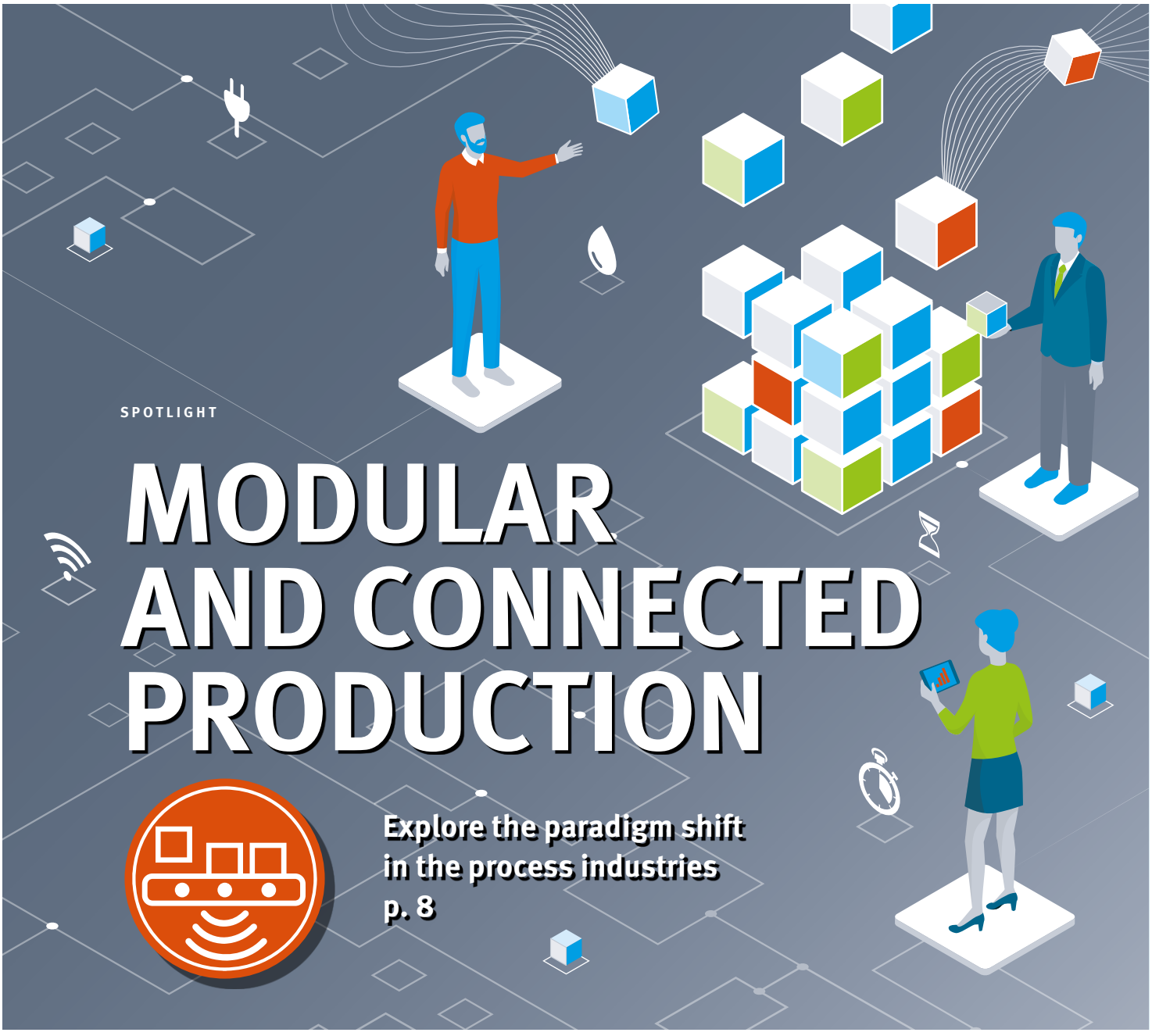
ACHEMA MAGAZINE
2/2020



SPOTLIGHT

MODULAR AND CONNECTED PRODUCTION

Explore the paradigm shift in the process industries
p. 8

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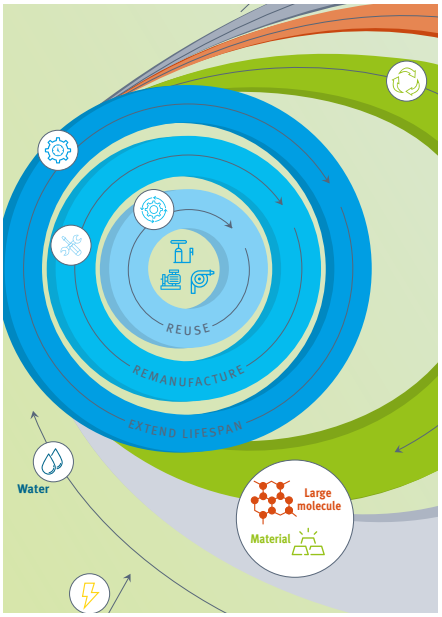

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EDITORIAL

Dear readers,

Keeping distance, washing hands frequently, wearing a face mask – we have all had to adopt a new lifestyle very quickly that conforms to the COVID-19 pandemic. Granted, it's not much fun, but it works. It works so well that we are sticking to the date of ACHEMA 2021. We are convinced that ACHEMA can be successfully held in coronavirus mode – although we certainly hope that we will already be in post-coronavirus mode come June next year. All over the world, the trade show business has restarted with no ill effects. We have put a lot of thought into our health and safety concept to make ACHEMA as exciting and inspiring as ever while keeping you safe. Learn the details on page 18.

The process technology world will certainly take longer to change from monolithic batch plants to modular and connected production. The paradigm shift required for this change is no less groundbreaking, however. Designing a process in modules takes an entirely different mindset.

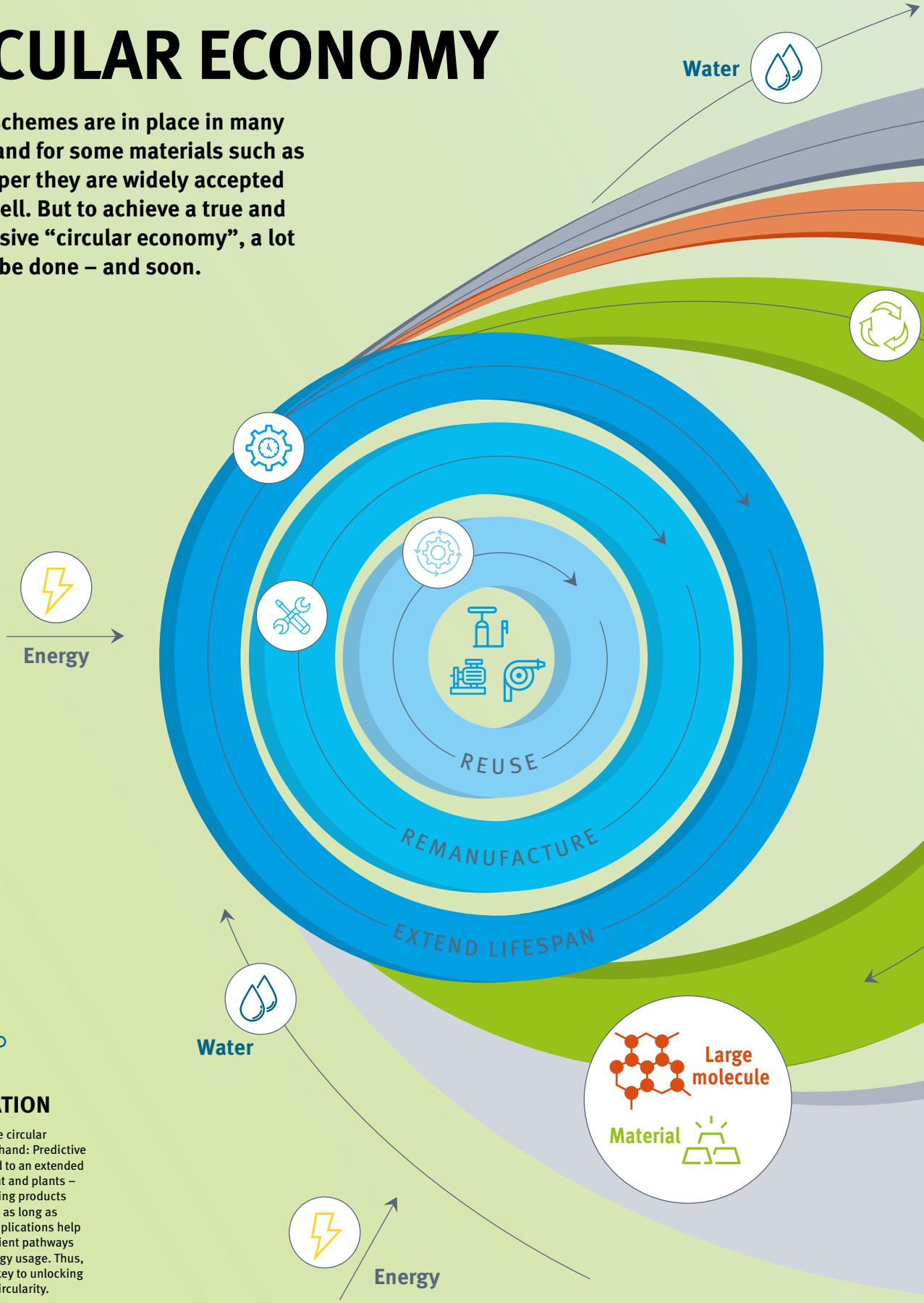
We are looking forward to meeting the great minds pioneering modular production and set the stage at ACHEMA 2021 with the corresponding focal topic. Join them, discuss with them, spar with them and make inspiring sustainable connections.

