Then there's the chicken-and-egg problem: demand for secondary raw materials remains low – partly because primary raw materials, such as plastic granules, are in many cases still cheaper.

Nevertheless, there is a growing realization among political actors that the future is circular. In the USA, for example, the EPA has adopted the Sustainable Materials Management Program. China has had legislation promoting circularity since as long ago as 2009. And the European Commission adopted a circular economy action plan back in 2020.

COOPERATION IS KEY

"Most companies are still finding their feet and are only just beginning to understand what circularity means for them and their customers," says Michael Sinz, director of strategic business at Endress+Hauser. "And it's quickly becoming clear that no one company can solve the problem on its own, because everything is interconnected." In his view, circularity is a complex system that can only be realized if companies cooperate and see themselves as part of an ecosystem. "For the same reason, this new collaborative path is often something of a challenge for companies that are typically reticent about their innovation activity."

>60%

of all greenhouse gas emissions are attributable to the extraction and processing of natural resources, according to calculations by the UN Environment Programme.

Julia Binder, too, sees it as a must for companies to put aside their competitive instincts and opt for cooperation: “Unlike traditional linear business models, embracing a circular economy requires a systemic change that involves not only rethinking product design and manufacturing but also reshaping supply chains, consumption patterns and waste management practices.”

One example of this cooperative approach is the EV battery recycling tie-up between chemical company Solvay, waste and recycling specialist Veolia and automaker Renault. Recovering rare metals from end-of-life EV batteries is extremely difficult owing to their complex composition. As a result, very little of these valuable metals tends to be recycled. To solve this problem, the three-way consortium coordinates the requisite expertise at each step along the battery value chain to recycle EV batteries in a closed loop. Clearly, the chemical industry, with its expertise in processes and analysis methods, has a key role to play in recycling.

But what works for makers of homogeneous, high-volume products poses a challenge for highly diversified manufacturers. How do they collect their products after the end of their useful life? To date, this challenge has caused many a circular economy initiative to fail. One possible solution may be to develop ‘as a service’ business models of the type now common in the software industry. Such models could also close the loop for chemical products, as evidenced by Swedish environmental services group Ragn-Sells’s plans for products such as iron(III) chloride, an important precipitant in wastewater treatment. Ragn-Sells aims both to supply these chemicals and to recover them from sewage sludge for reuse.

CIRCULARITY MEANS NEW OPPORTUNITIES

These examples are clear evidence that circularity presents major opportunities. Indeed, nearly 10 years ago, the management consultancy Accenture estimated that circularity could potentially generate an extra 4.5 trillion US dollars in economic value by 2030. This is one reason why more and more economic actors are thinking circular. Another is that circularity makes their supply chains more resilient: every kilogram of materials they recycle in-house or in cooperation with partners is a kilogram they don’t need to source on the global market. This idea is also influencing current EU lawmaking – as can be seen from the Critical Raw Materials Act and the new Ecodesign for Sustainable Products Regulation (ESPR).

“No one company can achieve circularity on its own – everything is interconnected.”

Michael Sinz, director of strategic business at Endress+Hauser

Technology – principally digitalization – ranks alongside these new business models and regulatory frameworks as a key enabler of circularity. Experts agree that a successful shift to circular value creation requires a more data-driven approach to recycling, more efficient and flexible automation of dismantling processes, and greater use of predictive models like digital twinning in production. The new ESPR is intended to facilitate this. From 2026, the regulation will require nearly all products sold in the EU to feature a digital product passport containing comprehensive details of the product’s lifespan and environmental footprint.

COMMERCIAL MOTIVES TO GET THE CYCLE TURNING

The clock is ticking: natural resources are dwindling, and climate change is marching on. For Ellen MacArthur, the founder of the eponymous foundation, this makes transitioning from the current linear to a circular economy the only option. As she said on the sidelines of COP28: “Life itself has existed for billions of years and is by definition circular. We have been straining against this system since the Industrial Revolution. Our ‘take-make-waste’ model, in which we generate environmental pollution, squander resources and support a growing world population in a linear economy, is not sustainable in the long term.”

Of course, application of pressure and the threat of resource scarcity are only two sources of impetus in the circular transition. Commercial motives will also be decisive – and in the case of iridium spark plugs, perhaps that will lead to the realization that collection and recycling is smarter than exposure to the vagaries of supply chains.

The author, Armin Scheuermann, is a chemical engineer and science and technology journalist.

$ 5.4 billion

was invested in circular economy startups worldwide in 2022. That’s according to an analysis by UnternehmerTUM, Europe’s leading center for innovation and business creation.

Circular polymers

Covestro has made circular economy a guiding principle – and is showing the way forward in the plastics industry by fully committing to it. A look at the latest developments from Leverkusen, Germany.

Text: Christine Böhringer
Photography: Covestro, Pexels, Shutterstock
Graphics: 3st kommunikation

1

1
Covestro develops new technologies at its headquarters in Leverkusen, Germany.

2
At a pilot facility, the company pioneers the production of bio-based aniline.

3
The innovative process is optimized with the aid of measurement technology.

2

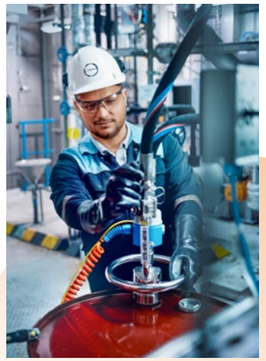
COVESTRO AT A GLANCE

Established: 2015

Employees: 17,500 (2024)

Sales: 14.2 billion euros (2024)

Covestro is one of the world's leading manufacturers of high-quality polymer materials and their constituents. With its innovative products, processes and methods, the company based in Leverkusen, Germany, helps to enhance sustainability and quality of life in many areas. Covestro supplies customers around the world in key industries such as mobility, construction and domestic goods, as well as the electrical and electronics sector. Polymers from Covestro also find uses in sectors such as sports and leisure, telecommunications and health, as well as in the chemicals industry itself. In 2024, Covestro had production operations at 46 locations worldwide.



3

9%

of the world's plastic waste is recycled, according to the OECD.

Polyurethanes are ubiquitous. For the past 90 years, these all-rounders of the plastics world have been bringing comfort, stability and weather-proofness to our lives. As liquid coatings, they impart hard-wearing surface finishes to cars and floors. In the form of adhesives, they hold shoes and books together. The synthetic polymers are also essential to the furniture industry, in the form of flexible foams used for upholstery and mattresses. They are in rigid foams too, the kind that thermally insulate refrigerators and millions of buildings, thus boosting energy efficiency and making a significant contribution to climate protection.

IN THE MIDST OF CHANGE

Yet polyurethanes have some catching up to do in terms of their own sustainability. Like almost all of the world's 414-million-tonne annual plastics output, they are generally made from petroleum products – a pathway that generates CO_2 emissions and drives climate change. And, at end of life, they wind up in landfills or incinerators. According to the OECD, only nine percent of the world's plastic waste is recycled. But things are changing. "More and more chemicals companies are starting to rethink polymers. The industry is in the midst of a fundamental transformation process," says Thomas Pellender, technical sales manager for the chemical industry at Endress+Hauser Germany. The pioneers here include Covestro, one of the world's leading manufacturers of high-quality plastics and plastics intermediates. "The circular economy has been a guiding principle for us since 2019, and we are fully committed to it. We can't achieve climate neutrality without circularity," explains Dr Thorsten Dreier, chief technology officer at Covestro.

Covestro's aim with its strategic program is to transition the production of plastics and their chemical constituents to environmentally friendly and climate-neutral alternatives wherever possible. Hence, the company makes increasing use of bio-based raw materials and renewable energy in its production processes. Alongside this, it is developing innovative, energy-efficient technologies to optimize the mechanical and chemical recycling of end-of-life products and unavoidable waste. The idea is that products and processes should be circular by design. Thorsten Dreier: "In all areas, we are cooperating with actors from across the value chain and the science community and forging new partnerships to find solutions that are best for the circular economy."

BUILDING BLOCK OF THE FUTURE

The fruits of these efforts can be seen at Covestro headquarters in Leverkusen, Germany. On the factory campus there is a pilot facility with a vast array of reactors, columns, vessels and heat exchangers that occupies no fewer than four levels of an expansive laboratory and testing center. The facility, a world first, also has 600 meters of pipework as well as over 150 measuring points and sensors – many of them made by Endress+Hauser. The colorless liquid produced by this facility may in future be instrumental in expediting the transition to circularity – for the chemicals and plastics industry generally, and for Covestro in particular. "We have pioneered a process for producing aniline, one of our most important precursors, that uses plant biomass instead of petroleum-derived benzene," explains project lead Thomas Vössing.

Covestro produces about a million tonnes of this organic compound annually, or about one sixth of worldwide output. “We use the aniline to produce MDI,” Thomas Vössing explains. MDI stands for methylene diphenyl diisocyanate – one of the main chemical building blocks used in the manufacture of rigid polyurethane foam. Covestro’s investment in the pilot plant runs into the single-digit millions of euros. The plant is the culmination of eight years of research conducted in partnership with RWTH Aachen and the universities of Düsseldorf and Stuttgart, also supported by government funding. “Commissioning the pilot plant was a major milestone,” Vössing says. “The biggest challenge with this project was to develop a holistic process concept from scratch and then translate it to a technical scale. That involved designing items of equipment that had never been built before.”

