DCAT®

THE SUSTAINABILITY LEADERS

A Sponsored Content eBook from the Drug, Chemical & Associated Technologies Association (DCAT)

SEPTEMBER
2023

A Thank You From the Executive Director

Margaret M. Timony
Executive Director,
Drug, Chemical & Associated Technologies Association (DCAT)

Dear DCAT Members:

Companies in today's global Bio/Pharmaceutical value chain understand the need to ensure a healthier and more sustainable environment for the planet and its citizens. Many in the industry are driving innovation and investing in sustainable manufacturing practices by using renewable energy sources, reducing water usage, and minimizing the waste created by production processes.

Most importantly, sustainability requirements are quickly becoming an important part of supplier evaluation and selection. For that reason, we wanted to provide those in our DCAT Member Company Community an opportunity to share their sustainability initiatives.

It is our hope that this e-book will be helpful to those interested in the challenges facing today's Bio/Pharmaceutical industry. Thank you to our Member Companies who contributed to this publication. The important efforts you have made towards sustainability thus far are truly appreciated.

Sincerely,

Margaret M. Timony

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PCI PHARMA SERVICES: THE JOURNEY OF GENERATIONS. WE ARE COMMITTED

About PCI Pharma Services

PCI Pharma Services is a leading global CDMO, providing integrated end-to-end drug development, manufacturing, and packaging solutions to increase product speed to market and opportunities for commercial success. PCI brings the proven experience that comes with more than 90 successful product launches each year and over five decades in the delivery of supply-chain healthcare services. With 30 sites across North America, Europe, the UK and Australia, and over 5,300 dedicated employees, our mission is to bring life-changing therapies to patients. Leading technology and continued investment enable us to deliver development to commercialization solutions throughout the product lifecycle, collaborating with our clients to improve the lives of patients globally.

Our Commitment to Environmental Social Governance (ESG)

At PCI, our values such as accountability, flexibility, and excellence inspire us as we help our customers develop, manufacture, package, and deliver critical medications for clinical trials and the public at large.

We embody these values in our global Environmental, Social and Governance (ESG) Program, which serves as the foundation for our sustainable business

practices. Today more than ever, businesses are uniquely qualified to address the impacts of climate change, resource management, social inequality, and commitment to the community, and we believe in acting directly toward creating the changes we want to see in the world.

Our ESG program consists of nine impact categories representing our pillars of change. Our measuring and reporting are done according to internationally recognized standards such as the Global Reporting Initiative (GRI), CDP, SBTs and IRIS+. We have developed global, time-bound targets aligned to each impact category in order to hold ourselves accountable and accelerate change. These ESG targets and KPIs will keep our efforts focused, authentic, ambitious, and results-oriented.

Our ESG journey is constantly evolving as we improve efficiencies in data capture and program implementation and execute our action plans across the PCI network. Every employee at every site can make a positive impact by turning their ideas into action.

Notable Achievements

- More than 100,000 companies were assessed by EcoVadis in the past year. PCI has been awarded a Bronze Medal and has maintained its position among the top third of all companies rated for two consecutive years.

- Our Carbon Footprint targets are aligned to the Science Based Targets initiative (SBTi) and the Business Ambition for reducing global warming to 1.5 °C. This calendar year, PCI has submitted targets for validation.
- PCI has committed to achieving Net-Zero supply chain by 2045 and joined a UN-backed global campaign to halve global emissions by 2030.
- One quarter of PCI's global network of facilities are purchasing 100% renewable energy. This is a 100% increase from the previous year as we make progress on our target of all sites purchasing 100% renewable energy by 2030.

Creating a More Sustainable Supply Chain

PCI is committed to sustainable procurement and creating a more sustainable supply chain, which ensures that our core ESG values extend throughout our supply chain. Our approach to Sustainable Procurement integrates specifications, requirements, and criteria for our supply-chain partners that contribute to both environmental and societal impacts.

At PCI, we recognize our need to implement policies and strategies to future-proof our procurement practices primarily around scarcity in supply due to climate related risks, the ability to cope with the demand of emerging markets, pressures brought upon by cost, and the ability to reduce cost through reductions in energy consumption and waste.

We build supply-chain resiliency through supplier collaboration, greater visibility, rigorous risk management and innovation. Collating, analyzing and leveraging our supply-chain data allows us to make decisions faster, improves accuracy, and helps identify and solve inefficiencies. Successful supply-chain risk management starts with understanding what's happening at each stage of our supply chain, from sourcing materials to manufacturing, packaging, and final distribution and driving continuous improvement against our Sustainable Procurement targets.

We can create a sustainable future for generations to come, building productive and effective business relationships based on trust, mutual respect, and common values.

Supplier Engagement

PCI believes an effective Sustainable Procurement Program is based on collaboration and meaningful supplier engagement. We expect our suppliers to share our ESG priorities, by ensuring that working conditions are safe, workers are treated with respect and dignity, and business operations are environmentally and socially responsible. Our guiding principles are outlined in our Sustainable Procurement Policy.

To understand the sustainability performance of our supply chain, we partnered with the world's largest sustainability rating platform, EcoVadis, and invited key suppliers to conduct their own assessment. This provides us with insight into our own supply chain, enabling us to initiate corrective actions along with training exercises directly through the platform.

We work closely with long-standing suppliers to clearly communicate our expectations, and only approve those who are regularly audited by the Pharmaceutical Supply Chain Initiative. If any issues are identified during an audit, the supplier is required to prepare a Corrective Action Plan and resolve all issues within an agreed upon timeframe.

Our vision is to establish an ethically driven, sustainable, and quality-centered supply chain. We aspire to work with suppliers who share our commitment to sustainability and align with our values and vision.

Together, we strive to raise the standards of sustainability, promote responsible practices, and foster positive social and environmental impacts throughout our operations and supply chain.

Supply-Chain Diversity

Supplier Diversity is a critical component of creating an inclusive supply chain, and we have committed to increasing our spending on diverse suppliers in the US year-over-year as part of our Sustainable Procurement program. Globally, we monitor the percentage of total spend among suppliers who meet our diverse supplier certification criteria via a third party, which are categorized as either a Small Business (SBE), Women-Owned Business (WBE), Veteran-Owned Business (VET), Women-Owned Small Business (WOSB), Historically Underutilized Business Zone (HUBZONE), Small Disadvantaged Business (SC-SDB), and/or Minority-Owned Business (MBE). By creating more opportunities for suppliers and diversifying our channels of procurement, we are building resiliency and contributing to economic strength in communities we live and operate in.

Additional Resources

Pharmaceutical Research, Development, and Launches Can Save Lives — and the Earth

Opening of World-Class, Eco-Conscious Clinical Services Center of Excellence

PharmaBlock

PHARMABLOCK'S SUSTAINABILITY JOURNEY:

INNOVATING FOR A BETTER FUTURE

As the demand for life-saving medicines and treatments continues to grow, so does the responsibility of the pharmaceutical industry to operate sustainably. As a fully integrated CRDMO in the pharmaceutical supply chain, PharmaBlock recognizes this responsibility and is committed to making a positive impact. The company places green chemistry and low-carbon technologies at the forefront of its sustainability efforts, along with technology-driven & lean management, and strategic backward integration strategy.

Source Design for Green Chemistry

Source design is essential for achieving environmental protection and sustainability. Designing manufacturing routes with sustainability in mind reduces the consumption of energy-intensive raw materials and waste. It involves identifying potential environmental impacts at the early stages of the development process and substituting them. At PharmaBlock, a critical area of focus is PMI (process mass intensity) control. Achieving PMI reduction on one reaction step is a key performance indicator at PharmaBlock.

To achieve this goal, the process development and manufacturing teams have implemented multiple measures, including designing optimal routes, developing low-carbon technologies for chemical reactions & post-process, and improving solvent recovery, etc.

Case: Optimal Route Scouting

Optimal route scouting is one of PharmaBlock's flagship capabilities, and it has produced numerous impressive results, including reducing waste & total number of reaction steps and improving yield. In one particular case, the team developed an optimal heavy metal-free route using SNAr reaction that avoided using Pd catalysts, simplified post-treatment, doubled the separation yield, reduced cost by 70%, and decreased the PMI from 348 to 66. Such innovative efforts helped improve production efficiency and educe waste generation.

Case: Low-carbon Technologies

Continuous processing and flow chemistry, with its special application in micropacked bed hydrogenation and immobilized enzymes, and other technologies such as biocatalysis, play a strategic role in PharmaBlock's sustainability efforts. The company applies these technologies from process design to manufacturing, improving production efficiency and reducing carbon emissions.

PharmaBlock's achievements in developing low-carbon technologies are recognized by the receipt of the 2023 ACS CMO Excellence in Green Chemistry Award. The award-winning project utilizes continuous flow processes to produce 3-oxocyclobutane-1-carboxylic acid, a building block used in the API synthesis of multiple marketed drugs. Two metric tons of the product were successfully produced in ten days. Compared to the conventional batch process, PharmaBlock's novel continuous process featuring decarboxylation, decolorization, extraction, and separation, helps achieve 20-fold energy reduction, workspace, and workforce efficiencies with far lower PMI.

Similar new technologies have been successfully implemented in over 1,500 projects at PharmaBlock. For example, PharmaBlock employs a continuous flow process in hydrogenation, using micro-packed bed reactors. Rather than using at a lab scale in the industry, PharmaBlock has taken a step further by designing and assembling manufacturing-scale equipment capable of achieving yearly outputs of hundreds of metric tons. Another remarkable

Continuous Manufacturing Workshop at PharmaBlock Zhejiang

application of flow technologies is eliminating the traditional batch process for nitration, which is present in about one third of pharmaceutical production. By improving thermal control, enhancing safety measures, and reducing waste, PharmaBlock has successfully transformed this corrosive process into a more efficient and eco-friendlier alternative.

Case: Solvent Recovery

To make the process of recovering solvents used in column chromatography easier and to avoid hazardous waste, the team at PharmaBlock limited the use of specific solvents, especially the environmentally harmful chloroform. PharmaBlock took advantage of its supergravity distillation tower to recover and recycle, achieving an 85% recovery rate. These efforts resulted in 60 MT of solvents recovered yearly and a cost reduction of $200,000 each year at PharmaBlocks Headquarters and the main R&D center in Nanjing.

Tech-Driven and Lean Management for Energy Efficiency and Waste Reduction

PharmaBlock integrates sustainability into daily operations, optimizing process control and end treatment with tech-driven and lean management & principles to improve efficiency.

Case: Energy Efficiency

PharmaBlock's energy-control system monitors and optimizes energy consumption across its operations, using real-time data to identify areas where energy consumption can be reduced.

For example, employing preheating and thermal recycling technology for air conditioning units, such as heat exchangers to warm the dehumidified cool air, has resulted in significant energy savings. With it, a manufacturing workshop can save 150 MT of steam per year and reduce electricity consumption by 30,000 kilowatt-hours per year. These savings reduce greenhouse gas (GHG) emissions and result in significant cost savings.

Case: Waste Reduction

Pharmaceutical and CDMO companies must deal with a large variety of complexities involving various chemicals. As a technology-driven player in the pharmaceutical industry, PharmaBlock has been exploring best practices.

These practices include optimizing waste gas treatment. Waste gas undergoes pre-treatment through secondary condensation, absorption, and RTO incineration to meet emission standards. However, non-condensable gases, such as nitrogen, reduce condensation efficiency and increase exhaust concentration. Inert operations, such as centrifugation, filtration, and pipe-blowing, are standardized to minimize nitrogen consumption, resulting in a 50% reduction in workshop exhaust gas volume. With this, a 300% improvement in condensation efficiency and a 50% reduction in natural gas consumption for RTO operation is achieved.

Backward Integration to Strengthen Supply-Chain Resilience

One of PharmaBlock's unique advantages in supply-chain management is its experience in scaling up over 5,000 building blocks. These building blocks are used as raw materials in many drug-substance and intermediate projects. This backward integration enables PharmaBlock to better back up the key raw materials sourcing, strengthen supply-chain

resilience, and ensure the quality of its products. Combining green chemistry and low-carbon technologies, PharmaBlock even extends sustainability to upstream pharmaceutical production processes.

In addition, PharmaBlock is improving supplier management, including developing multiple backup sources for key materials and implementing supplier development programs. As a CRDMO company, PharmaBlock has many Tier 2 and lower suppliers to monitor, and PharmaBlock believes it is essential to help lower-tier suppliers enhance sustainability awareness and operations.

Expanding the global footprint is another initiative that PharmaBlock has been working on to strengthen supply-chain resilience. While having R&D and production facilities in the United States and China, PharmaBlock's continuous business planning and execution assures minimized risk exposure at all the research and manufacturing facilities.

PharmaBlock's commitment to sustainability is reflected in its various practices, such as prioritizing environmental protection, enacting responsible supply-chain management, and improving drug R&D efficiency and quality. Implementing sustainable practices can come with high costs. PharmaBlock has seen the potential for significant cost savings in the long run. The journey to sustainability is a never-ending pursuit of excellence. We are committed to this mission and motivated by knowing that every small step towards these goals has great impacts and purpose.

CPL: CPL AWARDED ECOVADIS SILVER MEDAL FOR CORPORATE SOCIAL RESPONSIBILITY

As Director of Environment, Health, and Safety (EHS), Julinda Mani leads CPL's EHS team across its two facilities and recently managed its participation in the industry-recognized EcoVadis evaluation process. Julinda discusses the importance of Corporate Social Responsibility (CSR) and how CSR plays a critical role in providing additional value to CPL's and our customers.

Q: What is EcoVadis?

A: EcoVadis is an industry-recognized platform that comprehensively assesses and rates the performance of companies based on evidence-based criteria related to the environment, labor and human rights, ethics, and sustainable procurement.

By completing the CSR assessment, CPL's performance in these areas is benchmarked and ranked in relation to our industry peers. We also received a Scorecard that is easily shared with our customers to demonstrate our commitment to setting and achieving these important goals of responsible social and environmental business practices.

Q: What does the EcoVadis Silver Medal mean for CPL?

A: The EcoVadis Silver Medal is an important recognition of CPL's efforts to operate an environmentally and socially sustainable business. It validates CPL's alignment with industry standards and the expectations of our customers and regulators. This medal places CPL in the 82nd percentile of the more than 100,000 companies assessed by EcoVadis globally.

We believe that a strong CSR rating, like the EcoVadis Silver Medal, is essential in the pharmaceutical industry as reports show that 91% of companies consider sustainability criteria when making partnership decisions. In addition, almost half of the top 25 pharma/biotech companies are using EcoVadis themselves to measure their commitment to socially responsible practices. When companies are selecting a CDMO for their pharmaceutical development or manufacturing, they can be confident that CPL is an independently recognized leader in CSR practices.

CPL has seen movement away from sustainability as being "nice to have" among current and potential customers, toward being a more fundamental decision criteria as part of the CDMO selection process. Through our sustainability efforts, we're able to better align to the needs and corporate interests of our customers who also have set ambitious sustainability goals for themselves.

Q: What is CPL's commitment to environmental sustainability?

A: CPL is committed to the implementation of processes and practices that help reduce environmental impact while also reducing costs associated with use of materials, energy, emissions, and disposal. We are constantly working to find more efficient ways to reduce waste and divert it responsibly. Not only does this approach result in improved environmental

impacts, but also creates a safer operation by reducing or eliminating potentially hazardous waste. Additionally, some estimates have shown that the pharmaceutical industry contributes to more than 4% of worldwide greenhouse gas emissions. Our role as a responsible CDMO in the industry is to ensure that we do our part to contribute to reducing these emissions. Ultimately, we are aligning our daily processes with a Net-Zero approach, where we either eliminate the emission of greenhouse gases from our facilities or we offset them.

CPL believes our company's success depends upon the sustainability of the community, economy, and environment in which we operate. We are intent on building a holistic, sustainable, approach to CSR and integrating this philosophy into our daily operation which sets us apart from many of our competitors.

Q: What is next for CPL's sustainability activities?

A: Our company is focused on building an eco-friendly approach for identifying and sourcing packaging materials that reduce environmental impact and aiming for fully diversified waste in packaging - leading to a Net-Zero approach/certification. We have begun working with our material suppliers to identify new opportunities to reduce waste and are seeking those suppliers that are utilizing greener processes in their manufacturing operations and materials.

As we build our sustainability principles and approaches, we will continuously emphasize the importance of CSR and look for methods to improve how we conduct ourselves as individuals and as stewards of the environment towards a more sustainable future.