Yours,

Marlene Etschmann
Editor-in-Chief

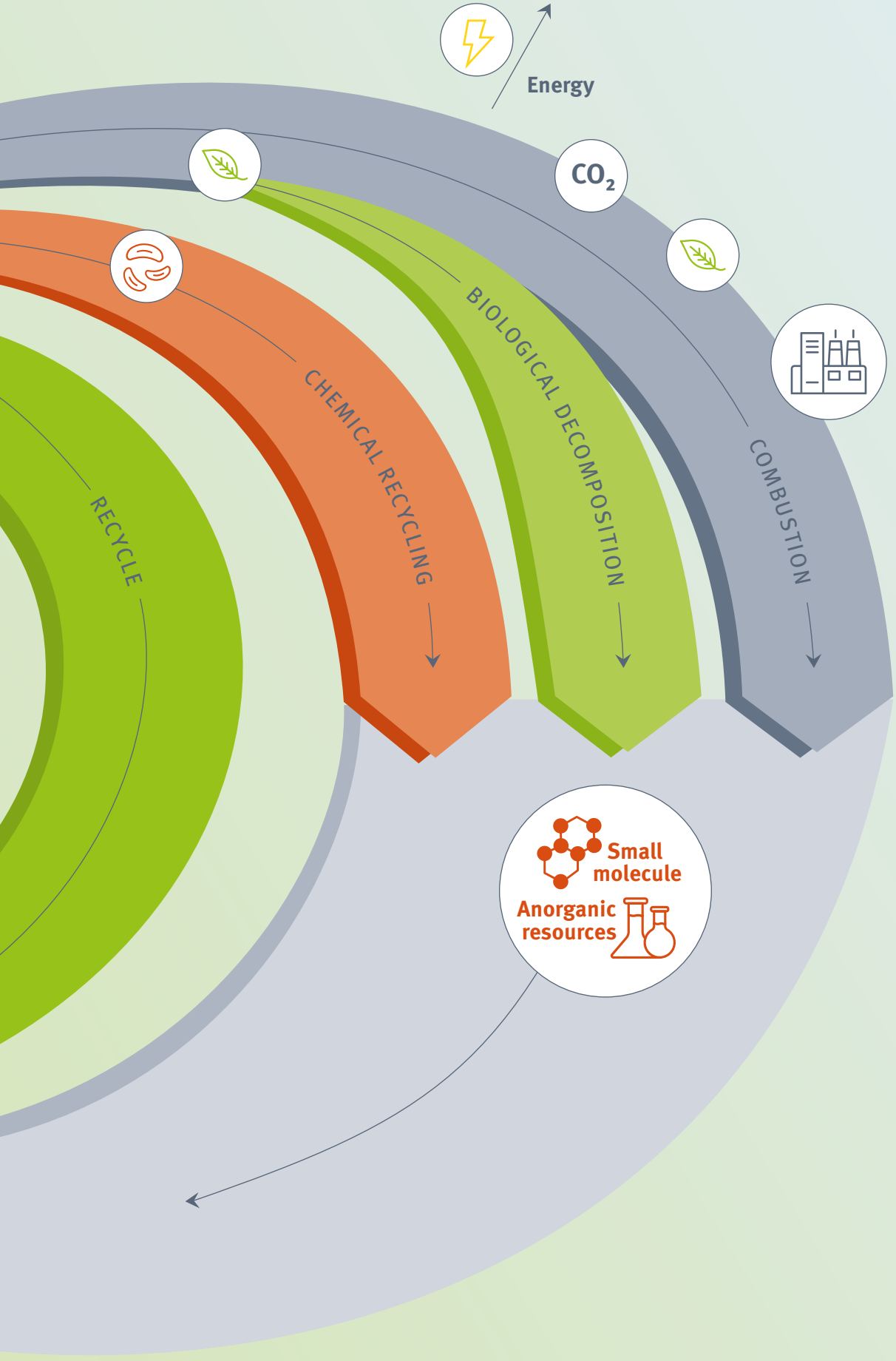
CIRCULAR ECONOMY

Recycling schemes are in place in many countries, and for some materials such as glass or paper they are widely accepted and work well. But to achieve a true and comprehensive "circular economy", a lot remains to be done – and soon.



DIGITALISATION

Digitalisation and the circular economy go hand in hand: Predictive maintenance can lead to an extended lifespan of equipment and plants – the first step to keeping products in the value chain for as long as possible. Big data applications help to find the most efficient pathways for material and energy usage. Thus, digital methods are key to unlocking the full potential of circularity.



ENERGY

While matter can in principle be kept in the cycle, the whole cycle depends on energy as a driver. In order to make the concept sustainable, this energy cannot come from within the cycle, i.e. not from gas or oil, but has to be provided from the outside – mainly by the sun. The required amounts of energy add up to awe-inspiring numbers. Energy efficiency therefore remains a major goal for the process industry.

WATER

No process industry without water - whether as part of the product, solvent, medium or cooling agent. Water is part of every step in the production cycle. As water resources are valuable and scarce, closing water cycles goes along with closing material cycles. Similar to the concept of a material-oriented circular economy, water can be circulated in one process, one plant or over a whole industrial site.

GET INTO THE LOOP!

“Closing loops” might sound simple and like nothing new – is has been working for glass and paper for decades. But thinking bigger calls for new concepts – and making loops smaller.

If strictly applied, the concept of a circular economy goes far beyond the handling of products or the recycling of materials. It calls for a holistic view – the biggest conceivable loop is the one that is limited by planetary boundaries. Although this perspective might not be the best starting point for applicable concepts, it provides the most striking argument for why a circular economy is mandatory with regard to human survival: resources are limited. Short of mining on extraterrestrial celestial bodies, we have to work with what is here.

This is obvious for some metals or rare earth elements, but limitations also apply to other resources like carbon. We might feel that carbon is available in abundance, but we would rather limit the amount of carbon that resides as oxidized carbon in the atmosphere. Thus, climate change does not limit the amount of existing carbon, but it limits the amount of carbon we can convert from oil, gas or biomass to CO_2.

On a more regional scale, resources are even more limited, and this applies not only to valuable metals or elements, but also to fresh water, which has also to be considered when speaking about closing loops.

Reusing what has already been collected instead of letting it dissipate is not only necessary due to environmental and sustainability concerns, but also economically viable: The available primary sources require ever more effort because they are not easily accessible or contain low amounts of the desired materials. Exploration and processing thus become ever more costly.

Closing loops and implementing a circular economy is thus not only at the top of the agenda for national governments, the EU and the UN, but also of high interest to companies who want to ensure a sustainable supply of resources for their plants. All there is to do is collecting what has been used and reprocessing it to something new without any loss of quality or value.

This sounds simple, but the decision about which path to follow requires the consideration of many factors. A thorough holistic life cycle analysis can indicate whether closing a loop really is economically and ecologically feasible and should always be the first step when thinking about where to close the loop. •

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MARK YOUR CALENDAR 16 JUNE 2021:

ACHEMA Highlight Session
Closing the loop with chemical recycling: potentials and challenges

— Prof Alexander Van Herk, Agency for Science, Technology and Research (A*STAR)

— Dr Andreas Kicherer, Director Sustainability Strategy, BASF

CIRCULAR INNOVATION ZONE

THE CIRCULAR ECONOMY PLATFORM AT ACHEMA 2021:

— Sustainable chemistry
— Industrial water
— Bioeconomy
— Raw materials
— Energy and climate

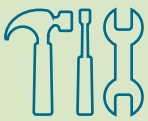
are topics that move the ACHEMA community across all industries. For the first time, there is now a dedicated stage, exhibition and networking area for all topics “circular”. Visit the Circular Innovation Zone in Hall 6.2. to meet people, ideas and technology and to make inspiring sustainable connections.

ACHEMA.DE/CIRCULARINNOVATION

p.4–5: Illustration: MPM; Icons: Noun Project; p.6–7: BsWei / iStockphoto; Icons: Noun Project

WHERE TO CLOSE?

What sounds simple is in fact a multi-layered concept: Loops can be closed at different stages, leading to a concentric scheme rather than one big cycle. As a rule of thumb, the smaller the circle, the less effort and resources are required to retain the value.



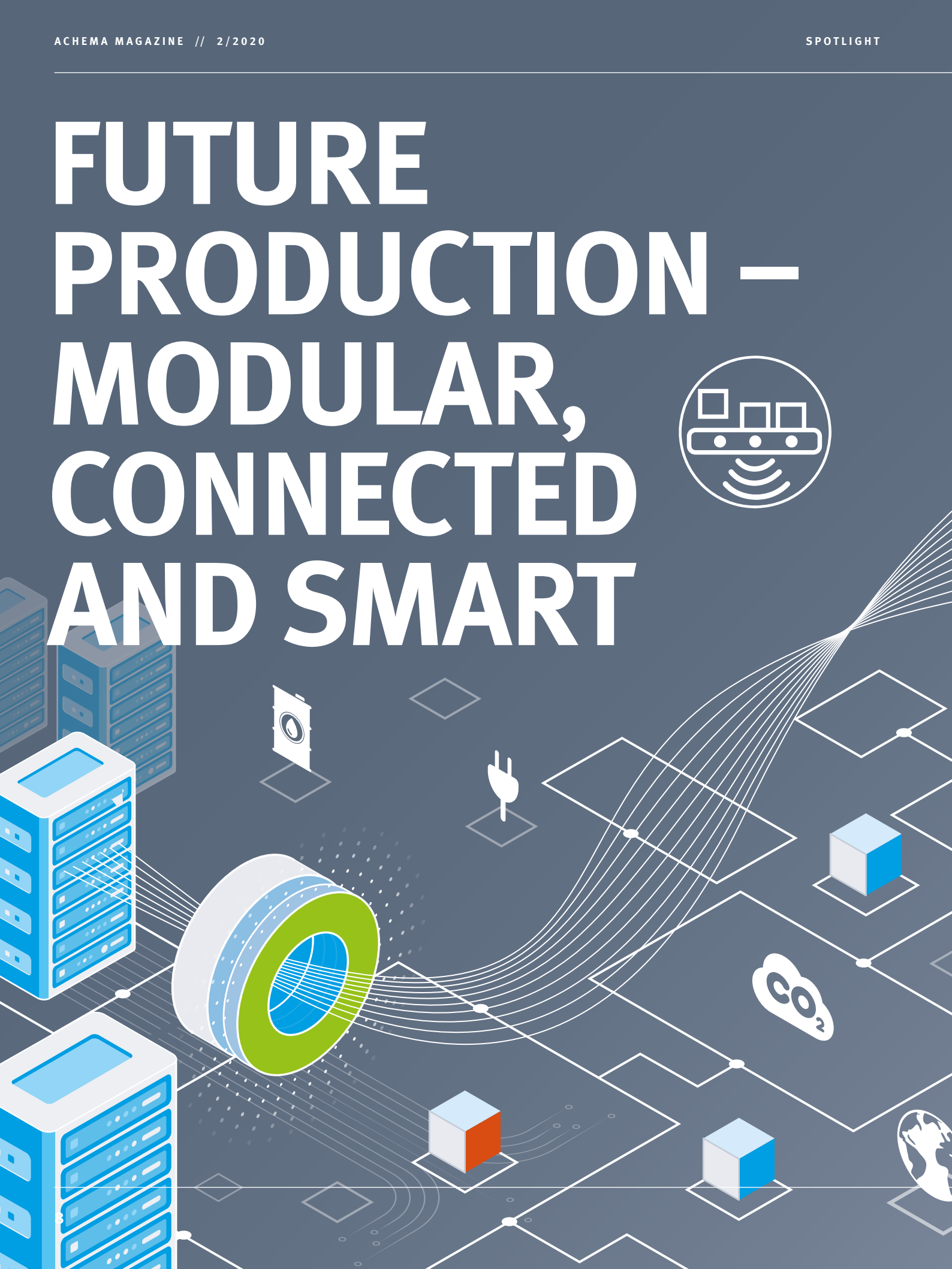
Repair / refit / remanufacture: Looking from the product perspective, these are the smallest loops. A piece of equipment can be repaired or updated so that it can be used even in a changing processing environment. One example for this is to fit an "analogue" compressor or mixer with data retrieval components in order to make it "smart" and usable in a more digital environment. This is a very important point for refitting brownfield plants. Another possibility would be to reassemble the modules of a pump to meet new requirements rather than buying a whole new pump.

Recycling: If a product or piece of equipment has reached the end of its lifespan, the next opportunity to close a loop is recycling. This means that the product is broken down into its components or, more drastically, the material is melted down or otherwise reshaped without affecting its chemical composition. While this is a well-established and proven process for glass, many metals and some other products, the case of plastics highlights its limits. They arise from several challenges at different points in the recycling system: Recycling requires sophisticated collection and sorting systems, demanding elaborate logistics. This becomes more complicated the more varieties of a material are on the market or, even worse, combined in a composite material. While glass bottles differ mainly by colour, "plastic" can consist of a plethora of different materials that need to be correctly sorted to allow for recycling without loss of quality. Every impurity can cause problems in the process.

Chemical recycling: One work-around for this is chemical recycling. This process which is currently much discussed with regard to the use of bio-based waste streams and plastics relies on breaking down the material chemically, resulting in small molecules such as monomers, oils and syngas. The range of waste streams that can be processed is wide and reaches from used cooking oils to polymers. They are broken down by pyrolysis, for example. The steps that follow are very similar to the processing of natural gas or fossil oil – a big advantage because it can be integrated into existing production landscapes. The downside is that this cycle is rather wide and contains many steps, each requiring resources and especially energy, first for breaking down, then for rebuilding the material.

