GEA Engineering for a better world.

WHEN CHEMISTRY WORKS WITH ENGINEERING...

...the result is life-enhancing.

You have a Vision.
Let´s make it real.

GEA takes pride in delivering solutions that allow our customers remain competitive and profitable while delivering sustainability in all its forms and in the long-run. With our high levels of engineering skills, dedicated collaborators, long-term strategy and bold actions that support the global transition to a net-zero economy, we are the skilled supplier you need along the way.

The following pages will give you a clear picture of what our strategy, values and promise of *Engineering for a Better World* have been doing for manufacturers worldwide and what it could be doing for your business.

We'd love to hear from you to continue the conversation.

Sincerely,

Dr. Christopher Braun

Vice President BL Chemical Technologies
Liquid & Powder Technologies Division

Here for the better.

“Over the years, GEA has built up a strong track record as a responsible company, but we can do even more. We have raised our ambition level incorporating our entire value chain into this effort, our new climate strategy position us as the leader in our peer group. With responsible business management and concrete actions towards our 2040 net-zero target, we are pursuing the most comprehensive and ambitious climate strategy in the mechanical engineering industry, tackling both direct and indirect emissions.”

– Stefan Klebert, CEO of GEA Group AG

(Source: GEA raises the bar in mechanical engineering industry, on www.gea.com)

GEA helps you turn chemicals into solutions for a better world.

The global manufacturing industry knows the current decade will be decisive for the future of the planet.

To reach long-term solutions, companies worldwide need to strategically engage with the right partners to deliver sustainability and innovation, hand in hand.

GEA develops and promotes sustainable engineering solutions, rigorously focused on our sustainability strategy and objectives.

We have realigned our thinking and our direction to meet the needs of the global community and are proud to be taking a leading role in helping manufacturers worldwide do the same.

We define and deliver innovative and sustainable process strategies for these specific areas:

- **Circular Economy & Renewables**
- **Process innovation for white Biotech & Biorefinery**
- **Carbon Capture & Footprint reduction**
- **Rethinking Production & Energy usage**
- **Lithium & E-mobility**
- **Product Purity**

You are looking to recover value and reduce waste. We make Circular Economy go round.

Challenge: Resources are limited. How we deal with this reality is a growing concern worldwide.

Fortunately, all sorts of by-products or waste can be safely reclaimed to fit with the growing sustainability demands.

Our take: Introducing sustainability into the manufacturing process through our edge-cutting, energy-saving process solutions -for a real impact on both production costs and carbon footprint.

Tailor made and supported on our wide range of process technologies for solvent and waste recovery, valuables separation and industrial wastewater treatment.

Why GEA? Because we have the know-how: GEA future-proofs businesses in the face of limited resources.

We developed a Zero Liquid Discharge System. We've helped recover and purify starch, sugars, salts and lignin-and-oil solutions. We can recover solvents at their highest purity level. We are involved in the recycling of PET and other valuables. And much more.

You are committed to reducing your Carbon Footprint. We deliver the engineering.

Challenge: CO2 pollution, combined with high energy prices and fossil reservoir depletion, has increased the importance of energy recovery applications for all industrial processes.

Successful industrial companies worldwide focus on three key elements in production: process optimization, emission reduction and cost reduction.

Our take: GEA offers a comprehensive array of energy-optimized processes and energy recovery solutions for process industries.

We can help you achieve your goals while reducing your carbon footprint and improving your energy consumption. Also, we are pioneers substituting cooling refrigerants for natural refrigerants.

Why GEA? Because we take the initiative: With our Mechanical Vapor Recompression, we helped Pernod Ricard - Irish distillery- reduce CO2 by 40% at their Middleton Distillery.

We also supplied global glass manufacturer Saint-Gobain with Waste Heat Recovery Systems (WHRS) to improve energy efficiency and regain resources from their production process while reducing their emissions.

You want to offer holistic sustainable solutions. We are rethinking Production and Energy usage.

Challenge: Sustainability is the major challenge of our times.

Resources are becoming increasingly scarce while environmental-related norms and restrictions become stricter. A global shift on large-scale industrial production is needed to provide safe, high-quality products while consciously getting energy from renewable sources instead of fossil fuels.