Bio-based aniline is produced in a series of steps. To begin with, a customized bacterium is used to ferment plant-based industrial sugar into an intermediate product that is isolated and then, in a following step, catalytically converted to aniline. “Once purified through distillation, this product can be used as a bio-based ‘drop-in’ alternative to petro-based aniline – the two are chemically identical,” explains Thomas Vössing.

CLOSE PARTNERSHIP

That the pilot plant’s process monitoring systems include Endress+Hauser measurement technology almost goes without saying. “Endress+Hauser is one of the suppliers with whom Covestro has a long-standing partnership,” says Sebastian Mahler, head of process control technology at Covestro. Indeed, it is a partnership that goes back decades. Covestro was created from the spin-off of Bayer AG’s plastics division in 2015 and previously did business as Bayer MaterialScience. A supplier agreement with Bayer concluded back in 2003 means that Covestro uses Endress+Hauser instruments as standard in its plants all over the world. “Our relationship with Covestro is very close and reliable at all levels, from service technicians to

“Measurement technology provides the basis for deep understanding of processes and is therefore fundamental to the development of new processes.”

Sebastian Mahler, head of process control technology, Covestro

150

measuring points and sensors feature in Covestro’s pilot plant for bio-based aniline.

senior leadership. We get onboarded in their projects at an early stage. This means we are in dialog with their technical people and can recommend the best sensors for their needs and advise them on systems design,” explains Endress+Hauser technical sales manager Thomas Pellender.

Covestro’s Sebastian Mahler agrees: “On the technical side, this is a partnership between equals. Endress+Hauser, like few other companies we deal with, is willing to dive deep into the special technical requirements of our processes to see if they can be realized. We and our counterparts are mutually supportive and can also provide input to further developments in both organizations.” At Covestro, a prime function of measurement technology is to keep plant and equipment operating reliably and efficiently, which in turn reduces consumption of energy and raw materials and minimizes waste. “Measurement technology is fundamental to the development of new processes,” Mahler says. “It provides the basis for deep understanding of processes and for determining and calculating scale-up factors.” High-precision measurements enable Covestro to test, understand and optimize new technologies so that it can progressively scale them up to the point where they can be used for full-fledged industrial production.

THE PATH TO CIRCULARITY

Covestro has been fully committed to the circular economy since 2019. Its circularity strategy for effecting this transformation and achieving its sustainability goals rests on five pillars.

Alternative raw materials

Plastics today are still based on fossil raw materials such as petroleum and its derivatives. Covestro wants to move towards making them from alternative raw materials that are based on plant biomass, CO_2 or waste, or that can be produced on a non-fossil basis using renewable energy.

Renewable energy

To become operationally climate neutral, Covestro is transitioning its own energy supply to renewable sources. The company has implemented an energy management system to reduce emissions from its production processes. The result: In 2022, the energy requirement per tonne of product produced was almost 40 percent lower than in 2005.

Innovative recycling

Covestro aims to use technologies specifically for producing certain raw materials from plastic waste. Of special importance here are chemical and enzymatic processes for recycling materials back into their constituent molecules. The resulting secondary raw materials are comparable in quality and properties to virgin resources and can therefore be reused as inputs in materials manufacturing.

Joint solutions

The transition to a circular economy is a major undertaking, achievable only through concerted action. That is why Covestro is teaming up with partners from industry and science. For example, Covestro is a partner of the Catalysis Research Center at RWTH Aachen, which is conducting pioneering research into sustainable and recyclable materials. The company is also partnering with Neste and Borealis to develop recycling solutions for used tires. And as a shareholder in the Netherlands-based company BioBTX, Covestro is helping to pioneer a new chemical recycling method.

Circular intelligence

To enhance market transparency around circular solutions, Covestro introduced a new portfolio of products under the label ‘Circular Intelligence’. These products feature a guaranteed minimum content of alternative or recycled raw materials.

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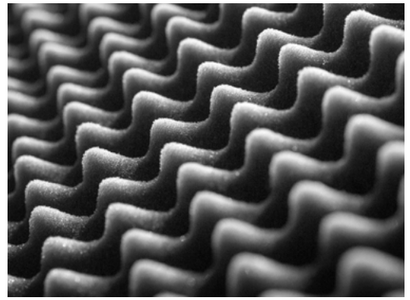


3

4

1
Covestro uses aniline to make a raw material for insulation panels.

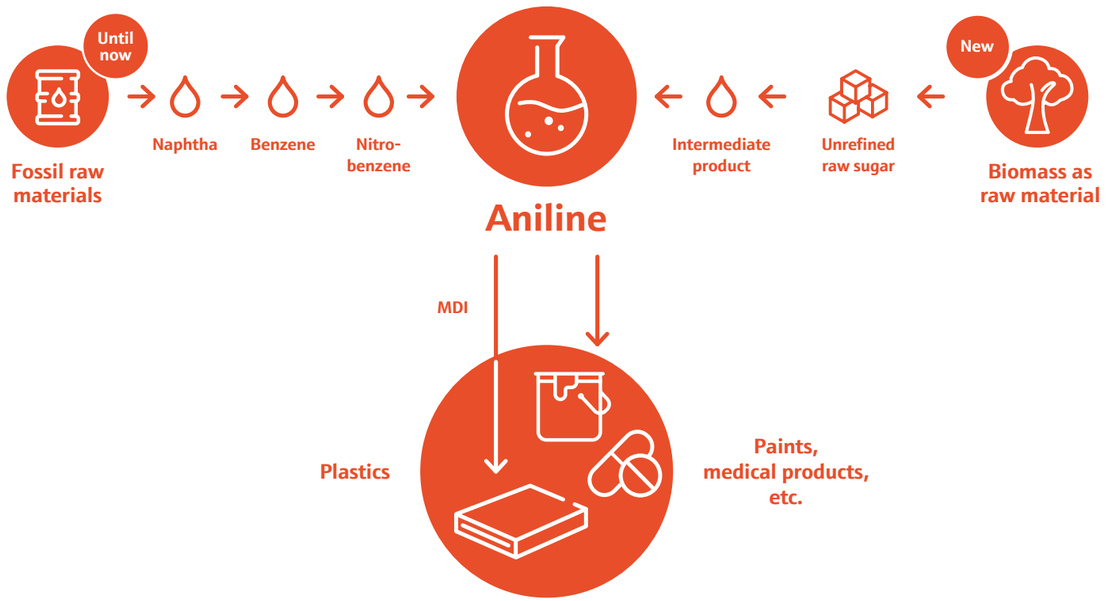
2
At a special competence center, Covestro conducts research into biotechnology approaches.

3
The company also aims to make foam materials more sustainable.

4
Covestro is looking at ways of recovering the constituents of flexible foams from old mattresses using chemical recycling.

Chemicals from plant sources

Production of the basic chemical aniline is now possible without the use of crude oil or other fossil raw materials – thanks to a research breakthrough by Covestro.



INNOVATION IS KEY

Several instances of such upscaling are currently under way on the Covestro factory campus. As an example, a pilot plant for bio-based hexamethylene diamine (HDMA), a precursor for liquid coatings and adhesives, has been operating since 2022. Covestro developed the process technology for this in partnership with US biotech company Genomatica. “Whatever the project, partnerships are important for us because synergizing specialist expertise brings us closer to our goals,” says Thomas Vössing. The same is true for the 20-plus projects where Covestro is researching novel recycling methods. “Alongside research into raw materials from new, bio-based sources, we are vigorously driving the development of these innovative recycling technologies. Our vision is to become fully circular and climate neutral, and we are pursuing all avenues for innovation that can bring us closer to this goal,” explains Thorsten Dreier, Covestro’s chief technology officer. “Recycling has the potential to take us a long way towards closing the loop and transforming waste into raw materials that we can use in production.”

In another pilot plant, Covestro and its partners have achieved an initial breakthrough in chemical recycling. The plant recycles polyurethane flexible foams from used mattresses – a worthwhile endeavor, considering that each one contains on average 15–20 kilograms of the material. The uniqueness compared with other chemical methods is that the Covestro chemical recycling technology, Evocycle CQ, is able to recover both main constituents of polyurethane – polyol and the precursor to diisocyanate – at high levels of quality and purity. In contrast, Covestro’s enzymatic recycling technology is still in early-stage development. This biotechnological approach uses enzymes to decompose plastics into monomers which can then be used for producing new plastics of equivalent quality to virgin material. The advantage of enzymatic recycling is that it takes place at very mild temperatures and produces few to no by-products. As such, it brings the chemicals industry a whole lot closer to the closed-loop systems of nature, where there is no waste and everything is recycled.

While these are important milestones, Covestro still has a long way to go before it achieves full circularity across its entire production landscape for plastics and their constituents. But for CTO Thorsten Dreier, one of the people tasked with championing the circular economy strategy at Covestro, these and other key milestones are cause for confidence: “We are making new advances in all areas almost on a daily basis. That having been said, we’re still a long way from reaching our goal.”

414 million

tonnes of plastics are produced worldwide every year.

Pulling in unison

The transition to a circular economy can only succeed if its many stakeholders work together as one, says Covestro's chief technology officer Thorsten Dreier. For Endress+Hauser CEO Peter Selders, willingness to cooperate is therefore the key.

Questions: Martin Raab
Photos: Christoph Fein

Mr Dreier, have you created a circular economy in your private life?

Dreier: We at Covestro have long scrutinized every one of our ideas, projects and actions for their sustainability and contribution to our vision of a circular economy. I too have adopted this way of thinking in my life outside the company. Of course, I avoid disposable products whenever possible. And where that's not possible, I look closely at quality and durability in clothing, furniture, electronics and so forth. That means the products I own stay serviceable for longer, thereby avoiding waste.