Combustion: While CO_2 resulting from "thermal recycling" is also a small carbon molecule, it is much more difficult to convert back into materials. Thus, combustion should be restricted to waste streams that can not be recycled otherwise. Biology offers one way for CO_2 usage by photosynthesis; another way is CO_2 capture and usage, which mainly relies on renewable hydrogen and sophisticated catalytic processes. The cycle is even wider than chemical recycling, and the energy demand especially is much higher.

FUTURE PRODUCTION – MODULAR, CONNECTED AND SMART



Making chemicals and pharmaceuticals at an industrial scale takes a lot of everything – raw materials, water, time and energy in the form of electricity, oil or gas. Industry has been working hard for decades to reduce its use of resources. Modular production is the Swiss-army-knife technology to accelerate this even further and make chemical production more sustainable.

FAST, FLEXIBLE, FEASIBLE

The speciality chemicals market demands ever-more adapted products. Processes need to be developed quickly, and production facilities designed as flexibly as possible. At the same time, they should consume minimal energy and raw materials to keep the CO_2 footprint light. One approach to meet all these objectives is modular production.

Two essential aspects play together in modularisation. The process equipment must be subdivided into modules, and the automation technology needs a modular structure. In combination, this results in a paradigm shift in process development away from unit-operation-based engineering to services provided by modules. Instead of individually integrating the feed valves, the temperature control unit, the stirrer and the required sensor technology into the automation of a stirred tank, there is a kind of printer driver for the module, the Module Type Package (MTP). The MTP interface provides the "mixing" service, which receives the parameters of the mixing process from the Supervisory Control and Data Acquisition (SCADA) system. The control of the individual components of the module is encapsulated in the service supplied by the module builder.

THE CONDUCTOR FOR THE MODULAR PROCESS PLANT

The Process Orchestration Layer coordinates the interaction of the individual modules and integrates the modules into the overall plant. In this way, new modules can be quickly integrated into an existing plant, as only one element needs to be added in the automation system. Even the integration into the user interface is simplified by the MTP, as the elements to be displayed are included. The design of the visualisation is specified by the control system to achieve a uniform look and feel. For this to work, standardised data exchange formats are required, such as the XML-based DEXPI format for describing the module structure.

HOW TO GET THE PROCESS DATA?

Since the process steps are encapsulated in the services of the modules, the question of how the process data can be made available for other Industry 4.0 applications arises, for example advanced analytics. The answer is NAMUR Open Architecture (NOA), which makes this data available via a second channel without affecting process control.

FLEXIBILITY THROUGH STANDARD MODULES – HOW TO TO FIND THE RIGHT MODULE

By using standard modules, more flexible production is possible. The modules can be combined to suit the respective process and can be quickly integrated into the automation through the interface. In the planning phase, the requirements are formulated and suitable modules are identified in a module database. This database can consist of the existing module park, but may also contain modules available from suppliers. Even if not all the required process steps can be mapped using existing modules, a partially modular structure can still save a considerable amount of time in plant planning, construction and automation and thus shorten the time to market. The repeated use of equipment also offers significant cost advantages.

MODULES IN PROCESS DEVELOPMENT – BATCH TO CONTINUOUS

If standard modules are used, correspondingly smaller and scalable continuously operated equipment can be used in pro-

World's first pilot plant composed of interoperable modules.

cess development. Continuous processes are usually much more efficient than batch processes. A pilot phase is necessary to transfer batch results from the laboratory to a continuous process. It is costly and is, therefore, often avoided resulting in production processes being run in inefficient batch modes. With the use of continuously operated laboratory equipment, this pilot phase can be significantly reduced or even completely eliminated.

COSTS OF MODULAR SYSTEMS – A STRATEGIC DECISION

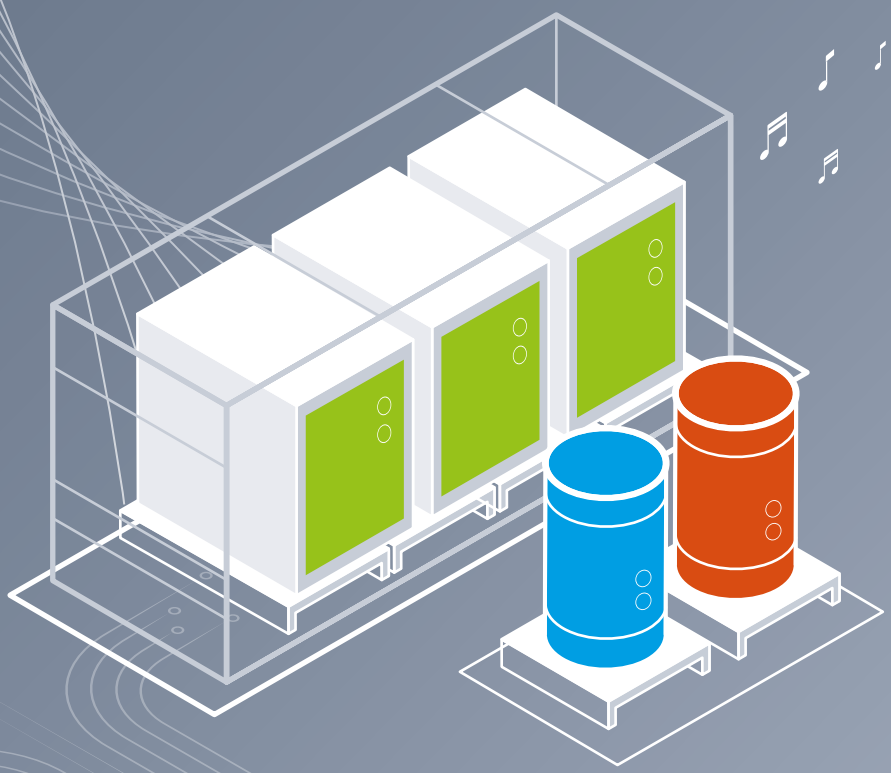
With modular systems, processes can be developed more quickly, and the use of continuous apparatus ensures high efficiency. This results in a noticeable cost advantage – but only over the service life of the equipment; the initial investment costs are higher than with conventional plant design. If the modules are to be reused, they cannot be designed for specific parameters, but must cover a larger parameter space. These costs are amortized by multiple use of the modules, and the design can be reused as well. Investment costs, however, are credited to the current project and not to optional processes that may be possible in the future. This requires a strategic decision for the concept of the modular plants to enable the implementation independent of individual projects.

Over time, further cost advantages will also arise because if a module park is gradually built, the production site will become more flexible.

On the automation level, it is much more complex to define possible services for the MTP than to program a basic operation once. However, the services are provided by module suppliers. They can reuse the programming service for similar modules, which relativises the cost on their side. Nevertheless, there is a shift of the programming effort from the operator to the supplier.

THE LEAP INTO COMPREHENSIVE APPLICATION

A large number of suppliers already offer equipment with MTP. The major automation suppliers have also integrated MTP functionality into their systems, and pilot projects at users' sites have been implemented. From these initial approaches, it is now necessary to shape modular production for the future. •



DR ALEXANDER MÖLLER

Dr Alexander Möller coordinates projects at DECHEMA on modular production, artificial intelligence and digitalisation in the process industry.

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MODULAR PRODUCTION: PERFECT PROCESS HARMONY

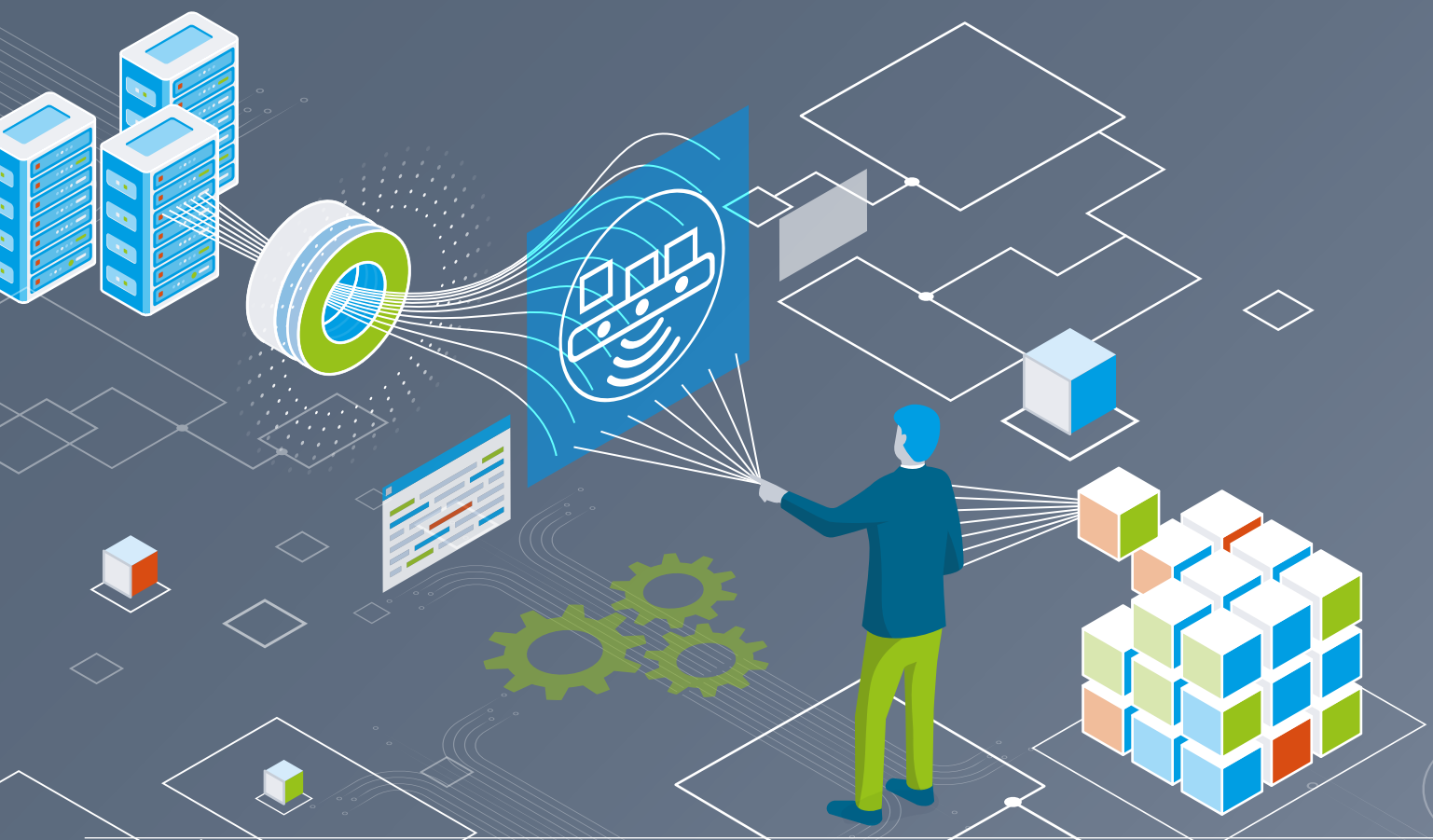
Smaller batches, individual products – the chemical industry has to adapt to the wishes of its customers. It does so by making its production plants more flexible and modular.

The chemical industry is one of the economic sectors in Germany that consume the most energy. Basic chemicals such as hydrochloric acid are already being produced in a very energy-efficient way because large-scale plants are operated continuously. However, often only a few tons of fine chemicals and active pharmaceutical ingredients are needed per year. They are therefore produced in multi-product plants in batch operation. Shutting down such a plant after production, cleaning it thoroughly and preparing it for the next product costs both time and money.

Both could be saved if the production plants were modular in design. To move around and exchange plant components as required, just like children do with their colourful plastic building blocks, is the dream of all engineers.

