



Groundbreaking textile recycling technology

Fast retail has led to shorter life cycle for garments, with millions of tons of fabrics piling up in landfills. This makes textile waste one of society's pressing environmental issues. Today, only a minor share of end-of-use clothing is recycled. Sulzer partners with H&M to control and develop Worn Again, an innovator in textile recycling technology, which aspires to enable full circularity in the garment industry.

Who doesn't love the sight of a decluttered wardrobe? Since Netflix made the renowned tidying expert Marie Kondo and her organizing method popular across the globe, decluttering has become an expression of contemporary lifestyle. Even more so in times of the pandemic, with more people staying at home and tidying up.

But what to do with all the pieces that – in the words of Kondo – no longer “spark joy”? Although secondhand fashion is increasing in popularity again, most clothing still ends up being thrown away.

Three-quarters of clothing end up in landfills

Of the more than 60 million tons of natural and synthetic textile fibers that are produced for clothing every year, 73% is incinerated or landfilled, according to the Ellen MacArthur Foundation.

While it is common in many countries to recycle materials such as plastic, glass and paper, it is estimated that only 1% of clothing is recycled into new garments. Why is that? Textiles are rather complex systems containing various types of fibers, dyes, fillers and additives, making them difficult to recycle into virgin-like raw materials.

Initiating the textile revolution

As an expert in separation and chemical recycling technologies, we have taken up the challenge of solving this pressing environmental issue. Sulzer and H&M together control the UK-based company Worn Again. The teams are working on a unique textile recycling process to convert textiles at their end of use back into virgin-like raw materials.

Scaling-up a novel recycling process

Sulzer provides the equipment, technology and expertise which is combined with Worn Again's unique solvent technology to form the heart of the process. Converting end-of-use polyester and cotton garments into polyester pellets and cellulosic pulp that can further be re-spun into new fibers, our technology closes the loop in the textile industry.

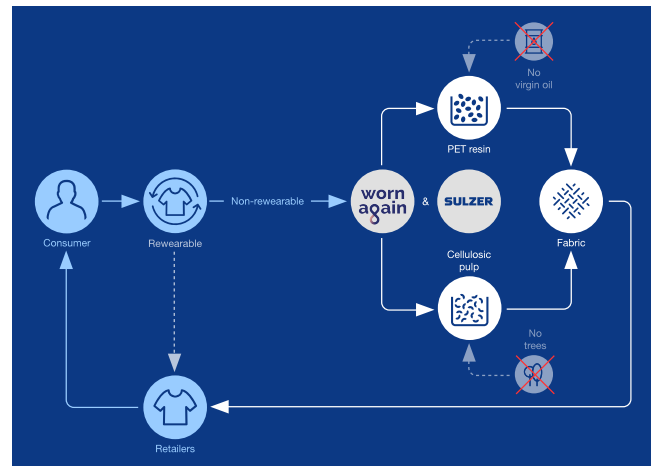
After extensive R&D, the results from the pilot plant have been promising. Our experts are now engineering a larger demonstration plant to further scale-up the technology to an output of a thousand tons a year, the final proof of concept before commercialization.

Sulzer and H&M are just about to allow your old clothes to be Worn Again!

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From old to new

Sulzer, together with H&M and Worn Again, has developed a new recycling process for the textile industry. The key is separating and recovering PET – a common component of clothes – and cotton or other cellulosics from end-of-use textiles. But the chemical processes behind this novel technology are complex.



The new recycling technology will enable textile circularity.

Polyester textiles are complex materials containing different types of fibers, dyes, fillers and additives. PET is a type of polyester and serves as the basis for many clothes. However, most garments consist of a mix of different materials; the majority are so-called PET/cotton blends.

How chemical recycling of textiles works

The chemical recycling process is complex: In the first step called “dissolution”, solvents are used to dissolve the PET material and remove dyes, catalysts and other organic additives. Other chemicals remove the dyes from the cellulosic fibers.

The insoluble additives are released as fine powders and removed in a filtration process. The result is two products: 100% PET resin chips on the one hand and a cellulosic pulp on the other hand, which can be re-spun into a cellulosic fiber. In other words, the output is virgin PET and cellulose that can be reused to produce new garments.

The teams are also researching how to treat the by-products that arise in the process (such as dyes or surface finishes) and to refine them into useful end products instead of incinerating or landfilling.