What about you, Mr Selders?

Selders: This is a frequent topic of discussion in our family. That said, we realize that it's not always easy to determine which way of doing things is the most sustainable – whether that concerns food or clothing, or the question of disposable versus reusable. We read different sources and exchange ideas – the same principle that applies to the circular economy. And yet, when we take out our separated trash for collection, we see that we're still a long way off!

For a company, the circular economy is a much bigger task. Why did Covestro decide to become a pioneer?

Dreier: We firmly believe that long term, a circular economy is the only way to create a sustainable future for our planet while staying a successful business ourselves. As an energy-intensive company, we knew the enormous effort required of us – especially because our operations and processes generate exactly the CO_2 emissions that we need to avoid. We want our own production to be completely climate neutral by 2035. And by 2050, we also want to reduce our Scope 3 emissions to zero – by that I mean the emissions our suppliers and customers generate up- and downstream in the product value chain. We've drawn up a concrete roadmap for achieving this, focused on four factors: renewable energy, alternative raw materials, innovative recycling methods and cross-industry partnerships.

Mr Selders, what sustainability goals has Endress+Hauser set itself?

Selders: We want an 80 percent reduction in our company's direct and indirect greenhouse gas emissions – Scope 1 and 2 – by 2034. And we want to achieve net zero by 2050 at the latest, Scope 3 included, which means the upstream and downstream value chains. We will make rapid progress in Scope 1 and 2 by purchasing green electricity, for example, and taking steps to improve our energy efficiency. Scope 3 presents us with challenges. These are emissions produced by things like manufacturing the steel and aluminum that goes into our products, or when our measuring instruments are operating at customers' plants. We're seeking cooperation with our suppliers and customers on this.

And what approaches is Endress+Hauser taking to implement the circular economy?

Selders: Our instruments are very long-lasting; they often operate over decades. The metals used can be recycled afterwards, as can the electronics. That's why we concentrate on production and use. We have a significant lever in procurement, for example by purchasing low-emission primary products from suppliers who use green electricity or work with a high proportion of recycled materials. Design practices present a further lever. We're talking eco-design here – things like optimizing the use of materials, energy requirements and instrument repairability.

“Such a gigantic transition to a circular economy is achievable only by all forces in society pulling in unison.”

Thorsten Dreier, CTO of Covestro

Mr Dreier, what will it take for the circular economy to gain momentum?

Dreier: Such a gigantic transformation is achievable only by all forces of society pulling in unison. There are many businesses powering ahead already, but they can’t make the transition to climate neutrality and a circular economy on their own. They need full support from politicians, scientists and society in general. And this is where the problem still lies. This is well illustrated by the energy issues in Germany and elsewhere in Europe. There’s a lack of sufficiently CO_2-reduced and CO_2-neutral energy at affordable prices. Expansion in this field is making slow progress, not least due to lengthy approval procedures. So we need transitional technologies to hold down CO_2 levels. Yet there are brakes being put on these, including in Germany, where technologies such as carbon capture and storage, and carbon capture and usage, have yet to gain official approval. Moving ahead with innovative and energy-efficient production processes requires investment, but this in turn requires politicians to provide planning certainty.

Selders: A key condition is giving the economy sufficient time and freedom to adapt. This is a generational task; idealism and sacrifice won’t solve it. We need to combine sustainable transformation with economic growth and achieve that transformation at competitive costs. Technological progress will help to get us there.

How do new technologies and processes contribute to implementing your strategy, Mr Dreier?

Dreier: We see new technologies as core elements on the path toward a circular economy. With them we can produce even more dependably, make best use of resources and avoid emissions. We do everything we can to make our processes as efficient and energy-saving as possible – and thus as sustainable as possible. We’re constantly developing new processes to this end. State-of-the-art measurement and automation technology plays a central role here. For one thing, it’s used for predictive maintenance. That in turn reduces the effort involved in testing safety equipment and simplifies instrument commissioning. Manufacturers of measurement and automation technology have the expertise to help us here. Improved diagnostics for field instruments benefit us enormously.

How is Endress+Hauser supporting customers with the transformation, Mr Selders?

Selders: Measurement and analysis technology does a lot to make systems more efficient by reducing energy consumption, increasing yield and improving availability. And we want to be at our customers’ side as they develop new processes and bring them to maturity. Our strength is our specialization in instrumentation. With our wealth of experience and knowledge we can support customers to operate their plants as efficiently possible. New technologies allow monitoring product quality during the production processes. Digitalization is also providing new insights and simplifying many tasks. And, of course, in collaboration with customers we are constantly developing our offering further.

How important are partnerships, Mr Dreier, when it comes to creating the circular economy?

Dreier: The circular economy has to be a joint achievement. Scope 3 emissions closely link individual players in the value creation process. With that in mind, we focus on cooperation with companies all along the chain, from raw materials to the end product. Exchanging knowledge and expertise is part of that effort. We also get involved with industry associations such as NAMUR – the user association of automation technology in process industries – where we work alongside other companies to define the operators’ requirements regarding standardization in automation technology.

Selders: Cooperating with customers at association level is very valuable for us. Generally speaking, I see cooperation as an important part – perhaps the most important part – of achieving sustainable transformation.

How is Endress+Hauser positioned for the challenges posed by sustainable transformation and the circular economy?

Selders: For this generational task, we as a family business have the long-term perspective that it takes. This provides security to people and stability to the company. We can focus on our primary goals and keep on pursuing them even when the unexpected happens. This is crucial in an environment that is developing ever faster and more unpredictably. And then there is our cooperative culture, developed over many years and deeply rooted in our company DNA. All of this helps us to harness the power of cooperation both inside and outside Endress+Hauser. It also gives me confidence that we will solve the challenges together with our customers.

Mr Dreier, what makes you confident of being able to implement Covestro’s ambitious strategy?

Dreier: I believe that many political, economic and societal players have now realized that there will be no future for this planet without a genuine circular economy. All parts of the economy have long been engaged in transformation. That makes me very optimistic, and I am convinced that we will accelerate further in the coming years.

DRIVING THE TRANSFORMATION

Chemist **Dr Thorsten Dreier** (52) is chief technology officer at Covestro AG, a world-leading manufacturer of high-quality plastics and their constituents. He began his career at Bayer Group in 2002 and subsequently held various management positions at Bayer, Bayer MaterialScience, Bayer Technology Services, and – following a spin-off – Covestro. He was appointed to the Management Board in 2023. The chief technology officer is responsible for the Group functions process technology, engineering, group health, safety & environment and group procurement. In his role, Thorsten Dreier sees himself as one of the driving forces behind the company’s sustainable transformation.

Staying ahead of the curve

Climate change, pollution, raw material shortages: The circular economy offers solutions for many of the major challenges of our time. Endress+Hauser helps leverage the potential of the circular economy – while combining environmental and economic goals.

A new era

Beginnings are always hard – and so it is with the circular economy. Michael Sinz, director of strategic business, explains how it can become a reality for the process industry and how Endress+Hauser is making headway with its implementation.

Questions: Christine Böhringer
Photography: Andreas Mader

TRANSFORMATION

As director of strategic business, you know what drives Endress+Hauser's key customers worldwide. How important is the circular economy to these companies right now?

The circular economy is of fundamental relevance to the entire process industry, this being the only way for it to achieve the goals of the Paris Climate Agreement and cut greenhouse gas emissions to net zero. Pressure to implement those goals is now rising, as governments of more and more countries demand that companies report on their sustainability and make improvements there. A circular economy is one key factor for getting this done, because it is about conserving resources while avoiding waste and emissions. Yet the whole venture is still in its infancy.

Why is that?

The circular economy is a gargantuan undertaking. Its all-in concept encompasses three domains. So far, companies have been concentrating heavily on the first of them, the energy transition. Its implementation is relatively quick and easy within a business and in the supply chain. This is where renewables, energy efficiency and, in future, green hydrogen will make processes more sustainable. The other two domains are about completely changing production and consumption: Although products will continue to be made from biomass-based materials, fossil-based products such as those made from oil – and minerals, too – should be kept in the product cycle. This means recycling and reintroducing them to the cycle as many times as possible. It all adds up to requiring a larger and longer transformation.

GROWING TOGETHER

Michael Sinz (55) has been working at Endress+Hauser for almost 30 years and develops the Group's business with key customers. He is convinced that the challenges of our increasingly complex and fast-changing world can only be solved through partnerships – in other words, collaboration beyond company borders: "When companies cooperate in ecosystems and learn from one another, they will find better solutions."

How can businesses accomplish this complex task?

Companies need to rethink their strategy and adopt a systemic approach. If they really want to close the loop, every product development will have to consider the entire life cycle – from raw materials, through design and manufacturing, all the way to recycling. This entails thinking in terms of material cycles, then developing innovative solutions and circular business models, and finally building new value chains. Success will depend on companies opening up, collaborating and sharing their knowledge more. A new era of cooperation is needed – one that will lead to added value for all.

Are there any sectors that are regarded as pioneers here?

I am seeing initiatives across all sectors. One common theme is recycling, particularly of plastics and batteries. This is where many alliances are emerging along the value chains linking the chemical industry, the oil and gas industry, mining, construction and the waste management business. It is both politically driven and holds the greatest potential for new business models. Waste is the raw material source of the future. Whoever can tap into that will reduce supply risks. The high initial investments will pay off in the long term.

What are the other priorities in the process industry?