Our take: Major fossil fuel savings and Carbon Footprint reduction can be achieved through substituting steam heated units by Mechanical Vapor Recompression (MVR).

SEnS – GEA's Sustainable Energy Solutions – will enable you to integrate process solutions with cooling & heating demands in the most energy-efficient way.

Why GEA? Because we maximize your production performance: We provide innovative solutions with short payback times. Reducing your total cost of ownership and maximizing your productivity while staying environmentally compliant.

Our approach leads to a reduction in primary energy use and avoids direct CO2 emissions, paving the way for a neutral carbon balance.

You take responsibility for our planet´s future.
We offer world-leading Biobased process solutions.

Challenge: Humanity´s advancement has been fast and impressive in the last couple of centuries. Sadly, at the cost of our Planet´s wellbeing.

Finding sustainable alternatives and developing renewable technologies capable of supporting the future of our civilization is of the utmost importance.

Our take: GEA is a worldwide leader supplier of key solutions for biotechnological processes, covering nearly every type of renewable resource and industry application.

From single components to complete biorefinery plants, we specialize on custom-developing and delivering the technologies needed for the efficient production of bio-based products for virtually all industries.

Why GEA? Because we are aware of our technologies´ possibilities: Our competences and technology solutions for the industrial biotech are broad, from alcohol to lactides and succinic acids.

We know how to adapt our technologies to our customers' needs and challenges to deliver solutions tailored to the product specifications and the market requirements.

You are working for the change to electric mobility.
We lead the way when it comes to lithium battery materials.

Challenge: The unsustainable dependence on fossil fuels, combined with rising energy prices and emission levels, have accelerated the adoption of lightweight vehicles and electric cars powered by rechargeable lithium-ion batteries.

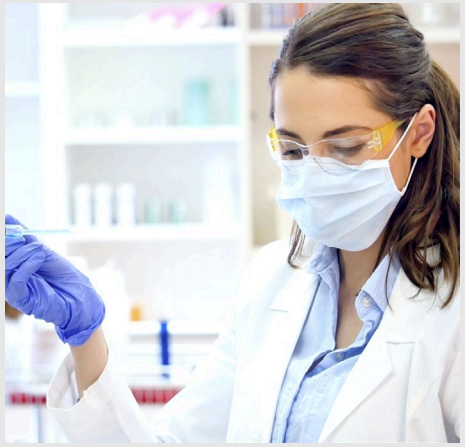
Our take: Evolving alongside the industry, GEA has developed an entire process portfolio for treating lithium salt compound.

We are world-leading experts in the spray drying of battery-grade powder for advanced lithium battery materials and pioneers in the field of Polymers. We help our customers build and power the new mobility.

Why GEA? Because we are a one-stop high-quality Supplier: GEA offers a large technology portfolio that not only covers the entire lithium production chain but goes beyond.

We support companies with lithium recycling among other operational aspects present at battery-producing plants. Our customers benefit from our innovative and pragmatic solutions.

You strive to achieve pure product quality. We help you reach the next level.



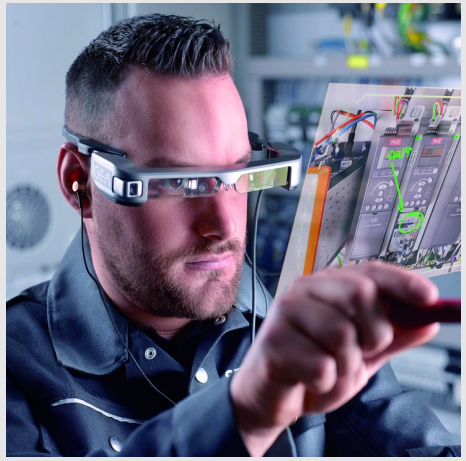
Challenge: Many industrial processes still involve ‘batch’ processes. But with scale economies being a factor, businesses looking to scale can’t afford to wait to finish one batch to begin the next one.

Our take: Continuous Processing enables manufacturing without interruption through the implementation of automated controls to manage variables such as temperature, pressure, level, flow rate and machine speed.

GEA uses continuous processing as part of the following technologies: separation, evaporation, distillation membrane filtration, crystallization and drying.