Unique recycling technology

Our technology is unique because it does not actually change the chemical composition of the material and separates the PET and cotton/cellulose in one process in contrast to other recycling practices, saving energy.

With the new demonstration facility, the teams will further develop the technology and scale up operations to make it commercially available.



Cutting-edge Swiss biopolymer and plastic recycling technologies

Human creature comforts – your clothes, your computer, your car – depend heavily on plastics and their many advantages. But our planet is being overwhelmed with the resulting waste problem. Advancing biopolymers and plastic recycling technologies can help to resolve this dilemma. Sulzer, the leading provider of polylactic acid (PLA) solutions, is expanding its R&D capabilities in Switzerland. The company is investing in testing facilities to support the scale-up and commercialization of pioneering biopolymer processes and plastic recycling technologies.

Today, the world produces more than 380 million tons of plastics every year. It is a valuable and versatile material with ever-growing application areas, but the rapidly increasing production of disposable plastic products is stretching our ability to deal with the waste.

A lot of plastics end up back in our natural environment, accumulating on our shorelines, in our oceans or in landfills and persisting for decades. Today, plastic pollution has become one of the most pressing environmental issues.

Establishing a new dedicated R&D facility for biopolymers

The detrimental impacts throughout the life cycle of fossil fuel-based plastics – land and water pollution, carbon emissions and toxins released upon incineration – underline the need for alternative biopolymers made from renewable resources.

Sulzer is a leader in this field. We are putting our money where our mouth is by expanding our R&D center located in Oberwinterthur, Switzerland. The company's biopolymer technology portfolio brings highly sustainable and alternative solutions to the market – with significant social, economic and environmental benefits.

Scaling-up the production of bioplastics

Biopolymers like polylactic acid (PLA) and polyethylene 2,5-furandicarboxylate (PEF) provide a sustainable alternative to conventional plastic materials. In contrast to PET, these materials are based on renewable feedstocks such as sugars, starches or agricultural waste.

As a [leading one-stop provider for PLA processes](#), Sulzer has already supplied large commercial-scale PLA plants to customers. Our teams have also produced lab-scale batches of novel polymers with unique barrier and tensile properties, such as PEF and PLA copolymers, with new and exciting physical properties that greatly expand the field of potential application of biopolymers (beer bottles! complex packaging!). Industrial partnerships emphasize the potential of this technology, and production will be scaled up with the new pilot plant in the first half of 2021.

Increasing the recycling rate of plastics to 50%

Despite rising efforts in the field of biopolymers, most plastics are currently non-biodegradable and non-recyclable, ending up in landfills and incineration plants.

To tackle this issue, a growing number of companies around the globe are developing chemical recycling technologies. It is expected that these processes can increase the recycling rate of all plastics from today's levels of around 15% to 50% by 2030.

Building a pilot plant for plastic recycling technologies

In 2019, Sulzer [demonstrated the uniqueness of its fractionation technology](#), used as an essential purification step in plastic-to-liquid (PtL) recycling processes of industry innovators like Danish company Quantafuel. Quantafuel developed a solution to recycle plastic packaging waste into usable fuels. We will now take the next step to further develop and expand the fields of application of this technology, with a dedicated new pilot plant in Allschwil, Switzerland.

The plant is designed to upgrade the outputs from various plastic recycling processes by separating and/or purifying them. These purified outputs will be used as fuels or monomers, enabling circularity for plastic waste. We are already testing the process on our existing units as we prepare to begin operations at the new plant in the second half of 2021.

Advancing the sustainable production of plastics

Our partnerships with various universities, such as our Swiss neighbors ETH Zurich, along with start-up companies, customers and other stakeholders in the value chain allow us to decrease time to market for these new solutions.

Reducing carbon footprints and negative environmental impacts is what drives Sulzer's innovation program. We help turn ideas into commercially viable reality, to foster a circular economy.

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“Making our way towards a circular economy”

Torsten Wintergerste, Division President Chemtech, outlines the stumbling blocks on the journey towards a world with more sustainable plastic solutions – and how Sulzer innovation helps find a way out of the plastic crisis.



Our R&D facility in Winterthur for the production of biopolymers.

Why don't we see more bioplastics and plastic recycling technologies in use today? What are the obstacles?