The food industry is looking into upcycling production by-products as well as waste. These can be converted into biomethane or upgraded into animal feed and thus reintroduced into the cycle. As all sectors are major consumers of water, conserving and reusing this resource is also on the rise wherever you look.

How does Endress+Hauser support customers in their transition to a circular economy?

Our broad portfolio of measurement technology and solutions supports our customers in giving shape to all three domains of the circular economy. Precise and reliable measurements help to make processes safe, resource friendly and energy efficient. With our application knowledge and willingness to develop further in step with our customers and their needs, we were an early entrant to areas such as green hydrogen, white biotechnology and chemical recycling. We grew stronger in the field of analysis, so customers can determine material properties and hence quality, both inline and online. This is of increasing importance with regard to blends, renewable raw materials and recycled materials.

And how is Endress+Hauser itself tackling the circular economy issue?

The current focus is on decarbonizing our portfolio. We opt increasingly for primary products from suppliers who use green energy or raw materials with a high proportion of recycled products. And we are trying to reduce the energy requirements of our instruments, as well as finding ways to further optimize their longevity and return them to the cycle at the end of their useful life.

Closing the circle with AI

Very little of the world's waste plastic makes it through the recycling process into high-quality new products. Researchers are now looking at remedying this by using real-time analysis and AI.

Text: Christine Böhringer
Illustration: 3st kommunikation

HOW THE PROJECT AIMS TO IMPROVE PLASTICS RECYCLING:

1

The waste plastic is first sorted, shredded and washed. It is then ready for the extruder, where it will be melted, homogenized and re-granulated.

2

Upstream of the extruder, Raman spectroscopy determines the material's composition – the types of plastic and the additives and contaminants present.

3

An AI algorithm recognizes patterns in the measurement data and recommends the additional steps needed to improve the output plastic's quality in terms of desired properties.

4

The desired properties are then achieved by mixing in additives or fillers or by adapting the recycling process. The resulting granulate is then re-analyzed using Raman spectroscopy.

RESEARCH

At only 30 percent in Europe and just nine percent worldwide, the plastics recycling rate is still short of what is needed for a properly functioning circular economy. One reason for these low rates is the poor quality of the recycling feedstock. Mechanical recycling – the most common form – requires properly sorted, clean waste streams. But it tends to be fed an unsorted mix of plastics, much of them contaminated. The result, despite highly advanced technologies for sorting, shredding and washing, is that when melted down, the material often still contains extraneous plastics, impurities and contaminants. It follows that the recycle is often of variable quality and not always suitable for making high-quality products.

"We do not currently have the necessary analysis tools to determine during processing exactly what's in the mechanically recycled plastics," explains Dr Bernhard von Vacano, head of the plastics circularity research program at BASF. The problem is that this analysis is needed to evaluate and improve the quality of plastics waste. "This information would enable us to use more mechanically recycled plastics to produce high-quality products and to make recycling processes more efficient and sustainable."

A solution to this problem may come from SpecReK, a joint research project undertaken with funding from Germany's Federal Ministry of Education and Research (BMBF). The project partners are BASF, Endress+Hauser, TechnoCompound GmbH and the universities of Jena and Bayreuth. "Our shared aim is to develop a real-time analysis tool for this application that incorporates AI and is based on Raman spectroscopy," says Patrick Ehlers. Ehlers researches optical technologies at the Endress+Hauser Optics Hub in Freiburg im Breisgau, Germany, and co-leads the company's contribution to the project along with Jürgen Dessecker.

IT'S ALL IN THE MIX

Raman spectroscopy can be used for continuous, inline qualitative and quantitative analysis of the chemical composition of liquids, solids and gases. It therefore lends itself well to the analysis of fast-changing and mixed materials and can also detect impurities. "For these reasons, our Raman systems are already used in multiple industries to adapt production processes and hence ensure consistently high product quality," says Ehlers. "Employed in combination with AI, they may potentially also make a difference in mechanical plastics recycling."

The desert is alive

Egypt is using a world-record-breaking plant to treat enough wastewater to develop new farmland. As the main supplier of measurement technology, Endress+Hauser ensures that every drop is precisely monitored.

Text: Robert Habi
Photos: Metito

WASTEWATER TREATMENT

Drinking water is a scarce commodity in Egypt. About 95 percent of the country is covered by desert, making the Nile river its lifeline. With a view to the growing population, the government aims to optimize sustainable use of limited water resources while improving food security in arid regions. The New Delta project is part of this effort: It collects agricultural wastewater from the northern Nile Delta and transports it 120 kilometers to the west, where it is treated and reused by agriculture and industry.

The huge processing plant in the El Hammam region has already scored several entries in the Guinness Book of World Records by dint of the numbers involved. Up to 7.5 million cubic meters of wastewater processed daily make it the world's largest sludge treatment plant, and the largest water treatment plant as well. Water leaving the facility meets the drinking water standards of the World Health Organization and is used to irrigate an area 20 times larger than the city of Paris.

A joint venture of specialist companies made it possible to complete the project in just 24 months from start to finish. Among them was Metito, a leading global solutions provider for water and wastewater management and an Endress+Hauser partner for 25 years. Metito planned the water treatment process and was responsible for selection of the electromechanical equipment, installation and commissioning. Metito chose Endress+Hauser as its main supplier for the measurement technology, and now there are more than a thousand instruments keeping track of flow, pressure, level and various water quality parameters.

Hassan Zaki, regional manager, North Africa field services – projects at Metito, says about the decision to collaborate: "First among the decisive factors were the calibration options and instrument accuracy. Secondly, it was about speed of delivery. But what we were looking for in general was all-round operational excellence."

Hassan Zaki has an illustrative example: Three streams of wastewater flow into the plant. For each one there is an underground chamber containing five electromagnetic flowmeters with a nominal width of DN 2200 and taller than a human. "For cost reasons, the chambers need to be as small as possible. However, the instruments had to be spaced apart to prevent interference between their respective magnetic fields. The Endress+Hauser experts knew exactly what distances we had to keep. They solved everything perfectly!"

DECARBONIZATION

Trailblazers

To achieve a more circular economy, the world must transition away from fossil energy and towards decarbonization. Green hydrogen will play a key role in this. Much depends on how it's produced and transported – challenges that require innovative solutions paired with precision measurement technology.

Text: Marlene Etschmann
Photography: Endress+Hauser, Frank Grätz/Ambartec

1

GREEN ENERGY FROM WASTE

Australian energy startup Wildfire Energy is on the cusp of a revolution in recycling. As an alternative to landfilling – which is still common practice in Australia – Wildfire has developed a novel process for converting municipal waste into valuable raw materials. Termed MIHG (moving injection horizontal gasification), the process operates at low pressure and eliminates the need for pretreatment. It works by injecting oxygen horizontally beneath the waste inside the reactor, generating temperatures in excess of 800°C. This causes the waste to break down into synthesis gas (syngas), which can then be processed into hydrogen. The yield is about 42 kilograms of hydrogen per tonne of waste. The syngas can also be converted into other products, such as fuels and alcohols. Thanks to the technology's modular design, users can set up small, highly scalable energy plants at the point of waste creation. Precision measurement technology is vital here. Grant Bollaert, general engineering manager at Wildfire Technology, explains: "Measuring instruments are central to development of the pilot plant and to the technology's future expansion." Accurately tracking critical process variables such as pressure, temperature and flow rate inside the reactor's low-pressure zone requires considerable sophistication.

2

1
Wildfire Energy's plants are small and flexible.

2
Ambartec uses iron oxide nuggets as a storage medium for hydrogen.

3
Enapter's modular electrolyzers can be combined to form strings.

HIGH PURITY THROUGH PARALLEL ANALYSIS

To work as an energy carrier, hydrogen needs to be extremely pure. This is where German-Italian company Enapter comes in. Enapter's electrolyzers split water into its component parts using AEM (anion exchange membrane) electrolysis, an innovative process that operates at normal atmospheric pressure and does not require iridium, which is scarce. The process generates pure hydrogen at the cathode, and oxygen at the anode. "We produce industrial-quality hydrogen with a purity of 99.999 percent," explains Hannes Klus, an electrical engineer at Enapter. "In order to measure this, the devices must be able to detect impurities of just a few ppm." The Endress+Hauser competence center for gas analysis systems in Lyon, France, and Enapter jointly developed a measurement system that meets the twin requirements of extreme accuracy and real-time output. It works by analyzing each prepared gas sample's trace moisture and trace oxygen content in parallel. Enapter is now also putting Endress+Hauser analysis and measurement technology into its 1-megawatt electrolyzer, capable of producing 450 kilograms of green hydrogen daily. Enapter chose to partner with Endress+Hauser because it wanted a company that could provide support across all measurement points.

3

IRON OXIDE AS A HYDROGEN TRANSPORT MEDIUM

Sometimes hydrogen is not produced at the point of use. Such cases call for intelligent – and preferably mobile – storage solutions. "Our customers can get on board right now – they don't have to wait 10 years for a hydrogen pipeline network to be built," says Ambartec CTO Uwe Pahl. The Dresden-based company has repurposed an almost forgotten technology: It produces nuggets from a special iron oxide that reacts with hydrogen to form pure iron and steam. Transporting hydrogen to the point of use then becomes a simple task of loading the resulting iron nuggets onto a truck or ship. At the destination, the reaction is reversed by feeding in steam to produce pure hydrogen. This process uses significantly less water than comparable systems and is also more efficient. It has already been scaled up successfully in transport units ranging in capacity from 1 to 1,000 liters. The first series product is due to be launched in 2025: a 6,000-liter unit in a standard 20-foot container that can store up to 900 kilograms of hydrogen. For process monitoring, Ambartec has chosen measurement technology from Endress+Hauser. "Our pressure and flow sensors are able to monitor the hydrogen-steam mix even at temperatures in excess of 100°C," explains Mathias Christ, the Endress+Hauser decarbonization technical sales consultant who initiated the partnership with Ambartec.

