Agents of Change

Reduce · Reuse · Recycle
One-third of food produced for human consumption is lost or wasted globally, which amounts to about 1.3 billion tons per year.

Only nine percent of all plastic waste ever produced has been recycled.

More than 75 percent of the world’s food comes from just 12 plants and five animal species.

Of the world’s wastewater, 80 percent flows back into the ecosystem without being treated or reused.
Dear Readers,

In the last few years, no topic has been more widely discussed globally than sustainability – and rightly so.

As a society, we are under tremendous pressure to address how we can take better care of our world, which includes rethinking how we use our diverse resources today and going forward. No one feels this more acutely than our customers and partners who are tasked with finding the right balance between the environment, the economy and society, which includes meeting the increasingly complex needs and demands of consumers, investors and other stakeholders all along the value chain.

The future presents several challenges in terms of population growth, increasing urbanization and an expanding middle class. It will take a truly collaborative approach to successfully meet the world’s future needs, particularly against a backdrop where business growth and sustainability are becoming indistinguishable.

In this issue we delve into how industry is helping to meet some of the toughest global issues head-on by turning challenges into advantages: tackling water and wastewater management problems; developing new sources for protein; engineering recyclable plastics and reusing waste to drive their businesses and communities. And in an interview you’ll read how one bio juice manufacturer is cultivating relationships to meet the growing desire for ethically and sustainably produced food and beverages.

At GEA it is our mission to provide customers with sustainable value creation and future-proof ideas for their continued success, whether it’s through our technologies for purifying and reusing water or recovering waste heat; our Brewery 4.0 and continuous production solutions or via a myriad of our other efficient products and process technologies. We call this: “Engineering for a better world” and it is what motivates us each day.

I hope when you finish reading this issue you will feel as determined and inspired as I do to be an agent of change!

Best wishes,

Stefan Klebert
CEO
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Agents of change

Sustainability has taken center stage – literally. It motivates and challenges us and is the greatest opportunity we have for driving innovation and positive change in industry and our world.
Last year, Earth Overshoot Day arrived on August 1—the day each year when humans have consumed a year’s worth of the planet’s natural resources. In the U.S., this day arrived on March 15. These and many other sobering facts are available today, many of them around key megatrends like rising population; food and water insecurity; increased urbanization; an expanding middle class and of course the critical demand to reduce CO2. Industry can have a positive impact in all of these areas, while at the same time minimizing its own footprint.

BRAVE NEW WORLD

Economists expect the next few years to be quite disruptive: with changing market conditions and customer demands, shifting supply chains, trade tensions and new technologies. Against this backdrop, we also have several environmental challenges that require immediate action.

In 2015, world leaders adopted 17 Sustainable Development Goals (SDGs) as part of the U.N.’s 2030 Agenda. One year after taking effect, the Business & Sustainable Development Commission reached out to the business sector urging them to align their goals with the U.N.’s SDGs. Their argument: by pursuing the SDGs, businesses could open up at least US$12 trillion in market opportunities while at the same time tackling social and environmental challenges and rebuilding trust with society.

Seeing that most countries would not reach their CO2 emission targets as agreed upon with the U.N. in 2015, Peter Bakker, President and CEO of the World Business Council for Sustainable Development, addressed the business community in late 2017. His message: If business cares about its success and overall survival, then it should also care about sustainability, as the present course is not sustainable. Bakker credited business with being “the most powerful lever to change any course of anything,” identifying three key strategies industry should embrace to drive sustainable development: innovating and developing new technologies and business models; rethinking how we calculate the value of things, as well as calculate risk; and lastly, working more collaboratively and moving away from a purely competitive model.
TECHNOLOGY & BUSINESS
MODEL INNOVATION

Today’s producers can take advantage of a plethora of equipment and solutions to eliminate waste throughout the manufacturing process to ensure they are getting the full value out of their raw materials, while achieving greater energy efficiency, product quality and safety. Coupled with powerful Industry 4.0 capabilities, manufacturers can and are exponentially multiplying all of these gains.

To have a significant and long-term impact however, we need to embrace a circular economy and move away from a take-make-dispose model to a more regenerative one. Imagine: advanced remanufacturing where cost-effective returns processing is in place and robots disassemble products and then perform advanced material sorting; connected devices feed information back to design and engineering to improve product durability and performance. And service plays an even greater role by increasing product longevity. Using this approach, we would retain more value from our resources, products, parts and materials, which would in turn alleviate supply chain issues, improve resource security and reduce energy usage and CO₂.

In agriculture, significant change is also required to feed the nearly 10 billion people expected by 2050, many of whom will give up growing their own food to pursue what they hope will be a better life in the city. Less destructive and more “smart” agricultural practices and solutions, supported by farmers, scientists, government and industry are critical for driving sustainable food production. For manufacturers this will require a commitment to support greater biodiversity and meet consumer demands for healthier and more sustainably and ethically produced food.

With increased urbanization, packaging and traceability will become even more important. Ensuring that food is protected and carries the right information, for example, helps reduce food waste. At the same time, there is mounting pressure to reduce plastic usage. With more legislation coming into effect every day, it will largely be the manufacturer’s responsibility to ensure that more of their packaging is recyclable and to work with material scientists to find non-fossil-fuel-based alternatives.
Lightweight, low-maintenance and possessing a high energy density, lithium batteries make driving more sustainable, even on Mars. In conjunction with solar cells, lithium-ion batteries have powered various missions and robotic rovers, helping keep the electronics warm and supporting nighttime exploration, experimentation and communication.

Algae’s uses are many, including for example in biofuel production; in foods, colorants and in the production of vegetable oil, proteins and in supplements and medicines. It also has applications in animal feed, the production of plastics, fertilizer and biopesticides. Algae can even be employed in the biological treatment of wastewater. Because it needs CO\textsubscript{2} in order to grow, algae can absorb CO\textsubscript{2} at high rates while releasing O\textsubscript{2}, or oxygen.

**REDEFINING RISK & VALUE**

While renewable energy continues to dominate new energy investment, greenhouse gas emissions rose globally in 2017 for the first time in four years. Already evident in the increasing erratic and severe weather experienced around the world, the situation is expected to worsen if we do not reverse this trend. The practice of disclosing sustainability information, according to the Global Reporting Initiative (GRI), helps businesses and investors identify and manage risks better as well as pursue new opportunities. For example, when opening a new plant, factoring in future water availability or the consequences of a global temperature rise. Or, identifying a gap in the market for a new product or service that addresses an unmet need – ideally aligned with one of the U.N.’s Sustainable Development Goals.

Businesses should have a better understanding of their increased interruption and liability risks due to “natural capital” depletion (soil, clean air, groundwater and biodiversity), according to global insurer Allianz, because they lead to higher costs as a result of resource scarcity, regulatory action and pressure from communities and wider society. Although it can be difficult to measure, quantify and monetize these risks, the GRI believes that as standards evolve, companies will be required to disclose this information.

The idea is that this level of transparency – achieved by reflecting the true value, costs and profits of business activities – will naturally lead companies to become more sustainable. And, would foster positive relationships with investors and allow companies to gain back trust and enjoy an enhanced reputation among their diverse stakeholders.
TOWARDS GREATER COLLABORATION

No one in business today who would say they’ve been more successful because they’ve “gone it alone.” Collaboration and sharing are on the rise everywhere, with people, NGOs, governments and businesses – and every combination in between – coming together proactively to reach goals and solve problems.

The opportunities afforded by Industry 4.0, for example, are the result of intense collaboration, with innovations and solutions coming from diverse sectors. This “revolution” also brings with it the need to retool workers to help them make the leap. As automation and artificial intelligence are more widely leveraged, frictional unemployment will likely increase. As a result, industry is increasingly being asked to join discussions on topics ranging from taxation on software and robots to guaranteed basic income and how we can mitigate further disparities in society. These types of discussions will be a test of industry’s ability to think beyond its current business model.

Success in sustainable development hinges on new and innovative approaches to public-private collaboration to accelerate transformation. In the EU, for example, billions of euro are spent each year to fund research, bringing business, industry, academia and science together to work on projects to promote clean energy, support sustainable agriculture and create green jobs. Collaboration increases the chances that ideas are scalable and economically viable, while allowing participants to influence new solutions and policies as well as network with potential business partners.

With the additional 1.8 billion people expected to join the consuming class by 2025, the relationships between companies and their suppliers will become more important than ever. Suppliers will be depended upon not only to help meet this demand, but will also play a critical role in helping companies become more sustainable in light of it. By examining their own supply chains, providing responsibly sourced products and materials, as well as efficient technologies that reduce CO2 emissions, suppliers can ensure companies remain competitive as growth and sustainability become inextricably linked.

MASTERS OF OUR OWN DESTINY

Consumers and society are still looking for convenience, however, not at the expense of our world. More than ever, people want to engage with businesses that are moving towards greater sustainability. This became quite clear the last couple of years as the plastics topic went viral, with near immediate effects on restaurant and retail behavior, on policy discussions and in the creation of several start-ups, new products and global initiatives.

Accounting for nearly a quarter of total global employment, industry is a great multiplier with close ties to consumers, government and other private entities. It has a unique position from which to lead and steer others towards more sustainable development. Doing so will allow manufacturers to remain in the driver’s seat of their industry and future.
Heat pumps

Heat pumps reuse energy from the air, water or the ground or waste energy from buildings and processes to provide heating. With a proper system design, both heating and cooling can be leveraged, turning one-time energy use into a circular energy economy, lowering energy costs by 30 percent and significantly reducing CO$_2$ emissions. Already a common feature in district heating, our ammonia heat pumps are also delivering impressive results in the food, beverage and dairy industries.

Zero water dairy processing plants

Our zero water processing plants recover precious water using reverse osmosis. Depending on the end use, the recycled water is further treated and purified to meet World Health Organization standards for potable water and reused in various plant processes, where permissible, or if minimally treated, to water gardens or flush toilets.