The engineering of plastic materials has been constantly evolving since the Second World War, to replace wood, glass or metal products with inexpensive plastic equivalents. These engineered plastics are not easy to recycle, nor can they be easily replaced with bio-based alternatives with similar physical properties – produced at reasonable costs. While promising technologies exist at laboratory or pilot scale, it takes time and effort to scale up and improve these processes for the mass market. Furthermore, it requires all players within the value chain to optimize and streamline their processes. Public policies favoring the use of bio- or recycled materials can accelerate this trend. Nowadays, there is fortunately a global consciousness of this issue that is enabling a fast-paced transition to the desired circularity for plastics.

What is so special about Sulzer's technology to produce biopolymers?

Biopolymers are produced from natural feedstocks and are thus degradable. These feedstocks are transformed by biochemical or chemical processes into biomonomers – the building blocks of biopolymers. As biomonomers consist of natural resources, they contain various impurities that must be removed prior to the polymerization process. Our technology consists of highly efficient process steps to produce and purify the biomonomers for conversion into biopolymers. This exclusive production platform is suitable for a wide range of very promising biopolymers (such as PEF, PLA and potential copolymers) that can be used for packaging, agricultural, transport and medical purposes.

The keyword of our newly designed plants is flexibility. Our facilities can create pure biopolymers of controlled length, structure and properties. Furthermore, our technology can process various raw materials – while maintaining Swiss quality and accuracy!

Please tell us more about Sulzer's R&D program for plastics.

Our R&D program is based on three pillars: functionality at reduced weight thanks to our foaming technology, closed-loop recycling of plastics, and sustainable production of biopolymers. Behind our program is a team of fully committed process specialists, driven by the ambition to provide a solution to today's environmental challenges. We all strongly believe that our efforts to develop advanced process solutions for polymeric foams, biopolymers and for the recycling of conventional polymers is the right path forward.

Cosmetic packaging made from recycled plastics and biomaterials

Historically, the beauty industry relied heavily on virgin oil-based plastics for packaging. Now, however, the industry is increasingly moving towards sustainable solutions. Geka offers cosmetic packaging that is made of recycled plastics and develops solutions using bioplastics from non-edible sources.



Sulzer's Applicator Systems (APS) division focuses on offering beauty packaging made from recycled plastics, so-called PCR (post-consumer resin) materials, and bioplastics from non-edible sources.

In 2020, Geka launched its "Reborn" green packaging collection for eye and lip makeup, made exclusively from sustainable components. The mascara bottles are based on 100% PCR PET (polyethylene terephthalate), the caps on 100% PCR PP (polypropylene), and the fibers for brushes are derived from non-edible castor oil. Despite limited global production capacity for PCR and high demand, Geka's goal is to fully integrate PCR into its components in the near future.

Like recycled plastics, biomaterials offer great potential for the future, with an average 30–50% lower carbon footprint than their fossil equivalents. However, they are considered more of a medium-term solution since they require changes to product designs and tools. Being part of the Sulzer group is a great advantage for APS, since its sister division Chemtech is a leading technology provider for bio-based plastics. Using this know-how and network, Geka will continue its efforts to make beauty packaging more sustainable in 2021 and beyond.



Bringing water to drought-affected areas

Brazil's hot climate poses major challenges for the country's water infrastructure. Large areas such as the Greater São Paulo metropolitan region are suffering from the consequences of water scarcity. The Brazilian water company Sabesp looked for a partner to increase the water supply and bring relief to millions of people. Not many suppliers were up for the job – but Sulzer was.

The land of carnival, football and eternal sunshine – the largest country in South America evokes in many a traveler enticing reveries of summer, sun and fun. But while this notion paints a perfect picture for tourists, it poses a problem for millions of people who call Brazil their home.

Three million Brazilians without access to safe water

Drought has the country in a firm grip, as climate change aggravates existing water scarcity. According to the global nonprofit organization Water.org, three million people in Brazil live without access to safe water, and a staggering 24 million lack access to sanitation. Frequent downtime in water supply, disruptions in service and deficiencies in drinking water systems are challenges that Brazilians face in their everyday lives.

Brazil's government is building new infrastructure to bring relief to its semi-arid areas where water scarcity is taking its toll.