“I fight for every milliwatt”

As an electronics developer, Romuald Girardey ensures that Endress+Hauser measuring instruments consume the least possible power. He’s also no slouch when it comes to cutting energy waste in his private life. Here, he explains why this topic is so important to him.

As told to Christine Böhringer
Photography: Andreas Mader

ENERGY EFFICIENCY

There are few electronics developers who are not interested in sustainability on a personal level. This is because, in our profession, we aim to use energy efficiently. I too have been fighting for every milliwatt my whole working life at Endress+Hauser. Our sensors should use as little power as possible, a necessity due to the 4–20 mA technology that is commonplace in many systems. And, of course, we want to keep our instruments’ environmental impact to a minimum.

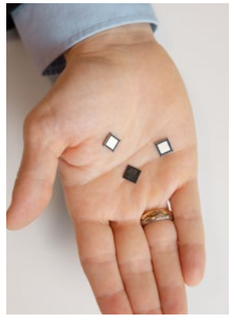
My specialty is developing application-specific integrated circuits. As central components of our devices, these microchips must be able to do more and more in this age of digitalization. For example, the tuning fork of our new Liquiphant FTL43 limit switch is no longer excited by analog means, but digitally. This requires a complex algorithm, for which there is no off-the-shelf microchip capable of running it both quickly and energy-efficiently. So I designed one myself – both the processor core and the peripherals.

I am proud of how my work has resulted in a microchip that is highly effective while consuming just 1.5 milliwatts of power. Compare that with a television in standby mode, doing nothing and yet consuming a whole watt, more than 600 times as much. So all new level switches in the future will feature the chip, which is also set for use in other product families.

The old house that I bought over 10 years ago with my wife – also an electronics engineer – was once a real CO_2 polluter: oil heating and zero insulation. I went on to renovate it myself. These days we need very little energy thanks to thermal insulation, triple-glazed windows and a ventilation system with a heat exchanger – and what we do need comes from renewable sources. We have solar thermal and photovoltaic modules on the roof, a heat pump and a heat and energy storage system. Smart automation fed with weather and environmental data controls them all, along with everything electrical in the house. So no energy goes to waste.

Some may think that a watt less or more can’t really matter much. But I want to keep my ecological footprint as small as possible. I can already see the effects of climate change in my home region, Alsace. Sometimes it rains too much, sometimes too little. In summer there are water shortages. Of course, I’m concerned about how I can give my young daughters a good future. In any case, I am convinced that even the smallest contribution is part of a larger solution.

This same principle also applies to my work. Endress+Hauser sells three million measuring instruments annually, many of which see 10, 15 or more years of service. Every milliwatt less adds up to a huge difference – and ultimately helps to make the process industry that little bit more sustainable.



Dr Romuald Girardey holds a doctorate in electrical engineering and has worked at Endress+Hauser for 26 years. In technology development, he is an expert in designing microchips and complex semiconductor packages.

A question of standards

The digital product passport is designed to support the transition to a circular economy. But how can this best be realized?

Text: Christine Böhringer
Illustration: 3st kommunikation

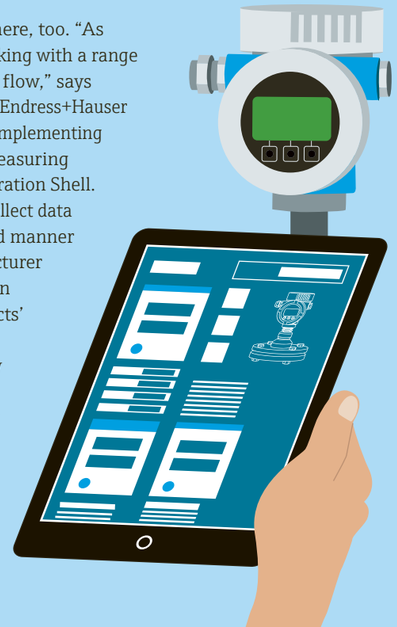
DIGITALIZATION

What goes into a product? What is its carbon footprint? How can it be recycled? Across Europe, the digital product passport will soon provide answers to these questions. “This is a set of data that consolidates sustainability-related information about a product through its entire life cycle,” says Franz Durmeier, head of digital integration at Endress+Hauser. The idea: Using a smartphone, simply scan the code on the product, and a technician can see the current spare parts list for the measuring instrument, while disposal companies can obtain an overview of the materials used. “This transparency aims to encourage purchasing of products that are more sustainable, putting them to longer use and improving the recovery of raw materials. The digital product passport therefore supports the circular economy,” adds Durmeier.

Endress+Hauser is among those pushing ahead with implementation of the passport, which will become mandatory from 2027 as part of the European Green Deal. “We have access to a veritable treasure trove of data,” continues Durmeier. “For over 20 years now, we have been automatically storing all information and documents relating to our instruments in a central database.” Any missing information such as power consumption is currently being added. One challenge here is data provision. The data needs to be standardized, structured and available in machine-readable form so that it can be exchanged and used across company and system boundaries. “Plant manufacturers can transfer data on instruments’ carbon footprint, while operators can transfer the documentation to their ERP system,” says the integration expert, describing two possible applications.

EVERYTHING IN FLUX

Endress+Hauser has laid the groundwork here, too. “As part of Industry 4.0, we have long been working with a range of industry groups to ensure seamless data flow,” says Kévin Rueff, head of product management at Endress+Hauser Digital Solutions. Endress+Hauser is already implementing digital twins – digital representations of measuring instruments – based on the Asset Administration Shell. This industry standard makes it possible to collect data on an item automatically and in a structured manner from various sources, regardless of manufacturer and system – and to provide the information needed by every use case. “All of our products’ digital twins can be downloaded from the Endress+Hauser Netilion cloud. Today, they contain our instruments’ digital nameplate – and in future, perhaps their digital product passport,” adds Rueff.



Is there a green option too?

Endress+Hauser is stepping up its focus on purchasing components and materials made from secondary sources. This not only creates more sustainable products but also brings all parties in the supply chain closer together.

Text: Christine Böhringer
Photography: Lisa Glatz

Head of purchasing Markus Mornhinweg (left) and head of logistics Alexander Albrecht at Endress+Hauser Temperature+System Products are joining forces with suppliers to seek ways to reduce the ecological footprint of products.

CIRCULAR PROCUREMENT

In a circular economy, the objective is to conserve natural resources. "Procurement provides a lot of leverage to achieve precisely this," says Markus Mornhinweg, head of purchasing at Endress+Hauser Temperature+System Products. He and his team aim to increase the recycling content in intermediate products, components and packaging. "Manufacturing from secondary raw materials prevents waste and uses a lot less energy than is the case with primary raw materials. This avoids a huge amount of greenhouse gas emissions," he explains.

The greatest potential here lies in components made from steel. This material can be recycled indefinitely with next to no loss of quality. "This was why, when we were looking for someone to make the housing for a new product, we sought a manufacturer that uses stainless steel with a particularly high recycled content," says Markus Mornhinweg. Indeed, more than 90 percent is recycled metal. What's more, around 80 percent of the energy used by the supplier comes from renewables. Thus the housing has a very small carbon footprint.

Switching from primary to secondary plastics, though, is not so easy. "Plastics are composed of long-chain molecules, which get chopped and changed by the mechanical recycling process commonly used today. That affects the material's properties, which results in quality fluctuations," Markus Mornhinweg explains. So to ensure that the product and hence process reliability are up to the standard required for measurement technology, primary plastic will stay in use until fresh solutions arrive. Chemical recycling in particular could present new options in the future.

RETURNING WASTE TO PRODUCTION

"However, we have managed to establish an internal recycling process in the production of our head transmitters," says Markus Mornhinweg. Injection molding of the plastic components produces sprue that is no longer disposed of as waste but instead recycled directly on site: Now it is the sprue, rather than primary plastic, that goes into making funnels that are used in casting the transmitters. "That adds up, considering that we manufacture hundreds of thousands of head transmitters every year. One of these, the iTEMP TMT82, is Endress+Hauser's top product in terms of manufacturing volume," says the procurement head.

In packaging too, success stories are starting to come in. "We are currently switching the mailing tubes for compact thermometers to recycled material," Alexander Albrecht, head of logistics, reports. And bubble wrap is set to become redundant through the development of corrugated cardboard membrane packaging for field transmitters and housings. Yet this successor material requires cutting to size specifically for each product, in a way that provides complete protection as well as easy handling. "That is why development takes up to a year and needs close collaboration with our suppliers in order to succeed," says Alexander Albrecht. The first membrane packaging will soon be used for a new control unit.

HIGH LEVERAGE

In keeping with the Science Based Targets initiative, Endress+Hauser has committed to reduce emissions in upstream and downstream value chains by 35 percent (relative to 2023) no later than 2034. Procurement provides high leverage for achieving the objective – for example through intermediate products and materials with higher recycled content.

"Our suppliers are very interested in working with us to find and implement innovative solutions," Markus Mornhinweg emphasizes. The ongoing transition to a circular economy will further intensify partnerships along the supply chain, of that he is convinced: "Making products as sustainable, durable, reusable and recyclable as possible needs more knowledge transfer than ever, especially at the start of every new or next-stage development."