CONNECTION, COORDINATION, CONTROL

Unfortunately, the reality of the process industry is not quite as simple as a nursery. Plant operators, module manufacturers and automation engineers are working to agree on standards, methods, models and procedures. A modular plant can be operated efficiently only if the modular units are intelligently interconnected, coordinated, controlled and regulated – just as a symphony can sound perfect only if all the musicians in the orchestra arrive to the concert on time and play the right notes at the right time. Both are highly complex processes, and that is why engineers have borrowed a term from music for their own: orchestration. •



SETTING THE BEAT IN PROCESS AUTOMATION

For engineers, orchestration means the systematic methodology for combining individual process equipment assemblies and their services to create a production specification that can be run and executed. In an industrial plant, orchestration is done by what is known as the Process Orchestration Layer. Depending on the application, orchestration can be carried out using various methods. Common to all is that they use the Module Type Package concept. This defines the common language used by the Process Orchestration Layer and process equipment assemblies. In music, these are the notes. The Process Orchestration Layer sets the beat for the individual equipment assemblies. It retrieves the functionalities currently required in the individual process equipment assemblies at the right time. In the Module Type Package, these are referred to as services, which are started, parameterised, paused and stopped by the Process Orchestration Layer.

THE FUTURE IS MODULAR

The requirements and functions of the Process Orchestration Layer vary depending on the industry and application. Therefore, future systems of the Process Orchestration Layer will be much more modular and flexible to provide plant operators with exactly the functions they need to orchestrate their modular plant, concentrated within one single workbench. First concepts in products will be shown at ACHEMA 2021!

Flexible production is, with respect, still a long way off. Flexible production systems require a degree of adaptability that will be achieved more and more in the future. On the way there, Siemens is actively participating in the standardisation work with countless partners. In addition, Siemens supports its customers in the introduction and implementation of the standard in its overall portfolio for original equipment manufacturers and plant operators. With COMOS, SIMATIC TIA Portal and the S7-1500, as well as SIMIT, we offer an integral solution for planning, engineering and testing modular process units.

With COMOS, the new web-based SIMATIC PCS neo or SIMATIC eBR or OpCenter Execution for pharmaceuticals/chemicals, we also offer a wide range of options for implementing the Process Orchestration Layer. In summary, we offer products and services over the entire life cycle for process equipment assemblies and modular plants.

ANDREAS STUTZ

Andreas Stutz is a research engineer at Siemens AG in Karlsruhe and co-author of the standard of the Module Type Package concept.

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“The Process Orchestration Layer sets the beat for the individual equipment assemblies.”

p.13: Photo: Andreas Stutz

PLUG-AND-PLAY FLOW MEASUREMENT THANKS TO MTP

The water meter in your basement is a rather simple example of a flow meter; in the process industry, these need to conform to significantly higher demands. They can cope with liquefied gas at –200 °C as well as with 2000 litres per hour of viscous tomato paste and are also fully digitalised. In addition to the classic 4.20 mA/HART signal, they also communicate via common protocols such as Modbus, Foundation Fieldbus, Profibus as well as Profinet and even Bluetooth.

Until now, there was no manufacturer-independent standard for the integration of modules; hence flow meters had to be manually integrated into the IT environment of the respective plant. In some cases, this involves a great deal of effort, which is why KROHNE engineers are now cooperating with the company Semodia. Semodia's MTP control engine encapsulates the intelligence of the Coriolis OPTIMASS 6400 mass flow meter and describes it in a module type package conforming to VDI/VDE/NAMUR guideline 2658. The MTP semantically captures, models and communicates the system's properties and capabilities. The Semodia MTP control engine can be used on any field device. This means that an OPTIMASS 6400 as a module is now able to provide the Human Machine Interface and certain services via the manufacturer-independent Module Type Package. The effort of signal-based integration is eliminated; instead, the module can now be integrated quickly and efficiently and play its part in the plant orchestra.

The joint contribution of KROHNE and Semodia significantly increases both the efficiency of modular process plants at all levels of their architecture and the overall resource efficiency in the process industry.

RALF HAUT, KROHNE MESSTECHNIK
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RALF HAUT

Ralf Haut is the Technical Manager in the KROHNE Group's Global Chemical Industry Division. He holds a degree as process engineer and worked in a number of roles for companies including Bayer, Siemens and Honeywell.

"The module can now be integrated quickly and efficiently and play its part in the plant orchestra."

p.14: Photos: Krohne Messtechnik, Ralf Haut

The OPTIMASS 6400 mass flow meter is ready to be integrated into modular plants.

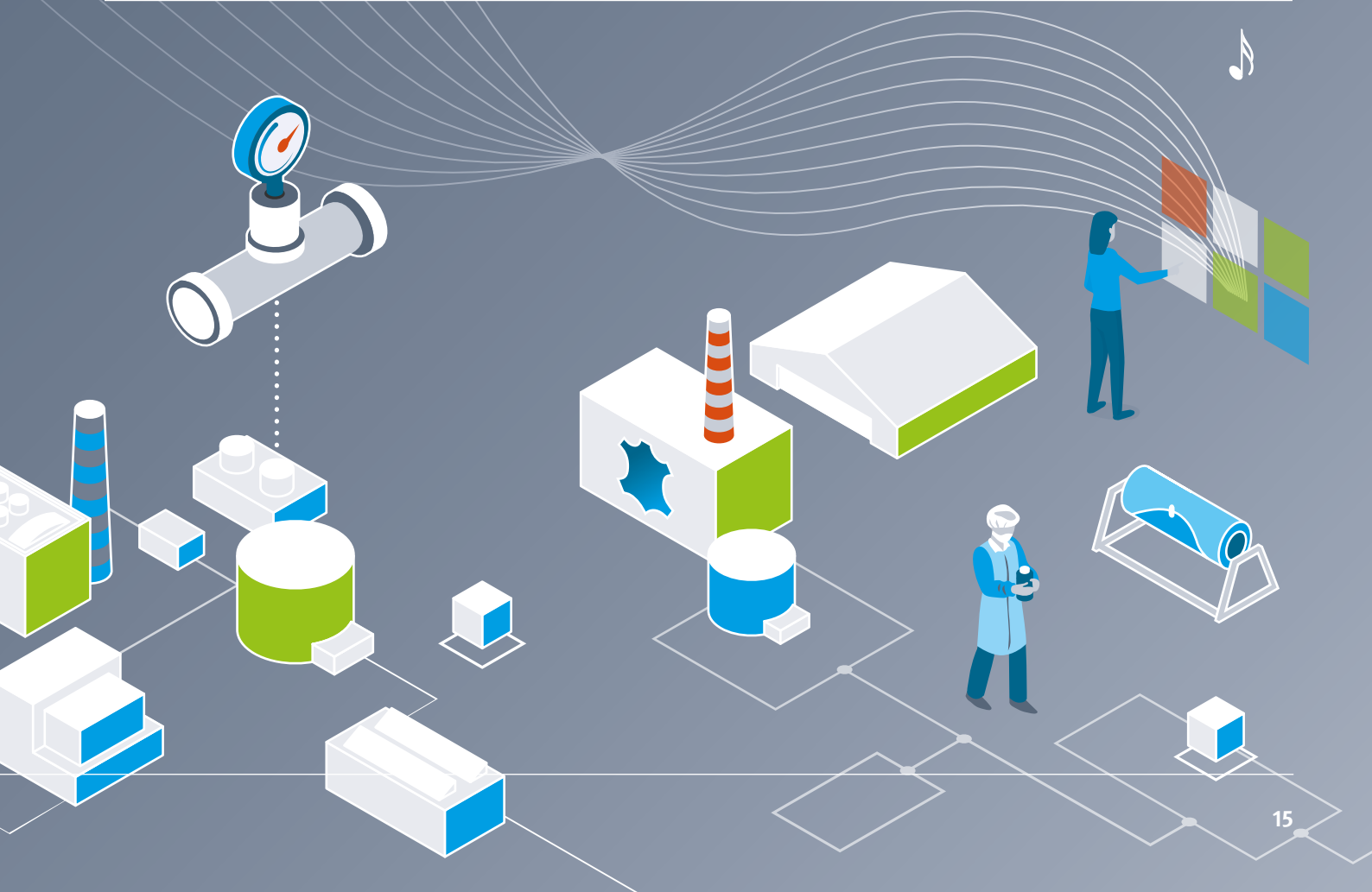
MODULAR PRODUCTION: FROM SHOW FLOOR TO SHOP FLOOR

A leather cloth for cleaning the inside of a saxophone needs to be smooth and supple, while the leather for a cello case must be sturdy and waterproof. Transforming rawhide into leather bespoke for a particular application takes a lot of high-tech chemistry in the tannery. At ACHEMA 2018, the model of a pilot facility for manufacturing leather chemicals was presented as part of the special exhibition “Process INDUSTRY 4.0: The Age of Modular Production”. Now the plant is going to market.

The pilot plant for in-situ production of a retanning agent had been run since November 2017 by LANXESS at, and together with, the Heller Leder tannery in Hehlen in Lower Saxony, Germany. There, the process has been tested under real-life production conditions and developed to market readiness. To bring the container-sized production modules to commercial scale, LANXESS has now joined forces with the Swiss Hüni AG for their expertise in plant engineering and construction of the modules; LANXESS will contribute its chemical process engineering and application expertise.

In the modular process, shavings from leather production will be recycled in the tannery directly on-site used to produce retanning agents in a fully automated manner. At a medium-sized tannery, there are around one to two tonnes of shavings per day. These can be used to produce a comparable quantity of liquid retanning agent. The waste is fully recycled, leaving no residues and generating no emissions. This approach also eliminates any of the costs involved in transporting the materials to recycling companies or for disposal.

LANXESS has been producing leather chemicals for over 100 years. Hüni AG designs and manufactures drums and process automation systems for the leather tanning and processing industries. The pilot plant was sponsored by the German Federal Ministry of Education and Research (BMBF) as part of the ReeL research project (resource-efficient manufacture of leather chemicals).



FACTS AND FIGURES

MARKET POTENTIAL CHEMICAL AND PHARMACEUTICAL INDUSTRY

2016 2030

212.80 > 280.79

Global investment (bn €)

0.2 > 3.5

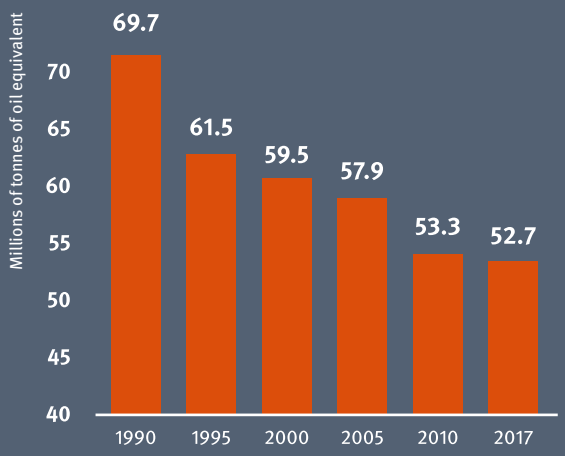
Modular measurement and process automation equipment (bn €)

Source: CEFIC Report, ZVEI estimates

FUEL AND POWER CONSUMPTION* FALLS 24% SINCE 1990

Fuel and power consumption in the EU chemical* industry

-24 %



Source: CEFIC facts&figures 2020

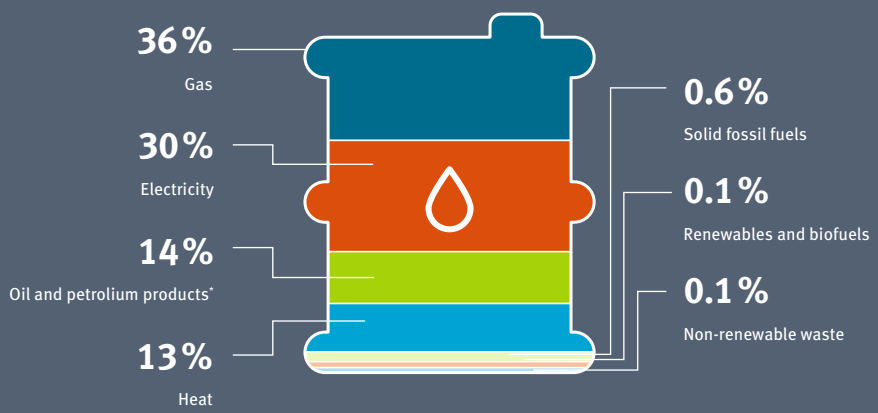
2x

Renewable and biofuels energies consumption* in the EU chemical industry more than doubled since 2000.