Quality assurance system

The world’s first non-invasive quality assurance system that checks the residual oxygen content and seal quality of each package inline during production. GEA OxyCheck represents a major improvement over random sampling methods, which only give an indication of the batch quality during production and require packages be thrown away after testing. With our solution, packages that do not meet specifications are automatically rejected and do not enter the supply chain, which means fewer product recalls.

Separation technology

Our separators and decanter centrifuges represent some of the finest solutions available on the market – regardless of application. China is using GEA centrifugal technology to produce high-quality vaccines for controlling foot-and-mouth disease – a win-win for farmers, consumers and the animals. Our centrifuges are also facilitating efficient wastewater treatment around the globe via sludge treatment, minimizing overall resource usage.
Biopesticides: stemming resistance

As crops become more resistant to synthetic pesticides and pressure mounts regarding their effect on our health and the environment, the race is on to bring biopesticides to market that are effective at scale, affordable and can ensure future food security.
Biopesticides are derived from renewable sources such as plants, animals and bacteria and are used to control weeds, pathogens and pests. Unlike their synthetic counterparts, they are less toxic, effective in smaller quantities, decompose quickly and target specific pests better than broad-spectrum pesticides, the latter having often been applied to the detriment of birds, insects and the environment in general.

Tougher ‘truth in labeling’ laws and pesticide legislation require pest controls that neither have a safety period between application and harvesting, nor leave pesticide residue behind. While they currently account for only 5 percent of the total global crop protection market, biopesticides are expected to play an important role in meeting these demands and ensuring the world has enough safe food in the future.

**Bacillus thuringiensis**

The most common biopesticide is the bacterium, *Bacillus thuringiensis* (Bt), which after ingestion, produces toxic crystals in pests causing them to die in 1 to 2 days. In use since the 1930s, it is popular with organic farmers in spray applications, whereas many large-scale growers have turned to its genetically modified (GM) form, where the codes that produce the toxic Bt crystal are incorporated into the corn, cotton, soybean or eggplant seed itself.

Despite this advancement, which means the Bt doesn’t have to be applied later and risk degradation by sun and water, some countries reject GM seed outright, because they believe it is unsafe or at least untested.

Today, there are thousands of strains of Bt and it is the primary ingredient in about three-quarters of all biopesticides. However, multiple insects have now developed resistance to it.

**APPLIES & ORANGES**

A significant barrier to biopesticides gaining traction, proponents say, is that they are often compared to synthetic variants even though there are fundamental differences between them – from how they get approved and are launched to how they work.

In stark contrast to the highly regulated, long and expensive road to get synthetic solutions on the market (ca. 12 years), biopesticides tend to follow an agile, fund-as-you-go model; the latter are often placed with willing testers and go through a quicker succession of trials and are optimized along the way.

When new products are finally available, synthetic product launches are generally supported by large marketing budgets and a host of eager distributors. The same cannot be said for biopesticides, which have fewer champions at the sales and distribution level and are sometimes dismissed outright. The reasons cited being: low profit margin; too complicated to use (or at least perceived to be); lack of sufficient test results; higher cost, narrow spectrum of activity and tendency to degrade more quickly and inconsistent performance, making them a tough sell to some farmers, who themselves often have very little practical experience with biopesticides or evidence to draw on.
What is microalgae?

Typically found in freshwater and marine systems, microalgae are a single-celled species that exist individually, in chains or in groups. Unlike other plants, microalgae do not have roots, stems or leaves, yet they are able to perform photosynthesis and are key to life on earth – producing nearly half of the oxygen in the earth’s atmosphere and using CO₂ to grow.

Microalgae, together with bacteria, form the basis of the entire food chain and are rich in proteins, carbohydrates and lipids. They already contribute to diverse applications ranging from cosmetics and pharmaceuticals to nutritional additives, fertilizers, livestock feed, wastewater treatment, the binding of heavy metals, and to a lesser extent, biofuel production.
Refining algae to support more sustainable food production

GEA and several partners from the EU’s scientific and business community have come together on the Sustainable Algae Biorefinery for Agriculture and Aquaculture (SABANA) project. The team, which kicked off work in 2016, is developing a large-scale integrated microalgae-based biorefinery for the production of value added products for use in agriculture and aquaculture, namely feed and feed additives, biostimulants, biofertilizers and biopesticides.

An EU-funded Horizon 2020 initiative, SABANA is led by the University of Almeria in Spain, where the team is demonstrating the technical, environmental and social feasibility of producing valuable algae bi-products using only marine water and wastewater as a nutrients source. Their goal: to achieve a zero waste process at the 1-hectare demonstration center built in Almeria in 2018 and similarly at a 5-hectare production plant planned for 2020.

In the biopesticide workstream, the team is growing, testing and processing strains of algae that have antimicrobial agents that fight against various plant pathogens. In order to process the sensitive biomass, GEA has supplied expertise and equipment, including centrifuges for harvesting and concentrating the microalgae; homogenizers for cell disruption and a spray dryer for biomass drying so that the active agents can then be tested. The project results will be available at the end of 2021.

WHERE DO WE GO FROM HERE?

Ensuring that we have enough safe food in the future will require work on multiple fronts, according to experts. One of them involves introducing diversity back into agriculture by moving away from monoculture (growing single varieties of plants). By doing so we can reduce our usage of harmful pesticides and put nature back to work, letting other insects control pests for us, for example.

Having more plant and animal diversity will help minimize the problem of resistance—meaning if we do need to use a (bio)pesticide, it has a better chance of working.

At the same time, research around nanoformulations (controlling individual atoms and molecules) and microencapsulation technologies can, scientists say, improve the stability and efficacy of biopesticide products, which could increase their usage. Microalgae biomass also contains valuable compounds well-suited for biopesticides to counter fungal diseases, although to date there are no algae-based biopesticide products on the market.

With world population estimated to reach 9.8 billion by 2050, food security and production are a top global priority. All stakeholders will need to work together to bring more sustainable agricultural methods and products to fruition, including biopesticides that both farmers and consumers trust.
How cows saved carrots

“A challenge is an opportunity in disguise.” In the case of the Sekita family, who have been farming in Brazil for the last 80 years, it really was. Their willingness to meet challenges head-on and to try new things has made them one of Brazil’s most successful agribusinesses.

Eduardo Sekita, CEO, Sekita Agronegócios
Japanese emigration to Brazil began in 1908 with many immigrants working in the expanding coffee industry. By the onset of World War II, the corridor was quickly closing; 19-year-old Katsui Sekita packed a few clothes and booked a one-way ticket to Brazil. His future wife, Etsuko, had arrived in Brazil thirteen years earlier. After marrying, they bought a small farm in the state of Paraná, and with their hard-earned knowledge of farming, threw themselves into their work and raising a family.

A COOPERATIVE IS BORN
The Sekita’s sons eventually set out on their own, establishing farms in the fertile São Gotardo region; first Tamio, then Seiji and finally the youngest, Makoto, as well as the elder Sekita’s themselves, made the move. It was hard going with lots of challenges, politically and physically, as many areas still required opening up for farming. However, in time, all three sons were successfully growing coffee, beans, corn and wheat – pooling their resources to hire employees, purchase inputs and negotiate prices for their crops.

With a handful of friends and family members, the Sekitas formed their cooperative in 1991, with Makoto serving as CEO for the first 25 years. Carrots and later garlic were brought under cultivation. Eduardo, a third-generation grandson was drawn to the work his uncles were doing, studying agronomy before joining the team in 1999; he has served as CEO since 2015. The dairy business is expertly managed by another third-generation family member, Leonardo Garcia, Makoto’s son-in-law.

JUST ADD MILK
In 2007, with fertilizer reaching upwards of 3,000 to 4,000 kilos per hectare, costs weighed heavily on the group. They identified three options, all of which involved generating manure to alleviate fertilizer costs: breed pigs, raise steers or implement a dairy farm. In discussions with GEA, they decided to add dairy cattle due to the quality and volume of the expected manure and the efficient space requirements of the cows, thanks in part to the GEA Freestall system they would purchase.

Although lacking experience, their own determination combined with GEA’s expertise and support, allowed them to get the dairy off the ground by 2008. “Eleven years ago, when we started the dairy business, GEA was the only company that fulfilled all of our aspirations. They gave us the most support regarding animal comfort, milking and issues related to manure,” says Eduardo Sekita.

REAPING THE REWARDS OF GOOD STEWARDSHIP
The dairy has been a clear win-win. It allowed the Sekita cooperative to optimize the land by adding another activity using existing acreage, without reducing vegetable production; optimize the use of their existing machinery; and lower their overall costs while generating a monthly revenue stream from milk sales, thus enabling better cash flow. They have also reduced the corn crop cycle by producing silage for feed and reduced nutrient exports by rotating other animal feed crops, which they’ve also learned to use more efficiently. Overall productivity is higher thanks to the application of manure.

THE POWER OF SMART WASTE MANAGEMENT
A common complaint leveled at farmers with cows is that the manure is improperly managed and bad for the environment. With the Sekita dairy herd hovering around 1,500 cows, plus 300 dry cows and 2,000 calves and heifers, manure management has been a top priority since day one.

The first step in the process is collecting the manure, urine, animal bedding and water from the sprinklers and placing it all in a homogenization tank where the solids are separated from the liquid. The liquid waste then goes to the biodigester, which produces methane gas, which in turn is converted into electricity. The electricity powers the machine that washes the carrots and provides the energy for the cold storage rooms.

After the bacteria have transformed the liquid waste into biofertilizer, it’s applied to the crops via the irrigation system. The solid part of the waste is sent to a composting area – along with other vegetable waste – and eventually applied to the fields to replenish the soil’s organic matter.