As director of service, Philippe Genevé is responsible for Endress+Hauser's service offering in France. He helps customers to safeguard the performance of their instrumentation throughout the entire life cycle, including maintenance, calibration and repair.

3 questions for Philippe Genevé

Questions: Kirsten Wörnle
Photography: Endress+Hauser

Certain aspects of circular economics are gaining importance in the process industry. How is this reflected in your service department?

Heightened sustainability requirements mean that customers increasingly ask about our instruments' repairability. Of course, this has always been relevant to them: The process industry strives for maximum plant availability. It has preventive and corrective maintenance solutions in place to minimize downtime. That makes sensor repairability and maintainability very important.

How does Endress+Hauser support customers when it comes to repairs?

Our sensors are high-quality products, so they are designed for longevity. They are modular too, which makes for easy maintenance and repair. Very few of our products are non-repairable. Moreover, we continue supplying replacement parts for five years after the phase-out of a product. Our customers can undertake repairs themselves if they have suitably qualified personnel. Alternatively, they can turn to our service offering. Endress+Hauser is the only measurement technology manufacturer in France to provide both on-site and workshop repair services.

In what situations do customers use the workshop-based repair service?

That mostly happens with warranty claims, or in cases that require our specialist expertise – such as when they need us to repair Ex-certified instruments, make modifications or carry out an inspection after a failure. Most instrument defects are caused by improper use or operation in an unfavorable environment. So, once our customers know the cause of failure, they can take steps to prevent a recurrence. Incidentally, instruments for which we still carry replacement parts are repairable in over 95 percent of cases. We can even complete the repair within 24 hours if required.

Singular excellence

Endress+Hauser has adapted Coriolis technology to be viable in single-use applications. The newly developed Proline Promass U 500 measures flow rates with precision and efficiency to match – as well as being ideally built for subsequent recycling.

Text: Robert Habi
Graphics: 3st kommunikation

Biotech is a rapidly growing market: Using genetically modified cells taken from microorganisms to produce drugs and vaccines is an enabler for new therapies to tackle many serious diseases. The boom in biotech is also changing production techniques. The trend is for smaller batches made using more compact and flexible systems, and increasingly with a continuous process. Absolute purity is a must when working with sensitive cell cultures: “The slightest contamination can ruin an entire batch,” says Samuel Neeser, Coriolis product manager at Endress+Hauser.

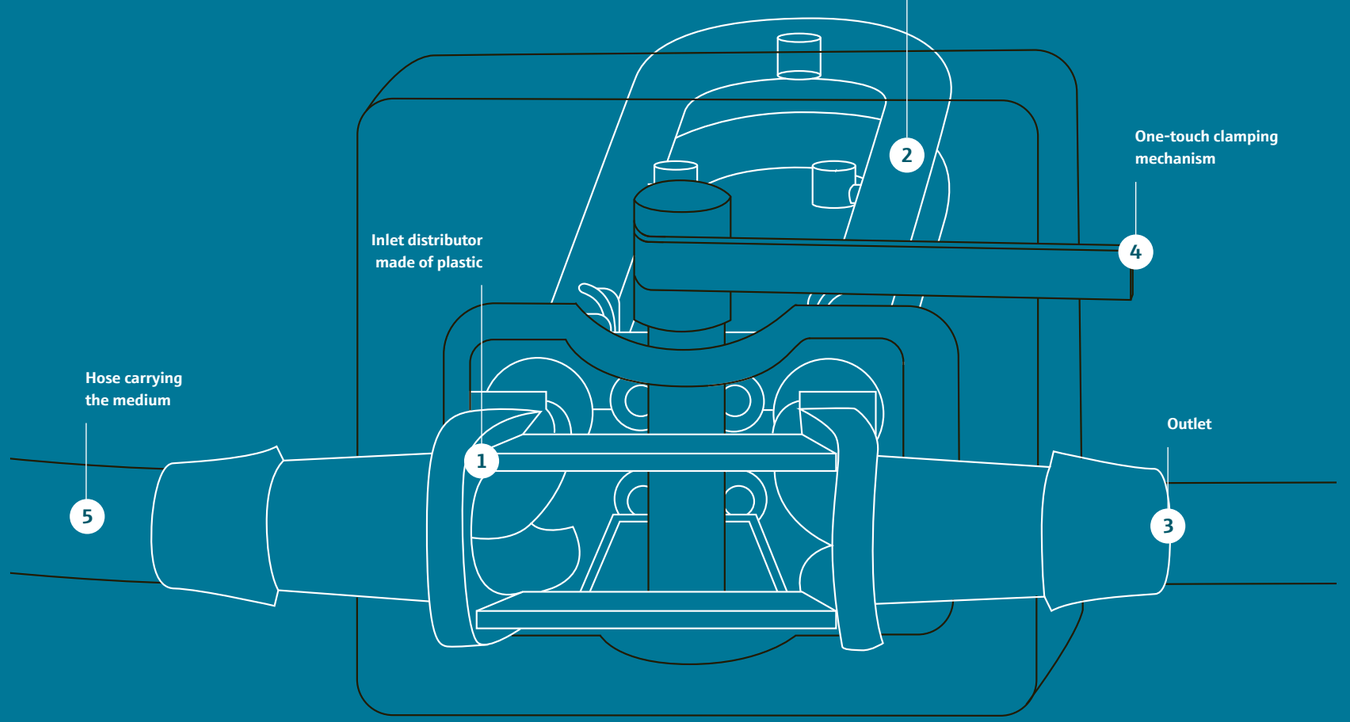
In production facilities built around a multi-use design, all components that come into contact with process media need thorough cleaning and sterilization every time. That involves aggressive acids and a lot of energy for generating steam. “Even then, the risk of contamination is still not zero,” says Samuel Neeser. Hence a clear move to single-use technology: Worldwide, one in every two biotech products is now manufactured like this, with every component contacting a medium only once.

SOPHISTICATED DESIGN, HIGH-QUALITY MATERIALS

However, this growing segment has so far lacked a precision flow measuring instrument that also meets the strict cGMP standard. Coriolis technology would be ideal here, yet the complex arrangement inside a conventional instrument makes it far too expensive for single use. But that’s changing, with the Proline Promass U 500. The engineers’ trick is to make the instrument out of two separable parts. Power supply, exciter, sensors and signal processing all go in the base unit. But what the exciter sets in vibration, the measuring tube itself, becomes part of the disposable component. Just like in other high-quality, high-precision instruments, the tube is made of stainless steel; measurement accuracy is to within 0.5 percent. “This separation of the functional units makes Coriolis technology a viable economic proposition in the single-use sector,” says Samuel Neeser. And to ensure that the disposable component does not later end up in the trash, its constituent parts can be separated by material type and then appropriately recycled.

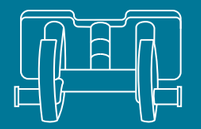
$ 38.8 billion

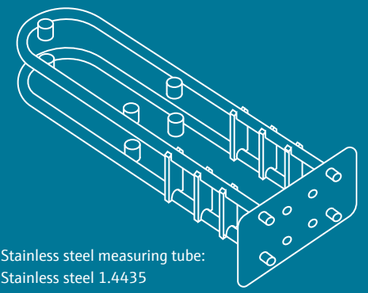
is the projected size of the market for single-use biotechnology in 2030. More aggressive estimates put the figure at over 80 billion US dollars. The 2024 figure already stands at around 18 billion US dollars.



RECYCLING CONCEPT

Manifold:
Polycarbonate
Makrolon RX1805





Stainless steel measuring tube:
Stainless steel 1.4435

The stainless steel measuring tube, once sterilized, is fully recyclable as scrap metal.

After steam cleaning, the polycarbonate manifold and the O-rings undergo specialized recycling processes.

The packaging film and protective container for the disposable part are recyclable just like everyday household plastics.

O-rings:
Silicone VMQ

PLUG IN AND MEASURE

The disposable part of Proline Promass U 500 slides onto the base unit – the sensor part – and is locked in place.

Field calibration is unnecessary as the device automatically verifies the factory calibration data using Heartbeat Technology.

Either mounted to a front panel in skids or as a bench-top version for the laboratory, the flowmeter finds uses at every stage of biopharmaceutical production.

Dosing, adding ultrapure water, filtration – mass flows throughout are determined using the Coriolis measuring principle. The disposable part comes in four nominal widths.

At the end of a production run, the disposable part that contacted the medium is unlocked, removed and disassembled for recycling. The base unit stays in service.

Moving forward together

As a way of finding good answers to forward-looking questions, Endress+Hauser is networking more and more both inside and outside the company. The result is innovations that benefit customers and boost sustainability.

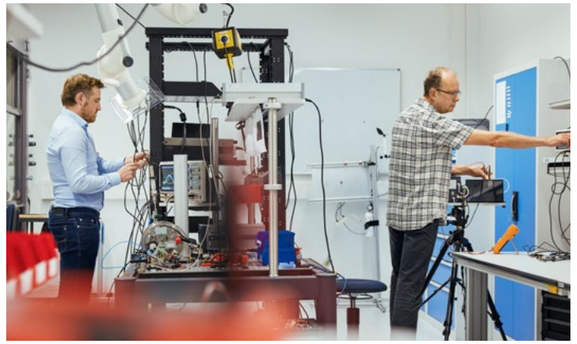
Text: Christine Böhringer, Kirsten Wörnle
Photography and illustration: Endress+Hauser, 3st kommunikation, Pexels, Shutterstock, Unsplash

>9,000
patents and patent applications are in the Endress+Hauser intellectual property rights portfolio.