Source: CEFIC facts&figures 2020

TOTAL ENERGY CONSUMPTION* IN THE EU CHEMICAL INDUSTRY BY SOURCE

52.7 million tonnes of oil equivalent (2017)



* Chemicals including pharmaceuticals

Source: CEFIC facts&figures 2020

p.16: Illustration: NikWB, davooda, Artco / Adobe Stock; p.17: Photo: Nils Weber

4 QUESTIONS TO

Nils Weber

Managing Director of NAMUR – User Association of Automation Technology in Process Industries

How did modularisation start?

WEBER: *The first major initiative in Germany/Europe was the F3 Factory project – lexible fast and future factory. The EU funded the project for four years starting in 2009, and all the important global players were already on board: Bayer, BASF, Evonik, Ehrfeld Mikrotechnik, Buss-SMS-Canzler and many more.*

The INVITE research company then built a technology centre as part of the project. Small modular plants on a container scale were developed – these were the very first forerunners. The concepts are now further advanced, and first industrial prototypes are already available. This has led to the concept of Module Type Package, which is now the focus of much attention.

What role does NAMUR play?

WEBER: *We have represented the interests of the process industry in the field of automation technology since 1949. For some years now, we have been working together on the modularisation of automation with ZVEI, the VDMA trade association VtMA, BioPhorum and the ProcessNet initiative of DECHEMA and VDI. We are very eager to have open standards instead of proprietary interfaces as this is the prerequisite for the user to combine modules from different manufacturers.*

How is modularisation viewed outside Europe?

WEBER: *China and India are white spots on the map, as far as I know. Some developments in the US have come to my attention, like the Open Process Automation Forum (OPAF), but not in the sense of a module with defined interfaces, open standards and interoperability. We are far ahead of the field in Germany and Europe. The potential has been recognized here, and a large number of companies and manufacturers are working on the topic – many more than elsewhere. If you look at different industrial sectors, biotechnology is way ahead in terms of modularisation. Single-use units for fermentation and downstream processing can be purchased ready-configured, but unfortunately not with open interfaces.*

“Open standards for data transfer are a key issue in modularisation.”

NILS WEBER

When will I be able to approach a manufacturer and order a modular chemical plant?

WEBER: *This is a very good question – maybe in ten or fifteen years? Both parties, manufacturers as well as users, need to be enthusiastic about new technologies. Both sides need to have a common understanding of “we want to missing move this topic forward together”. Perhaps some people are still hesitating because certain standards are missing. Internationally valid standards are often drivers that manufacturers wait for because only then do they have a reasonable basis for their development.*

I believe that a lot more needs to happen in people’s minds. We should take the IT industry as an example; It has shown a path forward on how openess can be a benefit for all instead of thinking in silos. •

QUESTIONS ASKED BY MARLENE ETSCHMANN
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NAMUR.NET

ABOUT NILS WEBER

NILS WEBER has been Managing Director of NAMUR since April 1, 2020. After training as a chemical technician, he studied chemical engineering in Magdeburg with a focus on instrumental analysis. During his time at Bayer and INVITE, he was active in the field of process analysis technology with increasing responsibility, most recently as Principal Expert.

ACHEMA 2021 GOES HYBRID

Experiencing technology hands-on and talking with experts in person are at the core of ACHEMA, and will be in 2021, too. However, during the coronavirus pandemic, ACHEMA consistently relies on a hybrid form: An unforgettable and safe trade-show experience on-site, including smart additions with digital offers.

We have used the past few months to discuss and plan intensively with the industry about the changing conditions. One thing is clear: Our society has a fundamental need to connect, and the desire for personal meetings has been significantly strengthened by social distancing. Many issues can be solved digitally, but nothing replaces personal meetings and exchanges on-site.

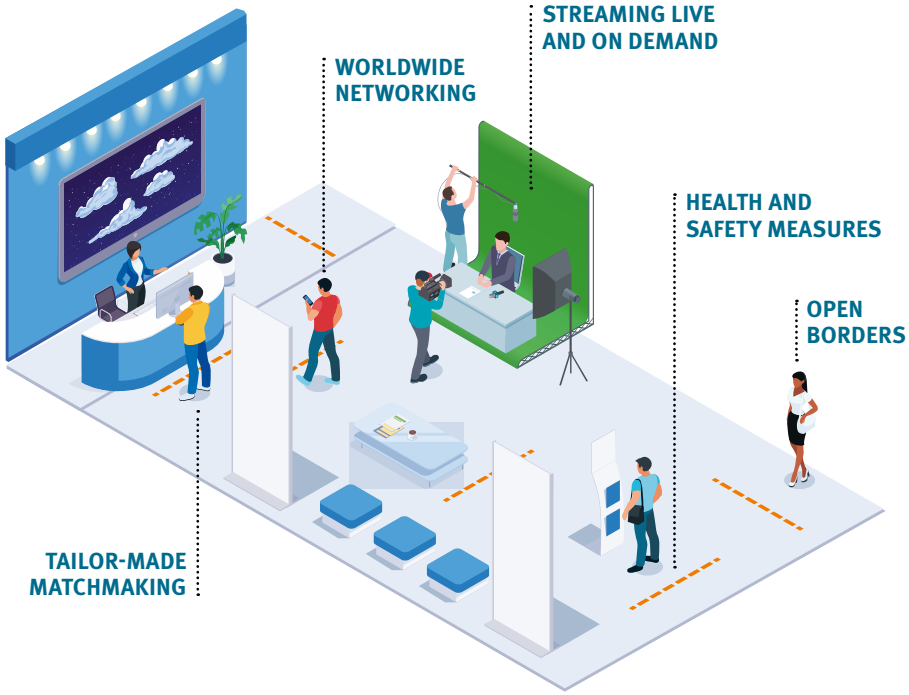
A UNIQUE OPPORTUNITY

For us, as organizers, it is a pleasure and an honour to serve our communities; to help them explore, advance and share best practices and new ideas across sector boundaries, nations and continents and boost their business. Particularly in these times, it is our obligation to signal that things are starting up again. ACHEMA offers unique opportunities to spread confidence and a sense of new beginning in the process industry. One hundred years in, ACHEMA is, therefore, more important than ever and is one of the cornerstones to get the business of our community going again.

For this, we are ready to welcome you in Frankfurt: Germany has opened its doors to all trade show attendees from abroad even in times of COVID-19. Trade show attendees from all over the world can easily enter Germany, as they are considered business travellers with an urgent need to travel. All ACHEMA attendees from countries outside of the EU must provide just simple proof of their participation in the trade show when applying for a visa or when entering Germany.

SAFE AND HEALTHY ON SITE

We now see that strict travel restrictions are not containing SARS-CoV-2, but the strict observance of extensive health & safety concepts does. Trade show halls – especially those in Frankfurt – belong to the safest indoor places during this pandemic. The air volume within the halls is large and is constantly exchanged with fresh air. Wider hall aisles, an overall looser stand allocation as well as professional crowd management provide plenty of space to hold your business discussions risk free. Contact surfaces and sanitary facilities are disinfected regularly and intensively, and we provide hand sanitizer stations all over the fairgrounds. Contactless access control, electronic tickets, and contactless payment methods contribute to the protection of ACHEMA exhibitors and visitors. Attendee data is personalized to allow for contact tracing, if necessary.



INFORMED AND INSPIRED FROM REMOTE

Independent of current developments, we have our community covered with a range of hybrid offerings. Many of the talks will be streamed live and on demand, increasing the reach and extending the life of the unique ACHEMA program content; digital showrooms will expand the ACHEMA exhibition presence with comprehensive multimedia, contact and interaction formats; and the new matchmaking will offer extended lead-generation potential, pre-qualified contacts, tailor-made recommendations and measurable interactions – before, during and after ACHEMA.

ACHEMA as a hybrid event will continue to be the world's most important meeting place for the process industry and beyond. •

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DIVING INTO DIGITAL THEME WORLDS

The Digital Hub premieres at ACHEMA 2021, and its unique concept focuses on four trending themes in the digitalisation of the process industry

WHAT TO EXPECT AT THE ACCESS POINTS:

ENGINEERING & OPERATIONS:

As a cognitive amplifier, artificial intelligence enables engineers and plant operators to gain a deeper understanding of the process and supports process optimisation. In addition, modular plant concepts offer the flexibility to react to a rapidly changing market environment.

LOGISTICS & SUPPLY CHAIN:

Compared to discrete manufacturing and transportation, the logistics and supply chain in the chemical and pharmaceutical industries is far more complex. The demands on the quality, availability, safety and sustainability of products are high and constantly increasing. Digitalisation, new systems and intelligent solutions are the natural consequence of meeting these challenges and optimising and securing supply chains.

CYBER SECURITY:

While the increasing interconnectivity within and between companies has many advantages, the importance of cyber security is also rising. It is essential to protect both internal IT and OT against external access. Find out how cyber attacks on your company can be averted.

DATA INTEGRATION & MANAGEMENT

Digitalisation requires the use of machine-readable data. Standards and exchange formats form the basis for data use in the process industry. The integration of sensors and a growing number of IIOT devices also require an open architecture. Learn how comprehensive data integration and the management of large amounts of data can work.

The ACHEMA Digital Hub will bring digital innovations in the process industry to the big stage. Being the 12th exhibition group in the ACHEMA line-up, it serves as open invitation to the digital ecosystems catering to the chemical industry. In addition to exhibition space and centre stage, four Access Points are the heart of the concept. They are dedicated to the current hot topics engineering & operations, cyber security, data integration & management and logistics & supply chain management.

Imagine manufacturer-independent overview exhibitions and additional stages presented by DECHEMA in cooperation with industry experts from leading organisations to promote peer-to-peer learning and networking. In addition, the theme worlds of the Access Points serve as hashtags that cross-link the entire digital solution portfolio on display at ACHEMA. Every exhibitor can hashtag their solutions to appear as an entry in the ACHEMA catalogue and app. •

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ACHEMA.DE/DIGITALHUB

p.18: Illustration: aklionka / Adobe Stock; p. 19: Icons: Eucalyp, ProSymbols, Vectors Market, Creative Stall / Noun Project

SPOTLIGHT ON...