FUTURE-PROOFING SUCCESS
Not immune to the turbulences in the dairy industry, Sekita Agronegócios depends on the quality of all of its products for its success.

“We always work with the best genetics and the best feed to produce the best quality milk in the region. That’s how we achieve differentiated prices,” explains Sekita. “We have a wide range of products and when the price drops in one, others help keep the business viable. It’s all about optimizing resources.”

Today, the Sekita cooperative has more than 40 members. Milk production is around 20 million liters per year (54,000 liters/day) and roughly 100,000 tons of vegetables, raised on 3,000 hectares, are sold each year throughout Brazil, Uruguay and Argentina. The work is carried out by 1,500 dedicated employees. In 2017, the highly awarded Sekita Agronegócios was recognized as the fourth largest milk producer in Brazil according to the Top100 MilkPoint survey. “We’re proud of is not our ranking,” says Sekita humbly. “We see this as a result of teamwork – and as a team we’re always in search of excellence, which means producing quality food in a sustainable way.”

A partnership for the long haul
With a relationship spanning more than 10 years, GEA continues to provide Sekita Agronegócios with superior end-to-end service and solutions covering milking, cooling, barn and manure equipment and diverse products for cleaning. With their GEA ExpertCare Services agreement, Sekita can rely on at least three onsite visits per month, equipment inspections, spare parts and key supplies, ensuring that their milking process is running smoothly.
Just water please – clean water

It’s been called the environmental issue of our century, however there are concrete steps we can take to shore up water insecurity and better use – and reuse – this precious resource.
You turn it on. It comes out. Clean water from the tap. Unfortunately, that’s not the reality for a lot of people today. According to the U.N., water scarcity affects four out of every 10 people and by 2025 they expect 1.8 billion people to be living in countries or regions with absolute water scarcity. Unchecked, the inevitable result of this situation is more conflict and emigration.

The causes stem from population growth, environmental degradation and the impacts of climate change, which leads to severe drought and flooding. Likewise, a lot of water is used to excess and often not recycled.

BIG CITIES, BIG CHALLENGES
Ironically, drought and lack of water infrastructure are factors driving people to cities, particularly megacities, where populations can swell into the tens of millions. However, while urbanization is providing billions of people with greater economic opportunities, if planning and infrastructure are missing or deteriorated, people often live with inadequate or even non-existent water and sanitation services. The U.N. estimates that 80 percent of the world’s wastewater flows back into the ecosystem without being treated or reused and that 3.6 million people die each year globally from water-related diseases – 84 percent of whom are children.

In India, about 30 percent of people live in cities where populations are expected to double by 2050. This puts intense pressure on already “water stressed” municipalities, many of which are unable to provide regular water supply. The situation is exacerbated by surface water pollution and illegal withdrawals from unsanctioned boreholes. Today, 60 percent of irrigated agriculture and 85 percent of domestic water use in India depends on groundwater, which is now severely depleted.

Infrastructure and financing are significant challenges for Indian cities. Several lack sewer networks for capturing wastewater and the financial capital to run a wastewater treatment plant. Of the sludge captured and dewatered, most is sent to landfills, rather than being sold or put to use to enrich the much-depleted soil. Also, much of India’s electricity production depends on the extensive use of freshwater for cooling at its thermal power generation plants. When water supply is too low, the power shuts off, which has knock-on effects across the entire economy. However, the situation should improve as India transitions to renewables.

The Indian government and several of its municipalities have reached out to the global community for support and expertise to address water and wastewater issues. Given its state-of-the-art centrifuge technology, GEA has supplied numerous biosolids decanters as part of wastewater treatment plants in Bengaluru, Surat, Mumbai and Varanasi. Likewise, several GEA decanters will be hard at work in the city of Gayespur, near Calcutta, and in the northern state of Uttar Pradesh as part of the effort to clean up the Ganges River.

“We’re proud to be involved in this historic effort to bring about positive change in India,” says Dinesh Gehani, Regional Product Sales Manager for GEA APAC.

Global water withdrawals

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<tr>
<td>Agriculture</td>
<td>69%</td>
</tr>
<tr>
<td>Industry incl. power generation</td>
<td>19%</td>
</tr>
<tr>
<td>Households</td>
<td>12%</td>
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Agriculture
- Irrigation
- Livestock
- Aquaculture

Industry
- Incl. power generation
To date, more than 150 GEA environmental Decanters have been sold for industrial effluent and municipal sewage – many of them performing beyond the agreed KPIs. Likewise, the equipment and solutions, which are based on GEA global engineering standards, are being produced in India – which includes installation, maintenance and repairs – providing local, high-skilled jobs.

FIRST WORLD PROBLEMS
Industrialization and GDP are not safeguards against issues related to water quality and security. The Republic of Ireland, for example, is one of the top ten wealthiest countries in the world; unfortunately, its water supply and wastewater disposal system had not kept up with increasing demand and stringent EU guidelines. In 2015, national water utility company Irish Water adopted a six-year plan to improve its existing wastewater plants and increase capacity – both key given their expectation that wastewater sludge will increase by more than 80 percent by 2040.

Irish Water opted for a green treatment solution using the Nereda® process, for which GEA is the world’s first preferred supplier. The wastewater, purified by bacteria, produces compact granulates with outstanding settling properties. As a result, the new Irish Water plants are highly efficient and require only a small footprint. Energy savings are up by 40 percent – a major contributor being GEA’s final sludge dewatering technology which was adapted to accommodate Nereda® specifications, reducing operating costs by producing sludge that is 10 to 15 percent drier and therefore less expensive to transport or reuse. In Ireland, most sludge is used as agricultural fertilizer.

Work, however, still continues in Ireland: updating aging networks, minimizing leaks, ensuring consistent water supply, improving water quality and looking for opportunities to maximize renewable energy generation from wastewater sludge.

In 2018, the European Environmental Agency (EEA) published a report assessing the status of European waters and the pressures faced, based on data collected from 2010 to 2015. The report indicates that only 40 percent of the lakes, rivers, estuaries and coastal waters studied in Europe met ecological standards, with only 38 percent meeting chemical pollution standards.

Countries with higher population densities, more intensive agriculture and industry, including Germany, the Netherlands and Belgium, have the most work to do to improve their waters, according to the data. The EU members have agreed to several actions, including making more barriers passable for migrating fish and restoring degraded aquatic ecosystems. To reduce pollution, water treatment will continue to play a critical role, including upgrading wastewater treatment facilities and infrastructure maintenance.

You can’t manage what you don’t measure
Launched in spring 2018, the Gravity Recovery and Climate Experiment Follow-On mission is a partnership between NASA and the German Research Centre for Geosciences. It has launched two satellites to track the changing pull of gravity around Earth and the movement of its water masses. The data has shown, for example, that Greenland is losing an average of 280 gigatons of ice per year and that humans are pumping out groundwater faster than it is being replenished in a third of Earth’s largest aquifers. Likewise, scientists have been able to isolate the causes and better understand the pace of future sea level rise.

Getting the salt out
In arid regions like the Middle East, the Caribbean, parts of the U.S., Australia and Spain and places like Singapore and Hong Kong, seawater desalination is an important contributor to the overall water supply for municipalities, agriculture and industry.

Using heat treatment to desalinate water is an option, but a very energy-intensive process, therefore reverse osmosis (RO) is more common. RO uses high-tech polymer membranes that are permeable to water, but reject the passage of dissolved salts. In this process, GEA decanters form part of a larger reverse osmosis desalination plant, reliably and efficiently separating the sludge into solids and reusable water. Because of their high dewatering capacity, GEA decanters can concentrate solids, achieving up to 25 percent dry matter, providing operators a substantial cost savings.
Aiming for Zero in Industry

In Mexico, saving water isn’t just a nice-to-have – it’s become an absolute necessity. The country is heavily dependent on underground aquifers and needs to update much of its water infrastructure. Yet somehow, against this patchwork of challenges, the show must go on. The dairy processing sector in Mexico – and globally – is playing a pioneering role in becoming water neutral. Given that milk is approximately 85 percent water, there is huge potential when turning milk into powder to recover the water to meet most – if not all – of the water demands of the milk processing plant, which means reduced fresh water demand and waste discharge.

A major global food manufacturer and GEA customer installed the first-ever zero water dairy processing plant in Lagos de Moreno, Mexico, where the water is recovered using reverse osmosis, delivering a savings of 1.6 million liters of water per year. Depending on the end-use, the recycled water can be further treated and purified to meet World Health Organization standards for potable water and then employed in various dairy plant processes, including final flushing; tank and pipework cleaning and even as an ingredient in the finished product. Water that is minimally treated is used to water gardens or flush toilets.

In addition to getting the most out of water resources, industry must also comply with ever-stricter regulations, particularly when it comes to managing effluents. In 2018, GEA was brought in to design and build a zero liquid discharge (ZLD) wastewater treatment plant for a power plant in Ciudad Juárez, Mexico. The system converts salt-laden wastewater into pure water for internal recycling and dry solids for disposal, all with high-energy recycling and dry solids for disposal, all with high-energy efficiency and minimum labor requirements. This system ensures less salt ends up in our waters, reduces the customer’s own water acquisition costs and risks, as well as overall CO2 footprint by reducing transportation costs for water and waste hauling.

Ways & Means

When it comes to rectifying our global water situation, both nature-based and human-built solutions are required. In places like the drought-stricken Tigray region of northern Ethiopia and Rajasthan state in India, entire communities have come together to solve their water challenges. People have returned. Water is flowing. Trees, grasses and crops are flourishing again and groundwater is regenerating thanks to land restoration projects, improved farming and grazing methods and smart water management.

Another lighthouse is Singapore, which has also taken a holistic approach to water resource management to overcome its once precarious water situation. Thanks in part to GEA technologies for sludge dewatering and sludge thickening, Singapore’s Changi water reclamation plant, the world’s largest, is able to return much of its former wastewater back into the ocean or a nearby lake from which potable water is generated for people and for industries requiring high purity water.