BASF: A DEEPER LOOK INSIDE A PILL: MOVING FROM CORPORATE ESG COMMITMENTS TO CARBON FOOTPRINTS OF DRUG PRODUCTS

What's the environmental impact of a pharmaceutical drug product? What role do excipients, APIs and other raw materials play in the carbon footprint of final dosages? How can the industry develop lower carbon footprint medicines in the future? These questions and more are entering the sustainability conversation after a large wave of corporate ESG commitments from (bio)pharmaceutical companies in the past several years. However, these questions are easier to ask than to answer—unless the value chain starts to provide increased environmental transparency, and fast.

Key environmental data that need to be calculated and shared in the pharmaceutical industry are product carbon footprints (PCFs), which measure the greenhouse gas emissions associated with a product along its life-cycle in kg CO_2 equivalents per kg product. BASF has been calculating PCFs for individual products since 2007 but has more recently developed a proprietary digital solution to efficiently calculate cradle-to-gate PCFs for approximately 45,000 sales products in complex chemical value chains based on high-quality emissions data. The PCF calculations follow general standards for life-cycle

assessment (ISO 14044) and carbon footprints of products (ISO 14067), as well as the Greenhouse Gas Protocol Product Standard [see Reference 1].

The Power of Product Carbon Footprints (PCFs)

In addition to providing insights into a company's own CO_2 hotspots, PCFs are also becoming a key metric to baseline and track CO_2 reductions—bridging the conceptual divide between corporate ESG initiatives and aspirations of net-zero medicines.

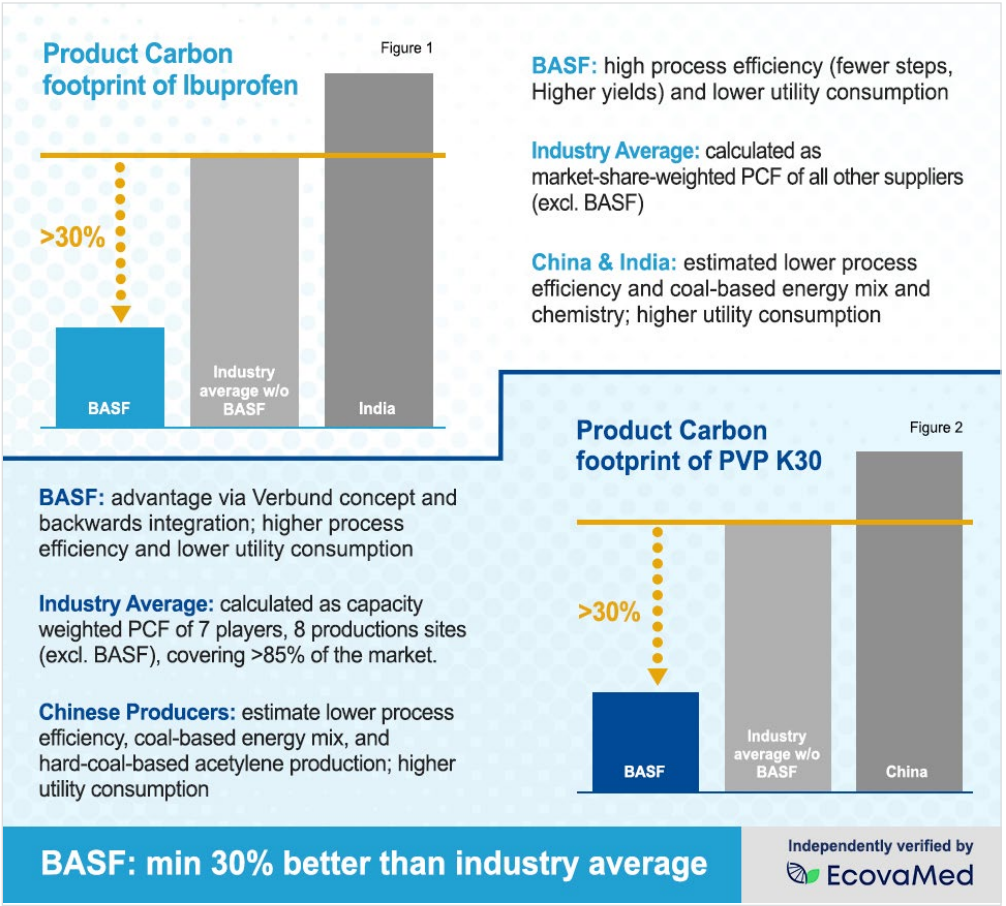
Among the many use cases of PCFs in the pharma value chain, one of the most powerful is in the "eco-design" of drug products early in the development process, by the end of which more than 80% of the environmental impact of the final drug product will have already been determined [see Reference 2]. PCFs enable a quantitative assessment of the environmental impact of potential drug production processes and formulations while balancing other product requirements such as cost, technical specifications, safety, and shelf life.

But what about medicines already on the market? How do we reduce the environmental impact of drugs, currently on pharmacy shelves, which can't easily be redesigned? This is where PCFs, and industry benchmarking, in particular, also play a crucial role.

For several products in the BASF Pharma Solutions portfolio, an industry benchmark—the market average PCF—has been calculated by life-cycle assessment and technology experts and validated by EcovaMed, a third-party consultancy that focuses on life-cycle and carbon footprint assessments for the health sector. For BASF, industry benchmark PCFs provide a valuable reference to assess the progress of CO_2 reduction initiatives. For companies down-stream in the value chain, these industry benchmark PCFs can inform procurement decisions that affect the environmental impact of medicines already on the market.

As seen in **Figures 1 and 2,** the PCFs of BASF ibuprofen and Kollidon® 30 (povidone) were assessed compared to the industry benchmark and were found to be at least 30% below the market average PCF [see Reference 3]. Both results were independently validated by EcovaMed. While the results appear simple, the efforts behind the scenes to achieve them were not.

For ibuprofen, the PCF advantage is a result of the highly efficient production process at the company's Bishop, Texas, plant, that uses several Principles of Green Chemistry (prevention of waste, atom economy, minimization of solvents, energy efficiency, reduction of derivatives,



and catalysis) that won the U.S. Presidential Green Chemistry Challenge [see Reference 4] and uses four production steps rather than the 5–7 steps that are more common among other ibuprofen suppliers. Furthermore, the Bishop site is committed to continuous optimizations and carbon reduction initiatives, with achievements in steam and flare management programs, catalyst recovery projects, and green electricity purchases [see Reference 5].

For Kollidon® 30 (povidone), the PCF advantage can be attributed to BASF's unique "Verbund" concept, in which the driving principle is to add value through the efficient use of resources [see Reference 6]. At the large BASF Verbund sites, production plants, energy and material flows, logistics, and site infrastructure are all integrated. In the Verbund system, chemical processes make use of energy more efficiently, achieve higher product yields, and conserve resources. For example, by-products of one process are often used as starting materials for other processes. This creates opportunities to reduce emissions, waste, and resource consumption, often resulting in a carbon footprint advantage on a product level.

The Road to Net Zero

At BASF, we continue to examine how we can reduce our emissions and achieve our 2050 Net Zero target. PCFs will remain a key instrument in this effort and have already shaped numerous strategic and investment decisions. PCFs are also the nucleus of BASF's Supplier CO_2 Management Program, in which supplier-specific data for purchased raw materials will replace average data to further enhance BASF PCF accuracy.

With PCFs offering unparalleled transparency into value chain emissions, new opportunities will be unlocked for companies to collaborate and develop innovative solutions to the pharma industry's sustainability challenges. Will we be able to calculate the carbon footprint of drug products? Can we provide patients with carbon-neutral medicines? The only way to find out is to roll up our sleeves and dive deep into the data.

References

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WUXI STA: DRIVING SUSTAINABLE MANUFACTURING FORWARD: HOW WE TURN COMMITMENT INTO ACTION

In today's world, where the threat of climate change looms large, the pursuit of sustainable practices in the pharmaceutical industry isn't just a trend—it's a necessity. Here at WuXi STA, we're more than just participants; we're pioneers. As a global leader in Contract Research, Development, and Manufacturing (CRDMO), we produce thousands of investigational and marketed innovative drugs for all synthetic modalities at all scales every year. We're passionately investing in carbon footprint reduction, driving innovative breakthroughs, and leading the change toward a sustainable future in our industry. Our mission embodies more than business goals; it's about contributing positively to the world, aligning our scientific advancements with a vision of health and sustainability for everyone.

Our target by 2030 compared to the 2020 baseline

We concentrate our sustainability efforts in four key operational areas where we make a significant difference:

- Carbon Emissions: 25% intensity reduction
- Energy Consumption: 25% intensity reduction
- Water Resource Management: 30% intensity reduction
- Waste Management: Be landfill-free for all productive hazardous waste by 2030.

Carbon Emissions and Energy Efficiency

In 2022, we achieved a remarkable 36% reduction in carbon emissions year-on-year and reduced our

Showcase of WuXi AppTec's ESG Award Achievements

overall energy consumption by 37% through strategic initiatives and sustainable practices across all sites globally. Here are some innovation highlights:

Our Couvet site in Switzerland operates entirely on renewable energy that leverages local weather conditions with solar panels and LED lights to enhance energy efficiency. Geothermal energy is harvested from the earth's subsurface using a system of 266 heat exchange piles drilled deep underground. This innovation results in an impressive 70% lower CO_2 emissions compared to similar-sized facilities in the pharmaceutical industry.

At our Wuxi City drug-product site in China, we have installed energy-saving heat pipes in the Heating Ventilation and Air Conditioning (HVAC) fresh air treatment section. This ensures waste heat recycling, saving an estimated 42,000 kWh of electric energy annually. Similarly, our Changzhou API site utilizes heat recycling devices for air compressors, saving an estimated 2,600 tons of steam annually. This is coupled with our VAR38 incinerator's flue gas heat-exchange system, which reduces 98,000 tons of purchased steam.

Water Resource Management

Through innovative technologies and responsible practices, we achieved a 41% reduction in water consumption in 2022 vs. 2021.

In 2018, our Wuxi City site initiated a new water reclamation and reuse project. By employing an innovative treatment process, we successfully repurposed production wastewater for non-production purposes. This initiative not only achieved zero discharge of production wastewater but also significantly contributed to the overall reduction of water consumption, lessening the environmental impact of the site. In 2022, the total amount of reclaimed water reached 51,861 tons.

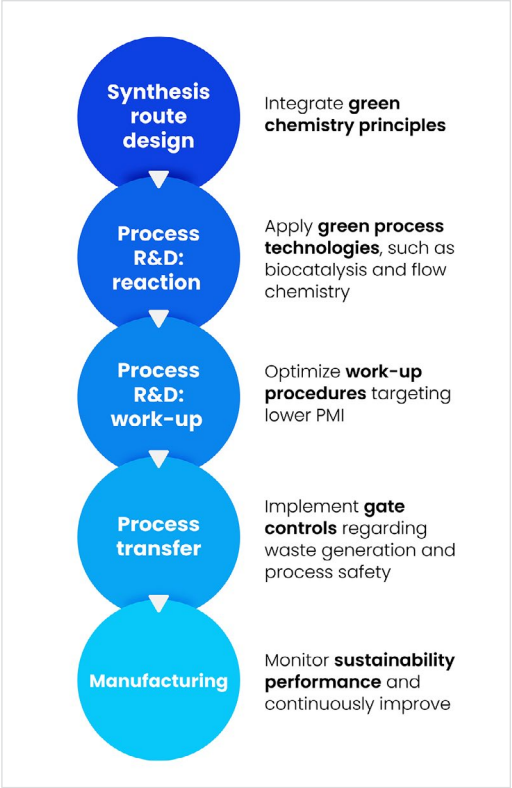
These measures, including our investment in water recycling technologies and continuous monitoring of water usage, enable us to maintain efficiency while ensuring that our operations align with the highest standards of environmental stewardship. Our commitment to sustainable water management was recognized globally, reflecting our mission to contribute positively to a world where water resources are conserved and used responsibly.

Solid Waste Management

In July 2020, our parent company, WuXi AppTec, launched precious metal recovery, and we have significantly improved the recovery process in recent years. We have engaged all suppliers for heterogeneous catalyst recovery, tracking the process of catalyst collection and use, ensuring that precious metals can be recovered to the maximum level. In 2022, we successfully recovered approximately 385.5 kg of precious metals, contributing to our overall waste reduction efforts.

Process Mass Intensity (PMI) Management

As a recognized leader in synthetic chemistry, we have embedded process mass intensity management into every stage of our research, development, and manufacturing processes. PMI is a metric that measures the ratio of kilograms of raw materials used per kilograms of product manufactured. In 2022, we achieved an impressively low combined PMI of 41 across our API manufacturing sites, reflecting our commitment to eco-friendly practices.



Workflow of API process development and manufacturing for greener processes

Our approach to API process development and manufacturing incorporates advanced and environmental-friendly technologies, such as biocatalysis and flow chemistry. From the design of new synthetic routes to work-up development and process transfer, we prioritize green process technologies and waste control. By adhering to the 12 Principles of Green Chemistry and focusing on continuous improvement through a PMI scorecard, we transcend regulatory compliance and exemplify our unwavering commitment to sustainable manufacturing.

As a pioneering leader in the healthcare industry, we recognize the profound connection between climate change, public health, and sustainable manufacturing. Faced with these global challenges, we are committed to the best sustainable practices, creating a path toward a healthy future for our planet.

About WuXi STA

WuXi STA, a subsidiary of WuXi AppTec, is a leading pharmaceutical development and manufacturing capability and technology platform company serving the life sciences industry, with global operations. As a premier contract development and manufacturing organization (CRDMO), WuXi STA offers its world-wide partners efficient, flexible, and high-quality solutions for integrated chemical, manufacturing and controls (CMC) from preclinical to commercial uses, including the development and manufacturing of small molecules, oligonucleotides, peptides and various complex chemical conjugates. For more information, please visit our website.

WESTROCK: SUSTAINABILITY AT THE CORE OF OUR PACKAGING SOLUTIONS

WestRock is a global leader in sustainable paper and packaging solutions. Our integrated packaging capabilities offer end-to-end solutions to help customers address their greatest challenges.

Sustainability has long been an important part of our company's history—recycling and sustainable forest management are the fiber of our being. Across all markets we serve, our customers' commitments to sustainability are driving more conversation about what is needed to ensure that product packaging is made from renewable resources, is recyclable, and even compostable.

We've set ambitious sustainability targets, including a 2025 target to make 100% of WestRock's products recyclable, compostable or reusable, driving the transition to a more circular economy through cutting-edge innovation.

And when it comes to innovating for our healthcare customers, driving sustainability shares priority with improving the patient experience. We believe packaging can play a role in making healthcare more patient-centric, and we begin our innovation process with consumer insights. We partner with our customers to scale our innovations from design to manufacturing across an unmatched suite of packaging solutions.

Helping our customers win means leading in sustainability—with packaging that enhances relationships

Circularity at WestRock: Our fiber-based packaging solutions have a continuous life cycle beyond the shelf.

between brands and their consumers. More than half of the surveyed consumers say packaging that communicates the brand's core values and purpose impacts product satisfaction (1).

It is time to think of sustainability not only through the lens of environmental impacts, but also continuing the transition to a more circular economy. From responsible fiber sourcing to advanced machinery and our network of recycling facilities, our capabilities in support of the circular economy are a true differentiator for WestRock.

The challenge before us is to continue innovating to make packaging that is right-sized, made from renewable materials, and is recyclable or compostable. Plastics replacement is important, but we are thinking beyond replacing plastics and exploring ways to advance the strength and sustainability of fiber-based packaging.

- We are exploring technology that makes fiber-based packaging resistant to water and grease with enhanced thermal insulation while preserving its recyclability.
- We are working with customers to create packaging that is right-sized for use, with advancements in design and customized machinery that increase the overall efficiency of their operation through on-demand machinery solutions.

While sustainable packaging that is scalable and cost-effective is already core to our product offering, we must lean into the partnerships we have built and apply our discoveries to continue to solve our healthcare customers' greatest challenges – in a way that serves patient experience and also serves the environment.

For more information email:
healthcareinfo@westrock.com

Or visit our website at www.westrock.com

WestRock offers an integrated portfolio of fiber-based packaging solutions with the aim of protecting products and being patient centric while addressing the growing demand for more sustainable packaging.