A project of superlatives

With its 22 million inhabitants, Greater São Paulo is one of the largest metropolitan regions on Earth. The Brazilian water company Sabesp took ambitious action to build a new source of water supply for the region. The São Lourenço system brings 6'400 liters of drinking water per second – enough to fill roughly ten Olympic-size swimming pools every hour – to the residents of seven municipalities.

The project involved the construction of a brand-new water treatment and storage facility on a mountaintop close to the city. Water for the plant comes from the Cachoeira do França reservoir, 83 kilometers away and several hundred meters lower in altitude.

The one company up to the job

Several large pumps located at the reservoir intake station would transport the water from the reservoir to the new treatment facility. Back in 2018, the construction consortium had to find a partner with the ability to manufacture pumps capable of delivering up to 6'400 liters per second and a head of 365 meters. Not an easy task.

After conversations with several original equipment manufacturers, only Sulzer was able to demonstrate the necessary experience, engineering and manufacturing capabilities to design, test and supply pumps of this size.

Five giant Sulzer pumps

Sulzer manufactured the giant pumps and tested them at full load on our in-house test bed. With a 500 mm discharge diameter, 970 mm nominal impeller diameter and an output of 1'500 liters per second at a 365-meter head, the result was five of the largest pumps ever installed in the country.

“I remember we had to carry out the customer witness tests at night to avoid overloading the local electricity supply because the pumps were so incredibly big”, remembers Claudio Wada, Sales Manager Engineered Water at Sulzer.

Meeting water demand for the next ten years

Sulzer specialists also oversaw the installation and commissioning of the pumps at the site.

Sulzer is using technology to bring water to millions of people in the Greater São Paulo metropolitan area, meeting projected growth in water demand for the next ten years at least.

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Essential services for critical infrastructure

Large infrastructure requires frequent maintenance and care – particularly in times when it is overtaxed, such as the COVID-19 pandemic. During lockdowns, authorities put their trust in Sulzer to continue providing essential services for the infrastructure we rely on every day. Sulzer's skills, proximity and speed helped a UK hospital keep two operating theaters open over a winter weekend.



Our employees worked selflessly throughout the lockdowns – with stringent health and safety precautions in place – to keep power, water, medical and transport infrastructure up and running around the world.

Free health checks for energy equipment in hospitals

When medical facilities were increasingly confronted with COVID-19 patients and fast approaching capacity limits, Sulzer's service teams stepped in to offer free health checks for energy equipment in hospitals. This enabled healthcare professionals to focus on their important work without having to worry that their infrastructure might fail.

Sulzer's service specialists in the UK offered free support to the National Health Service. UK hospital estate managers and facility management providers seized this opportunity and called on Sulzer to carry out checks and maintenance on critical plants and equipment, thereby guaranteeing uninterrupted performance amidst the increasing strain on medical infrastructure.

Emergency weekend repairs at a hospital

Towards the year-end, Sulzer's UK service team received a breakdown call from a hospital in Southern England. Two fire alarms had gone off because both their motors had failed, leaving the hospital unable to use two operating theatres.

This would be dangerous in any situation but even more damaging during the coronavirus crisis – it was clear that the hospital needed urgent assistance. When the customer contacted Sulzer, the team went the extra mile to source and supply a new motor within 50 minutes following the request for assistance.

Operating in these difficult times has meant modifying working practices, but Sulzer remained committed at all times to providing a flexible and high-quality service – while protecting the safety of staff and customers alike.



Artificial intelligence solution for solar power plants

Climate change calls for innovative, energy-efficient solutions to reduce CO₂ emissions. Renewable energy sources like solar thermal power improve today's carbon footprint. To manage equipment at such plants efficiently and be one step ahead of outages, Sulzer supports Atlantica's solar power plants with the artificial intelligence of its advanced data analytics platform, BLUE BOX™.

With its thousands of reflecting parabolic troughs facing the sun, the site looks like a giant mirror in the middle of the desert. Located in one of the hottest areas of North America, the solar power plant in the Mojave Desert generates 280 megawatts of clean electricity to power roughly 90'000 homes in the region. A similar picture on the other side of the Atlantic Ocean: KaXu Solar One in South Africa uses the power of the sun to generate 100 megawatts of electricity for the population.