Although very different in their approaches, both cases show that even the near impossible can be achieved when people work together. 
Lithium: fueling the clean energy revolution

The transport sector alone contributes roughly one-quarter of all energy related CO₂ and is still primarily dependent on fossil fuels. But that’s changing thanks to the lightest solid on Earth, which some are even calling the “new gasoline.”

Lithium, it’s the soft, silvery-white metal that’s become a critical component in hundreds of applications, including the auto industry’s new shining star – the electric vehicle (EV). While EVs have been around for some time, it’s due to much-improved lithium-ion (Li-ion) battery technology that we’re actually seeing them on the road in greater numbers. These super-tech batteries keep their charge for long periods (100 to 300 miles), are lightweight and recharge quickly (ca. 30 minutes via a super charger) – key criteria for buyers.

And, if you look around at the devices and equipment you’re using today, you’ll find Li-ion batteries powering everything from your mobile phone, laptop, digital camera, your cordless hand drill and your e-bike. They’re also used to store energy from wind and solar, which removes even more CO₂ from the environment.

21ST CENTURY GOLD RUSH

Lithium does not occur as a metal in nature, but is extracted from igneous rocks – primarily spodumene – or from bodies of water with high salt content or brine deposits. And while not classified as a "critical" raw material, lithium is a coveted commodity. It traded for a whopping US$16,500 per ton in 2018 – up 45 percent from 2017. However, prices vary widely because it’s traded directly between buyers and sellers versus through an exchange.

Latin America is leading the world in production. Its “Lithium Triangle,” made up of Chile, Argentina and Bolivia, hold anywhere from 54 to 80 percent of the world’s lithium resources, much of it in brines. Brine extraction is a less expensive process than obtaining it from ore, but is a longer process, given that it can take up to two years for the evaporation phase.

Australia, the world’s second largest producer, holds the most lithium reserves. Most of it has to be crushed out of rock, so to balance the costs, it is largely shipped to China for processing. China also has its own reserves and is buying rights to mine lithium in other countries. In the U.S., lithium is recovered from brine pools, although how much is produced has not been published. Zimbabwe, and to a lesser extent Portugal and Brazil are also producing lithium in smaller quantities.
Global lithium-ion battery production capacity will increase by 521% between 2016 and 2020.

WHO’S SUPPLYING THE DEMAND?
The massive price jump for lithium is due to the rise – and the even greater expected rise – in the production and sale of EVs, domestic solar usage and digital devices, all of which require Li-ion batteries.

Globally, more than 120 different EV models are expected to hit the road by 2020, in countries like the U.S., China, India and Norway, among others. To power them, both China and the U.S. have ramped up Li-ion battery production, with China in the lead. In the U.S., Tesla has two gigafactories for EV battery and component production and is building another in China. However, EV growth in the U.S. has been slower than expected, making up less than 2 percent of auto sales and it could be another six to seven years before they become mainstream. In 2016, global Li-ion battery production capacity reached 28GWh and by 2020 it is expected to reach 174GWh – an increase of 521 percent. Not surprisingly, lithium materials demand is projected to grow at a 13.8 percent CAGR between 2018 and 2023.

TIPPING THE BALANCE
Different lithium compounds have different end uses, therefore lithium is not homogenous, like aluminum, for example. This, and the fact that it is a relatively small market dominated by a few players, makes it more difficult to set a “price” for lithium, trickier to hedge, and therefore, secure financing for new extraction projects.

The ramp up of lithium production is primarily dependent on increasing EV adoption. This of course requires consumer buy-in. However, it also requires persuading others along the chain – investors, chemical processors, battery/cathode manufacturers, carmakers and politicians – that lithium supply will be reliable, of high-quality and affordable. Likewise, EVs and Li-on batteries are not without their critics, who are quick to point out that a structure for recycling Li-ion batteries is still largely missing. Finding closed-loop solutions for recovering and reusing Li-on battery materials would boost the technology’s green credentials and further solidify lithium’s future.

On the consumer side, drivers are warming up to EVs, as concerns about product safety, battery durability and range subside. The combined technical improvements, increased model choices and drop in price, as well as the appearance of more charging points, suggest that we’re in for a brighter and cleaner future.

And the award goes to …
In 2017, GEA was recognized with the “Award for Excellent Supplier” by Shenzen BTR New Energy Materials.
A globally leading lithium battery anode and cathode material solutions provider, BTR recognized GEA’s top performance. In particular, the Chinese company recognized GEA’s technology, as well as innovative and pragmatic solutions, which have contributed significantly to the production of high-quality lithium.
How to do it: Processing battery-grade lithium

Lithium hydroxide, and to a lesser extent, lithium carbonate, are used to make Li-ion batteries and must be exceptionally high-grade – 99.5 percent pure – to meet manufacturer specifications. Given extraction costs, it is critical to get as much value as possible out of each ton of ore or brine during processing. Here’s how it’s done:

1. **Spodumene ore**
   A source of lithium, spodumene, is a mineral found in prismatic crystals, often of substantial size.

2. **Mineral conversion**
   The raw ore is put through a series of crushing and size-classification steps to create the required particle size.

3. **First treatment**
   The ground lithium ore (lithium sulfate) is heated in a rotary calcining kiln where the lithium is displaced by sodium. The concentrate is cooled, milled into a fine powder and mixed with sulfuric acid and roasted again. Magnesium and calcium are also removed.

1. **Lithium brine**
   Lithium is obtained from saline brines (salt lakes), which are fed from seawater, surface water or groundwater.

2. **Solar evaporation**
   The salt-rich brine water is pumped into a series of evaporation ponds where solar evaporation occurs over an average of 14 months.

3. **First treatment**
   When the lithium brine (lithium chloride) reaches the right concentration, the solution is pumped to a recovery plant where extraction and filtering remove unwanted impurities.
GEA covers nearly the entire value chain of lithium processing – from evaporative concentration, precipitation, crystallization to purification and drying – tailoring the powder to specific end-use requirements. Our award-winning customer service and unrivaled technologies are valued by lithium manufacturers globally because we deliver a competitive advantage due to higher rates of production, reduced costs and more efficiency, while complying with stringent regulations. GEA test centers allow customers to pre-test their lithium samples so they can make informed decisions before committing to industrial level production.

**Compound processing**
Sodium hydroxide is added to both streams, producing lithium hydroxide. This process generates two byproducts: table salt (from the brine) and Glauber’s salt (from the spodumene).
Lithium carbonate is produced if soda ash is added to the brine solution.
Each solution is purified and concentrated via evaporation and crystallization. The crystals are separated by centrifugal force, dried, packed and shipped as powder to a cell component manufacturer.

**Crystallization**
Irrespective of its source – brine (lithium chloride) or spodumene (lithium sulfate) – GEA has developed state-of-the-art technologies for concentration and crystallization. As the source solution goes through precipitation steps to become a lithium hydroxide solution, sodium chloride or sodium sulfate is generated as a byproduct. They are separated out from the lithium solution and once isolated, the salt (table or Glauber’s salt) is melted down, recrystallized and dried so that it can be sold. GEA’s double stage crystallization method utilizes both vacuum and surface cooling to limit fouling and minimize lithium losses.

**Spray drying**
When it comes to spray drying, GEA powder engineers tailor each solution to a specific downstream component, utilizing one of two types of atomization devices: rotary or nozzle. Nozzles are available with pressure and pneumatic configurations as are combination or multi-flow systems.
Rotary atomization is the best solution for most scenarios given the equipment is easy to operate and energy efficient. The GEA COMBI-NOZZLE™ combines the best features of pressure and pneumatic nozzles and is specifically designed for Li-ion battery material, offering unique advantages over other nozzle types. Regardless of the atomization approach, GEA offers compact, single-line spray drying plants for any capacity.

**Cell component manufacture**
The lithium carbonate or lithium hydroxide powder is mixed with diverse materials – mostly metals – to give them the desired component qualities.
To produce the electrode (cathode & anode) components, the mixed materials are coated on both sides of their metallic foils: copper for the anode, aluminum for the cathode.
After coating, the foils are cut into narrow strips.

**Cell/battery manufacture**
A thin membrane (separator) is placed between the anode and the cathode to prevent contact between them, while allowing ion movement.
The electrode structure is connected to the terminals, plus any safety devices, and inserted into the case – which is then filled with an electrolyte solvent and sealed.
Once assembled, the battery is activated via a charging and discharging cycle, then tested, after which it can be sold.
A major growth star in the beverage category, ready-to-drink (RTD) tea is undergoing a lifestyle makeover. The drink North Americans generally refer to as “iced tea” is hot, hot, hot!

Available in a dizzying array of green, black, fruit or herbal-based options – refrigerated or on the shelf – RTD teas offer consumers the convenience of enjoying this ancient favorite either on-the-go or at home.

According to market research company Euromonitor International, the size of the global RTD tea market has grown by roughly 25 percent since 2011. Forty billion liters were sold in 2016 and this figure is expected to reach 45 billion liters by the end of 2022. Overall lifestyle changes, increasing disposable income and the move away from carbonated drinks, including to some degree alcohol and even juice, are the main drivers fueling this growth.

THEY'RE READY TO DRINK TEA

Millennials in particular are turning to tea largely due to the health benefits often associated with it, including anti-inflammatory and antioxidant properties, cancer and cardiovascular protection and weight loss stimulation. They’re also looking for ways to express themselves via their product choices and thirsty for authentic stories; this includes where the tea comes from and its unique properties – further enhancing tea’s aura and appeal. As a result, brands are placing more emphasis on natural ingredients and honing in on trends and flavors that resonate locally, which has led to an explosion in flavors and combinations.