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1. Source: WestRock Pulse Packaging Survey, 2020.

Recipharm

RECIPHARM: OVERCOMING CHALLENGES TO REDUCE CARBON EMISSIONS IN THE PHARMACEUTICAL INDUSTRY

Driven by carbon and other greenhouse gas (GHG) emissions, global temperatures have already increased by 1.2°C compared with just over a century ago, causing climate change. With atmospheric CO_2 levels continuing to rise, changes are required to prevent further warming [1].

To minimise the impact of climate change, 195 countries, including the European Union (EU), signed the 2015 Paris Agreement to keep global warming under 1.5°C. They committed their economies to a 45% reduction of GHG emissions by 2030 and to reaching net zero by 2050 [2].

To help tackle climate change, the pharmaceutical industry must reduce its contribution to carbon emissions. This requires coordination with the wider industry to account for every aspect of company operations and supply chains, identifying how CO_2 and other GHG emissions can be removed from key processes. In addition, any energy-saving opportunities identified should be integrated into current operations.

Setting targets to meet new regulations

To meet their commitments made as part of the Paris Agreement, national governments have been drawing up domestic legislation demanding reductions in GHG emissions. Revision of current operations and governance practices is underway to comply with new regulations. As of 2024, EU legislation will demand annual reporting on emissions, which increases pressure to take meaningful action to minimise them. Governments will rely on the industry's adherence to new guidelines and regulations designed to cut emissions.

From the industry's point of view, incorporating carbon reduction initiatives can also help companies secure talent, as growing numbers of individuals want their employers to share their environmental values. These goals not only help companies reach their climate goals in line with the Paris Agreement but also enable customers to reach their own sustainability objectives. However, to reduce GHG emissions in line with new regulations, increased understanding and collaborative efforts are essential.

Challenges hindering GHG reduction

A number of challenges are currently limiting companies' ability to reach their full potential and play their part in achieving the Paris Agreement goals. Confusion around the terms used to describe companies' efforts to reduce GHG emissions can impact their ability to set effective goals. This confusion can also undermine measures to identify partners capable of supporting their initiatives to reduce the size of the carbon footprint. The terms include:

- *Carbon neutral:* Referring to a specific product or business, it indicates that all CO_2 emissions for the reporting period have been compensated for through carbon offsets. This can be done in combination with CO_2 reduction targets.
- *Carbon negative:* Going beyond carbon neutral through the purchase of additional carbon offsets once the full carbon footprint has been compensated for.
- *Net-zero:* Committing to purchasing carbon offsets only for the remaining part of emissions after reducing them to the best of the company's ability, within specified limits.

To address any ambiguity regarding efforts to reduce carbon emissions, it is essential to be clear on the activities undertaken and their impact on reducing your company's carbon footprint.

It is important to remember that all parts of the value chain contribute to a company's emissions. As such, the emissions across the entire supply chain should be considered when calculating GHG emissions for a company. A lack of understanding of the full scope of a pharmaceutical company's GHG emissions — considering only their facilities and their own transport networks and underestimating their overall contribution to carbon emissions — can restrict the impact of emission reduction objectives.

Limited visibility across the supply network makes it hard for companies to work together to determine the links in the value chain that are the largest carbon contributors, highlighting which businesses require the most attention. This means that many companies are setting goals in isolation, limiting their impact and the industry's overall GHG reduction efforts. It also prevents companies from learning from each other and improving their emissions reduction initiatives. Increasing visibility would help address these issues, enabling companies to work together and identify areas to target to reduce carbon emissions.

Overcoming challenges with science-based targets

Pharmaceutical companies introducing measurable and transparent targets show commitment to reducing GHG emissions. In addition, strategic coordination throughout the pharmaceutical value chain, defining the contributions of each party to the company's group-wide targets can be instrumental in setting and meeting realistic but ambitious targets.

The Science-Based Targets initiative (SBTi) supports companies in every industry, including the pharmaceutical sector, to use the structure of the GHG protocol to set science-based targets. In doing so, it helps to ensure companies' climate goals are truly meaningful in reducing the global carbon footprint. This initiative was formed through a partnership between the United Nations Global Compact, World

Wildlife Fund, CDP (formerly known as the Carbon Disclosure Project) and the World Resource Institute [3]. As a company that has committed to SBTi, Recipharm is doing its part in setting carbon-reduction goals in line with the Paris Agreement.

SBTi-verified goals provide independent third-party confi mation of a company's climate-related targets. These targets require a company to calculate emissions across three areas:

- **Scope 1:** Direct GHG emissions from sources on site (such as fuel combustion in boilers, leaks from refrigeration and process emissions).
- **Scope 2:** Emissions from consumption on site but emitted elsewhere (such as electricity or district cooling).
- **Scope 3:** Emissions from activities in the value chain, but outside of the direct control of the company (such as carbon footprint from material to products, emissions or waste from material manufacturers' operations and waste from used products).

These calculations must be made according to the requirements of the Greenhouse Gas Protocol, an initiative that provides stringent standards for measuring emissions.

The data are then submitted to and verified by the SBTi. The SBTi uses this data in a structured and science-based way to determine how much each signatory company needs to reduce their emissions to meet the Paris Agreement's target of 1.5°C global temperature rise.

As a result, each company signed up to the SBTi can make a meaningful contribution to global efforts by setting and committing to targets. Annual reporting optimises transparency, enabling companies to hold their partners in the value chain to account while also providing visibility across the industry and the wider economy. Companies in all sectors also have the transparency to share best practices and learn from each other to enhance the quality of industry-wide initiatives.

These kinds of partnerships can help companies set effective GHG targets, allowing for increased transparency and holding each other to account across the global economy.

Making a global impact

Today, over 3,000 companies around the world, including Recipharm, are committed to the SBTi, with clearly defined paths to meet the Paris Ag eement goals. Collaboration is essential to address major challenges, and the more pharmaceutical companies join the SBTi and other similar partnerships, the more impactful these efforts will be. Initiatives are also invaluable to help set, stick to and achieve goals, with expert advice and support provided.

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dsm-firmenich

DSM-FIRMENICH: SHAPING THE FUTURE, PROTECTING PEOPLE AND PLANET

For dsm-firmenich, sustainability is not a buzzword — it's intrinsically embedded in the company's purpose of bringing progress to life. After all, what good is progress if it's moving in the wrong direction?

Tackling the challenges of today and tomorrow

dsm-firmenich believes that finding the balance between what people individually want (the desirable), what the world collectively needs (the essential), and what the planet demands (the sustainable) is crucial. To help tackle this challenge and achieve balance between people and planet, the company has woven five of the United Nations' Sustainable Development Goals (SDGs) into its purpose and mission:

SDG 2. Zero hunger — improving nutrition for those who need it most, such as through fortified foods and micronutrients, as well as a unique partnership with the World Food Program.

SDG 3. Good health and well-being — ensuring healthy lives and promoting well-being for all at all ages through consumer-relevant solutions, such as the First 1,000 Days Program, which supports the health of mothers and infants.

SDG 7. Affordable and clean energy — making affordable, renewable energy a reality with yeast and enzymes for improving biomass conversion of biofuels and biogas.

SDG 12. Responsible consumption and production — minimizing waste across the value chain through innovative solutions, such as Pack-Age® — a packaging for meat and cheese that extends shelf life.

SDG 13. Climate actions — reducing the company's carbon footprint by increasing the use of renewable energy and advocating for responsible action on climate change.

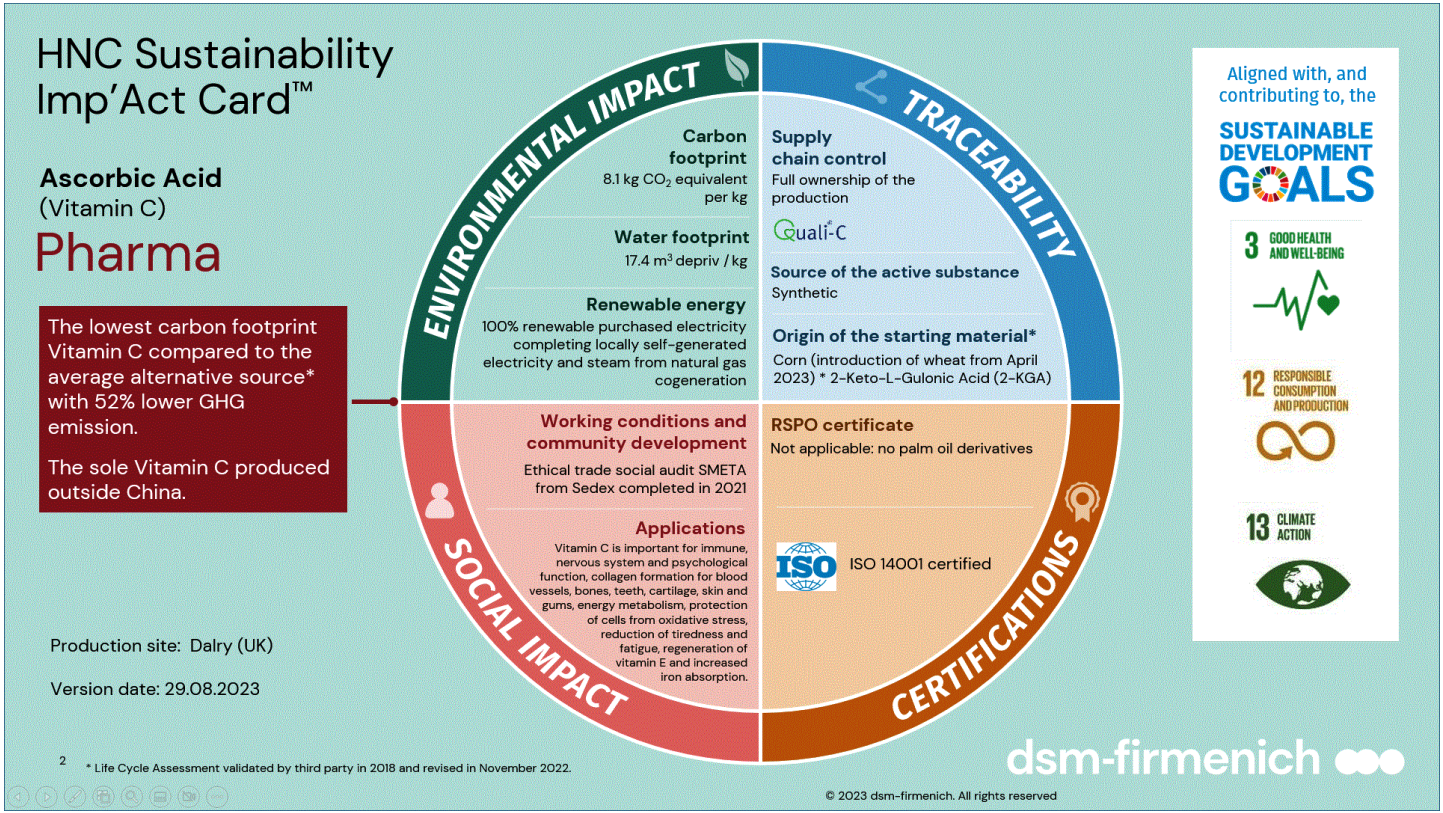
Helping customers reach their sustainability targets

No company can achieve net-zero emissions on its own. dsm-firmenich helps its partners meet their sustainability goals and get closer to net-zero. The company has a roadmap in place to steer and progress the reduction of greenhouse gas emissions, building on its Life Cycle Assessment (LCA) internal expertise, which quantifies the envi onmental impact of a product, technology, or process throughout its entire life cycle.

What's more, the company has created the Imp'Act Card™ to support sustainability claims and enable transparent and accurate communication of the environmental and social footprint at the ingredient level. The card represents IMPact and ACTion, which is what is needed to create sustainable innovation. It provides clear information, including the calculated environmental impact, traceability, certifications, and social impact of each ingredient. For example, the ascorbic acid (vitamin C) Imp'Act Card™ demonstrates how this pioneering solution generates 52% lower green-house gas emissions compared to the main ascorbic acid alternative sources (LCA validated in 2018 and revised in 2022).

Accelerating the route to net-zero with ambitious, science-based targets

The health of the planet is in the hands of humanity and every company has a part to play. The collective reduction of carbon emissions by the healthcare industry can significantly contribute to mitigating



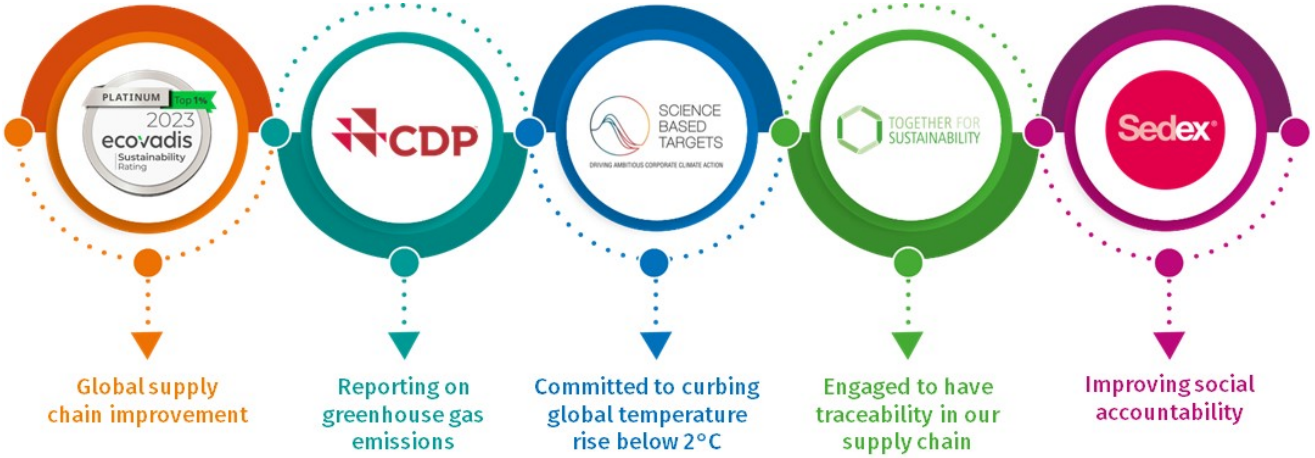
Imp'Act Card™ provide tangible value to customers and partners.

climate change. That's why in 2016, legacy DSM set climate targets to track its progress as the company moves towards net-zero for a healthier, cleaner, and more resilient future. By 2030, legacy DSM aims to achieve the following targets:

- reduce Scope 1 and 2 absolute emissions by 59%
- reduce value chain emissions by 28%
- purchase 100% renewable electricity
- improve water efficiency by 10% (in water-stressed sites).

dsm-firmenich understands the importance of communicating its progress towards a sustainable future, to be as transparent as possible to its customers and the rest of the pharma market. That's why the company calculated its environmental impact from 2016–2022. Legacy DSM reduced Scope 1 and 2 absolute emissions by 35% and value chain emissions by 17%, in turn helping its customers reduce their Scope 3 emissions. In addition, legacy DSM purchased 78% renewable energy and improved its water efficiency by 7.2% compared to 2016 (1). In 2018, legacy DSM launched its $C0_2$REDUCE program to help suppliers reduce their carbon footprint by sharing ambitions, exchanging information, and creating reduction roadmaps to achieve emissions targets.

Legacy DSM targets are independently validated by the Science Based Targets initiatives (SBTi) — an organization that helps companies calculate how much they can decarbonize to prevent the worst impacts of climate change. Legacy DSM was one of the first companies to align its efforts with the science presented in the Intergovernmental Panel for Climate Change (IPCC) Special Report,"Global Warming of 1.5 °C" of 2019 and immediately set a pathway to reach net-zero greenhouse gas emissions across its operations and value chains by 2050. The company's science-based targets are the foundation to achieve this goal, supported by ambitions on renewable electricity and energy efficiency, as well as intense work with key suppliers and customers. In addition to SBTi, legacy DSM is recognized by benchmarks as leading the way in integrating sustainability in operations and business.



Legacy DSM sustainability recognitions.

Success in Sisseln, Switzerland

To reduce Scope 1 and 2 emissions at its vitamins and formulation production site in Sisseln, one of Switzerland's largest biomass plants, the company installed a woodchip-fired power plant. The result? A reduction of 50,000 tons of carbon emissions every year and enough renewable energy to power 17,500 local households. The steam energy from the plant supplies the Sisseln site as well as three adjacent industrial sites. The plant also benefits the local community, providing over 1,000 jobs.