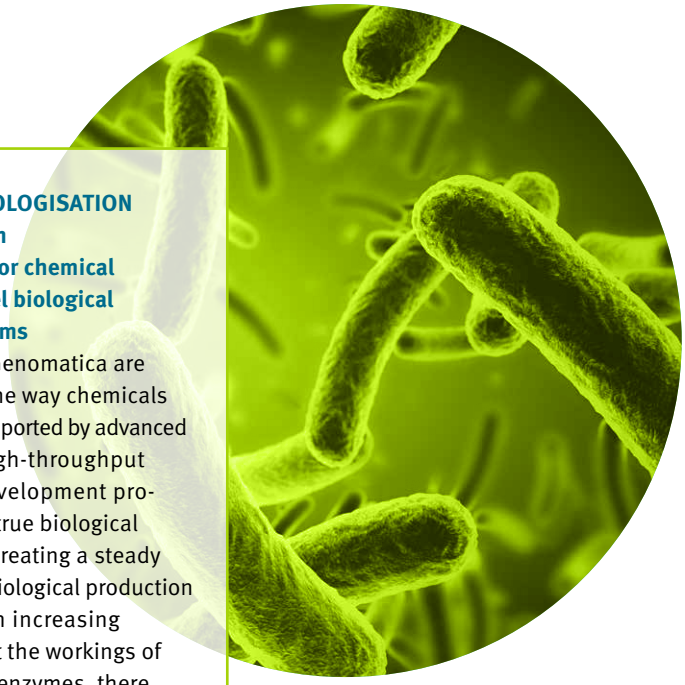
How do the game changers in the process industries affect your business? Discover answers at the ACHEMA Congress.

What are true game changers for the process industries? It's certainly hard to judge in advance. Many trends are not only caused by technological developments, but also by factors such as economic conditions – oil prices, shifts in global economic power, a virus that freezes whole economies – or cultural changes – the consumer's craving for SUVs or "fast fashion". But there are some scientific and technological developments that have the potential to significantly change the way the process industry works.

The ACHEMA Congress sets the spotlight on four of these trends in its Highlight Sessions. This brand-new format is designed to not only provide participants with food for thought, but encourage discussions even more than "conventional" presentations:

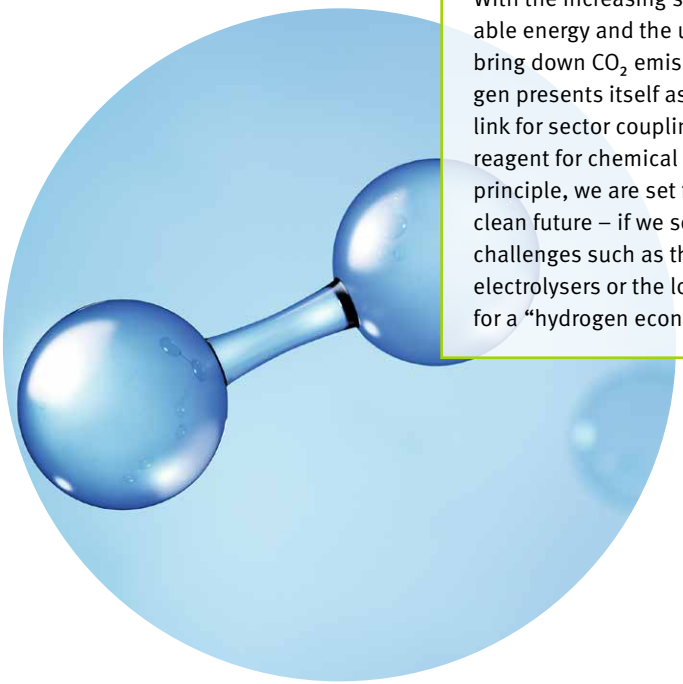
Outstanding international speakers and seasoned practitioners present their opposing poles of visions. The potential, but also the barriers and downsides, of novel technologies are exposed and stimulate discussion between speakers and the audience. The highly interactive and compact format ensures that a multitude of aspects can be discussed. Every ACHEMA participant should mark these sessions in their calendar! •

MEGATREND: CIRCULARITY
Highlight session
Closing the loop with chemical recycling: Potentials and challenges
Running around in circles may not be the best way to move forward, but it is highly desirable when dealing with plastics, i.e. carbon-based polymers. Closing the loop solves two problems at once: The dependency on fossil resources is reduced, and plastic waste no longer litters the environment, but is treated as a valuable raw material. So far, however, plastics recycling has been limited by purity and quality specifications that in turn have required sophisticated collection and sorting systems. Chemical recycling seems to offer a way out, especially for plastics that cannot be directly recycled due to their purity: instead of burning the plastics and thus using the energy they contain, the material is broken down radically into its most basic components, monomers, or even further into synthesis gas. These can again be the building blocks for new high-quality products. Is this the "missing link" to close the cycle?



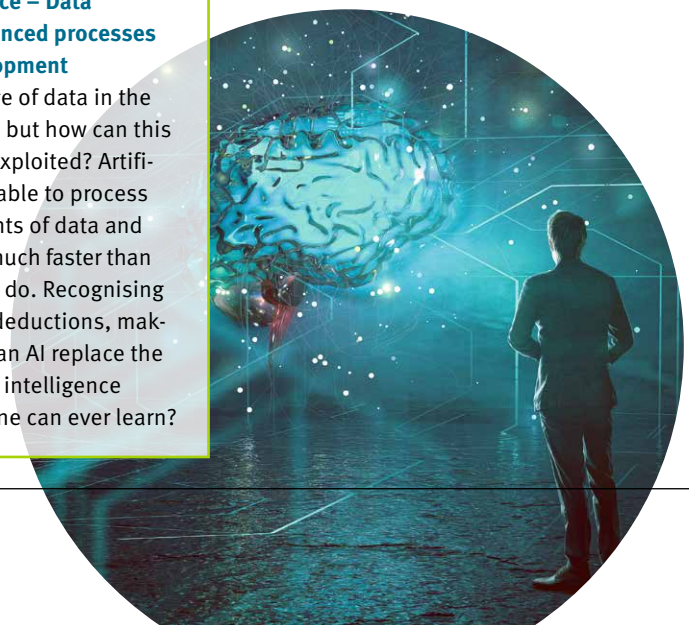
MEGATREND: BIOLOGISATION
Highlight session
Recruiting cells for chemical production: Novel biological production systems
Companies like Genomatica are revolutionising the way chemicals are produced. Supported by advanced analytics and high-throughput research and development processes, they are true biological mega-factories, creating a steady stream of novel biological production systems. With an increasing knowledge about the workings of metabolism and enzymes, there seems to be no limit to what can achieved – or is there?

Photos: Paulista, Irina, lassedesignen, Thomas / Adobe Stock; Icons: mynamepong, lastspark / Noun Project



MEGATREND: RENEWABLE ENERGY
Highlight session
Hydrogen as a game changer within process industries
Gold rush, oil rush, hydrogen rush? After the enthusiasm of the the '80s, the hydrogen buzz seemed to have died down – only to experience a stunning revival in recent years. With the increasing supply of renewable energy and the urgent need to bring down CO_2 emissions, hydrogen presents itself as the natural link for sector coupling and the ideal reagent for chemical production. In principle, we are set for a green and clean future – if we solve a couple of challenges such as the scale-up of electrolysers or the logistics needed for a "hydrogen economy".

MEGATREND: DIGITALISATION
Highlight session
Artificial intelligence – Data utilization for advanced processes and product development
There is no shortage of data in the process industries, but how can this treasure grove be exploited? Artificial intelligence is able to process tremendous amounts of data and draw conclusions much faster than any engineer could do. Recognising patterns, drawing deductions, making predictions – can AI replace the human brain? Or is intelligence more than a machine can ever learn?



BEYOND LECTURES: ACHEMA ACTIVITIES

ACHEMA INNOVATION CHALLENGE
Digitalisation offers new perspectives and approaches to mastering the challenges in process engineering. Experience at ACHEMA how ideas become innovations. In an innovative competition, we want to find solutions for current and future problems. Be inspired by creative and new solutions for the process industry that emerge from the field of digitalisation.

BATTLE OF THE BEST:
What are the best concepts and solutions for specific industry challenges? In this new competition, solution providers have the opportunity to pitch their best solutions and products for a selected challenge. Be part of the jury at ACHEMA and vote live to decide who will be awarded in this competition.

Watch out for more information on these and other interactive formats in the run-up to ACHEMA and during the show at **achema.de!**

JOIN THE RACE

Founding a company is a marathon, not a sprint. And somewhere along the way, a supply station might be a welcome sight – such as the ACHEMA Start-up Award.

The starter's gun for the ACHEMA Start-up Award went off in 2015: Three winners (at the time from three different categories) went on the track towards entrepreneurial success. The next three winners joined them in the race in 2018. The track record is impressive: Five are still on a growth path, and the series of awards and distinctions they share between them exceeds the space available here. Four of them have announced significant investment over the past years of seed-financing organisations and/or corporate investors.

Now it's your turn to go to the starting block: Until 30 November, founders and young start-ups from Germany and beyond are invited to submit their business plan to the competition. All will receive expert feedback; the best will be invited to pitch to the jury in early 2021. Up to 10 prospective founders or young entrepreneurs have the chance to exhibit at ACHEMA 2021, where "the best of the best", the top three, will be announced as the winners of the ACHEMA Start-up Award 2021. •

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YOUR COMPANY – JOIN THE RACE!