Why GEA? Because we constantly innovate while remaining high quality: GEA uses its proven know-how on continuous processing to help customers meet demands for faster product development, cost reduction, and increased manufacturing flexibility while focusing on quality along the whole product lifecycle -not just at “tested” stages– and understanding the capability of your processes.

You monitor throughout your production life cycle. We help you stay sharp and improve with GEA Service.



Challenge: A production plant is like the human body. In order to keep it healthy and optimize its performance, it's crucial to take good care of it.

Today, digitalization helps us stay sharp by closely monitoring all vital production parameters.

Our take: With 3D modeling, simulations and digital twin technology, we give customers the power to test, hone and improve their processes in a safe, virtual environment. By removing the unknowns from the equation, we ensure customers can bring their equipment and plants online quicker and with better results.

Why GEA? Because we are at your side at every step: At any phase of your life cycle, we'll be at your side, keeping your production plant fit and helping you tackle your sustainability challenges.

Our digital services like OptiPartner, InsightPartner or PerformancePlus work behind the scenes to optimize production, reduce greenhouse gas emissions and energy consumption, safeguarding water and reusing waste.

Leading the way towards a Bio-based industry.

The fastest and most significant advancement humanity has ever experienced has taken place over the span of the last few centuries -although fascinating, the demands made to the planet to keep up this pace have been, and still are, insatiable. Finding sustainable alternatives and developing renewable technologies capable of supporting the future of our civilization is of the utmost importance. It is here where the Bio-based economy emerges as a promising alternative, offering undeniable opportunities not only today but in the decades to come.

GEA is a worldwide leading supplier of key solutions for biotechnological processes, covering nearly every type of renewable resource and industry application. From single components to complete biorefinery plants, we specialize on custom-developing and delivering the technologies needed for the efficient production of bio-based industrial sugars, lignin, cellulose, hemicellulose, biofuels -including stillage processing-, biopolymers and products for the food and feed industries.

Our competence and technology solutions for the industrial biotech include:

- Centrifugal separation.
- Crossflow filtration.
- Homogenization.
- Evaporation.
- Distillation.
- Crystallization.
- Drying.

We deliver solutions tailored to the product specifications and the market requirements. Just as we did when supporting a global Norwegian biochemicals leader in the installation of a new plant for producing Lignin, helping them increase their total production and reduce their water use. Or when collaborating with the largest paper pulp and wood products company in Europe and their biorefinery aimed at converting solid wood into next generation biochemicals.

Delivering lithium, end-to-end.

Lithium, the soft, silvery-white metal has become a critical component in hundreds of applications, including the auto industry's new shining star – the Electric Vehicle (EV).

GEA's broad portfolio for the production and processing of lithium begins right at the mine, goes on to refining the intermediate products and ends with the dried powder that needs to be at least 99.5% pure to meet the standards set for battery material.

We are supporting customers around the world, like the Australian lithium-manufacturing pioneer, whom at its Talison Greenbushes lithium mine, became the first to ever cover all end-to-end process steps in lithium recovery.

What can we say about Shenzen BTR New Energy Materials, the largest lithium battery cathode material supplier in the world, who has recently presented GEA with their "Award for Excellent Supplier" -acknowledging our top-level performance and quality in addition to our delivering of innovative and pragmatic solutions.

Our portfolio has a lot to offer:

- Lithium concentration from brine or spodumene
- Lithium salt crystallization and purification
- Impurity removal by centrifugal separation
- Drying of lithium salt compounds
- Spray drying of lithium cathode & anode materials
- By-product recovery from lithium processing
- Process development for lithium recycling

Our process specialists are available for both test work and process development. Our skilled project managers understand customers' specific KPIs and bring projects on stream and on schedule while helping customers meet strict environmental regulations, rigorous permitting processes and finding solutions to water scarcity, including Zero Liquid Discharge (ZLD) systems.

GEA

Advanced technologies & solutions for Biorefineries.

The progress that fossil fuels and oil have made possible in our civilization has also meant an insatiable resources demand that is now environmentally unsustainable.

It is here where biorefining -the process of converting biomass into diverse biobased products and components for their use across sectors- turns into a critical pillar to sustain life as we know it and reduce carbon footprint across all industries, even in the chemical segment.