Solar expansion in Belvidere, New Jersey

Legacy DSM expanded the solar fields at its production site in Belvidere, New Jersey, located on 66 acres and comprising over 62,000 solar panels. The

Woodchip-fired power plant in Sisseln, Switzerland.

company partnered with GeoPeak Energy to develop, engineer, and construct the solar fields, which will result in a reduction of close to 40,000,000 lbs of carbon emissions in one year, which is equivalent to around 3,000 households' annual electricity use, and the carbon sequestered by over 20,000 acres of US forests. Moreover, the solar panels are made from the company's own anti-reflective coating for the solar glass that increases efficiency by up to 3%.

dsm-firmenich, innovators in nutrition, health and beauty, is a company formed by two global sustainability leaders. It has a strong vision to bring progress to life with solutions that protect people and the planet. The company is recognized as a positive contributor to a changing world, backed by a team of close to 30,000 talented people with a shared ambition to drive sustainable change. As such, dsm-firmenich enables its customers to deliver healthy solutions through sustainable innovations, advocates for system transformations and improves

66-acre solar field in Belvidere, New Jersey, USA.

its overall carbon footprint. Plus, the company's progress so far is indicative that it is committed to championing a more sustainable world by accelerating its pace of change with ambitious goals, science-based targets, and a transparent approach to accurately measure the environmental footprint of individual ingredients.

Sustainability is at the core of all dsm-firmenich's actions and the progress the company has made so far is just the beginning. Stay tuned to find out how dsm-firmenich continues to excel in driving sustainable change.

Learn more about dsm-firmenich's sustainable strategy here — Sustainability (dsm-firmenich.com)

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PFIZER CENTREONE: WHY SUSTAINABILITY SHOULD MATTER TO US ALL

Matters of sustainability are very much in the public eye. Although many companies throughout the life sciences sector have already taken significant steps toward a more sustainable future, there is still work to be done.

To thrive in the current landscape, pharma and biotech companies should adopt the right mindset and demonstrate action when it comes to sustainability. From a reputational perspective, they should be seen to be doing a large, demonstrable and palpable amount of good. Moreover, patients are increasingly demanding more sustainable choices when it comes to their treatments. Sustainability, then, is both the "right thing to do" and a competitive differentiator for many contract development and manufacturing organizations (CDMOs).

But how can companies improve the way they operate? What kind of actions can be taken? For most organizations, Scope 3 emissions (created within a company's supply chain) are the biggest contributor to their carbon footprint. This means that for pharma and biotech companies becoming more sustainable means relying heavily on their CDMO partners to deliver on sustainability initiatives.

Reducing emissions

To minimize their overall environmental footprint globally and support the sustainability initiatives of their customers, CDMO manufacturing and R&D sites should seek opportunities to implement new policies or modify projects to achieve a reduced environmental impact (relating to aspects such as energy consumption, water usage, and waste management). Taking these steps can also reduce resource demands—for example, when older equipment becomes redundant, energy-efficient alternatives can be introduced.

Sites should aim to invest in no- or low-carbon technologies and in power purchase agreements that promote the use of renewable energy sources. Where workable, process enhancements should be implemented throughout product manufacturing to increase efficiency and reduce the number of process steps and resources required.

By embracing new policies and investing in sustainable technologies, CDMOs are reducing their environmental impact and paving the way toward a greener future.

Preventing pollution

Pharmaceuticals in the environment and antimicrobial resistance (AMR) continue to be critically important environmental issues for the life science industry. Biotech and pharma companies should limit the discharge of active pharmaceutical ingredients into wastewater during the manufacturing processes. This can be addressed with a thorough environmental risk assessment and the implementation of emission control best practices, alongside improved technologies.

The AMR Industry Alliance's Antibiotic Manufacturing Standard, published in June 2022, is an invaluable document and an essential industry roadmap. Within it, a number of industry-published targets are listed as clear goals—for instance, "predicted no-effect concentrations" for antibiotics.

Improved wastewater management and treatment practices should be implemented and adhered to at all sites, including manufacturing and supplier sites, to properly oversee the safe management of wastewater discharges.

Managing waste and water

Access to clean water is a basic human need and ensuring its availability requires constant vigilance at a local level. To avoid contamination of water supplies, all sites emitting wastewater should be conducting comprehensive risk assessments, with action plans developed for sites with elevated risk scores. These plans should include elements such as:

- Quantifying water usage
- Implementing mitigation plans
- Establishing water conservation targets
- Protecting water quality
- Improving wastewater treatment where necessary
- Evaluating recycling practices
- Engaging with surrounding communities around potential issues

Organizations should measure progress at these sites while engaging with key suppliers in water-stressed areas to encourage them to develop and implement similar action plans.

How can the Pfizer CentreOne team help?

At Pfizer CentreOne, our goal is to lead the way in ethical and sustainable manufacturing. Pfizer CentreOne actively pursues and develops ways to reduce environmental impact in areas such as waste management, water stewardship, and smarter packaging, to name but a few. Our team has worked tirelessly for over a decade to improve sustainability, adhering to a program updated annually to ensure its relevance and maintain our position as an example to the rest of the industry.

Case study: Using Enviero® progesterone to reduce environmental impact

Green chemistry has the potential to support improved, ongoing sustainability and negate ecological errors in perpetuity.

Enviero progesterone is a first-of-its-kind compound launched via Pfizer CentreOne's green chemistry program, which is being adopted across Pfizer, helping to provide lower environmental impact products for patients around the world.

Pfizer's Kalamazoo site, Michigan. Spanning 90 acres, the site has a legacy of innovation, safety and regulatory compliance producing approximately 1 million kg of API and 10 million kg of intermediates per year. Kalamazoo developed the first-of-its-kind progesterone using Pfizer's green chemistry program.

Working from our state-of-the-art 1,300-acre facility in Kalamazoo, Michigan, our team developed Enviero to significantly curtail any risk during manufacture. Eliminating metal catalysts and the bulk of organic solvents used has reduced environmentally damaging waste emissions by more than 70%. Here are some of the key features of Enviero:

- Resulting in more than 70% reduction in carbon footprint versus our traditional process
- Using no metal catalysts
- Granted the Certificate of Suitability (CE 2018–200) by the European Directorate for the Quality of Medicine (EDQM)
- Authorized for pharmaceutical use in North America and the European Union

Manufacturers such as Effik, a French company, have made the switch to Enviero to help enhance their sustainability and environmental performance while maintaining a reliable supply of their product.

A sustainable CDMO for your every need

Pfizer CentreOne is ideally placed to help companies of all sizes on their journey toward a more sustainable and ethically sound way of operating. This makes us an altogether different kind of CDMO.

Start a conversation with one of our experts today to find out how they can help address your sustainability concerns.

Learn more at www.pfizercentreone.com

AUSTINPx™
PHARMACEUTICS / MANUFACTURING

AUSTINPX: KINETISOL® TECHNOLOGY: BROADER. FASTER. GREENER.

The pharmaceutical industry is pushing the chemical drug space boundaries in search of new and more effective compounds. Consequently, the number of poorly soluble drugs has grown. To meet the challenge of poor solubility, pharma has developed processing technologies for the generation of amorphous solid dispersion (ASDs). However, several ASD technologies utilize organic solvents, namely spray drying. These solvents can have a significant environmental impact, as well as greater manufacturing complexity and costs. AustinPx's KinetiSol® Technology has enabled the development of ASDs without the use of solvents, often with improved bioavailability facilitating lower doses compared to alternative ASD methods.

Industry's Climate Change Impact

While the pharmaceutical industry makes tremendous contributions to the advancement of health, it is also a sizable CO_2 contributor. A study by McMaster University found that pharma emits 13% more megatons of CO_2 than the automobile industry.[1] A significant portion of pharma's carbon footprint is from drug product manufacturing, including the manufacture of ASDs.

Spray drying is a common process for producing ASDs and organic solvents are crucial components of spray drying. These solvents can have detrimental environmental effects. The volume of solvent required for a single commercial spray dried

dispersion (SDD) can reach metric tons (MT). We estimate >1,000 MTs of solvent are required annually to support the development and commercial manufacture of SDDs. While there are efforts to reduce the volume of solvents used, such as the addition of processing aids and solvent recycling programs, these activities do not completely remove solvents and can be costly to implement.

There's a Better Way - KinetiSol® Technology

With KinetiSol Technology, drug developers have a better option for developing ASDs and the opportunity to reduce their carbon footprint, while accelerating development and lowering their manufacturing costs for final drug products.

KinetiSol is a solvent-free, fusion-based ASD manufacturing process that has been shown to work with difficult to process APIs with high melting points, poor organic solubility, or sensitivity to heat degradation.

Using ultra high-speed mixing elements inside a cylindrical chamber, KinetiSol mixes API and excipients at rates up to 7,000 RPMs. The powder rapidly circulates as a fluidized bed of particles until frictional forces cause particle aggregation and agglomeration until the particles coalesce, at which point shear forces dominate and the crystalline drug rapidly solubilizes into the molten polymers yielding a solid solution in as little as ten seconds. The resultant KinetiSol amorphous solid dispersion (KSD) is ejected and quenched, at which point it can be milled for inclusion into tablets or capsules.

KinetiSol Technology Advantages

The absence of solvents, fast-processing time, and broader formulation design space makes KinetiSol an optimal ASD processing technology.

Broader

Due to its inherent design, KinetiSol is applicable to a greater number of molecules and offers a wider formulation design space.

The system's rapid processing time and high-energy mixing mechanism minimizes cumulative thermal stress. Therefore, KinetiSol enables rapid solubilization

and formation of ASDs well below the API melt transition point, permitting the processing of heat-sensitive APIs and excipients without degradation.

KinetiSol can incorporate a wide selection of excipients into the KSD, including polymer mixtures, surfactants, wetting agents, chemical stabilizers, and anti-nucleating agents, which enhance particle performance, manufacturability, and stability.

Unlike most SDD particles, KinetiSol creates highly homogenous, high density, low surface area particles that are less susceptible to water ingress, ASD destabilization, or premature diffusive release of the drug from the polymer matrix.

KSD particle properties lend themselves to improved manufacturability due to increased density and porosity. Additionally, they can demonstrate an improved "spring and parachute" effect, which results in enhanced bioavailability and exposure. Studies with KSDs have shown bioavailability gains in head-to-head comparisons with SDDs (figure 1).

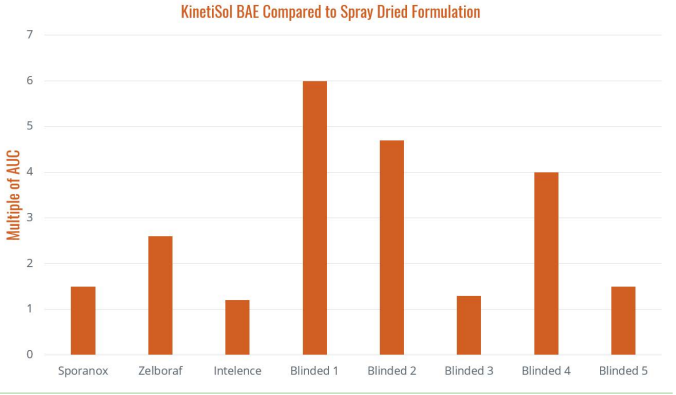

Figure 1: Oral bioavailability enhancement (BAE) achieved by KinetiSol over SDD formulations.

An added benefit of KSD's higher exposure levels is the ability to target lower dose reduction. This represents an opportunity for more patient-centric dose forms through reduced pill burden. Additionally, lower dose could have knock-on benefits of lower API costs.

Faster

Due to the equipment's operating speed, KinetiSol rapidly generates prototypes lending to accelerated development timelines. KinetiSol also offers stream-

lined scale-up from R&D to commercial equipment due to the geometrical similarity of the processing chambers, avoiding the need for extensive scale-up development activities. Finally, unlike SDDs, KSDs do not require secondary drying, residual solvent testing or roller compaction for densification and improved downstream processing, which lends itself to faster development and batch processing.

Greener

While absence of solvent is KinetiSol's primary sustainability driver, KinetiSol also requires a significantly smaller footprint. Measuring just 8' x 12', the commercial scale KinetiSol equipment (figure 2) is amenable to placement in most pilot-scale manufacturing facilities. This is a key advantage over commercial spray dryers, which require a sizable footprint. For example, a commercial scale spray dryer, with equivalent throughput to a commercial KinetiSol unit, can require a multi-story building. Additionally, the spray dryer solvent and nitrogen systems and secondary dryer require additional maintenance and operational support adding to the system's total environmental footprint.

Figure 2: KinetiSol Commercial Scale Equipment

Conclusion

As climate change concerns grow, the pharmaceutical industry must consider technologies that transition away from solvent-based ASD processing.

KinetiSol represents a giant step forward in sustainability for ASD manufacturing.

AustinPx has applied KinetiSol to more than sixty molecules. While most programs enter at the preclinical phase, we have seen strong interest from clients with candidates previously formulated as SDDs due to their desire to reduce their solvent footprint.

We are excited to further KinetiSol adoption and support our partners' carbon net-zero journey. Our corporate goal is to be a part of the solution versus the problem. For more information about KinestiSol visit AustinPx.com/KinetiSol.

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bormioli pharma

BORMIOLI PHARMA: ECOPOSITIVE, A DATA-BASED, SUSTAINABLE PACKAGING RANGE FOR MEDICINES

As a part of a wider ESG approach, Bormioli Pharma offers one of the few sustainable packaging ranges for medicines available on the market. To support the industrial implementation of these solutions, Bormioli Pharma commissioned a third-party scientific analysis. The results show extractables values 150 times below the risk index while providing a 37.2% decrease in terms of environmental impact compared to the equivalent virgin PET solution.

Sustainability in pharma packaging: an urgent call for action

The issue of environmental sustainability is becoming more and more urgent and drives the implementation of measures that are required to mitigate its effects, as shown by the 2030 Agenda for Sustainable Development signed by the UN and the ecological transition goals set by the European Union.

In this context, pharmaceutical packaging companies are called upon to make their products more responsible by embracing a circular economy approach. Research in this area has already brought important results, and there are already numerous solutions with a reduced environmental impact.

Bormioli Pharma, the international leader in the production of glass and plastic containers for pharmaceutical use, has introduced EcoPositive to the market, a full range of responsible packaging solutions. To complete the offer with science-based

information, the packaging manufacturer provides a set of data highlighting that **pharma-grade, sustainable packaging is able to fulfill the industry's strictest requirements in terms of quality and safety.**

EcoPositive: one well-defined goal, three different approaches

EcoPositive is the Bormioli Pharma's range of eco-friendly solutions that includes a vast assortment of products made from sustainable glass and plastic. This is the result of research that began over 15 years ago, guided by a bold, challenging target at the corporate level: **reaching 50% sustainable raw materials in production by 2025.** To turn this objective into a solid fact, Bormioli Pharma has defined a five-year product plan that mainly leverages on three different approaches.

- **Regenerate:** including glass and plastic containers that are certified for pharmaceutical use, such as rPET or rHDPE bottles, which are made by recycling materials from external and highly qualified supply chains.

Recycled PET bottle production at Bormioli Pharma's plant in Saint-Sulpice, France.

- **Renew:** collecting packaging made from bio-plastics derived from renewable plant-based resources, such as pill boxes made from Green PE, a material produced from sugar cane, or accessories made from PLA, which is derived from corn starch.

- **Reloop:** featuring products obtained by processing and feeding waste elements back into the production cycle, such as bottles made from cullet or from Carbon Capture PET, a special material produced from carbon dioxide, which is captured through a chemical process and transformed into molecules that make up the polymer structure of plastics.

Supporting the EcoPositive range with scientifical analysis

In a market where normative frameworks and guidelines are focused on guaranteeing the utmost safety for the patient and the highest efficacy of th pharmaceutical product, supporting commercial proposals with relevant, scientific info mation is essential to make a difference. This is why Bormioli Pharma decided to perform a relevant analysis on different products from its EcoPositive range.

The analysis has taken into consideration **multiple recycled PET and Carbon Capture PET bottle formats.** These products have been tested to scout for the **presence of extractables in highly demanding test conditions,** exceeding USP and European Pharmacopoeia requirements, using tools such as **mass spectrometry** and **different solvents,** as well as resorting to the most severe extraction conditions.