Submit your business plan by 30 November at achema.de/start-up_award

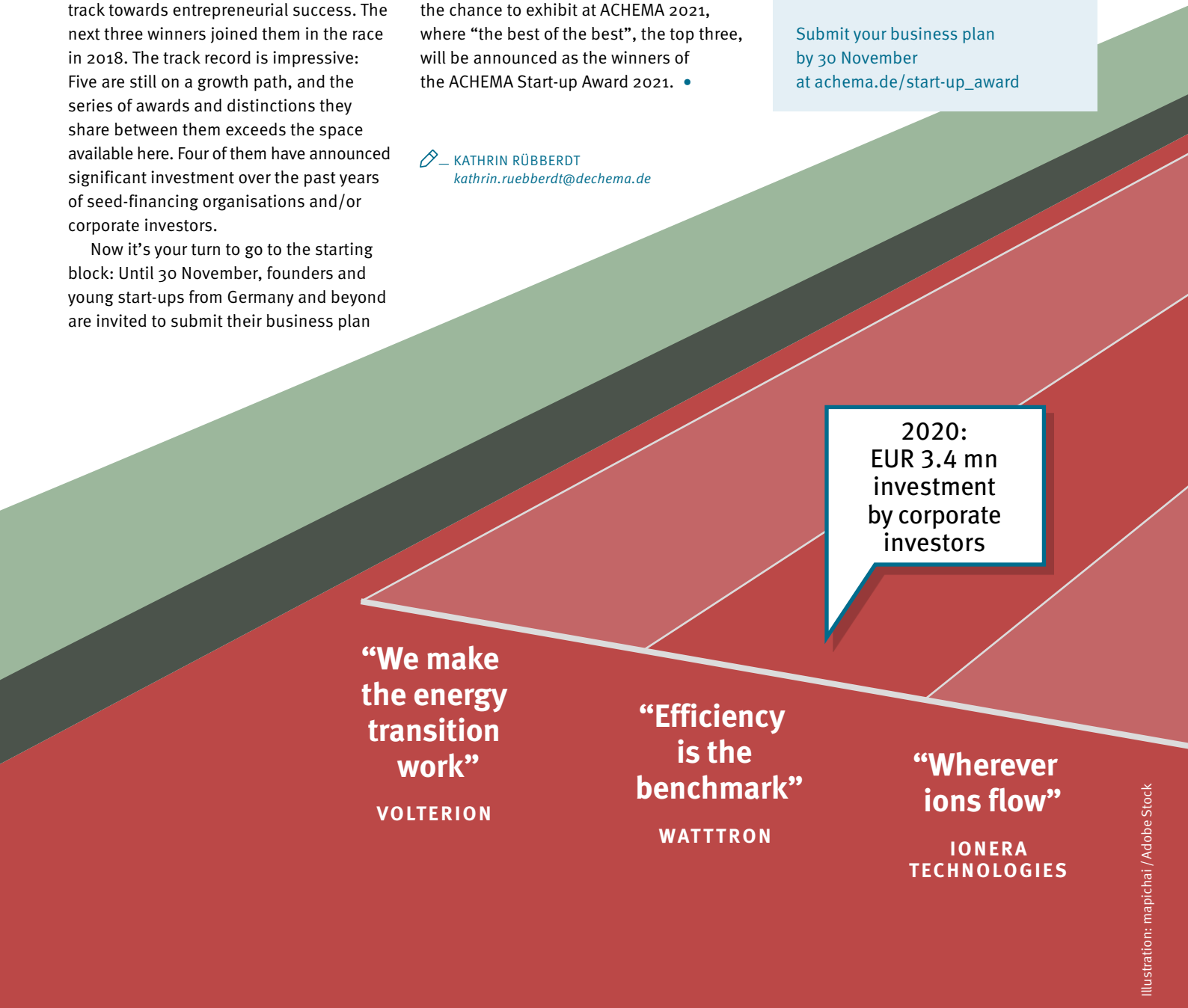
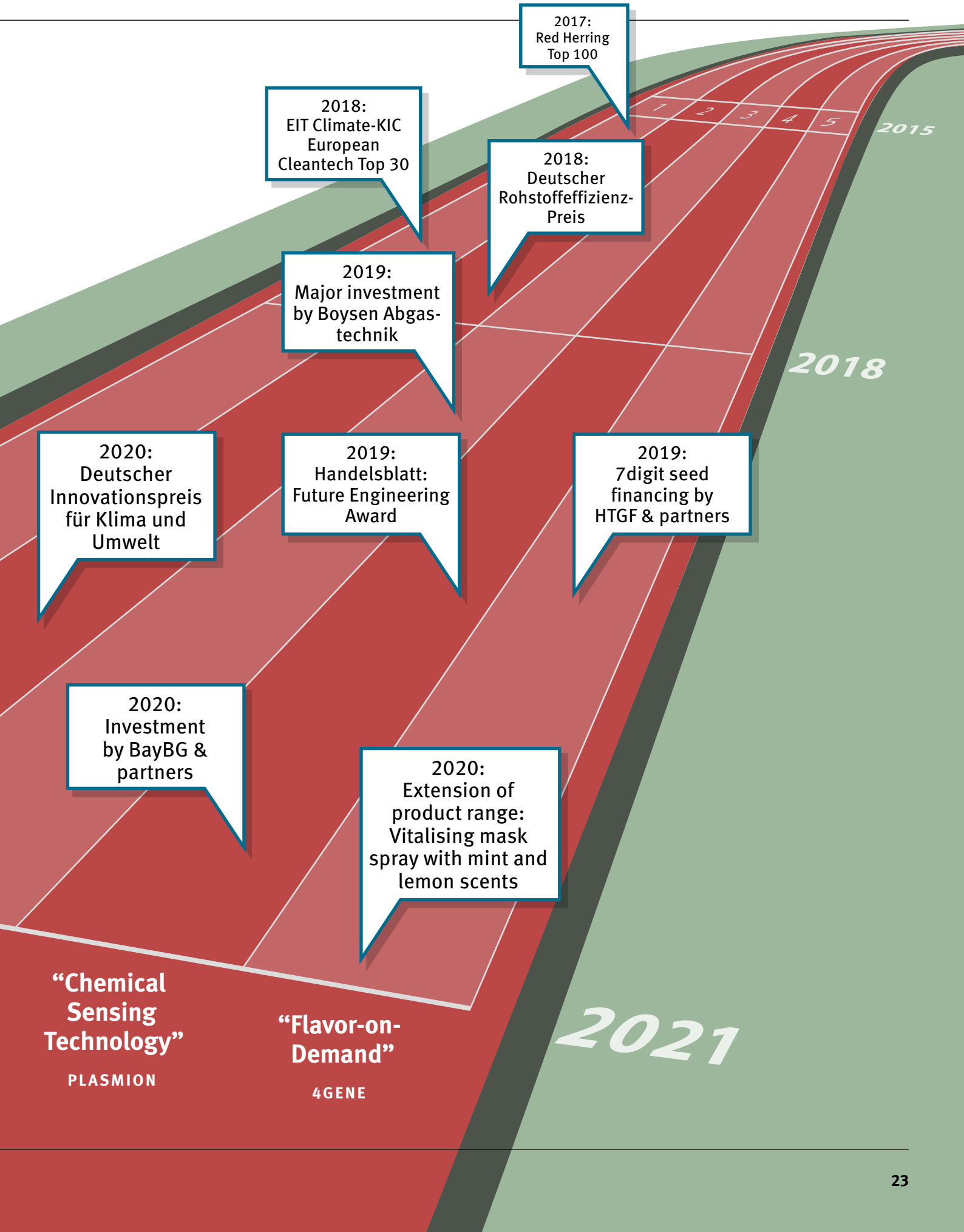


Illustration: mapichai / Adobe Stock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PORTRAIT

THE AMERICAN WAY OF DOING ACHEMA

Alan Morris has been the first point of contact for customers from the US and Canada for 22 years and shares his experience.

Your history with ACHEMA reaches back over more than three decades. How long exactly?

ALAN MORRIS: *My first contact with ACHEMA was actually as an exhibitor in 1988. At the time, I was publisher of Chemical Engineering Magazine at McGraw-Hill. We had a lot of European advertisers, many of whom exhibited at the ACHEMA. So the ACHEMA was very useful: we could see them all in one place. In 1998, I became a representative and have been for 22 years.*

Can you remember the first time entering the exhibition halls?

I remember that I was amazed at the size of things and feeling absolutely dwarfed by the tall ceiling of hall 8 and the multi-story, spaceship-style displays. It

Photos: Alan Morris

was quite an eye opener, a real spectacle of equipment displays.

What is different from ACHEMA today from when you think back two or three decades? What has changed?

ACHEMA has definitely become more modern with the information flow. I remember the heavy printed hardcover catalogues: several volumes, each weighing more than a kilo. What a relief when they were replaced by electronic media in 1997!

Of course, the equipment has changed, too. Things have gotten so much more digital, and they are really progressing along the lines of automation and environmental concerns.

You just said the equipment has become more digital. So has the whole world of communication. Why do we still need a place where we can touch the equipment – can't we just do it over the internet?

I suppose we're trying to be more digital, especially in times of COVID-19, but I think there's great value in physical presence. What better way to learn than to actually see and experience the equipment and the technology? At ACHEMA, so much of the equipment is operating live, and you get to see the whirring action, the filling, mixing, blending and packaging. That's not possible over the internet.

Trade shows in the US are supposedly quite different. How would you explain the ACHEMA to someone from North America?

It is hard to convey the enormity of ACHEMA. The shows in the United States have downsized pretty much because our industrial bases have somewhat diminished in the last 20 years. Along with that, a lot of people who used to go to shows have been downsized. So, the ACHEMA is a place where you have a lot more buyers, all in one place and from all over the world, whereas in the US the shows are a lot smaller.

How do you feel about the Congress? It is seen as an important part of ACHEMA.

I'm a big believer in this idea of the two being married, it makes for a great learning experience. It's one thing to hear about something in a session or a panel discussion, but it's another thing to see that same technology at work in the exhibition. The Congress also draws a core of technology people from the companies that then get exposure to the equipment and to the vendors in the in the exhibition.

That's another difference between shows in the US and Europe: In the US, we have only just begun to develop more of an educational bend to these events. In the past, we depended too much on the trade show to attract a technical audience when it could have been done much better with a robust set of sessions.

How do you explain ACHEMA to a prospective customer who has never heard of it? -

I try to convey the excitement of the ACHEMA and the enormity of it. Then I explain how many birds they can kill with just one stone. Maybe you're looking for a new representative in a part of the world that's new to you. Maybe you've sold in the US for many years and now you're looking to export. You're going to not only see customers, but also your competition. That's a big change for Americans who don't want to exhibit near their competition. They usually get over it quickly and learn that if you're not there, you're sort of conspicuous in your absence.

What challenges have you encountered over the last two decades in your role as ACHEMA representative for the US and Canada?

With the COVID-19 pandemic, this year is a difficult time, and I hope it will be resolved by summer 2021. ACHEMA and DECHEMA always do the best job of preparing for infectious diseases – I remember SARS 2003 and the swine flu 2012.

Apart from these awful things, I witnessed a change in the American way of doing business. We have been content to sell domestically for a long time because we had robust domestic markets and enough buyers. This changed about 20 or 30 years ago, when Americans became exporters by necessity. Competition got fierce when our markets downsized and the world came to us. The challenge is getting people to think outside of our borders, think about an international show for the first time.

Please complete the following sentences:
1) If I wasn't the representative for ACHEMA, I would like to be ...

Elon Musk – just kidding, but I like his entrepreneurial spirit and super intelligence. I've been so lucky to be the representative for the ACHEMA and to have my own business after working in the corporate world for several decades.

2) A first-time visitor to ACHEMA should take care to ...

wear really comfortable shoes! The first time I went to the ACHEMA back in the 80s as an exhibitor, I had fancy Italian thin-soled shoes, and I had to buy a new pair after two days. Most of the floors are carpeted, but you are on concrete a lot nonetheless.

The other thing I tell people: don't come alone! It's a long day being in the halls from 9:00 in the morning till 6:00 at night, seeing people, talking to people, on your feet all the time. Bring some help and share that responsibility.

3) I am looking forward to ACHEMA 2021 because ...

the 2021 show is my last ACHEMA. I am sad, but excited, too, because I look forward to seeing my friends, my customers and my fellow representatives the last time in a while.

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ALAN MORRIS

Alan Morris has a B.A. in Journalism from the University of South Carolina and has served in several industry association positions. During his time as publisher of Chemical Engineering magazine, he launched the ACHEMA Show Daily newspaper, which continues today. With his company Morris Marketing, he has represented ACHEMA in the US and Canada since 1998.

WELL ADVISED WITH ARTIFICIAL INTELLIGENCE

Can plant operators, engineers and process developers of chemical production plants be supported by self-learning systems? Within the research project KEEN, various AI-based applications for the process industry are developed.

Planning and operating chemical and biotechnological processes is becoming increasingly complex. Humans need support for their decision making, and they get it with a system based on artificial intelligence (AI). Currently, AI methods are implemented in the process industry within the project KEEN – "Artificial Intelligence Incubator Laboratories in the Process Industry". The project is funded by the German Federal Ministry for Economic Affairs and Energy; it connects 20 industrial and scientific institutions and is divided into three thematic areas: AI-based optimization, AI-based engineering of plants and AI-based modelling. Among other things, the use of machine learning, which is a subtopic of artificial intelligence, will be investigated. The functionality of machine learning is in principle comparable to human learning. Humans use examples from their experience to differentiate and cope with complex requirements. A self-learning machine learns from data and can make decisions and predictions based on this data. These predictions can support the plant operator, the engineer as well as the process developer in their activities. Artificial intelligence acts as a cognitive amplifier.

> **"Artificial intelligence can be used as a cognitive amplifier."**
>
> PROF LEON URBAS

OPERATING PLANTS SAFER AND MORE EFFICIENTLY

A concrete application in the process industry is to support operating personnel of chemical plants with AI-based control and assistance systems. These are developed by technical universities (TU) in Dresden, Dortmund and Berlin, Germany, and others. They use models that have been developed from historical sensor data and simulations of complex models. These models recognize critical plant conditions and predict the future behaviour of a plant. The learning process can be supervised or unsupervised. With an unsupervised learning process, a model is developed from data without a specific target via pattern recognition. Based on the models, the performance and safety of the plants is to be improved by the use of control algorithms as well as by the support of the plant operator being able to intervene on time and efficiently.