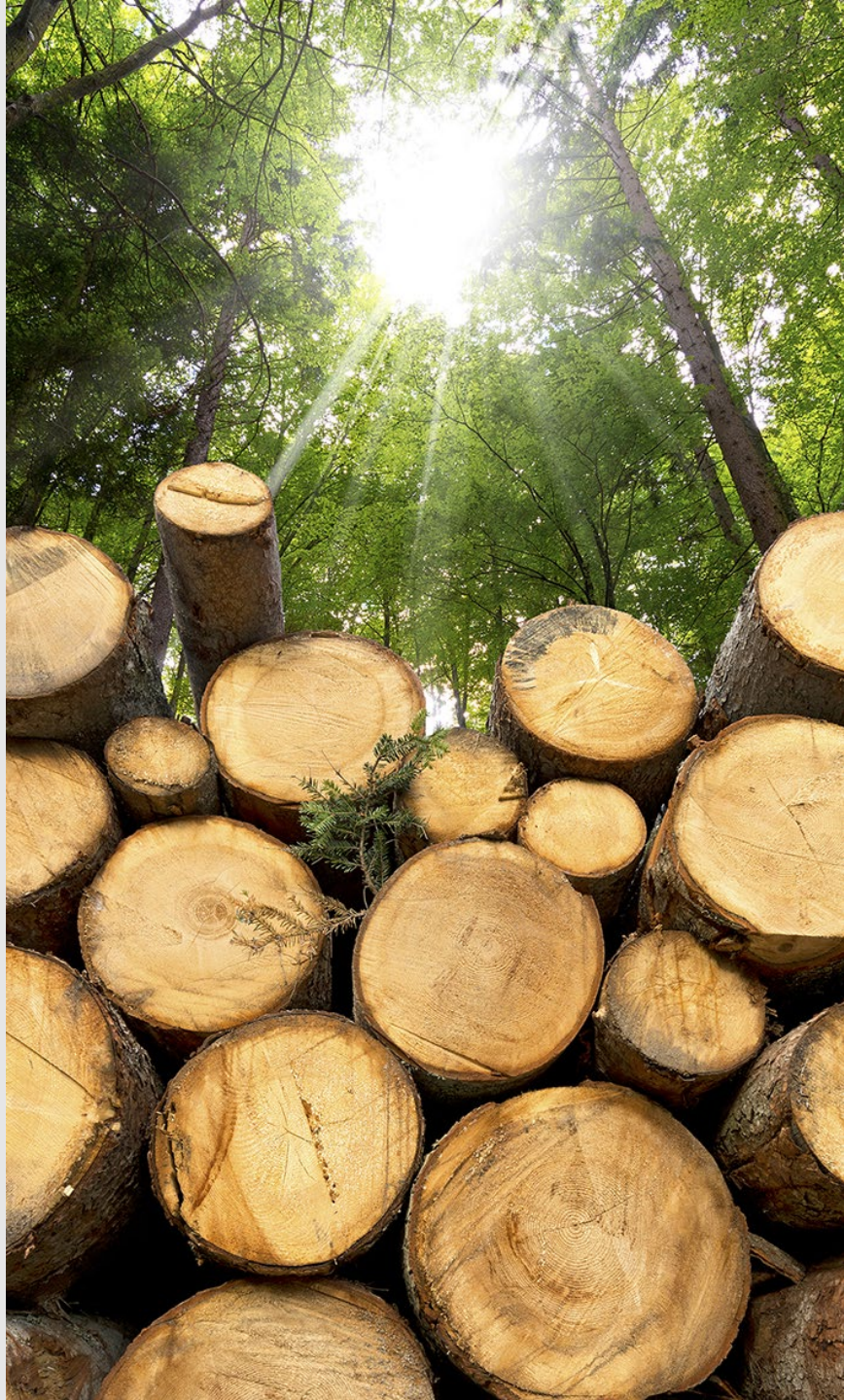
Since the beginning of the 21st century, GEA has been increasing its experience with biobased production processes. We have delivered bioethanol plants as well as plants to crystallize succinic acid or purified lactides and much more.