Moreover, a cradle-to-gate life cycle assessment (LCA) investigated the differences in environmental impact between primary or "virgin" PET, recycled PET and CarbonCapture PET bottles.

Scientifically proven results: undeniable safety and lower environmental impact

The research on extractables, conducted by the specialized laboratory Lab Analysis and reported by the Tecnopolo Mario Veronesi Institute, part of the Democenter-Sipe Foundation, represents a **breakthrough for the adoption of sustainable packaging in the pharma industry,** as it provides data-proof evidence about the safety of sustainable PET, achieving excellent results comparable to those of "virgin" PET. Indeed, these solutions have registered values –

PET bottles quality check at Bormioli Pharma's plant in Castelguelfo, Italy

in terms of the presence of extractables - **150 times below the risk index in the worst-case scenario for rPET and -200 times for CarbonCapture PET.**

With regard to the LCA analysis, Stantec, a consultancy company with high competencies in ESG, determined that a 15-mL carbon capture PET bottle offers **a 21.9% reduction in environmental impact** when compared with primary or "virgin" PET while recycled PET (rPET) reduces environmental impact by **37.2%**.

EcoPositive, the central element of a wider ESG strategy

In addition to the science-driven approach applied by Bormioli Pharma to substantiate its eco-friendly range, EcoPositive is part of a more ample ESG strategy, featuring 4 areas of action:

- the product offer, including the EcoPositive range mentioned above;
- a solid and transparent governance model;
- the optimization of industrial processes;
- the protection of the health and safety of the Group's people and the enhancement of diversity and talent.

Within this framework, the company has set important goals for the future, including:

- using sustainable raw materials for 50% of its production by 2025;
- reducing CO_2 emissions by 30% by 2030 (vs a 2021 baseline) and reducing water consumption by 41% within 2030;
- closing the gender pay gap by 2028;
- assessing 90% of its suppliers by 2026 on the international ratings platform, EcoVadis, measuring the performance of suppliers' sustainability management systems.

The Company's commitment to sustainability, environmental and social responsibility is in line with its mission: "Making health a positive practice, accessible to everyone, kind to the planet."

Conclusion

In conclusion, sustainability is a fundamental pillar of the pharma packaging industry. Through technological advancements, material innovation, and the adoption of green technologies with a scientific data-based approach, packaging manufacturers can drive positive change and contribute to a more sustainable future. By leveraging enablers such as collaborative partnerships, regulatory support, and consumer demand, the industry can accelerate the transition towards sustainable packaging practices.

Kindeva DRUG DELIVERY Manufacturing More Tomorrows™

KINDEVA DRUG DELIVERY: LEADING THE GREEN PROPELLANT REVOLUTION

Kindeva's ongoing commitment to combination product sustainability.

As recent legislative proposals signal the transformation of sustainability standards for inhaler propellants, Kindeva Drug Delivery is in a familiar spot on the front lines of the transition. Guided by firsthand knowledge of the challenges associated with this kind of shift, we have developed multiple approaches to ensure we meet future regulations head on. At Kindeva, extensive hands-on expertise and technical excellence are helping us create more sustainable drug-device combination products for patients worldwide.

Unrivaled experience

When we introduced the first pressurized metered-dose inhaler (pMDI) free of chlorofluorocarbons (CFCs) to the market in the '90s to address ozone-layer depletion, we learned a lot about the best ways to approach industry-wide sustainability initiatives. With numerous current legislative proposals putting the scent of large-scale change in the air once again, it is worth reflecting on the success of this earlier propellant switch. While the move from CFCs to hydrofluoroalkanes (HFAs) was a challenge, the influx of investment across the industry led to improvements not only to propellants, but also to other pMDI device components, enabling increased lung deposition, a

reduction in chemical degradation, better end-of-unit dosing consistency, and more (1).

While the current in-use propellants, HFA-134a and HFA-227, might have seemed perfect by ozone-protection standards, their respective Global Warming Potentials (GWPs) of 1430 and 3220 have led to the justifiable targeting of them over climate concerns.

Guided by a holistic approach and extensive experience, Kindeva is dedicated to developing more environmentally friendly pMDIs that are safe and effective for patients.

It is worth remembering, however, that these previously adopted HFAs had significantly lower GWP than the CFCs that they replaced. Still, even those reduced levels are now unacceptable, calling for a better solution.

Perhaps the most important lesson here is that no solution is perfect. CDMOs must stay invested in finding new and better ways to enhance health, both directly and indirectly. This is why Kindeva remains focused on the holistic development of drug–device combination products that reduce environmental harm to patients while providing life-changing therapies.

Addressing every aspect

For us, working toward products that are safe and effective for patients means examining every element of a drug–device combination therapy to ensure it is as friendly to the planet (and therefore human health) as possible. This requires looking beyond just the GWP of a device, instead seeking to improve its overall footprint.

This holistic approach is supported by a 2019 University of Manchester, U.K., study of the impact of dry-powder inhalers (DPIs) and pressurized metered-dose inhalers (pMDIs) on the environment across their life cycles (2). Examining 14 categories—including freshwater and marine eutrophication and fossil and metal depletion—the study found that while the DPI did have a lower GWP than the HFC-152a pMDI, it also had the most damaging impact on the environment in more than half of the categories overall, owing in part to its componentry and lack of recyclability. The HFC-152a pMDI, on the other hand, had the lowest environmental impact in 10 categories, backing up the idea that the only way to truly create a green therapy is to make every element of the product as green as possible, and that requires a holistic examination.

Patients are the priority

While it can be easy to forget in the initial noise that accompanies new legislation, the patient must take precedence when developing strategies for therapies. At Kindeva, our focus is always on optimizing outcomes, so we remain device agnostic, striving to make every product we create—whether pMDI, DPI, soft mist inhaler (SMI), or nebulizer—as effective, reliable, and environmentally friendly as possible. The right therapy for the patient is the one that works for them, so our goal is to preserve patient options by making sure each one works for the planet as well.

Innovating the industry

Our state-of-the-art Loughborough, U.K., facility will house one of the first commercial green propellant lines using HFA-152a, with a planned opening in 2025.

With regard to current and upcoming legislation impacting the substances used as propellants in pMDIs, we continue to bring new solutions to environmental problems. Kindeva has dedicated massive resources to the development of pMDI products with alternative propellants HFA-152a and HFO-1234ze, which have 90% and 99.9% lower GWPs than the current greenest propellant in current use.

We have installed pilot-scale lines and have plans in place for the 2025 opening of one of the first commercial green propellant lines using these two propellants. Housed in our Loughborough, U.K., facility, this manufacturing line can fill inhalers using either of these lower-GWP propellants, with product development support handled in-house at two of our other eight state-of-the-art facilities. We have increased our manufacturing capacity to help drive quick partner adoption of these low-GWP propellants and commercialization of products using them.

Forging a more sustainable future

Just as we led the transition to HFA-based inhalers 25 years ago, Kindeva is helping guide the path to more environmentally friendly options today. We never stop exploring ways to create new and better options for bringing effective therapies to patients while reducing environmental pollutants that might worsen their conditions. Our component and hardware adaptability coupled with our unrivaled experience in the industry help us match the performance of new, greener devices to that of current ones, offering better ways to provide healthier therapies to patients worldwide.

For more information on our sustainability initiatives, visit our website, and for ideas on transitioning to green propellants, read our blog.

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SUSTAINABILITY AT MILLIPORESIGMA: NOT JUST ABOUT CHANGING LIGHTBULBS

This global life sciences company is embracing end-to-end sustainability – and helping customers do the same.

Introduction: Big Pharma's big footprint

In 2015, the global pharmaceutical industry emitted 52 million tons of carbon dioxide equivalent greenhouse gases—more than the 46.4 million tons created by the automotive industry in the same year. Without rapid decarbonization, we're on pace to triple those emissions by 2050. But to mitigate the worst effects of climate change, we need an entirely different reality by 2050: one where humans produce no net new emissions (net zero).

Many life science companies, including MilliporeSigma, are looking at how to become more sustainable. MilliporeSigma has set a target of being climate neutral by 2040. *How do we get there?*

The solution: Closer collaboration

MilliporeSigma believes that becoming truly sustainable requires close collaboration and alignment of goals across the entire business. Darren

Verlenden, Head of the Process Solutions business, and Ivan Donzelot, Head of Integrated Supply Chain Operations, share examples of how the alignment of business and supply chain goals, and the support of the Life Science Sustainability team, is key to the success of meeting our sustainability goals.

Here are a few initiatives we're currently working on.

1. Re-engineering processes and product development

To reach our sustainability goals, we're building sustainability principles into product conception and re-engineering processes to improve environmental footprints. Our Design for Sustainability framework (DfS), fully implemented in 2022, embeds sustainability into the development of products (beginning with R&D) and product lifecycles. This framework includes working with customers to solve specific environmental and green chemistry challenges and re-engineering our portfolio to improve environmental performance.

Darren Verlenden, Head of the Process Solutions business, MilliporeSigma

Ivan Donzelot, Head of Integrated Supply Chain Operations, MilliporeSigma

In 2023, we launched the Millistak+® HC Pro Micro 20 depth filter, our first bioprocessing product using the new DfS framework. By reimagining the product geometry, we were able to reduce the amount of material in each filter by 75% compared to the Millistak+® HC Pro µPod® device. The new filter is more recyclable and has paper-board packaging with a zero-deforestation certification

Re-engineering also offers significant opportunities for improving environmental footprints. We're eliminating the use of process gases in membrane permeability testing, the last vestiges of a decades-old process that is still widespread in the industry. In 2022, process gases accounted or 17% o our Scope 1 and 2 emissions. It's our intention to bring this to zero by 2030.

2. Improving the sustainability of our packaging

Collaborating with external stakeholders, we developed SMASH Packaging, our proprietary framework to improve the sustainability of our packaging. Through collaborations between our product management, sustainability experts, packaging engineers, and supply-chain teams, we're optimizing resources, using more sustainable materials, and designing for a circular economy.

It's already proving effective. For example, we've developed new bulk packaging solutions for a subset of our filters and prefilters, which is estimated to reduce corrugated packaging between 43%–60% per unit. It will also increase the number of units per pallet some 14%–33%. So far, our 20+ product- and distribution-packaging improvement projects have resulted in a total annual reduction of over 300 metric tons of corrugated and plastic packaging.

3. Developing circular recycling solutions

MilliporeSigma estimates that the pharma industry disposes of 94,000–200,000 metric tons of plastic annually—contributing to greenhouse gas footprints when disposed in landfills or by incineration. We're developing circular recycling solutions for single-use plastic, with the goal to recycle as much plastic as we sell by 2030.

Our successful **Triumvirate partnership** (2015-2020) is still diverting large quantities of plastic from landfills: Since its inception, the program has recycled over 9,380 metric tons of biopharmaceutical plastic, equating to an estimated reduction of 6,000 metric tons of CO_2 equivalents.

We're now building on that success by working with advanced recyclers, conducting trials in high-waste areas, forming partnerships with our customers, testing the recyclability of different polymers, and looking for ways to integrate our recycled polymers into single-use equipment or packaging.

4. Reducing greenhouse gas emissions in our operations.

To reduce our greenhouse gas footprint, we're transitioning to renewable energy with a goal of being powered by 80% renewable electricity by 2030. In 2022, our Life Science business reduced its Scope 1 and 2 greenhouse gas emissions by 33% compared to 2020, thanks in part to its 77% renewable energy mix.

Our flagship energy and water-reduction program, EDISON, earmarks approximately $10 million annually to improve the footprint of our sites. At our global headquarters in Darmstadt, Germany, we installed a 560 kW photovoltaic system on the roof of our Distribution Center. This project reduces 235 tons of CO_2 annually and generates 400 MWh of electricity annually.

One of our sites for manufacturing single-use products is saving 298 metric tons of CO_2 and 1,617 MWh of energy annually thanks to a new heat pump installed to replace steam heating in HVAC units.

To extend our impact beyond our own operations, we're developing a Supplier Data Library to acquire primary data from suppliers about their products and operations. This data will inform several workstreams including refinement of our Scope 3 emission calculations, design decisions made in the Design for Sustainability process, and feeding our pipeline to generate cradle-to-gate carbon footprints for all our products. Eventually, we aim to provide this Product Carbon Footprint to our customers, helping them with their own greenhouse gas inventories.

Conclusion: True sustainability requires closer collaboration than ever before

To address their considerable environmental footprint, suppliers and their customers must work together to effect real change. MilliporeSigma is investing in sustainability to move the industry closer to its environmental goals. The results of this close collaboration between our Process Solutions and Integrated Supply Chain Operations teams are a testament to our sustainability success, providing a model for other life sciences companies looking to improve their own footprints and those of their clients. Our success to date is just a small preview of what's possible for the industry. Achieving climate neutrality will be no small feat, but this is an industry that routinely improves lives through science and innovation—and there's no reason we can't do the same for the planet.

CAMBREX: SUSTAINABILITY PROGRAM REDUCES SCOPE 1 AND SCOPE 2 EMISSIONS BY 20%

Over the past two decades, the pharmaceutical industry has experienced a notable shift in sustainability practices, with most organizations now integrating Environmental, Social, and Governance (ESG) programs into their core operations. While many initiatives began in the early 2000s as reactions to rising stakeholder expectations and regulatory pressures, ESG programs have evolved into transformational corporate strategies that can yield tangible business benefits.

Today's pharmaceutical companies have aligned ESG initiatives to their corporate growth goals, focusing on initiatives such as improving supply-chain resilience, increasing innovation, and enhancing operational efficiency. Through those initiatives, companies have realized tangible business benefits, including lower overhead cost, reduced supply-chain risk, and improved brand value and reputation with stakeholders.

But while many pharmaceutical companies were early adopters of sustainability initiatives, vendors along the pharmaceutical value chain have lagged in developing actionable, time-based sustainability programs.

As a contract development and manufacturing organization (CDMO), Cambrex's ESG programs are aligned to our corporate goals, including top-line growth, cost reduction, and increased employee productivity. Simultaneously, our ESG programs are

designed to support those of our customers – including the measurement and reduction of Scope 3 emissions within the supply chain.

As defined by the US Environmental Protection Agency, Scope 3 emissions are the result of activities from assets not owned or controlled by the reporting organization, but that the organization indirectly affects in its value chain. Scope 3 emissions, also referred to as value chain emissions, often represent the majority of an organization's total greenhouse gas (GHG) emissions.[1]

For CDMOs, manufacturing facilities traditionally require a vast array of environmental resources – from chemicals and solvents to electricity – to produce both drug-substance and drug-product materials for clinical trial, commercialized and OTC products. With the industry relying heavily on outsourced manufacturing, pharmaceutical organizations must ensure that their manufacturing partners can support their overall ESG goals to address Scope 3 emissions.

The Evolution of Cambrex's ESG Initiatives

Cambrex's sustainability roadmap was created with several objectives in mind, including ethics and transparency, protecting both workers and the environment, enhancing supply-chain practices and responsible corporate citizenship. Our ESG policy is approved and overseen by the Cambrex Board of Directors.

Over the past five years, Cambrex has been on a continuous journey to improve its social and environmental impact through measurable, time-bound ESG initiatives, which included the goal of a 20% of Scope 1 and Scope 2 greenhouse gas emissions reduction by the end of 2022. In addition to internal metrics, Cambrex has joined the Carbon Disclosure Project and has implemented a Supplier Code of Conduct, which incorporates the concepts identified in the Pharmaceutical Supply Chain Initiative's (PSCI) Principles for Responsible Supply Chain Management. We recognize that we, and our customers, rely

on other vendors within the pharmaceutical value chain and deployed this formal program to ensure that our suppliers are aligned with our values and principles across the spectrum of ESG elements.

Measurable Results

While many initial ESG programs often focus on small pilots, Cambrex selected our highest resource-consuming facilities for this first phase of improvements: three large-scale active pharmaceutical ingredient manufacturing sites across three different countries. This wasn't simply a pilot at one small facility—we wanted to make considerable progress that yielded substantial, measurable results.

At the end of the five-year transformation period, 2018–2022, Cambrex achieved its target of 20% company-wide reduction in Scope 1 and 2 greenhouse gas emissions. In early 2023, we completed the first accounting of Scope 3 emissions, which will be critical element of our ongoing sustainability strategy.