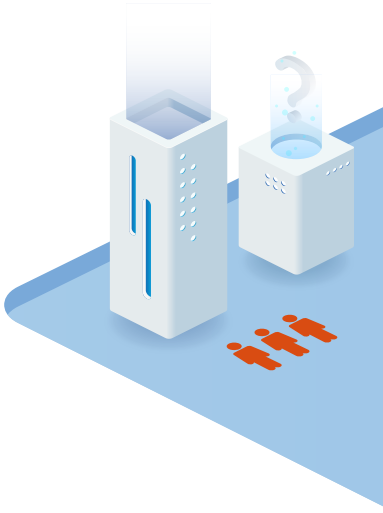

Illustration: lembergvector / Adobe Stock; photo: © Urbas

RECOGNIZING HAZARDS FASTER

Artificial intelligence is also to be used in the planning of conventional and modular process plants. For example, it is used for the Hazard & Operability (HAZOP) analysis, which must be provided for the approval and operation of a plant. The AI-based system learns from existing HAZOP data, heuristics and literature data. This accelerates the preparation of risk assessments, as is currently demonstrated for existing laboratory plants at the Laboratory of Equipment Design of TU Dortmund, Germany. The results will contribute to the acceleration of approval planning, the introduction of

new processes and the training of the operators. Thus, the engineer is supported with an intelligent tool for plant development.

PREDICTING SUBSTANCE DATA

For the process developer, knowledge of material data for process simulation is fundamental. Today's material databases are extensive, yet incomplete. Artificial intelligence methods predicting substance data open up a whole new perspective. This works similarly to portals that suggest movies to their users based on movies they have already watched: You watched "Harry Potter" – you might also like "The Lord of the Rings".

For modelling, physical knowledge, such as substance data and physical laws, is integrated into machine learning methods. The corresponding algorithm is developed by KEEN partners in Kaiserslautern, Germany [Fraunhofer Institute for Industrial Mathematics (ITWM) and TU Kaiserslautern].

THE FOCUS IS ON PEOPLE

When scientists and developers consider various use cases, they always ask themselves how well end users can understand AI-based solution and decision proposals. The new AI methods should be comprehensible and contribute to better understanding by the responsible persons. Otherwise, there is a risk that users will not accept the methods or the use of AI-methods does not do justice to operator responsibility. Artificial intelligence will expand the scope of action of humans when used correctly as a cognitive amplifier. •

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_ KEEN-PLATTFORM.DE

PROF LEON URBAS

Leon Urbas directs the Chair of Process Control Systems Engineering at Technische Universität Dresden. His research focuses on the digital transformation of the process industries.

A COMMON GOOD? THE TREND TOWARDS DATA SHARING

Data sharing is not a completely new concept, but in recent years, the trend has left the abode of science – and for concepts such as the digital twin, it is a mandatory prerequisite.

For academic research, the idea of open access and data sharing is not new. It originated around the turn of the century and was instigated by the runaway subscription cost for scientific serials. But soon, the resulting movement – which benefited greatly from the evolution of the Internet – developed a more profound rationale: In 2002 and 2003 respectively, the Budapest Open Access Initiative and the Berlin Declaration on Open Access set the tone for the ensuing development: "Removing access barriers to this literature will accelerate research, enrich education, share the learning of the rich with the poor and the poor with the rich, make this literature as useful as it can be, and lay the foundation for uniting humanity in a common intellectual conversation and quest for knowledge."

Today, open access has become a widely accepted standard in publicly funded research, and it extends beyond publications. Rather, protagonists of open access call for the scientific data itself to be made available. Funding bodies such as the National Science Foundation and the EU Research Program Horizon 2020 have made the sharing of research data mandatory. This allows for quality assurance and transparency, but also for more efficiency, cost savings and the opportunity to conduct secondary analysis on existing data.

But a fundamental problem remains: Even though the data may be available, they often do not follow any common standards- beginning from the data acquisition via the formats and the ways the data are stored. In some disciplines, shared infrastructures have been established, such as in the fields of enzymes, genomics and microbes.

This is where a new ambitious initiative in Germany comes into play: The development of a National Research Data Infrastructure ("Nationale Forschungsdateninfrastruktur" NFDI). It was brought under way in 2018 by a common agreement between the Federal Government and the Federal States: "To turn research data into scientifically broadly usable data treasures with added value for society, Germany needs an NFDI."

The NFDI will be responsible to systematically unlock, secure and provide access to the data pools of science and research. It will also seek an international interlinkage. The establishment of this infrastructure is driven by science in a network structure of independent consortia. The final funding of up to 85 million euros per year can be split between up to 30 consortia. In the first wave, nine consortia have been selected for funding. One of them is NFDI4Cat, the National Research Data Infrastructure for Catalysis.

As an interdisciplinary field, catalysis research is of great strategic importance for the economy and for society as a whole: It is a core technology to mitigate climate change, provide sustainable energy and materials. Examples are the reduction of CO_2 emissions, the valorization of plastic waste or CO_2 in chemical production, sustainable hydrogen generation, fuel cell technology or the sustainable provision of food for more than 7 billion people on earth. For all of this, revolutionary progress is required in catalysis science and technology. This will only be achieved by a fundamental change in catalysis research,

Over

4,500

institutional and cross-institutional repositories have been registered in the Registry of Open Access Repositories

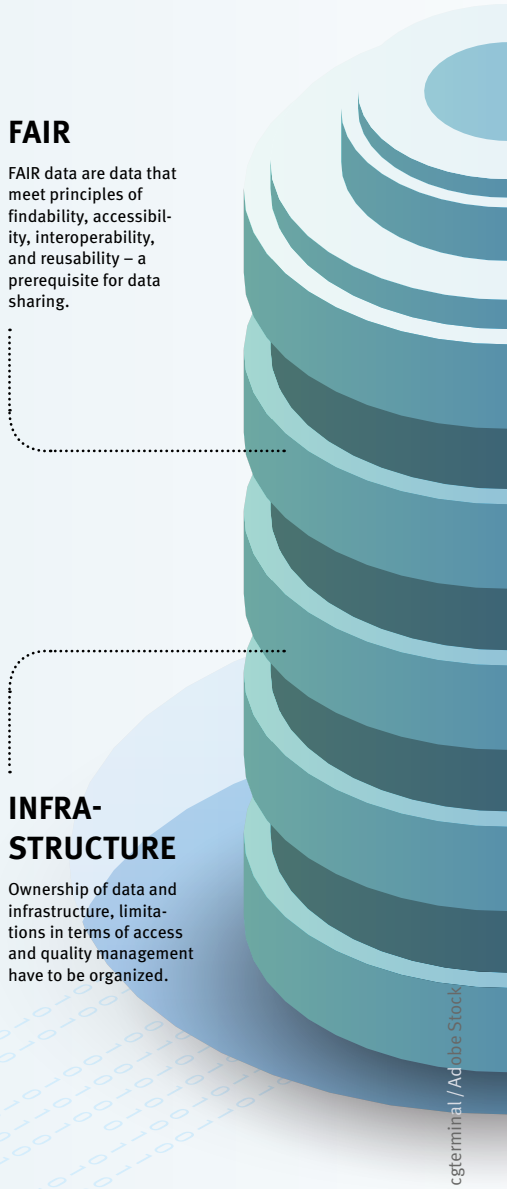

Illustration: MPM Material from cgterminal / Adobe Stock

chemical processing and process engineering. One challenge is to bring together the different fields of catalysis research with data scientists and mathematicians with the ultimate goal of creating a "digital catalysis". It will be aligned with the data value chain from the molecule to the chemical process.

Slowly, the "share culture" is also seeping into the industrial sphere. This is reflected by industry involvement in NFDI4Cat: Catalyst developer hte GmbH takes a leading role, six other renowned industry players will support NFDICat as advisors. In other industries, especially the pharma industry, sharing pre-competitive data is already widely accepted – and for good reasons: Pharmaceutical studies are very expensive and take a long time. Repeating failed approaches can be costly, and apart from economic considerations, it may even cost lives.

"Turn research data into scientifically broadly usable data treasures with added value for society."

The chemical industry is following suit, especially in the area of safety data. This may have been pushed by safety regulation such as the European REACH, which has not only caused a common "pain" of providing large amounts of data that need to be shared along the value chain, but also the cure in the shape of joint initiatives to collect and share data and thus lessen the individual burden.

Other motives are becoming equally urgent: Automation of laboratories and plants requires common data formats. Initiatives like NAMUR bring competitors together to agree on common standards and thus enable technologies that benefit all without distorting competition. The integration of value chains takes this one step further: To exploit the full potential, data needs to be shared between companies at different steps of the value chain. In a report published in April 2020, McKinsey and Fraunhofer list potential barriers and benefits of "data sharing in industrial ecosystems". They also point out that there is no such thing as a digital twin without data sharing. Thus, all players in the industrial ecosystem need to do a bit of soul-searching and remember: Knowledge is the only resource that grows when it is put to use. •

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NFDI.DE

WHAT ABOUT THE POPCORN?

“Dear exhibitor, due to the pandemic situation, we have decided to move our event to a virtual setting. Please find your login data below. There, you can design your virtual exhibition stand.” You might have read this or something similar during the past weeks if you had previously booked a stand for an event this summer.

“After all, organising an exhibition stand is quite a hassle.”

At first, there might be a certain feeling of irritation. After the first login to the apparently very comfortable exhibition backend it is replaced by…relief? Slight enthusiasm? After all, organising an exhibition stand, especially if it is only a backdrop to a scientific conference, is quite a hassle:

Discussing a concept that meets every department’s needs (“my product has to take center stage” – “my flyer needs to be displayed prominently” – “where have you planned the computer terminal for my product demonstration”); dealing with the shortcomings of furniture offerings (“Why don’t they offer comfortable chairs/ displays where flyers actually are displayed instead of hidden in a box/ elegant tables); haggling with the architects; trying to staff the stand with experts who’d rather spend their coffee break meeting their peers; worrying why yours is the only stand that has obviously been forgotten during set-up or whose company logo has been glued on upside down…

Trading this for a couple of days in the office, designing your cool-looking virtual stand (which you could never have afforded in the “real world”) and, during the event, chatting with participants from your comfortable office chair instead of trying to woo passers-by to your stand sounds really cool!

As time passes by, the enthusiasm is put to a stress test: The very cool stand design got scrambled while you tried to photoshop your graphics on the virtual displays; the glossy brochure that has been printed on special paper which feels great to the touch doesn’t look half as good if uploaded as a pdf. Anyway, it would have been nice to put an exhibit on the stand that could actually be touched, discovered or just played with. And what about last year’s tremendous success with the popcorn machine that drew people in clusters to your stand? You had a chance to make a lot of new contacts there who you might not have sought out on a virtual platform.

As the day of the event draws near, your stand does not look as great as in the service provider’s sales pitch, but all the material you wanted to present is there and ready for download. The audience is certainly more diverse than it would otherwise have been, and you even get a chance to talk to a couple of people who would never have made the journey in person. You leave the virtual venue satisfied – and yet, the following night, you dream of that not-so-cool exhibition stand with the hideous furniture where you could share your thoughts and your popcorn with real people. •

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p. 30: Cartoon: Claus Ast; p.31: Photo: malaha3/Shutterstock

MEET THE COMMUNITY

DECHEMA AUTUMN SPECIAL "BLOCKCHAIN"

4 November 2020, online

How relevant is blockchain for your business in the process industry? Find out at this highly interactive hands-on event.

DECHEMA.DE/BLOCKCHAIN2020.HTML

PRAXISFORUM ELECTROLYSIS IN THE PROCESS INDUSTRY

9–10 November 2020, online

Discover the latest technologies and applications and discuss them with industry delegates and solution providers.

DECHEMA.DE/ELECTROLYSIS.HTML

INDUSTRIAL WATER 2020

17–19 November 2020, online

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