Three-quarters of worldwide RTD tea sales are in Asia and as a result, the category is more highly developed there with a wider variety of brands, flavors and health-enhanced products than found elsewhere. Euromonitor International has ranked the top ten RTD tea countries in terms of liters sold, with China taking the lead, followed by Japan, the U.S., Indonesia, Vietnam, Taiwan, Germany, Italy, Thailand and Canada.
REACHING FOR THE TOP SHELF

Tea, including the RTD market are shifting upwards in terms of quality to keep pace with increased interest in healthier ingredients and authentic tea experiences. As consumers become more tea-savvy, brands are responding by bringing tea leaves directly into the plant as part of their brewing process and moving away from teas made from liquid extracts and powders. Doing so allows brands to enter the ‘premium’ tea space, which not only has implications on price, but also on how manufacturers are connecting and communicating with consumers.

The category is awash with trends, one being, cold-brewed tea, which followed on the heels of cold-brewed coffee. As its name suggests, it is made with tea leaves that have been steeped in cold water for up to 24 hours. This brewing style requires more leaves to ensure that enough flavor is extracted. Although still considered a niche product, its devotees, particularly in Asia and Europe, claim it produces a more full-flavored and less bitter tea.

CRAFTING UNIQUE FLAVORS FOR UNIQUE CUSTOMERS

With diverse consumer tastes – which can change quite quickly and vary tremendously from market to market – it’s fair to say that the RTD tea category is dynamic.

GEA understands the subtleties of both its customers and the teas brands want to create for consumers. With a strong portfolio covering North America to Asia and everywhere in between, GEAs RTD tea customers include local and regional champions as well as global beverage players.

GEA offers end-to-end RTD tea solutions, which often begins during the pilot process at one of our eight facilities for process testing and product development. Here we collaborate with customers to try out new recipes and ingredients. For manufacturers with a global footprint, GEA helps them achieve economies of scale by designing a single brewing solution and then adapting it to local requirements.

“Our solutions are digi-ready and plant operators appreciate our proven data analytics tools. We’re also constantly looking for opportunities to maximize energy recovery throughout the entire brewing process,” says Lisa Eckman, GEA Regional Sales Manager for Beverages, U.S. “GEA has superior credentials in the sensitive beverage sector, including global tea experience, but we don’t take anything for granted. We always assemble a solutions-driven team for our customers – sometimes from more than ten different countries, depending on the size and complexity of the project,” explains Eckman.

Ready-to-drink tea brought to you by GEA

Whether it’s testing or the design, construction and installation of 24/7 turnkey plants, processing lines or modular technologies you need, GEA is the right partner. We cover the entire RTD tea production process, including the following key steps:

Tea brewing
GEA test centers, including a dedicated RTD tea pilot process facility in Ahaus, Germany, help customers achieve the perfect brew. Here, working with GEA technologists and other process experts, customers can take risks and experiment with different ingredients and formulations to be sure they get exactly the overtones and profiles they want for their teas before investing further.

Thermal treatment
Following clarification, RTD tea is heat-treated and hygienically bottled to ensure product safety and promote a long shelf life. GEA offers thermal treatment systems covering heating & cooling, pasteurization, UHT treatment and in-line cooling.

Clarification
GEA’s credentials in separation technology are best in class across numerous applications, including in the production of RTD tea. Our hygienic designs ensure the production of brilliantly clear and consistent tea.

Aseptic filling
GEA aseptic fillers eliminate any possible risk to the product, meet critical environmental control requirements and achieve the best performance in terms of filling speed, accuracy, flexibility and safety.
The insect revolution: Too hard to swallow?

Feeding ourselves – and doing so sustainably – are challenges faced around the globe. With the need to find protein alternatives and more options on our doorstep, insects are being touted as a good solution for people, animals and the environment.

As world population increases, so too does the demand for food, especially meat. Unfortunately, traditional livestock production is exasperating water and land resources and will not, experts say, be able to meet future needs. Food scientists are certain that entomophagy – the human consumption of insects – can.

Insects are high in protein, fat and mineral content; they also grow quickly, require minimal space and can be reared on waste streams, including edible by-products from the food industry. And, nearly two billion people around the world – notably in Asia, Africa and Latin America – already consume more than 2,000 different types of insects, most of which are consumed or sold locally in street markets.

Insects are already a natural part of the diet of pigs, poultry and fish, and can, in certain countries, also be used in animal and pet food. This frees up natural resources and diverts more grain to human consumption – good news, given it’s estimated that a third of the world’s cereal production is currently fed to animals. Using insects in feed also minimizes fishmeal production and therefore the impact of overfishing. Processed insects also have applications in medicine, cosmetics and alcohol.

INSECTS AS FOOD

Depending where you are, the legal path to bring insect-based foods to market ranges from simple to more complex. In the UK, U.S., Australia, New Zealand and Canada edible insects fall under existing food regulations. In Switzerland, three insect species are approved for use in food. In 1997, the EU adopted the Novel Food Regulation, identifying as “novel” any food or food ingredient which had not been used for human consumption to any significant degree in the EU before May 15, 1997, including “food ingredients isolated from animals.” The vagueness of the language, which for example, made no reference to whole insects or ingredients from whole insects, led to diverse interpretations.

Technologies & solutions for insect-based industries

From devitalization, grinding and separation to drying, processing and packaging, GEA is well-positioned to provide all the necessary technology for processing insects. We’re supplying processing equipment to the world’s largest fly larvae manufacturer in South Africa to facilitate its expanding high-protein animal feed business and providing support to Australian feed start-up, Future Green Solutions.

GEA is also participating in a project with the Research Institute of Feed Technology in Germany, processing insects for the production of protein and fat.
<table>
<thead>
<tr>
<th>Animal</th>
<th>Feed (kg)</th>
<th>Land (m²)</th>
<th>Water (l)</th>
<th>Edible (%)</th>
</tr>
</thead>
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<tr>
<td>Beef</td>
<td>10</td>
<td>250</td>
<td>15,500</td>
<td>40</td>
</tr>
<tr>
<td>Pork</td>
<td>5</td>
<td>70</td>
<td>6,000</td>
<td>55</td>
</tr>
<tr>
<td>Chicken</td>
<td>2.5</td>
<td>70</td>
<td>4,250</td>
<td>55</td>
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<tr>
<td>Grasshopper</td>
<td>1.75</td>
<td>40</td>
<td>2,500</td>
<td>80</td>
</tr>
<tr>
<td>Mealworm larvae</td>
<td>2.25</td>
<td>35</td>
<td>4,500</td>
<td>80</td>
</tr>
</tbody>
</table>

In 2015 the language was finally clarified to cover whole insects and their parts and defined the standards and authorization procedures for the commercialization of “novel” foods, with the law coming into effect in 2018. As a result, insect-based products, even those previously approved, had to be submitted for a safety review by the end of January 2019 before being placed (or placed again) on the EU market.

In the meantime, insect-based products (from whole insects to flours) have already found their way onto mainstream European shelves; for example, at global hypermarket Carrefour in Spain, which carries products from Jimini’s, a French startup founded in 2012. With its insect-based products now on shelves in France, Belgium, the Netherlands, Finland and Denmark, Jimini’s owners expect acceptance to take time, but believe insects will be adopted faster than say, raw fish or sushi. Their estimate: less than 15 years.

Recent studies however, still reveal low acceptance across Europe, with “disgust” and neophobia clear barriers. Emeritus professor, Arnold van Huis, University of Wageningen, the Netherlands, who helped launch the topic of edible insects globally with his work for the FAO in 2013, believes that processed insects are the way to go for insect newbies. Dirk Sindermann, Head of Process Technology – Renewable Resources at GEA agrees: “If you can process insects or insect larvae in such a way that you get a neutral protein source in terms of taste,
How insects stack up to traditional livestock

Figures represent averages as species and diet all affect the nutrition profile; Nutrient content per 100 g edible portion.

**Beef**

- Energy: 169 kcal
- Protein: 20.6 g
- Fat: 9.3 g
- Saturated fat: 3.8 g

**Pork**

- Energy: 186 kcal
- Protein: 20.1 g
- Fat: 12.4 g
- Saturated fat: 3.5 g

**Chicken**

- Energy: 152 kcal
- Protein: 19.9 g
- Fat: 7.2 g
- Saturated fat: 1.81 g

**Mopane caterpillar (final instar)**

- Energy: 409 kcal
- Protein: 35.2 g
- Fat: 15.2 g
- Saturated fat: 5.74 g

**Adult cricket**

- Energy: 153 kcal
- Protein: 20.1 g
- Fat: 5.06 g
- Saturated fat: 2.28 g

**Mealworm larvae**

- Energy: 247 kcal
- Protein: 19.4 g
- Fat: 12.3 g
- Saturated fat: 2.93 g

appearance, color and smell, then acceptance will be much higher. Only when they’re processed will we see more widespread interest in insect-based foods becoming a sustainable industry.”

According to Meticulous Research, even in the face of consumer trepidation, the global edible insect industry is expected to be worth nearly US$1.2 million by 2023 with a 23.8 percent compound annual growth rate from 2018 – with the U.S and Canada predicted to deliver the highest growth. So who are these insect enthusiasts?

The target audiences are generally categorized as: adventurous eaters, health-conscious consumers or sustainability-minded eaters, often between the ages of 18-35, with children aged 4-8 also showing significant interest.

**INSECTS AS FEED**

On the feed side, momentum is also building. The EU permitted the use of insect protein as fish feed in 2017, an important step given fishmeal uses about 10 percent of the global fish haul, is expensive and difficult to source,
due in part to overfishing. In the U.S., individual states decide if insects can be used in animal feed, whereas in Canada, insects are already approved for fish and poultry feed. The EU doesn’t allow insects to be used in feed for poultry or pigs, due to historical problems with bovine spongiform encephalopathy (BSE) – mad cow disease – although it is allowed to feed live insects and fat derived from insects to farm animals. If the EU feed laws are relaxed, it’s likely this market will explode, as companies are already geared up to produce tons a day if necessary.