Located on a 45-acre campus in Charles City, Iowa, Cambrex's largest drug substance manufacturing site sources 88.5% of its power supply from wind. Cambrex projects that this facility will run on 100% wind energy by 2025.

Third-Party Result Validation

To ensure accurate ESG initiative benchmarking by individual manufacturing sites, Cambrex utilized EcoVadis for standardized evaluation. EcoVadis's platform assesses suppliers based on a range of

At the close of 2022, our Charles City, Iowa site received a 2022 Gold rating, indicating it is in the top 5% of organizations evaluated. In Europe, Cambrex's sites in Karlskoga, Sweden, and Milan, Italy, both received 2022 Silver ratings, indicating that they are in the top 25% of organizations evaluated.

criteria, including environmental impact, labor and human rights practices, fair business ethics and sustainable procurement. This standardized approach facilitates benchmarking and enables companies to track improvements over time.

At the close of 2022, our Charles City, Iowa site received a 2022 Gold rating, indicating it is in the top 5% of organizations evaluated. In Europe, Cambrex's sites in Karlskoga, Sweden, and Milan, Italy, both received 2022 Silver ratings, indicating that they are in the top 25% of organizations evaluated.

With our first milestone complete, Cambrex looks forward to continuing its cross-discipline improvement plan, driving solutions that ensure long-term business viability, protect the environment, and contribute to the local communities in which we operate.

Reference

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About Cambrex

Cambrex is a leading global contract development and manufacturing organization (CDMO) that provides drug-substance, drug-product, and analytical services across the entire drug lifecycle. With over 40 years of experience and a growing team of over 2,400 experts servicing global clients from North America and Europe, Cambrex is a trusted partner in branded and generic markets for API and finished dosage form development and manufacturing.

Sai

Make it
better
together

SAI LIFE SCIENCES: SCIENCE & SUSTAINABILITY WORK IN TANDEM

Introduction

As a global Contract Research, Development & Manufacturing Organization (CRO-CDMO), Sai Life Sciences works with over 200 global innovator pharma and biotech companies to accelerate the pace of drug discovery. Science is at the core of what we do, and Sustainability is the credo guiding our actions.

Roadmap to achieve Sustainable Development: Goals (SDGs) by FY 2027

We first charted out our Sustainable Development Goals (SDGs) in 2019 with a three-year timeline. During this period, despite rapidly scaling up of operations, we exceeded our targets in areas such as the utilization of renewable energy, recycling of hazardous waste, and reduction in greenhouse gas emissions while making substantial progress in other areas.

In August 2021, we became a signatory of the United Nations Global Compact (UNGC), the world's largest sustainability initiative, to reiterate commitment to adopt the universal principles on human rights, labor, environment, and anti-corruption, and take actions that advance societal goals.

On World Environment Day 2023, we announced renewed SDGs charting out the roadmap to achieve specific Environmental, Social and Governance (ESG) targets by March 31, 2027.

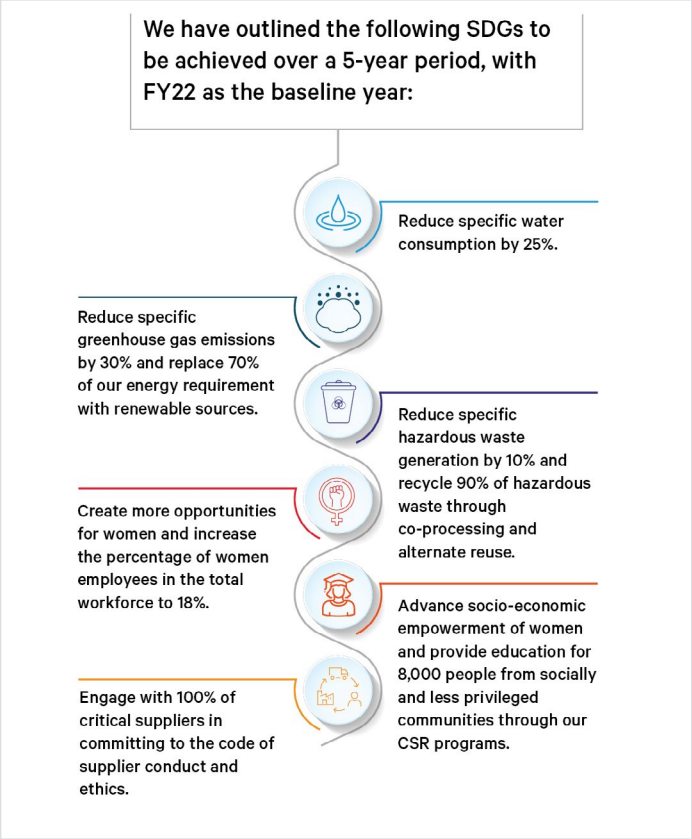


Figure 1: Sai Life Sciences' Sustainable Development Goals (SDGs).

Approach towards Sustainability

We have spelled out a four-pronged 'Sustainability Framework' to integrate sustainability into our strategy and operations.

Sustaining as partner of choice: We adapt our offerings and capabilities to suit the evolving requirements of our existing and prospective partners. We follow sustainable manufacturing practices to boost operational excellence and develop a science-driven, robust & scalable approach from concept to scale-up.

Being an employer of choice: We support our employees' personal and professional development in line with their strengths, aspirations, and competencies, laying the groundwork for enriching growth and partnership with our customers. In addition to this, we are guided by our SDGs and work towards ensuring gender diversity across employee groups in India, the US, and the UK while driving for improved diversity year after year.

Growing as an HSE champion of choice: We continually integrate HSE considerations into our operations and business practices. We work towards reducing resource consumption, emissions reduction, sound waste management, and promote energy management practices throughout all our facilities. We reinforce a strong culture of health & safety across operations by establishing robust health and safety guidelines, operational controls, occupational hygiene strategy, and building process safety competence that are at par with international standards.

Becoming a neighbor of choice: We work with communities around our sites to identify opportunities for meaningful engagement in three priority areas—Education, Livelihood Development, and Health. We collaborate with governmental and non-governmental organisations, whose missions align with our focus areas.

For more information, refer to our Sustainability Reports:

Download Sustainability Report 2022

Download Sustainability Report 2021

Download Sustainability Report 2020

Environmental, Social, Governance (ESG) Pathway

The sustainability framework helps us meet ESG targets. Some of our key initiatives are listed below:

Water

- Set up zero liquid discharge system for effluent treatment at our flagship API manufacturing unit in Bidar, India.
- Follow rigorous hazardous waste-management practices and use treated sewage water for developing green cover in and around our sites.
- Stepping up the treatment and reuse of rainwater and reducing the consumption of freshwater.

Energy

- Executed several energy-conservation measures contributed to a 37% reduction in specific greenhouse gas (GHG) emissions as reported in our latest sustainability report.
- We have received Leadership in Energy and Environmental Design (LEED) 'Gold' certification

from the U.S. Green Building Council for our Research & Technology Center in Hyderabad, India, for blending work efficiency, aesthetics with sustainability through its intelligent lab design, collaborative workspaces, optimized resource consumption, and ambient indoor air quality.

- At flagship manufacturing unit at Bidar, the usage of renewable energy increased to 78% in FY 2023 from 67% in FY 2022, thereby significantl reducing CO_2 emissions.

Green Chemistry

- An in-house computational model, the Greenness Index, was developed to assess projects on water conservation, resource conservation, solvent management, and waste management. Our chemists design reactions and processes with improved efficiency, reduced waste, and lower environmental impact.
- Our contribution to Green Chemistry is recognized by GSK in winning the GSK's Environmental Supplier Award 2021 in the 'Primary Manufacturing' category for effectively embedding green-chemistry principles in the approach to process development.

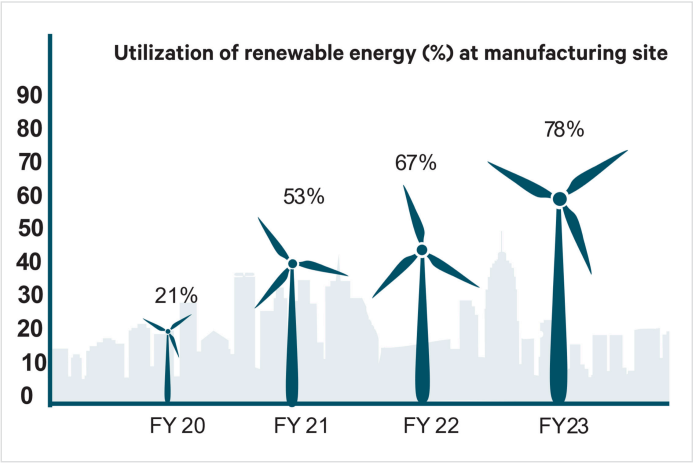


Figure 2: Utilization of renewable energy at manufacturing site

Tree Plantation:

- In 2022, we conducted a block plantation project at a Reserve Forest in Hyderabad, Telangana, India, to transform a five-acre barren land into a verdant landscape by planting over 2,000 saplings.

- Developed a green cover spread across 6.2 acres as part of our Manufacturing site in Bidar, Karnataka, India, with over 5,000 trees. Leased an additional 10-acre plot to plant an additional 5,000 saplings by 2027 and create a nursery for native plant & tree varieties.

Committed to 'Collective Future'

To help combat climate change, in June 2023, Sai Life Sciences joined the Science Based Targets initiative (SBTi), a global body enabling businesses to set ambitious emission-reduction targets in accordance with the latest climate science. Accordingly, we have committed to set near-term company-wide emission reductions in line with climate science set by the SBTi.

In recent years, we have made significant investments in advancing our Sustainability agenda as part of our organizational transformation initiative, Sai Nxt. Some of the notable highlights:

- First India-headquartered company to join the Pharmaceutical Supply Chain Initiative (PSCI) membership.
- Joined the American Chemical Society's (ACS) Green Chemistry Institute Pharmaceutical Roundtable (ACS-GCIPR) as an Associate Member.

Our approach towards Sustainability reflects a coming of age in our journey. We hope to raise the bar high and continue to create impact on the ground by working closely with all the stakeholders, including customers and the community at large.

WEST PHARMACEUTICAL SERVICES: BY YOUR SIDE FOR A SUSTAINABLE FUTURE

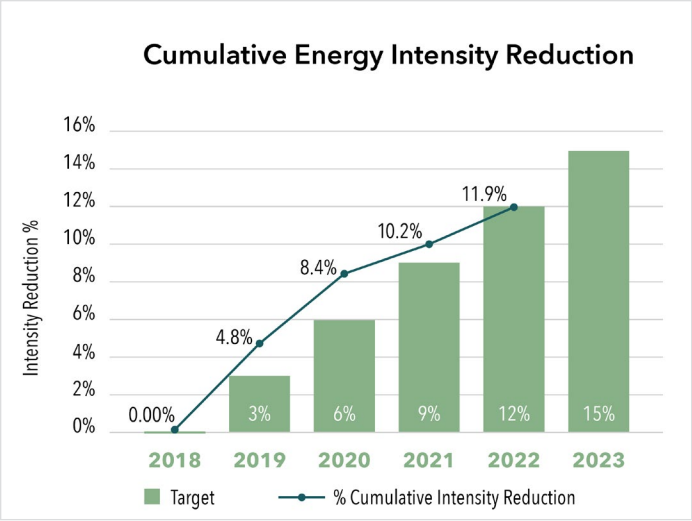
About West

West Pharmaceutical Services, Inc. is a leading provider of innovative, high-quality injectable solutions and services. As a trusted partner to established and emerging drug developers, West helps ensure the safe, effective containment and delivery of life-saving and life-enhancing medicines for patients.

In 2023, West is celebrating its centennial anniversary. For 100 years, West has been committed to working side-by-side with our customers to improve patient health. We are also committed to helping to create a healthier environment and to being good stewards of a sustainable future.

"The founder of our company, Herman O. West, was well known for his quote, 'Keep everlastingly at it,' a saying he frequently used to keep his employees focused with a continuous improvement mindset," states Ryan Metz, Head of ESG at West. "Today, we are proud to carry that mantra forward—and "Keep everlastingly at it" with our ongoing commitment to ESG. As we look ahead and build our strategy to best support our next 100 years of business, ESG will underpin all areas of our business strategy, budgets and expansion projects."

West's Sustainability Program has been designed to target reductions in the areas where we can have



Hitting the mark: trending towards achieving our 2023 Energy Intensity Reduction target.

the greatest impact: CO_2 emissions, waste and increased recycling, and energy and water use.

Here are a few highlights that are expanded upon in our **2022 ESG Report:**

- In 2022, we saw steady improvement in our Energy Intensity, bringing us to 12% improvement over our baseline year in 2018.
- For Emissions, we made a 4.1% improvement over 2021.
- We continued to focus on landfill diversion, with 83% of our waste being recycled in 2022.
- We achieved a 6.7% reduction in water intensity versus the baseline year in 2018.

Our Globally Aligned Commitment

West is a signatory to the Task Force on Climate-related Financial Disclosures (TCFD), which affirms our commitment to fiscal transparency and to being a leader in addressing the current climate emergency. In addition, West is a proud founding member and active participant with the Pharmaceutical Supply Chain Initiative (PSCI) and is a supporter of the PSCI Principles, aligning with its vision for excellence in safety, environmental, and social outcomes for the global pharmaceutical and healthcare supply chain.

As we enter the final year of our 2019–2023 metrics, we are excited to look ahead to the future with an enhanced focus on our strategic approach to sustainability.

- We have added greater scientific rigor and a more quantitative focus to our environmentally based targets. Science-based targets will provide a more clearly defined pathway for West to reduce greenhouse gas emissions (GHG) that are in line with the Paris Agreement goals.
- We are aligned with the 2015 Paris Agreement, where world governments committed to curbing global temperature rise and limiting global warming to 1.5 °C. We know that the private sector has a crucial role to play in this, and West has committed to joining other organizations worldwide by setting emissions reduction targets grounded in science through the Science-Based Targets initiative (SBTi).

Sustainable Products for the Pharmaceutical Industry

Through our collaboration with Corning, West is excited to bring sustainable products to the health-care industry, starting with the launch of **Corning® Viridian™ Vials**. Viridian Vials, externally coated Type 1 borosilicate vials, are a drop-in solution made with 20% less glass material, enabling up to a 30% reduction in Cradle to Gate, Scope 3 emissions.

Corning® Viridian™ Vials are a drop-in solution that reduces glass waste and manufacturing emissions, while enabling faster and safer fill finish operations.

Viridian Vials reduce glass waste and manufacturing emissions to deliver a more sustainable choice. Less glass means less raw materials extracted from the environment and less material waste at end-of-life.

Viridian Vials have a positive impact on every stage of vial usage, from manufacturing to patient use. This cutting-edge coating technology allows our customers to deliver medications safely and efficiently – for both patients and the planet.

Our Commitment for the Future

We have been working hard to enhance our quantitative targets, which will enable us to achieve success in the Environment-related priorities of our ESG Strategy, including Climate Strategy, Waste in Operational Processes, R&D for the Environment, and a Responsible Supply Chain.

Our 2030 targets are expected to include:

- Achieve 50% renewable electricity
- Continuously improve energy efficiency by 3% year-over-year
- Reduce absolute emissions by 40%
- Achieve a 15% water intensity reduction
- Eliminate up to 100% of operational waste to landfill
- Partner with customers to reduce, reuse, and recycle secondary packaging
- Collaborate with customers to explore sustainability improvements throughout the product lifecycle
- Gather additional Scope 3 emissions information from our supply chain and develop a plan to reduce those emissions.

West takes a concerted, cooperative approach with our customers and other stakeholders to work together to help each of us most efficiently achieve our ESG targets for mutual benefit. This includes investigating shared power purchase agreements, researching more sustainable materials, exploring more efficient shipping methods, and studying beneficial reuses for our products.

We view sustainability as a vital responsibility for our business and will continue to monitor the ever-developing global sustainability standards and regulations, ensuring that we are aligned with leading organizations in this area and following best practices in setting science-based targets.

In 2022, West was recognized by several organizations, including being named as one of Barron's Top 100 Most Sustainable Companies and one of America's Most Responsible Companies by News-week. West was also honored with several regionally focused awards, including a Corporate Societal Excellence Award in Singapore and Global Public Service Award in Ireland.

In 2023, West was named as one of America's Climate Leaders 2023 by USA Today. We were also excited to announce our new sustainability partnership with the National Football League's Philadelphia Eagles for the deployment of West's Field Goal Forest program.