Preventing 665'000 tons of CO₂ emissions per year

The two solar plants belong to the diversified portfolio of Atlantica, a global player with sustainable infrastructure assets all over the world.

Together, the two facilities prevent the release of 665'000 tons of CO₂ into the atmosphere every year. That's the same amount of emissions that forests the size of Yosemite National Park can absorb in one year.

Using the power of the sun

Several energy scenario studies consider concentrated solar power (CSP) to be a key sustainable source of energy to meet ambitious climate protection goals.

CSP systems use mirrors or lenses to concentrate the sunlight onto receiver tubes. These tubes contain a heat transfer fluid that is pumped around the whole site. Together with boiler feed pumps, the heat energy is used to create steam, which drives a generator to produce electricity. Pumps therefore play a vital role in ensuring the functionality of the entire plant.

One step ahead of outages

Because thousands of people depend on this plant for power, the operators are keen to run their plants as efficiently as possible and avoid downtimes. For this reason, Atlantica invested in Sulzer's BLUE BOX advanced data analytics platform to monitor and optimize the performance of its plant.

BLUE BOX uses machine learning to interpret live pump operating data. Based on this data and with the know-how of Sulzer experts that comes with the solution, the system supports plant operators to optimize operation and maintenance of their pumps.

It detects and flags anomalies, estimates the remaining lifetime of the equipment and helps make data-driven decisions for preventive maintenance.

More uptime and less operational risks

Collaborating with Atlantica's own data science team, Sulzer and its digital solution increases uptime, improves reliability and mitigates the operational risks of solar energy plants, leading to cost savings and higher revenues.

Connecting the Mojave and KaXu plants to Sulzer's cloud solution was just the first step: Atlantica plans to implement BLUE BOX in all its assets worldwide as part of its digitalization efforts.

The future of energy is clean and renewable. BLUE BOX enables companies like Atlantica to get the most out of their installations around the globe. By optimizing the performance of these sustainable energy sources, Sulzer helps to create a brighter future.

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“Adding value by combining human and artificial intelligence”

Sulzer’s solutions play a critical role in infrastructure all over the world where downtime means profits lost. Marc Heggemann, Head of Group Commercial Digital Solutions at Sulzer, explains how artificial and human intelligence together optimize the efficiency of assets and predict equipment failures.



Can artificial intelligence and algorithms predict an outage of a plant?

It needs machine learning, but that’s not enough. Why? The amount of data is often limited, and quality is sometimes not good enough, since operators lack a complete history of pump operation and maintenance. Hence, machine learning needs to be combined with physical pump modeling to increase confidence in the results. That’s where Sulzer comes into play: as an OEM, we already have the required pump knowledge in-house. It takes thorough expert understanding, or human intelligence, of how the physical equipment design and operation are represented in a so-called “digital twin”. Building on that, our equipment optimization specialists support customers with the data analysis required to draw the right conclusions.

How does BLUE BOX work in practice?

BLUE BOX is an early detection system flagging anomalies on key performance indicators of pumps. These anomalies are often not uncovered by threshold alert systems on individual sensors until it’s too late. Contrary to an instant alert, anomaly detection occurs early enough to allow preventive maintenance action. Let me give you a real-life example. After implementing BLUE BOX at Atlantica’s plants, the system flagged four anomalies on a single pump over a couple of days, indicating that the performance of the asset deviated from its healthy state.

This finding was confirmed by Atlantica’s on-site data science team which also found an abnormal event by analyzing the data. The analysis of the motor power and shaft speed afterwards identified a bearing that was close to failure, yet far below the alarm limits for vibration and temperature in conventional methods. The customer was able to proactively order spare parts, mitigating the risk of failure and saving money.

Why should a cost-conscious plant operator invest in such an artificial intelligence solution?

If you look at the total life cycle cost of the equipment, the investment in such AI solutions in relation to potential savings is rather small and makes a valid business case. We add value by supporting our customers in their decision-making processes through customized cost-benefit analyses. The unexpected failure of critical pumping systems can easily have implications exceeding USD 100’000 per occurrence. BLUE BOX monitors equipment and flags anomalies before failure happens, thus avoiding costly downtime and reducing operational risks. Combining these results with our expert knowledge, we can recommend the best and most cost-efficient solution. This allows the customer to extend equipment lifetimes and reduce life cycle costs, typically achieving payback within months.