~90%
of all innovations result from teamwork.

20%
of R&D expenditure at Endress+Hauser goes into new technologies and market scenarios.

>400
inventors were honored at the 2024 Innovators' Meeting. For a quarter of them, it was the first time they had been involved with an innovation.



Various Endress+Hauser teams are working in Freiburg, Germany, on measurement technologies of the future.

Boundless ideas

18 November 1955 was a historic day for Endress+Hauser. That was when company founder Georg H Endress visited the forerunner of today's Swiss Federal Institute of Intellectual Property (IPI) to file a patent application for a measuring probe with an electrode. What he did back then laid the foundation for the company's culture of innovation: Its portfolio of industrial patents now encompasses more than 9,000 active patents and patent applications. There are currently 4,000 registered trademarks – and an undiminished spirit of innovation. Accordingly, the online statistics platform Statista in 2025 once again recognized Endress+Hauser as one of the most innovative companies in Switzerland.

THE RIGHT MIX

So what is the source of this success? "Innovation is one of our growth drivers; that is why we encourage inventions and improvements throughout our company," says Dr Andreas Mayr, chief operating officer at Endress+Hauser. More than seven percent of Endress+Hauser's turnover goes into research and development. Around 80 percent of that amount goes to optimizing the portfolio; the remaining 20 percent is plowed into the advancement of new technologies and business models. The company provides incentives for inventors and promotes an exchange of ideas among them with an annual Innovators' Meeting.

Endress+Hauser gains fresh inspiration through open innovation concepts. One example comes from the six groups working on tomorrow's sensor technologies and software solutions at the FRIZ innovation center, located on the University of Freiburg campus in Germany. The developers are closely networked and embedded in an environment of research institutes, startups and established companies. In the first two years they had already filed patent applications for 35 inventions; more than one third of those were created in cross-group collaborations. Indeed, development activity nowadays is almost always teamwork. "That shows how important a mutual exchange of ideas is for the creative process," says Dr Christine Koslowski, director for intellectual property rights.

Sustainable from the outset

In future annual Innovators' Meetings, Endress+Hauser will be awarding an additional prize for eco-design and the circular economy. "The award is aimed at continuing to steer the company's product development toward sustainability. It will focus on inventions that combine our measuring instruments' exceptional functionality and reliability with a resource-saving and eco-friendly approach," says Daniel Persson, process and portfolio manager for innovation at Endress+Hauser.

There are numerous opportunities to reduce measuring instruments' carbon footprint through their design: paring back the amount of material that goes into them, manufacturing from more eco-friendly raw materials, lowering their energy consumption or extending service life are a few examples. Circular business models are likewise eligible for the award. "We want to use the prize to pay tribute to our inventor teams and create role models for sustainable product development," says Daniel Persson.

Pooling knowledge

Endress+Hauser participates in the Energy Transition Campus Amsterdam (ETCA), an initiative launched by energy company Shell. The campus environment is collaborative, with companies and research institutes working together on innovative solutions for the energy transition. Endress+Hauser's role in the ETCA includes active exchange of knowledge, collaboration on projects and providing expertise for key technologies like green hydrogen and carbon capture.

>1,000

people visited the laboratories of Endress+Hauser subsidiary Analytik Jena as part of the ‘Long Night of the Sciences’ in Jena. This is an event format where companies and research institutions on German university campuses regularly open their doors so that the public can experience science at first hand. Hence there were many experiments at Analytik Jena where people could participate: For example, visitors analyzed recycled materials, revealed the DNA of bananas and discovered how key materials that go into lithium-ion batteries are tested to ensure long-lasting performance.

On the right path

Endress+Hauser attained yet another sustainability milestone when the Science Based Targets initiative endorsed the Group’s greenhouse gas reduction goals. This confirms that it is in line with the 1.5 degree path set out in the Paris Accord and corresponds to present scientific understanding. The Group has pledged to cut emissions to net zero by 2050 (based on 2023); no more than 10 percent may be offset by ongoing carbon capture and storage. By 2034 the Group’s direct and indirect emissions (Scope 1 and 2) should already be 80 percent lower; greenhouse gas emissions in the upstream and downstream value chains (Scope 3) should likewise be down by 35 percent.

Clean water

A better water infrastructure for Lillydale elementary school in South Africa: Endress+Hauser employees around the world will dedicate themselves to this goal as part of the Water Challenge 2025. Launched in 2019, this internal initiative is about collecting money through sponsored runs and other joint sporting activities that will bring people access to clean drinking water; in every case the company then doubles the amount collected. The proceeds go to selected aid projects in Asia, South America and Africa. In 2024 they were used to refurbish the well of an elementary school in Bushbuckridge in South Africa. In addition, the school received Hippo rollers – barrel-shaped 90-liter containers that are easy for people to roll along, thus making lighter work of transporting drinking water.

Next generation

Endress+Hauser aims to reserve five percent of all jobs for apprentices, students and interns. How is this working out? Here are three examples.

OFF TO A STRONG START

In 2024 alone, close to 130 young talents began apprenticeships or dual vocational training programs at the six Endress+Hauser sites in the tri-border area of France, Germany and Switzerland – a new record! As part of their induction week they were welcomed by two granddaughters of the company founder: Sandra Genge, a member of the Supervisory Board of the Endress+Hauser Group, and Tifaine Endress both spoke about the culture and values of the family-owned business. Thus, on the first day of the new 2024/25 apprenticeship year, Endress+Hauser had 700 apprentices and dual vocational training program participants.

HANDS-ON STEM

Science, technology, engineering and mathematics can be so fascinating! To spark early interest in STEM subjects and hence in corresponding professions, Endress+Hauser is collaborating with schools – for example with student research centers, innovation labs and introductory internships. Most recently, Endress+Hauser Liquid Analysis entered into an educational partnership with the high school in Gerlingen, Germany. This includes collaboration in classroom teaching as well as supporting pupils with job applications.

EXPORT SUCCESS

The German American Chambers of Commerce have bestowed the 2024 Apprenticeship Award on Endress+Hauser in recognition of the company’s commitment to the Industry Consortium for Advanced Technical Training (ICATT) as well as its efforts to promote workforce development. In 2019, Endress+Hauser began offering a US vocational training program too – in Greenwood, Indiana. Twelve young talents are currently participating; eleven apprentices have already been through the program and all were retained by the company.

Future prospects: A visualization of the company campus in Maulburg after the extension.

118 million euros

is being invested by Endress+Hauser in the biggest construction project so far in the company’s history: The Group’s oldest and largest production facility in the German town of Maulburg is being comprehensively modernized and extended in a drive to get production and development of level and pressure measurement technology in shape for the future. Sustainability will also receive a further boost: The site already generates 45 percent of its own electricity needs; in due course the new and refurbished buildings will be up to 90 percent energy self-sufficient.

“Developing the facility means we can serve our customers’ needs even better and boost our international production network.”

Dr Dirk Möhrmann, managing director at Endress+Hauser Level+Pressure

2024

The financial year at a glance

> Despite a challenging business climate and a more or less flat overall market, we achieved marginal growth, with our small and mid-sized sales centers offsetting the weak performance in our three biggest markets – the USA, China and Germany.

Net sales

€3.74 bil.

(+0.7%)

Sales by region

Europe
€1,484 mil.
(–0.9%)

Americas
€993 mil.
(+4.2%)

Africa, Middle East
€175 mil.
(+13.3%)

Asia-Pacific
€1,092 mil.
(–1.9%)

Operating margin

15.0%

(2023: 15.4%)

> Every year, we invest vast amounts of capital in expanding our worldwide production network. This positions us for continued growth and makes our production locations more sustainable.

Net income

€408 mil.

(–0.2%)

Investments

€349 mil.

(2023: €261 mil.)

> Around the world we created new jobs to help drive growth in our business.

Employees

17,046

(+514)

EcoVadis rating Gold status

78/100

points

(2023: 71 points)

> We have retained our Gold status in the EcoVadis sustainability ratings, scoring record points despite increasingly strict reporting requirements. This means we have kept our place in the top five percent of the 130,000 companies listed on the EcoVadis platform.

Patent applications

285

(2023: 257)

> First filings with patent offices all around the world have now returned to pre-pandemic levels.

R&D ratio

7.4%

(2023: 7.2%)

> How did Endress+Hauser perform in the past year?

Holding steady

Endress+Hauser increased its sales only marginally in 2024, after three years of double-digit growth. But while the hoped-for economic upturn in the second half of the year failed to materialize, we still managed to hold steady. We were aided in this by our diversified market position with its extensive range of products, solutions and services and its broad mix of regions, industries and customer segments.

Although achieving only muted growth, we were able to keep our profits on par with the high levels achieved in the previous year. At the same time, we invested heavily in growing our global production and sales networks. We are cautiously optimistic for 2025 – in part because of our strategic partnership with the German sensor technology specialist SICK, which we initiated last year. The partnership enables us to offer a broader range of products and services and enhances our expertise in gas analysis and flow measurement technology.

DR LUC SCHULTHEISS, CFO

Strong together

A weak economy, global crises, political tensions: President of the Supervisory Board Matthias Altendorf and CEO Peter Selders talk about Endress+Hauser's path through turbulent times. And why cooperation makes the company more resilient.

Questions: Martin Raab
Photography: Andreas Mader

Mr Selders, the economic environment in 2024 was far from easy. How uncomfortable was your first year as CEO?