Given the slow adoption of edible insects, it seems likely that the feed side will move more quickly. However, learnings around rearing, processing and supply can be transferred to the food side, explains Sindermann: “Nearly all of the know-how we are getting from the feed industry we can apply to the food industry.” Adding that, “We believe in investing in innovative and future-oriented technologies and industries, even if we’re not 100 percent sure they will succeed.”

THE ROAD AHEAD
For insects to deliver the greatest impact, several things will need to happen. First, stakeholders want to see more data, not only when it comes to nutritional performance and safety, but also around solutions for increasing automatization and lowering production costs. Secondly, once the data is available, legislation must be forthcoming and industry will need to scale up quickly to meet demand.

To maximize their sustainability, insects will need to play a critical role in the circular economy by being reared on leftover crops, food, food by-products and other kinds of waste (e.g. manure). Where countries land on the pre- and post-consumer waste continuum remains to be seen and will no doubt be hotly debated, but it will help “offset” the relatively high energy used during rearing, which depends on warm, ambient temperatures.

Lastly, increasing urbanization and the mimicking of “Western” values has caused some people to give up the practice of eating insects. A concerted effort is required to keep existing insect-eating traditions alive while continuing to promote it elsewhere – ensuring that early adopters have a positive experience. Changes in production and supply chain strategies will need to be explored to ensure new urbanites still have access to insect-based foods. Other watch-outs include: overexploitation, pollution, the use of pesticides and deforestation which need to be mitigated globally to safeguard existing insect populations.

“If you can process insects or insect larvae in such a way that you get a neutral protein source in terms of taste, appearance, color and smell, then acceptance will be much higher. Only when they’re processed, will we see more widespread interest and insect-based foods becoming a sustainable industry.”

DIRK SINDERMANN, HEAD OF PROCESS TECHNOLOGY - RENEWABLE RESOURCES, GEA
Industry’s hidden champion: the heat pump

Operating in the dark, hidden in basements, on roofs or in machine rooms, the heat pump is often overlooked and its capabilities underestimated. However, improved engineering coupled with tougher CO2 regulations has shone a spotlight on this unassuming hero.
With applications in B2B and B2C, the heat pump has come a long way since it was first used to dry salt mined from Austrian marshes in the 1850s. Already well known for its use in district heating and the residential sector, heat pumps are quickly becoming the technology of choice by manufacturers scrambling to meet ever-stricter environmental rules, their own targets and reduce costs.

So, wherein lies its magic? Heat pumps use renewable energy or waste energy from buildings and processes to provide heating. For example, during cooling, refrigeration systems emit heat from a condenser. Normally, this heat is simply released into the environment. The heat pump captures this wasted heat and then “pumps” or boosts the temperature to create heat suitable for other purposes. And when a heat pump is combined with a refrigeration unit, both cooling and heating are possible, turning one-time energy use into a circular energy economy, lowering energy costs by 30 percent or more. That’s a significant savings when you consider that within the food, dairy and beverage industries, up to 60 percent of energy usage goes to heating and cooling.

NATURAL REFRIGERANTS, NEW OPPORTUNITIES

As fluorinated gases are phased out, natural refrigerants are becoming more popular, especially ammonia, which is readily available, inexpensive and has no global warming impact. Although noxious at high concentrations, the implementation of carbon absorbers in ammonia-based heat pumps eliminates the smelly element before the air passes through a ventilator and leaves the plant room.

Due to improvements in compressor technology, ammonia heat pumps can now heat to higher temperatures. This has paved the way for their more widespread use in the food, beverage and dairy industries, where waste heat can be used for washing, cleaning and drying products; heating water for cleaning and processing purposes, as well as pasteurization.

GEA leverages its deep knowledge of industrial refrigeration and heating & cooling expertise to create both tailored and plug-and-play solutions for large customers, SMEs and cities all over the world. Here is just one example:

Moy Park, ammonia heat pump installations, Anwick, UK

Moy Park is one of the UK’s top food companies and a leading European poultry producer, processing more than 280 million birds per year. GEA installed the first heat pump at Moy Park’s Anwick plant to support poultry processing.

Over the years, Moy Park saw the difference this technology was making to its business, eventually adding another GEA heat pump to provide the hot water used for plant cleaning. By using the waste heat from the refrigeration plant, the heat pumps ultimately replaced three boilers. In addition to delivering massive cost savings, oil usage has gone down dramatically and CO2 emissions reduced by more than 700 metric tons annually.

While Moy Park was one of the first in the UK food industry to install a high temperature heat pump, it is now becoming common practice for manufacturers in the food, beverage and dairy industries to integrate heat pumps into their processes.
Traditionally, these industries used boilers to cook or pasteurize products, and then refrigerated products to cool them down again, resulting in massive energy waste since the temperature of the waste heat from the refrigeration process was too low to be reused. A heat pump, however, boosts the waste heat temperature up to 70-85 degrees Celsius so it can be put back into the system. The result: more boilers can be retired, heat is no longer wasted and CO2 emissions are reduced – by as much as 50 percent in some cases. According to Robert Unsworth, Head of Sales (Utilities) in the UK for GEA, “The application of heat pumps in the food, dairy and beverage sectors is going to be the biggest leap forward that food production and refrigeration has ever seen.”

A PEEK BEHIND THE LAB DOOR

In some industries and applications, even higher temperatures are required. Sintef, a Norwegian R&D company, has been working on this issue for several months and is also participating in the largest heat pump project – the DryFiciency consortium – to be funded under the EU’s research and innovation program, Horizon 2020. Sintef is looking into solutions that combine ammonia and water heat pumps in one system and developing others that will leverage steam to allow heat pumps to reach 150-175 C.

According to Sintef Research Scientist, Dr. Michael Bantle, at temperatures above 90 C, water is the best natural refrigerant in terms of efficiency and safety, particularly for the food industry. “If energy-efficiency and cost-efficiency targets are met,” he says, “it’s basically a no-brainer for the industry to choose this kind of solution.” He anticipates the first industrial heat pumps using water as a refrigerant will be available on the market starting this year.

DISTRICT HEATING – SMARTER

Heat pumps have played a critical role in district heating since the 1980s – particularly in Scandinavia – centralizing the heating or cooling of water and then distributing it to multiple buildings through a pipe network. Fast-forward forty years, and heat pumps are now essential to our “energy transition,” particularly in cities, due to their ability to connect electricity and thermal energy grids, even storing excess electricity and acting as a thermal battery. These capabilities are key as municipalities move away from centralized electricity production to decentralized power production, where photovoltaic, wind and small-scale combined heat and power plants are augmenting or will eventually replace existing structures.

Now that more district heating networks have been established, some businesses are even selling their unused waste heat and cooling, much like the people who sell their extra solar or wind-generated electricity back to the grid. In Stockholm, for example, data centers have established long-term, multi-million Euro contracts to sell their recovered heat which is used to provide central city heating to tens of thousands of households.

CLOSING THE LOOP & THE GAP

The heat pump is a technology that delivers value regardless of the industry in which it is used or the extent to which it is utilized. It can do basic jobs, like heating and cooling a small suburban home, right up to taking a central role in a super smart, zero-emissions strategy for district heating or in a large food production plant.

In countries where emission requirements are less stringent or where cap and trade policies allow, some manufacturers are choosing to maintain the status quo given that fossil fuels still tend to be cheaper than electricity. However, according to the International Renewable Energy Agency, renewable energy needs to be scaled up at least six times faster if we expect to meet the emission goals set out in the 2015 Paris Agreement. Most would agree: any winning strategy to meet these targets must include the heat pump.
Question & Answer

Jacob Voelkel, CEO
Voelkel GmbH
Voelkel is one of the leading German producers of organic juices, with many different products on offer. What products do you manufacture and where are they sold?

JV: We produce more than 200 different types of beverages – including sodas and smoothies, as well as mulled wines and punches for winter – made from fruits, vegetables, plants, spices and vinegar extracts. They're sold via diverse distribution channels: health food stores, conventional grocery stores and bio supermarkets throughout Asia, Europe, Canada and parts of South America and the Middle East. We're currently increasing our use of beverage wholesalers as a sales channel to help meet the growing demand from the food service industry. Authentic organic sodas – soda made by “real” producers with a face, a history and a conscience – are also becoming increasingly popular. Combined with our other segments, such as syrup fruit juices, sodas, vinegars and smoothies, we provide almost every category of nonalcoholic beverage – all of them at organic quality. Voelkel’s leading position in our core market, the specialist organic trade, is undoubtedly a result of our manufacturing depth. We process the fruits and vegetables in-house, whenever possible.

Voelkel is a family-run business with a very clear philosophy. What does it mean to you to be the CEO of a company founded by your great-grandparents?

JV: Our family places great importance on upholding our great-grandparents Margret and Karl Voelkel’s core philosophy: “Working together for sustainable agriculture.” This means that Voelkel’s products are 100 percent organic and ecologically friendly. The capital the company generates is used to serve company activities and the common good, not the private interests of the Voelkel family. To ensure this, we have transferred the company capital to a company shareholder foundation and a non-profit foundation. I really enjoy working with my siblings, who are also part of the management team, to continue the legacy of our ancestors. Each of us has a leading role in the company, as does our father, Stefan Voelkel, who is still active as a managing director and combines his experience with our appreciation for innovation. We are also proud of our many dedicated and motivated employees, some of whom have been with us for decades. They help us ensure that all of our products embody the principles of our great-grandparents – it’s a real pleasure developing ideas with them.

In late 2018, you had a new production line installed for fruit and vegetable juices and carbonated beverages. How will this help you improve your production processes and, ultimately, the products themselves?