Moving forward, we will "Keep everlastingly at it," continuing to build a healthier world and knowing that our strategic commitment to sustainable practices will deliver positive outcomes for our people, our customers, and our communities for generations to come.

View our ESG Report to learn more about West's sustainability commitment.

ARCONDIS: THE ARCONDIS WAY: DOING RIGHT, DOING IT RIGHT, ACCELERATING SUSTAINABILITY

Arcondis, as a boutique consulting firm exclusively serving the healthcare industry, stands at the center of the sustainability challenges this industry faces. Our organization rises to the challenge of becoming truly sustainable while supporting our clients on their own sustainability journeys. Through this reciprocal relationship and continuous knowledge exchange with our clients, we celebrate successes but also recognize the industry's long road ahead. A large-scale transformation is urgently needed to secure the future of healthcare and the greater good. We embrace this challenge by supporting and driving development with and at our clients in line with our mission statement.

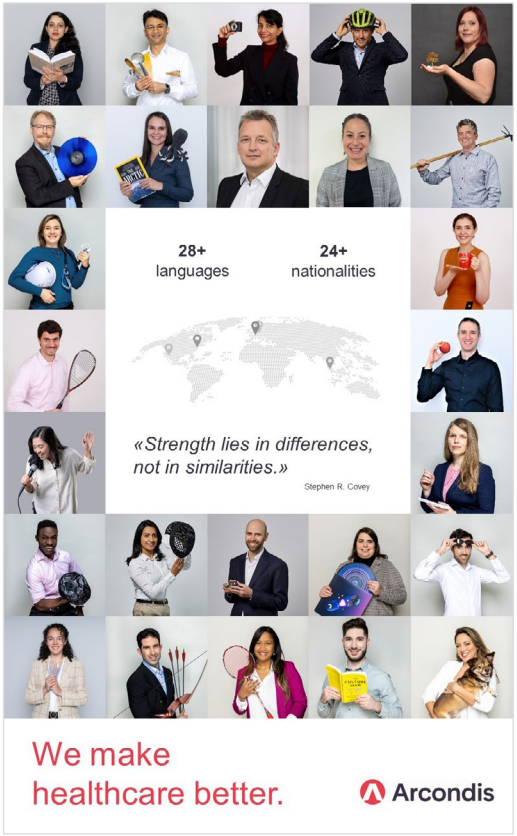
What sustainability means for Arcondis

To understand Arcondis' perspective on sustainability, we must explore its definition. Sustainability, as defined by the Club of Rome in 1972, represents a holistic approach to meeting present needs without compromising future generations. It encompasses the social, economic, and environmental interdependence, seeking long-term balance and harmony between human activities and the natural world. Unlike ESG, which addresses organizational risks and opportunities, true sustainability extends far beyond this. It necessitates systemic changes and a comprehensive approach to achieve meaningful progress

towards a sustainable future. Arcondis aligns with this holistic meaning, which we aim to support through our work and mission.

Arcondis sees its mission in being a global community of brilliant minds driven by shared values, inspiring its partners to making healthcare better. This mission is tied to the United Nations' Sustainable Development Goals (SDGs) of good health and well-being (SDG 3), decent work and economic growth (SDG 8) and partnerships (SDG 17). Through our client work, we also contribute to industry, innovation, and infrastructure (SDG 9); responsible consumption and production (SDG 12); strong institutions (SDG 16); clean water and sanitation (SDG 6); and climate action (SDG 13). As we serve clients in food production, pharma, medtech and public health, we adopt a One Health perspective on sustainability.

We celebrate being an organization owned by a foundation whose purpose is sustainable development for people and the environment. The Arcondis foundation is an employee guarantee that also supports social causes such as Ukrainian



Meet the faces behind the name: This is Arcondis.

refugee aid and envisions fostering environmental sustainability causes. This goes hand-in-hand with building strong foundations with our workforce and being innovative about sustainable talent enablement. We prioritize decent work conditions (SDG 8), work-life balance, and sustainable procurement. This enables us to attract talents with diverse science backgrounds such as medicine, IT and environmental science (see Figure 1). All this empowers us to successfully tackle healthcare challenges across the value chain.

Supporting sustainability at our clients

Healthcare sustainability requires a paradigm shift towards a holistic health concept. The industry's significant environmental footprint and dependence on ecosystem services require action. Bioprospecting that is reliant on biodiversity fuels innovation and industry success. However, environmental degradation risks public health and healthcare functioning. Addressing energy, waste, water, and adopting circular economy principles are vital for a sustainable healthcare system. Similarly, scenario planning for risk and continuity management is crucial for ensuring resilience and success, especially as sustainability assures long-term profitability. Thus, balancing patient care with reducing emissions, optimizing resources, sustainable decision-making, and protecting biodiversity is imperative.

So far digitalization has been a key enabler for making companies more sustainable. Many digitalization solutions have directly or indirectly contributed to making the industry more sustainable. While many jump to timely and costly innovation for sustainability, it is important to recognize the existing toolboxes that can equally help us achieve necessary transformations. Digitalization is one of these toolboxes, especially as few organizations have implemented state-of-the-art digitalization solutions across their entire organizations. Over the years, Arcondis, has been instrumental in bringing and delivering digital transformations to our customers that help to make the organisations more sustainable (see Figure 2).

Example of what work in a digitalized, connected lab of the future can look like. Our team has used this example as a vision blueprint for building real-world future labs at our clients.

One example of sustainability-focused transformation is the digitalization of lab landscapes for creating future labs. Our vision of a future lab encompasses sustainability, achieved through digital material and equipment management, resource-conscious practices, and enhanced data utilization via data F.A.I.R-ification and interoperability. With pride, we have supported various initiatives, including a flagship program where our team successfully enabled paperless workflows, seamless data access and enhanced data sharing in a greenfield lab environment. These changes significantly improved research efficiency, time utilization, and output, thereby optimizing economic, social, and environmental value in this cost, energy and time-intensive R&D setting.

Arcondis consultants have achieved notable successes in promoting good health and well-being (SDG 3) by enhancing healthcare access, patient safety, product safety, and data security. They contribute to strong institutions (SDG 16) through compliance and quality management in complex regulatory environments, thereby also addressing environmental impacts such as waste production (SDG 12; SDG 13). Currently engaged in supply chain, operational excellence, and business continuity projects, Arcondis values the increased sustainability aspects to our work and welcomes the growing stakeholder and partnership

interest. As we continue learning and building effective sustainability solutions together, we strive to make a positive and lasting impact.

Bringing sustainability to healthcare: Our role

Larger healthcare organizations often seek strategic advisory services, including sustainability, from seven major consulting firms with access to Fortune 500 companies and notable impact on global business. While this could accelerate systemic transformation towards sustainability, it also risks reinforcing easier-to-accept incremental change and business- as-usual within existing systems. Business and management professionals, encouraged to position themselves close to prestige and power, may inadvertently hinder transformative processes and innovation through self-selection and confirmatory bias. Consequently, solving sustainability challenges requires interdisciplinary expertise, e.g., from environmental scientists, toxicologists, chemists, and psychologists. This is precisely how Arcondis can best support sustainability in the healthcare industry.

Successful change management for sustainability is crucial for a lasting and effective industry transformation. Failing carries high risks, costs, and jeopardizes broader sustainability outcomes. Therefore, individually addressing sustainability dimensions is insufficient and a One Health perspective is essential. Likewise, a deep understanding of the impact on people is imperative to mitigate the risks of change saturation. As Arcondis specializes in healthcare-specific, interdisciplinary expertise, we translate change in a way to make a direct and lasting impact. Getting change for sustainability right is paramount. Are you ready to tackle this challenge with us? Then let's make healthcare better—together.

STERLING PHARMA SOLUTIONS: DEVELOPING A SUSTAINABLE BUSINESS FIT FOR THE FUTURE

What does sustainability mean to Sterling Pharma Solutions?

As a partnership development and manufacturing organisation (PDMO), sustainability for Sterling is about a commitment to the future success of the organization in the eyes of our stakeholders: employees, investors, customers, suppliers, our planet, and communities.

We are on a journey: learning, discovering, innovating and, most importantly, delivering. This is not a short journey; it's a long-term commitment to minimize our impact on our planet and maximize the positive impact for our stakeholders.

The most important thing for us is continual progress, which is regularly measured against our established goals.

The journey

Our Responsible Business Policy and ESG (environmental, social and governance) Roadmap set out our vision and strategy, which align with ambitious growth and investment plans.

Overview of Sterling Pharma Solutions' targets and environmental achievements.

Environment

Our Cramlington, UK, facility, has become the pioneer for our environmental sustainability initiatives.

We have achieved a 40% reduction in carbon emissions intensity on site, and now only 10% of electricity is drawn from the national grid. A combined heat and power (CHP) plant powers our manufacturing, lab, and office facilities.

The site treats the majority of process waste through onsite aerobic and anaerobic waste treatment facilities. The AD plant recovers waste solvents, converting them to biomethane, which is injected into the national gas grid, providing enough energy to power the equivalent of 6,000 homes per annum.

The investment and projects at our Cramlington site have established a benchmark for similar initiatives across our network, which are an integral element of our ESG Roadmap.

Sterling has recently begun engaging on a larger scale in global risk and sustainability initiatives. For example, under the Science Based Targets Initiative, we have signed the commitment, and believe our targets are aligned with limiting global warming to 1.5 °C. Within the pharmaceutical industry, we are engaging in Manufacture 2030's Activate program, which facilitates best practice sharing to achieve net zero.

Social

Continuing to ensure Sterling is a great place to work is one of our strategic imperatives, and is, therefore, something our executive team choose to focus on as part of its own governance. This focus ensures we prioritize our people, investing in learning and development, the environment they work within, and the rewards we can offer for their contribution to the business.

Our annual Employee Engagement Survey is an opportunity to provide anonymous feedback about how employees feel about the business and how we can improve our employee experience. This results in actions that are overseen by our CEO and our CHRO.

Sterling has seen a reduction of 4.5% in global employee turnover in the past two years. We invest

in programs that upskill current employees, providing them a career pathway while evaluating our compensation programs to align equity in relation to the knowledge, skills, and abilities of our workforce. We are also investing in the next generation with our apprentice and intern programs.

Sterling has a diversity and inclusion policy that details our commitment to oppose discrimination on the basis of age, disability, gender, race, pregnancy, religion, and/or sexual orientation.

Each of our sites also has a health and well-being committee, which provide advice, drop-in clinics, sports classes, guest speakers, and visiting professionals to support employees with all aspects of their lives. Our onsite occupational health and medical professionals are part of these committees.

The communities in which we work, and where our employees live, are important to us. We aim to be a considerate neighbor and a force for good in the community. Employees are encouraged to volunteer locally, and we also provide sponsorship and support

Some of our Wisconsin team volunteering in our local park.

for charities, projects, and clubs that are close to the hearts of our employees.

The pharmaceutical industry is forever changing through innovation, regulation, or the dynamic economic and political environments across the globe. Working in partnership with our industry peers, academic institutions, and government

bodies ensures we contribute to the future of the industry, ensuring challenges are tackled as a whole, new ways of working are adopted, and patients have access to the healthcare they require.

As a member of the Pharmaceutical Supply Chain Initiative, we share its vision of excellence in safety, environmental and social outcomes for the global pharmaceutical and healthcare supply chain.

Governance

Sterling Pharma Solutions' mission is: 'To deliver an exceptional experience to our customers and employees, setting a new standard of collaboration for the pharmaceutical industry with scientific partnership at its core.'

Our decisions and behaviors are guided by our core values. Be caring. Be transparent. Be willing. Be reliable. Our senior leaders and employees truly live these values every day.

We operate under a stakeholder model of governance; this model guides us to consider the interests of employees, customers, suppliers, and the communities in which we live and work, when making decisions.

We have a dedicated ESG team, which reports monthly to our executive team. This includes progress on our targets and developing the next steps in our ESG Roadmap.

We take our responsibilities as a drug-substance manufacturer very seriously. We understand the importance of the quality of our products and the impact this has on patients. While we have a global quality team of over 150 people, quality is everyone's responsibility regardless of their role.

Sterling has an exemplary compliance record with regulatory bodies, including the FDA, the MHRA, the PMDA, the TGA, the HPRA and the KFDA. In addition, over the last 12 months, we had 58 successful customer audits across our sites.

Sterling is committed to providing a work environment governed by the highest ethical and legal standards. Employees are expected to conduct activities

with integrity, ethically, and in accordance with applicable laws and regulations. The company has a suite of policies addressing business ethics to support this.

Sustainability is part of our business strategy and our culture; guiding decisions and investment, and part of everyday conversations. We measure our impact not just on the environment, but on employees, the communities we work within, and the industry we support. We aim to be a sustainable business now, and in the future, for the good of all our stakeholders, not least, those we make life-saving drugs for.

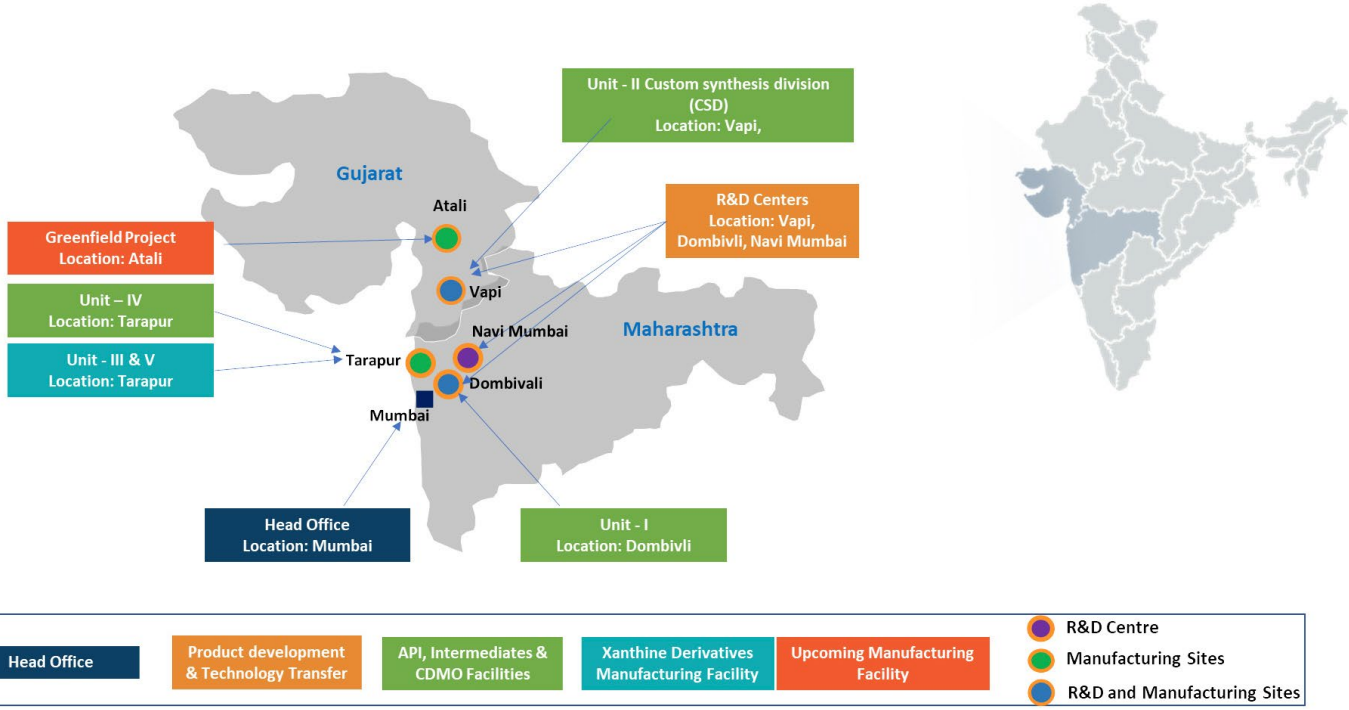
AARTI PHARMALABS: RIGHT CHEMISTRY FOR A HEALTHIER TOMORROW

Aarti Pharmalabs Limited (APL) is a leading small-molecules drug-substances CDMO and generic APIs & intermediates manufacturing company in India providing the highest quality services to biopharma companies addressing worldwide human health and well-being.

Over the past two decades, enabled by cutting-edge R&D and manufacturing capabilities, APL has evolved as a reliable partner of choice for generics players and innovator companies across the globe.