Selders: I wouldn't call it uncomfortable, but it was certainly very intense. The subdued way that business developed has demanded a great deal of attention throughout the year. Furthermore, the strategic partnership with SICK has kept us very busy. However, we managed both of these well, and I deliberately say "we" because everyone was involved in this result – our employees, the Group's management and my colleagues on the Executive Board.

Altendorf: The people at Endress+Hauser can be proud of this performance. We have achieved a great deal under the circumstances. But of course, we would have preferred better results in some markets.

So how was the year for Endress+Hauser?

Selders: Growth for the group as a whole was less than one percent. Our three largest markets – the USA, China and Germany – performed poorly for different reasons. However, our small and mid-sized sales entities successfully compensated for this. Overall, we kept our costs well under control, despite creating 500 new jobs worldwide and investing more than ever before. And with all this, we managed to maintain net profit at a stable, high level. It was a difficult year, but not a year of crisis. And to come back to the original question: On the one hand, of course I would have preferred a quieter start as CEO. On the other hand, this intense year gave me the opportunity to get to grips with the issues very quickly.

How quickly and how well did you settle into your new roles – Mr Selders as CEO, Mr Altendorf as president of the Supervisory Board?

Selders: That's probably a question better asked of the people around us. For me, it was a year of learning. Just like in the 20 years before, as CEO I still learn something new every day. In addition to my operational tasks, I took the time to get better acquainted with our business and the Group. I traveled a lot. I visited customers and our sites all over the world. Sure, I had to deal with some big issues from the very beginning. But I'm not on my own here. I have the Executive Board and the Group management at my side; I have the support of the Supervisory Board and the family. All of this, as well as my personal preparation, has helped me to settle into my new role.

“We can be proud of our achievements – but never complacent, because we are always in competition.”

Matthias Altendorf, president of the Supervisory Board of the Endress+Hauser Group

Altendorf: It always takes time to get to grips with a new role like this one – especially when you switch directly from one role to another. It also takes time for others to change their perspective of you in the new role. All in all, I think we did a good job during the first year. Mr Selders was effective from day one and has done well as CEO of the Group. He took the lead and set his own priorities, meaning that I could let go of the operational side of things. And the people who deal with me on a regular basis are probably also noticing some changes, because I certainly interpret and fulfill my new role as president of the Supervisory Board differently to my predecessor Klaus Endress. I agree with Mr Selders: We learn from each other and improve ourselves – this is true both for us and our environment. But ultimately it’s less about us and more about those to whom we are committed: our employees, our customers and our owners.

How is the family dealing with the changes and the new generation?

Altendorf: With customary Endress+Hauser style, the changes to the Group management and on the Supervisory Board were prepared well in advance and thoroughly coordinated between all parties. We have people in new roles and with different responsibilities, so we need to meet and get to know each other again. There are still many points of contact and lots of exchanges.

How is the shareholder family involved today?

Altendorf: Two members of the third generation, Sandra Genge and Steven Endress, represent the family on the Supervisory Board and maintain a profile as ambassadors for the family. Mr Selders and I regularly exchange ideas with Klaus Endress, who remains chair of the Family Council, and the other owners. Sarah Endress, another granddaughter of the company founder, will also increasingly act as a family ambassador. And looking to the long term, we are working on getting yet more family members involved in the company. We make sure the owners are regularly updated on developments at the company. And of course we have our formal get-togethers, such as the shareholders’ meeting and the family general meeting, which connect the business and the family. The family makes an impact on the company through its proximity and visibility, its connection and affiliations. And it has an influence through the choice of people it has entrusted to fulfill management positions in the Group. This is how the family ensures the values and culture that are important to them stay alive in the company.

REACHING GOALS TOGETHER

Dr Peter Selders (55), who holds a doctorate in physics, has been CEO of the Endress+Hauser Group since 2024. Previously, he worked for 20 years at the Group’s competence center for level and pressure measurement technology in Maulburg in southern Germany, where he was managing director since 2019. What he values about the family business is being able to pursue long-term goals; for him, cooperation is the key to success. Paraphrasing the extreme mountaineer Rainer Petek, he says: “We overestimate our ability to plan things and underestimate our capacity to deal with uncertainty.” For the passionate hiker, however, thorough preparation is essential – whether in the company or on a mountain tour. Peter Selders is married and a father to five children.

Why is this so important?

Altendorf: The family contributes values, warmth and experience – as well as capital. It shapes our culture and provides stability. Security, reliability and cohesion are particularly important in today’s world. They are enduring success factors.

We are seeing massive upheavals in the world around us. Crises and conflicts seem to never let up. What does this climate mean for Endress+Hauser?

Selders: We’re experiencing a seemingly unhinged world. Wars, extremism, migration patterns, protectionism, climate change and more, descending on us all at once. And much of it is interconnected. We have to find our way in a world where nothing can be relied upon, one that offers no certainties, a world that is more and more confusing and unfathomable. So what should we choose to guide us? As a physicist, I love models – and there are models that describe and explain the world as it is. These help me to better understand the challenges we face and to recognize the choices for action so that we arrive at good decisions. Our aim is not to have the wave crash upon us but rather to ride that wave, staying one step ahead. We want to act before we must react.

How is Endress+Hauser adapting to these new conditions?

Selders: In a nutshell, it is about strengthening the company’s resilience. Above all, we must learn to cope with the complexity and dynamics of this new world. We need structures and processes able to withstand challenge. By evolving one step at a time, we promote agility and flexibility. The culture and stability of our family business underpins the security we need to continue developing Endress+Hauser without fear. We face up to the unpredictability of this new world with cooperation and our network. This enables us to be fast and adapt quickly. Or to compensate for unanticipated developments like those of last year, when the small entities made up for the unexpected weaknesses of the large ones. The important thing in all of this is that we keep clear and steady goals in mind. And our strategy ensures that we do.

Altendorf: We are strategically, organizationally and culturally well prepared for the world we are presented with today. Our business is diversified across regions and industries. Our product portfolio is as strong as ever and the strategic partnership with SICK in process automation has made that portfolio better and broader still. Our customers trust and value us. We have employees who are committed to our company. And we have shareholders who think and act long term. We pursue long-term goals and have a strong set of values. Endress+Hauser has a solid foundation because we always operate on a sound basis. And so it will stay. Thus we can achieve the best for the company, even in challenging times. Indeed, we must maintain the courage and strength to question ourselves so that we can adapt to change and improve. We can be proud of our achievements – but never complacent, because we are always in competition.

Selders: It basically helps that we are in a growing industry – process and laboratory automation – even if this growth is neither uniform nor common to all industries. Digitalization, demographics, biotechnology, decarbonization, energy source change and energy efficiency are all powerful drivers for our business.

Aren't issues such as climate and environmental protection taking a back seat in the light of current upheavals?

Selders: I wouldn't over-generalize here. There is no shaking the scientific facts. If life on this planet is to be worth living in the future, we must take action. Behind such efforts is always the aim to be more efficient, make better use of resources and develop new methods and processes. That is our core business. All our customers have to do this too; there's no stopping it. This isn't new and it cannot be done without measurement technology.

Altendorf: It's certainly true that politicians must pay more attention to the feasibility of climate targets and have more confidence in business to implement them. We must make the environmental transition work in an economically and socially sustainable way. This takes time and social consensus – as well as innovation and new technologies. We humans are seldom prepared to make personal lifestyle changes quickly, but we are good at adapting to new, better circumstances.

ROOTED IN THE COMPANY

Matthias Altendorf (57) began his career at Endress+Hauser with an apprenticeship as a mechanic, followed by studies, time abroad and further training. He was appointed to the Executive Board in 2009 and took over as Group CEO in 2014. He has been president of the Endress+Hauser Supervisory Board since 2024 and in this role also guides the new generation in the family. Matthias Altendorf sits on other supervisory bodies too and is active in consultancy and teaching. In his free time he enjoys sailing, chess, motorcycle riding and forestry work. His other hobbies include traveling, art and reading. Matthias Altendorf is married with a grown-up son.

In this context, what are the implications of the strategic partnership with SICK in the field of process automation?

Selders: It fits our strategy as well as our brand identity. The gas analyzers and flowmeters fill important gaps in our product range. And with more than 800 new employees, we are gaining considerable expertise in these areas. For customers, this makes us an even more valuable partner – both now and looking ahead. We can better support them on important matters such as energy and resource efficiency and assist them long term with decarbonizing their production processes. To this end we will drive forward innovations in the production and development joint venture for gas analysis and measurement technology. Circling back to my previous points: We are establishing a broader and therefore more stable footing, strengthening our structures and expanding our network.

And what firm expectations do you have for the current year?

Selders: We anticipate another challenging year, with uneven economic development around the world and major political upheavals that will impact the global economy. We will stay alert, act prudently and keep an eye on costs. We believe that five to six percent growth is possible. But that's not a given. We have to be proactive and further develop ourselves. We are well positioned for major global trends and developments. Demand for measurement technology is increasing worldwide. So, opportunities exist, and we aim to use them.

Do you share this assessment, Mr Altendorf?

Altendorf: You know I'm always optimistic! We need to hope for the best, prepare for the worst and look to the future with as much confidence as we look back on the past with pride. A lot rests in our own hands. This is what we need to concentrate on: staying close to our customers, developing innovative products and maintaining excellent production and logistics networks. Our corporate culture helps us achieve this. Not least because it places "we" above "me". Team spirit and cooperation – inside the company, with the owners, with customers and partners – those matter more today than ever before.

"We are experiencing a seemingly unhinged world. We must learn to cope with its new complexity and dynamics."

Peter Selders, CEO of the Endress+Hauser Group

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