JV: In order to meet the annual increase in demand for our products, we need high-performance production capacity. The new production line will also help us reduce the resources used per packaging unit. As organic pioneers, we purchase high-quality raw materials and strengthen this focus with our specially initiated cultivation projects. The high quality of our raw materials does however have its price. That’s why our production processes have to be especially efficient if we want to remain competitive. After all, we are competing with other manufacturers, some of whom practice anonymous buying with a focus on what is least expensive – without any personal commitment or relationship with the farmer.

Why did you opt for a turnkey solution for the overall project instead of implementing it with individual partners?

JV: For a project of this size, you need a powerful and conscientious partner who takes every aspect of the overall project into account to achieve a rapid implementation. In terms of resources, we would not have been able to do this with individual partners, as this would have led to a large number of interfaces.

It was therefore very important for us to have a single point of contact who took all of the requirements of the individual components and treated them as an overall project. Having one contact simplifies the communication and implementation channels that are required here. We chose GEA VIPOLL based on the long-standing and close partnership we have with them.

What consumer trends are you seeing in your industry and which of them have influenced Voelkel’s business most in the last two years?

JV: Demand is developing very dynamically; some trends last longer, others change more quickly. Over the last two years, the most significant trends have consisted of an enormous upswing in the smoothie market, especially green smoothies, on the one hand, and functional beverages on the other. Today however, the sales figures for green smoothies are already stagnating. The demand for "less sugar" is a recurring theme. One key observation is that consumers still want more nonalcoholic products with proven health benefits – the trend is shifting from “functional food” to “medicinal food.” In the food service industry, there is a growing demand for ecologically friendly beverages that have a link to authentic people with tangible experiences and stories.
Best in class
The popular BioZisch beverages are made from 100 percent natural ingredients: organic mineral water from the Voelkel’s own state-approved natural spring and enriched with fruit and vegetable juices as well as extracts from bioherbs, spices and teas.

Many of your products are Demeter certified. That’s quite a significant achievement. Does this make it easier or harder for you to find the right partners to help you meet these high standards?

JV: The organic food industry has demonstrated how to produce healthy food for decades. This movement has now become widely accepted by mainstream society. That’s why other distributors – independent retailers and even discount stores – are jumping on the bandwagon. Here at Voelkel, we maintain a pioneer mentality. “Healthy food from healthy structures” is the next logical step; that makes Demeter the perfect choice. Long-term relationships with farmers are necessary for this type of agriculture, and this leads to healthy relationships. If you always buy from the least expensive provider, you’ll be left empty handed in the event of shortages. Plus, you’ll have set yourself up for all kinds of quality problems. Demeter offers us the chance to be part of the agriculture of the future. A circular economy, active soil conservation, compost management, preferably without using hybrid seed, prioritizing versatility rather than specialization, the use of homeopathic compounds – none of which leads to maximum yields. But it does lead to stability, continuity and nourishing the soil rather than depleting it. This is important in times of increasing weather extremes. Farmers and consumers are increasingly aware of this – and their demands are becoming clearer. Admittedly, being a pioneer can be a thankless task and often takes you out of your comfort zone. Nevertheless, our work is meaningful, and we take a lot of pleasure in it!

No industry can afford to ignore Industry 4.0, workplace automation or energy-efficient production. How is Voelkel dealing with this shift as a food producer?

JV: Industry 4.0 and automation are hot topics for us. Our first step was to achieve ISO 50001 certification for energy management, which involved installing a production data collection and evaluation system. Since then, we have networked nearly all of the components in our plants, allowing us to record not only energy values, but also – at least in part – throughput values, error messages and quality values. Of course, this process can’t be completed for the entire company overnight. Our company works with a variety of equipment suppliers, so we are connecting every single process, which is ongoing as we continue to grow and develop. This was another reason we chose to implement an entire project with GEA VIPOLL, which has made the interface as simple as possible and allows us to record and process the values from each machine in the new returnables/non-returnables facility systematically, using the Weihenstephan Standards to ensure quality assurance and internal traceability.
Plastic packaging: beyond the blame game

The topic of plastics has turned into nothing short of a global movement. As a result, the packaging landscape is changing – with sustainability and recyclability being important drivers – and with it the role of manufacturers.

According to the U.N., more than 99 percent of plastics are produced from chemicals derived from oil, natural gas and coal – non-renewable resources. Roughly half of the plastic products manufactured are designed for single use. And a lot of plastic is not recyclable given its complexity and chemical make-up. Slow to biodegrade, plastic has been getting into places where it shouldn’t for decades and clogging up our built environment.

The situation has brought about a global movement largely driven by consumers, NGOs and governments who are determined to see plastic usage reduced, plastic reused and made more recyclable. And where possible, alternatives made from renewable sources. As a result, retailers, restaurants and manufacturers are being asked to take more responsibility for the entire life cycle of their products, including the plastic packaging at the point of disposal.
MASS MOVEMENT FOR CHANGE

The energy and momentum that have gathered around the plastics issue has led to an array of scientific research, product innovations, global and local initiatives and concrete legislative action – all with the goal of ending plastic pollution. In Bali and Mumbai, beach cleaning events have drawn thousands of people, all pulling together to clean up their landscapes. Bans on single-use plastic are now in place all over the world.

But despite these efforts, many of which are heroic and making a difference, what is clear, is that the problem cannot be solved without support along the entire supply chain.

RECYCLING WOES

Today’s plastics and plastic packaging have become very complex, including multiple layers of more than one type of material. While great at their job, safeguarding food and beverages, they are difficult, and often impossible to recycle; chemical make-up also makes many plastics unrecyclable. The U.N. Environment organization estimates that only 9 percent of all plastic waste ever produced has been recycled; with 12 percent having been incinerated, and the rest – 79 percent – having accumulated in landfills, dumps or the natural environment.

It is true that many countries lack the waste management structures to deal with plastics properly and as a result are acutely suffering from the environmental ramifications of this, particularly in Asia, parts of Africa and South America. It is also true that the bulk of collected plastics from places like the U.S. and Europe were, and to some extent, still are being shipped (largely to Asia) for processing and turning into usable plastic and products when possible; however, because so little is recyclable, many plastics are burned or buried.

In January 2018, feeling the burden of its own environmental goals, coupled with a growing amount of contaminated and unusable plastic coming from other countries, China stopped accepting most foreign plastic imports. As plastics pile up in the U.S., Europe and elsewhere, China’s decision reveals to what extent this is a global problem, requiring global responsibility and ownership.

STEPPING UP TO THE PLATE

To be able to reuse it, we need plastics made of recyclable materials – which at the same time possess all the characteristics necessary for preserving and safeguarding products. The pressure is now on manufacturers to come up with solutions that will allow plastic to enter a circular economy, rather than being treated more or less as waste. More than ever before, stakeholders along the entire value chain are asking – or demanding – that businesses take more ownership of the end-of-life phase of their plastic products and packaging, including the impact it has on the environment.

And more businesses are stepping up to accept that challenge. At the 2018 World Economic Forum in Davos, for example, 11 leading brands, retailers, and packaging companies committed to working towards using 100 percent reusable, recyclable or compostable packaging by 2025 or earlier, representing more than 6 million tons of plastic packaging per year.

Getting more food to the table

Globally, about 30 percent of food is wasted or lost – roughly 1.3 billion tons per year. Some is lost due to poorly thought out or insufficient packaging. As the world becomes increasingly urban and the need for food grows, packaged food will increase to meet that demand. Getting packaging right has therefore never been more important.

Smart packaging helps to extend food shelf life and ensures food is protected, safe to consume and appetizing. The main enemies of food shelf life are: microorganisms (mold and bacteria); oxygen; moisture and steam as well as light and ethylene (ripening gasses in the case of fruit and vegetables).

<table>
<thead>
<tr>
<th>Item</th>
<th>Shelf life unpacked</th>
<th>Shelf life In flexible packaging</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bananas</td>
<td>15 days</td>
<td>x 2.4</td>
</tr>
<tr>
<td>Cucumber</td>
<td>3 days</td>
<td>x 6.6</td>
</tr>
<tr>
<td>Meat</td>
<td>4 days</td>
<td>x 7.5</td>
</tr>
<tr>
<td>Chips</td>
<td>7 days</td>
<td>x 25</td>
</tr>
</tbody>
</table>
Governments are also passing laws that require businesses to consider the product lifecycle and increase the recyclability of their plastics. For example, starting this year, businesses must register their packaging before they can participate in the German market. To be eligible, the packaging must be made with either recycled raw materials, or renewable materials wherever possible.

The idea behind the law is that if materials, such as plastics, are to be recovered for re-use, then responsibility must be placed on all producers across all industries. Also included in the new rule are increased recycling rates for plastics, which obligates city governments to meet targets by facilitating consumer and industrial recycling.

The European Commission has also passed a Europe-wide strategy to reduce plastic pollution and ensure that all plastic packaging across Europe is recyclable or reusable by 2030. Member states will be obliged to collect 90 percent of single-use plastic drinks bottles by 2025, through deposit refund schemes, for example; 55 percent of all plastic needs to be recycled by 2025.

THE FUTURE OF FOOD PACKAGING

Without a doubt, the food and beverage categories are the most challenging when it comes to developing packaging that meets strict food safety laws and consumer expectations. Whether we get to fully biodegradable or even packaging made solely from renewable resources – and at an industrial scale – is yet to be seen. However, it’s already possible to produce single layer plastic packaging from 100 percent recycled material without sacrificing quality. As these technologies improve and are scaled up, more plastic can enter the circular economy.

In our quest to identify new materials, what we must avoid, says Dr. Helen Williams, Senior Lecturer in Environment and Energy systems at Karlstad University in Sweden, is the “environmental sub-optimization of packaging, as this can lead to more food waste.” In reality, very often the food represents 90 percent of the climate footprint and the packaging 10 percent – or even less. In the case of meat, the meat may represent 99 percent of the CO2 produced. “We need to take care of the food we grow – taking into account all the energy, water and feed that went into it,” Williams reminds us. An important message as we prepare to feed an estimated 9.8 billion people by 2050.