In 2019 we helped a French biotechnology start-up launch and today, GEA is helping them scale up to zero-waste industrial production and to transform waste from sugar beet processing into a range of new, high on added-value molecules to produce building blocks for chemical products used in the food, pharma, chemical and agronomy industries.

GEA has also been contributing with a new plant in Germany, here, pulp from wheat straw -of the same quality as wood-based pulp and at competitive costs- is being produced and its by-product can be used as a substitute for petroleum-based chemicals. GEA is contributing with its evaporator technology to reduce the consumption of water, energy and chemicals.

Thanks to strategic partnerships with customers and consortia, GEA has established and tested biorefinery models for producing acids from renewable feedstocks, rubber from dandelions and protein from insects as well as leveraging microalgae for its use in biopesticides and feed -to mention some.

Today, GEA solutions and biorefinery experience cover nearly every type of renewable resource and industry application. Our customers benefit from a network of professionally staffed test centers, laboratory facilities and pilot plants that enable us to support them as they progress and make the shift to industrial production.



GEA

Raising the bar and lowering the cost of MAP Fertilizer production.

As the world's population continues to grow, the reliance on fertilizer to safeguard global crops, deepens.

Ecologically speaking, the challenge is to produce enough food without increasing the environmental footprint. This means that the fertilizer sector, together with the growers, need to make a more efficient use of nurturing resources and cause less negative environmental impact.

GEA is helping manufacturers meet these tough challenges while reducing their costs.

MAP (Monoammonium Phosphate) is an increasingly popular type of water-soluble fertilizer which contains the most phosphorus (crucial for the establishment of the root system at the beginning of the growth period) of all common solid fertilizers.

Since it is liquid, it can be applied in exact doses through the irrigation system.

GEA has developed and implemented a groundbreaking solution to produce high quality soluble MAP fertilizer that eliminates the need to additionally purchase purified phosphoric acid and then integrate an additional purification line.

This solution is successfully being used by a GEA customer in Eastern Europe who is now able to avoid considerable capital and operating costs thanks to the use of non-purified, merchant-grade phosphoric acid and achieve with it a high-purity MAP fertilizer with a high market value.

With more than 100 years of experience in crystallization alone, GEA Plant Technologies are designed to meet the requirements of diverse fertilizer applications and today, GEA is playing a leading role in creating the prerequisite for a responsible use of fertilizers.

GEA

Let’s make it real, get in touch.

The chemical and manufacturing industries play a particularly important role in the pursue of a global CO2 reduction. GEA is committed to help manufacturers worldwide rethink processes and embrace more sustainable, less wasteful and more efficient and cost-effective procedures and processes towards a better world and a healthier future.

We know that every company is at a different stage of its journey and has a unique set of variables and challenges to contend with. We are here to face them together with you. We are your long-term partner on your quest to reach your long-term goals.

Contact GEA today to start our conversation about your future.

We will be delighted to tell you about the industries we have been helping all along around the globe and the ways we are leading R&D innovation in a myriad of fields.

But mostly, we would like to hear about what matters the most to you right now and how we can help you with it. ACHEMA 2022 would be an ideal chance to meet you or your team members personally – see you there, hopefully.

Dr. Christopher Braun

Vice President BL Chemical Technologies

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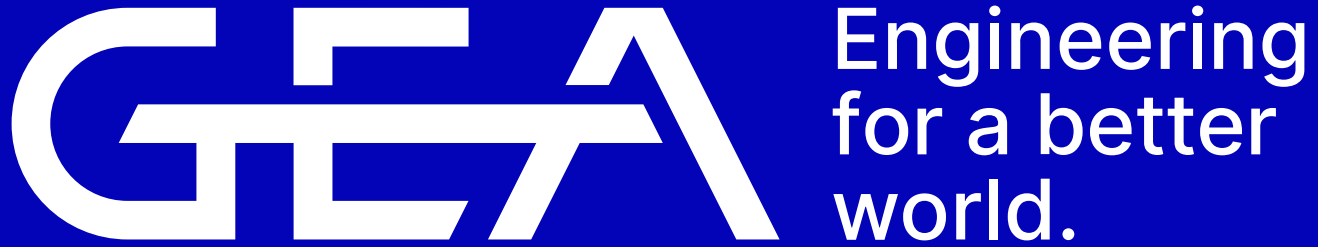
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