Supporting the next generation of flexible packaging technology

Over the last couple of years, GEA has teamed up with several leading technology companies to explore packaging alternatives. In 2017, GEA helped co-develop and test a new full polyethylene (PE) laminate with an oxygen barrier. During testing, this recyclable mono material film proved itself in terms of its flexibility, strength and resistance to puncturing.

The recyclate from full PE laminate packs can be used in high quality, non-food packaging film and other products. While the shift to producing at scale with these new materials will take time, adoption should increase as more companies move to recyclable materials. Other GEA collaborations involve testing paper and biodegradable film.

Jacques Timmermans, Applications Specialist Packaging, GEA (left in picture), showing the application of the full PE laminate on a GEA SmartPacker CX400 during a live event in the Netherlands in 2017.
Scaling great heights to provide professional technical support in Asia Pacific

Pavitra Badiger, Technical Expert, GEA Flow Components, is on the production floor, in the air, online and hovering over customer tanks, using her in-depth technical and engineering knowledge to support customers and colleagues.
It’s a sunny Monday morning in Bengaluru – India’s Silicon Valley – and traffic is moving at a snail’s pace in this megacity of 12 million. Helmet firmly strapped on, Pavitra is making her way to work on her scooter among the menagerie of buses, cars and other two- and three-wheelers, all honking as they press on to reach their various destinations.

Just before 9:00 a.m. Pavitra walks into the five-year-old GEA office building, where the palm trees planted on each side of the front door are gently swaying in the wind. The Bengaluru complex includes a 25,000 square foot flow components manufacturing facility where hygienic valves, valve matrixes, pumps, air compressors and cleaning and aseptic technology are produced for dairy, brewery, beverage, pharma and personal care customers across Asia. Working in a tight-knit team of three professionals with APAC responsibilities, Pavitra is actually part of a much larger Product Management & Sales Support team based in Germany.

Settling down with a tea, she checks the emails that have come in over the weekend – nearly 50 in all – mostly from Thailand, Singapore, Indonesia and the Philippines which include questions from customers and GEA sales teams about identifying the right product for a specific application; requests for advice and feedback regarding technical solutions for customized products, as well as a few claims to be handled. She follows up several of the mails with a quick call to resolve them.

“In the past, customers and colleagues in Asia requiring technical support regarding flow components were served by GEA in Germany. It was taking them at least three to four days or even a week to respond to requests, given the time difference and other priorities. We knew this was not acceptable. It’s now my job to make sure that people receive a reply, along with concrete solutions, within 24 hours,” she says with a tone of seriousness mixed with pride.

Just a few minutes before 11:00 she beelines over to a small conference room to join a call with a potential Indonesian customer who wants to hear more about GEA valves for personal care applications. To prepare, she has put together a short presentation that she shares via her screen during the call. Her sales partner is sitting with the potential customer in Indonesia; it’s a good discussion lasting more than an hour.

After the call, Pavitra and her colleague discuss between them what is required for putting together the offer. The customer’s deadline to have a new solution up and running is tight. There is some question from her sales colleague about whether or not it is really possible. She phones the in-house production manager who assures her it is – assuming they get a signoff from the customer in the next two weeks.

Back at her desk, she answers another 10 emails and makes a few calls before a colleague comes by to tear her away from her desk for lunch in the company canteen. When she returns, she discovers that a colleague from marketing has left a stack of layouts on her desk with a note and a smiley face: “Nobody knows the flow components portfolio as
well as you Pavitra – could you review this brochure material and give us your feedback by tomorrow? She sets the small stack aside and puts a blocker in her calendar to review the material later in the day.

Her mobile rings and she’s called down to the production floor. Walking past the lean audit scores, KPI and kanban boards, she heads back to the flow components area where she needs to look at a valve matrix for a dairy production plant. After examining the work carried out, and going back over the customer requirements very carefully, Pavitra gives the team feedback and recommendations so they can complete the job and then carry out the necessary testing. As she turns to leave, three additional people have gathered behind her with questions, two of them regarding electric modules.

Before heading back upstairs, Pavitra stops by the canteen at 3:30 where several people are taking a short afternoon tea break. The room is buzzing and a crowd has gathered around one of the tables where two colleagues are embattled in a game of *carrom* – a popular “strike-and-pocket” tabletop game. Just as she moves closer to watch, her mobile rings. As she hurries out the canteen door to take the call, the room behind her explodes as one of the players has just added three points to his score by “pocketing” the red queen!

The call is from a large home care customer in Pakistan. She heads back to her computer so she can refer to his last mail. “I was the person who selected all the valves and cleaners for this project,” she explains. “I also traveled to their head office in Mumbai to conduct trainings for the teams and continue to support them whenever they have technical or commissioning queries.”

Next, she turns her attention to prepare for a visit to a food & dairy customer in the Philippines where she will provide valve-handling training. Part hands-on, part presentation, she reflects on the last training – which was actually for the same company, but in a different country – and makes a few improvements to the flow of the deck and tailors it to the Filipino customer’s specific situation and needs. “When you build up trust with a company in one country,” says Pavitra, “then their colleagues in other parts of Asia have more confidence that you will also be able to solve their challenges.”

By 5:45 p.m. the office has largely cleared out. Pavitra uses the near solitude to respond to any last emails that have come in during the day and to review the marketing material left on her desk earlier. Finished, she tidies up before heading out the door at 6:30 pm. Back on her scooter, she gives a wave to the man at the security entrance and then she’s off, arriving home to change clothes before heading to the gym for a quick workout.

Back home, she prepares a simple dinner for herself; just as she’s finishing the last bite, shortly before 9:30 p.m., her work mobile rings. She peers over at it and then picks it up. It’s a customer – a dairy operations production manager near Mumbai whom she’s known since she started at GEA five years ago. He's stressed out about an issue related to valve feedback failure, so Pavitra calmly asks him a few questions to see if she can diagnose the problem over the phone. After walking him through a few suggestions, the issue is fixed.

Thirty minutes later, after a little light reading in bed, Pavitra flips the light off. Just as she begins to recline against the pillow, her tired back muscles provide a quick reminder of last week’s foray up a plant ladder to review a valve for a customer in Chennai. In that instant, she remembers her father, who was also an engineer and always said to her, “It’s not an easy job, but it’s a great job!”

“How right he was,” she says to herself while taking a minute to honor him before going to sleep.
Art in engineering
The interior view of a GEA Rotary Dryer used for drying and cooling solid materials, particularly within the starch-, agro-food- and agro-chemical industries. The rotary drum consists of a gently inclined rotating cylinder, fitted with a series of peripheral lifters, or flights, which distribute and transport the material. As the solids are conveyed through the drum, a stream of hot or cold gas is brought into contact with the product, inducing the evaporation of the moisture and the cooling of the solid material.
For more than 50 years we’ve been engaged in vocational education and training to enable customers to operate increasingly complex machines. When it comes to the Industry 4.0 environment, conventional approaches to education are as much in a state of transition as the production landscape itself. The topic of learning has become more important than ever. After all, if companies want to operate at a highly networked and interactive Industry 4.0 level and profit from the associated digitalization of value-added processes, they will have to take into account the human factor, not just technology. This can lead to drastically new work requirements for some employees and inevitably, they will have to acquire new knowledge and skills. For personnel developers, this is exactly where the difficulties begin: How can they plan training for employees, given that what is actually meant by Industry 4.0 – and what it encompasses – is still quite unclear? And the technical development required is such that classical training hardly suffices. Needs analysis, knowledge mediation and knowledge transfer – conventional tools simply do not reflect new workplace conditions. The shelf life of the technology is too short, the previous processes too tedious and not sufficiently needs-based.

And actually, isn’t it better for employees to find their own way in open, complex and dynamic situations? To independently identify what knowledge and skills they need for specific requests; acquire those skills and then confirm them through their own successes? We call this action competence. In the best-case scenario – and this was true before Industry 4.0 – this is learned directly on the job. In practice, however, this can present challenges. Because, who wants to shut down their production plant? Or even worse, risk a crash?

This is exactly why Festo chose a different approach, equipping its facilities with learning factories. Here, we’re able to simulate complete value-added processes with typical industry components and manufacturing equipment and simplify them didactically. Our learning factories follow the principle of testing, while at the same time, focusing on so-called complete activities – from planning and execution to checking work results. This makes it possible to try out
and test new activities and work sequences, or even to fail, which is so important since failure often leads to much deeper understanding.

The didactic basis for this transfer of knowledge are playful scenarios from an employee’s actual area of responsibility. For example, maintenance staff should learn how to detect anomalies and potential errors while learning; production controllers should develop sequences that utilize capacity enabling production up to batch size 1 and team leaders develop suitable KPIs for these plants. During the process, learners inevitably encounter problems typical in their real-life jobs. Ultimately, the team finds solutions together, using standard Industry 4.0 technologies: The maintenance crew explores the possibilities of predictive maintenance and condition monitoring; the production controllers experiment with elements of dynamic capacity planning and the team leaders visualize processes via dashboards.

This is how we promote professional as well as social and methodological competence. And regardless of how they perform, the learner can see from their results how good their problem solving skills really were. They reflect, discuss the process and the solution to ensure they are able to put it into practice. It’s exactly this playful process that Festo is so successfully leveraging – despite the commonly held view that work and play have nothing to do with one another.

Self-reflection is a central element in Industry 4.0, which we highly value. People who try things on their own find solutions independently, which strengthens their self-confidence. We should use this process of teaching people how to value themselves to help employees become more responsible and capable. In this way, Industry 4.0 empowers people rather than taking something away from them.