APL specializes in generic APIs, generic intermediates, and xanthine derivatives (especially synthetic caffeine) manufacturing. APL offers CDMO services for drug substances (RSM, Intermediates, GMP APIs) development and manufacturing for innovative pharmaceutical, biotech and research firms with a focus on clinical phase, launch, and commercial phase NCE projects. APL has dedicated facilities for the production of HPAPIs (oncology/ cytotoxic) and corticosteroids.

APL facilities



Overview of our locations in India; including R&D sites, manufacturing sites, and mixed sites.

ESG is our core business

Examples of how we accomplish environmental social governance (ESG) goals.

Green is our culture

PSCI
PHARMACEUTICAL SUPPLY CHAIN INITIATIVE

CII 3R AWARDS
EXCELLENCE IN WASTE MANAGEMENT
Reduce, Reuse, Recycle

Aarti is part of the Pharmaceutical Supply Chain Initiative (PSCI) and has received CII 3R Award in sustainability.

Highlights:

- Ecovadis sustainability assessment is planned in phase-wise manner
- CII 3R Award received for efficient waste management
- Facilities were audited as per Pharmaceutical Supply Chain Initiatives (PSCI) principles
- Green Chemistry:
  - o Biocatalysis: Using enzymatic catalysts to avoid waste that is generated due to chemical reactions
  - o Flow chemistry: Using micro reactors to save energy and to enable hazardous reactions to be handled safely
  - o Loop reaction technology: This is being used under pressure for three phase systems that reduces catalysts and solvents volume
- Overall 3.6% reduction in specific water consumption (KL/MT of products) in 2022 compared to 2020
- Approximately 400 KLD water is being treated and recycled
- Sludge/Salt from ETP/ATFD/STP are being dried to reduce hazardous waste. Approximately 18 MT/M HW is reduced at all sites
- Boiler steam condensate is being recovered at sites (avg. > 69%, targeting 85%)
- ~ 7% reduction in Organizational Carbon Footprint (kg CO_2 e/kg of product). Organizational CFP was 1.35 (kg CO_2e/kg of product) in 2021–2022: 1.25 (kg CO_2 e/kg of product) in 2023
- Solar-renewable energy project is being explored to reduce net energy consumption and reduce greenhouse gas (GHG) emissions.

Sustainability Council:

- To provide recommendations to the Board of ESG topics
- To advise the board on applicable and upcoming national and international laws
- To outline initiatives and develop strategy needed to institutionalize a culture of sustainability through the organization
- To review the sustainability performance of the company against set targets and report it to the Board
- To advise the Board regarding implementation of sustainability management system and assessment & management risks and opportunities.

Sustainability, Innovation and Operational Excellence at every stage of the pharmaceutical lifecycle:

Sustainability is part of our environment in everything we do, from the first step to the very last one.

"Over the past few years, the global socio-economic landscape has witnessed unprecedented disruptions. External factors such as climate change, geopolitical events, and shifting market preferences have challenged businesses. Under such circumstances, many organizations freeze and fail while resilient organizations weather such storms to grow and sustain.

Our risk-management framework is regularly upgraded to manage and mitigate new emerging business risks, inclusive of ESG risks. Furthermore, these risks have provided us with opportunities to innovate, strengthen our business model, and provide exemplary leadership to the industry for sustainable, equitable, and inclusive growth.

In the past two years, we have not only successfully managed disruptions caused by the COVID-19 pandemic, but also invested heavily in augmenting our capabilities through infrastructure development and asset creation. We have continued to grow during pandemic years and are committed to maintain our market position."

—APL Management

AVANTOR: AVANTOR'S SUSTAINABILITY INITIATIVES ARE CREATING A SUSTAINABLE FUTURE WITH SMART SOLUTIONS

From discovery to delivery, Avantor is a trusted global partner to customers and suppliers in the life sciences, advanced technologies, and applied materials industries. Our portfolio is used in virtually every stage of the most important research, development, and production activities in the industries we serve. Our global footprint enables us to serve more than 300,000 customer locations and gives us extensive access to research laboratories and scientists in more than 180 countries.

Everything we do is tied to our mission of setting science in motion to create a better world, and we are proud of the unique role we play in relentlessly advancing life-changing science. Avantor's Science for Goodness sustainability platform includes four pillars—People & Culture, Innovation & Environment, Community Engagement, and Governance & Integrity. It provides an important framework for how we create long-term value for all our stakeholders—including our associates, customers, suppliers, shareholders, and the communities we serve.

Our commitment to sustainability ensures our everyday actions generate positive impact for the environment and society. With sustainability embedded throughout our business, we fulfill our mission of setting science in motion to create a better world. We do this through our own operations, product and service offerings, and strategic partnerships with suppliers and customers.

Avantor has made great progress within our four pillars. We recognize there is still more to do and we will continue our efforts to generate a positive impact on the environment and society.

Operational Sustainability

To address our operational environmental footprint and deliver product and service solutions that support a transition to a low-carbon economy, we are:

- Reducing our greenhouse gas (GHG) emissions by lowering our energy consumption and seeking renewable and other lower-impact energy sources.
  - o We are well on track to beat our initial 2025 GHG emissions reduction target. In April of 2023, Avantor committed to set near-term company-wide emission reductions in line with climate science and the Science Based Targets initiative (SBTi).
- Addressing waste generation and increasing the use of recyclable and recycled content materials in packaging.
  - o In addition to utilizing product-to-package ratio optimization systems, we're adopting new technology that 'right-sizes' shipping materials by reducing the amount of empty space in each box, thereby eliminating the need for extra filler to protect products in transit. The new system has already saved more than 18,000 pounds of packaging and 60,000 pounds of filler material at two of our distribution plants.
- Addressing our water use and developing plans to target operations in high-stressed water areas.
  - o We embarked on a multi-year water management strategy focused on our operations in high- and very high-stressed water areas.

Solar array roof installation at an Avantor facility in California. Photo Credit: Redaptive

Environmentally Preferable Products & Services

Our Environmentally Preferable Products (EPP) program is designed to provide greater transparency

into product sustainability attributes to help our customers make informed sustainable purchasing decisions. We work with our suppliers to designate sustainable products, materials, and equipment based on one or more of the attributes listed below:

- Products that are energy and/or water efficient
- Products and/or packaging that are recyclable or reduce waste
- Products and/or packaging that contain recycled/renewable content
- Products that are manufactured with low carbon impact
- Products and/or packaging that are safer to human and environmental health

EPP-designated products are searchable and identifiable on our vwr.com sales site via the green leaf icon. When available, the option to filter for "Environmentally Preferable" within a product category will be displayed. By providing this product information and additional transparency with our EPP program, our teams can partner with our customers to benchmark sustainable purchasing today and begin to identify more sustainable alternatives.

Through collaboration with our customers and supplier network, we work to minimize waste generation and divert materials from landfills into usable raw material streams. We offer comprehensive recycling programs for a variety of products, including disposable apparel and gloves, pipette tip boxes, safety equipment and protective gear, batteries, and more. The programs provide a complete waste collection, shipment, and recycling solution. We collaborate with our customers to find recycling solutions that fit their needs and help them meet their sustainability goals.

Our inventory management solutions offer a one-stop, web-based platform to manage critical lab supplies and avoid wasteful overstocks and expired products, as well as stockouts.

Learn more about Avantor sustainability initiatives, offerings, and partnership opportunities for customers and suppliers at https://www.avantorsciences.com/pages/en/sustainability.

Siegfried

SIEGFRIED: INCREASING THE SUSTAINABILITY OF API PRODUCTION

With its expertise in process optimization, Siegfried helps its customers to develop greener production processes for their products and to achieve their ambitious sustainability targets.

One of the biggest levers for reducing energy and resource consumption in the pharma supply chain lies in the efficient production of active ingredients and pharmaceuticals. Siegfried therefore consistently works on optimizing its processes across the entire production cycle.

Siegfried has developed and implemented various measures to reduce energy and material consumption and to reduce the environmental footprint during the production of APIs.

Reducing Resource Consumption in API Production

A significant leverage for reducing energy and material consumption in particular lies in the API production itself. Siegfried has developed and implemented various measures to achieve this. One lever, for example, is the implementation of green chemistry. This involves minimizing or completely eliminating the use of hazardous substances. Jürgen Roos, Chief Scientific Officer at Siegfried explains "We target the simple things first as they can have a big impact. Some processes can operate just as effectively with less reagent and higher throughput. We design experiments to see how far we can 'green-shift' an existing process to reduce inputs."

In some cases, Siegfried goes further and fundamentally redesigns a manufacturing process by using more creative and innovative chemistry—a so-called 'second-generation process'. Thus, the company rethinks the API synthesis route and optimizes manufacturing processes for selected multi-client products. Such a method replaces the original API synthesis with more efficient approaches, e.g., shorter synthetic routes and more selective catalytic processes. For one of Siegfried's multiclient products, the synthesis route was shortened from 17 to 10 process steps, producing the API faster than the traditional method. As a consequence, the raw material and energy consumption was also reduced by half, and at the same time, the process generated 50% less waste and thus had a smaller environmental impact. Ultimately, all these benefits lead to higher product yields for our customers.

> *"The new process reduces raw material and energy consumption by 50% and at the same time leads to higher product yields for our customers."*
>
> — Jürgen Roos,
> Chief Scientific Officer, Siegfried

Siegfried helps its customers to develop greener production processes for their products and to achieve their ambitious sustainability targets.

Computer Modelling for Scaling-up

Not only shorter processes, but also the tool of computer simulations contribute to a better environmental footprint in active ingredient production at Siegfried. For example, data analysis enables Design of Experiments (DoE) for efficient laboratory development and Quality by Design (QbD) to achieve optimal product quality. And Big Data (process data) analysis helps to improve processes and to stabilize them at an optimum.

Computer modelling is also being used for "scaling-up" from small lab equipment to large reactors in the production plant. This allows, for example, to predict heat transfers or flow conditions in the large reactor. Says Siegfried's Roos: "In the past, scientists would use an intermediate-scale reactor as a stepping-stone, because chemical processes can be more challenging as the reactor gets bigger or changes shape. Nowadays, however, Siegfried's laboratories have accurate, small-scale models of large production reactors, and we combine these with computer modelling to guide us. This allows us to go straight to the desired manufacturing scale from the lab, without the wasteful and time-consuming experimentation at the intermediate pilot scale."

Membranes Reduce Waste

One example of a new process technology in API production processes is pervaporation. This is a sustainable solution for the removal of water and

methanol from solvents during API manufacturing. This method uses semi-permeable membranes that allow water or methanol molecules to pass through them. Through this process, the waste is reduced by up to 15 times compared to distillation. In addition, this approach has a smaller carbon footprint than incinerating the waste created in traditional methods. The use of pervaporation membranes offers an environmentally responsible way of managing solvent drying with lower energy requirements. At the moment, Siegfried is testing this technology to deploy it in the near future.

Enhanced Distillation Techniques

Distillation processes that have been in use for centuries and are a common method for separating chemical compounds, also offer the potential for greater efficiency and sustainability thanks to modern and sophisticated technologies. For example, enhanced distillation techniques enable higher product quality, yield, and a more efficient process while reducing waste. At Siegfried, distillation is used in numerous process steps of an API synthesis.

The classical distillation step is often long and thermally intensive. This results potentially in product degradation and yield losses. With increasing inefficiency and resource use, the sustainability of the process also decreases. To address these limitations, Siegfried optimizes the distillation with the help of subject-matter experts and computer simulations. By doing this, the chemical processes can be optimized significantly, and carbon emissions are being minimized. Furthermore, the use of solvents can be substantially reduced by selecting the right distillation equipment and conditions.

Carbon neutral by 2050

Siegfried's sustainability efforts go far beyond optimizing processes. By 2030, the company wants to halve its carbon footprint compared to 2020, and by 2050 Siegfried aims to be carbon neutral. Siegfried's

efforts in sustainability have been recognized by various external parties and independent institutions. In 2022, Siegfried was again rated positively in the ISS ESG, was included in the Dow Jones Sustainability Index Europe for the second time in a row and has again been confirmed AA in the MSCI ESG Ratings in 2023. For EcoVadis, the Our most recent results reflect "GOLD" for 4 Siegfried sites and "SILVER" for the other seven sites.

These awards are more than a nice figurehead for Siegfried. Nowadays, many customers expect the CDMO to operate and act sustainably. "With our expertise in process optimization, we help our customers to develop greener production processes for their products and to achieve their ambitious sustainability targets," says Roos.

In 2023, Siegfried celebrates its 150th anniversary. Management's goal for the company is to continue to operate successfully for the next 150 years. One thing is clear: this will not be possible without a focus on sustainable action.

Nosco®
complete packaging | individual solutions

NOSCO: REDEFINING ENVIRONMENTAL IMPACT WITH NOSCO'S SUSTAINABLE PAPERBOARD SOLUTION FOR PHARMACEUTICAL APPLICATIONS

In an era where environmental and sustainability awareness are critical focus areas, businesses across the pharmaceutical industry are adopting practices to mitigate their overall impact on the planet. From energy consumption and waste reduction to corporate social responsibility and sustainable packaging solutions, pharmaceutical brands realize the importance of environmental responsibility now more than ever. Similarly, Nosco has emerged as a frontrunner in the printed packaging industry, with a leading-edge sustainable material portfolio, Nosco® Grow. Included in this portfolio is Nosco's **Sustainable Paperboard Solution for Pharmaceutical Applications.**

> *"This new material has the pharmaceutical industry raving. Its ease of use and one-to-one replacement for standard SBS is like nothing else on the market today."*
>
> —Stacy Falconer,
> Business Development Manager
> at Nosco

Nosco offers a full sustainable material portfolio for cartons, labels, inserts and flexible packaging. Our teams are committed to helping our pharmaceutical partners achieve their sustainability goals.

Developed with Nosco's Design for Environment (DfE) strategy in mind, the Nosco® Grow sustainable packaging portfolio showcases materials that are both innovative and address a full range of sustainability goals. Nosco's sustainable material options were strategically sourced by the company's expert team of Solutions Engineers and include materials for cartons, labels, inserts and flexible packaging alike.

The Road to EcoVadis Gold

Nosco's journey towards sustainability began years ago when the company recognized the necessity for environmental stewardship. Determined to lead the charge in sustainable printed packaging, Nosco set its sights on achieving a desirable gold EcoVadis rating—an independent evaluation of the company's sustainability performance. The evaluation examines a variety of corporate social responsibility areas, including environmental, labor, human rights and ethics, providing a holistic view of a company's sustainability practices.

In an effort to achieve the coveted gold rating, Nosco implemented a cross-functional Corporate Social Responsibility Team in recent years. By leveraging innovative technologies, adopting efficient manufacturing processes, and committing to responsible sourcing, Nosco has taken significant strides towards achieving its ultimate EcoVadis goal and is already making waves with an impressive silver rating.

Sustainable Paperboard: Redefining Environmental Impact

Nosco's **Sustainable Paperboard Solution for Pharmaceutical Applications** performs above and beyond the industry standards for eco-friendly packaging. In fact, it serves as a true testament to Nosco's commitment to corporate social responsibility. Through strategic sourcing partnerships and rigorous research and development, Nosco is able to offer a sustainable paperboard material that not only matches, but surpasses the performance of traditional SBS paperboard—all while significantly reducing environmental impact.

"Our sustainable material is gaining enthusiastic reviews from the industry," said Falconer. "In direct comparison to standard 18-point SBS, our sustain-

able paperboard offers an impressive reduction in waste and energy consumption. By adopting this material, pharmaceutical companies can actively contribute to a greener future, while reducing their environmental footprint."

Uncompromised Aesthetics and Performance

Through thorough research, development, and testing, Nosco has proven that sustainability does not come at the cost of quality. Pharmaceutical brands can expect their cartons to maintain the same high standards they are accustomed to, while achieving a superior level of environmental responsibility. Nosco's **Sustainable Paperboard Solution for Pharmaceutical Applications** provides the ideal balance of aesthetics and performance, offering a seamless transition from conventional materials with:

- 30% post-consumer recycled material
- 70% responsibly sourced fiber
- Circular economy support and one-to-one SBS replacement
- Unmatched color balance and a white print surface.

Leading pharmaceutical brands are raving about Nosco's sustainable board – allowing top global companies to reach their 2025 sustainability goals, today!

Overall, the sustainable paperboard option provides a well-rounded approach to sustainable carton packaging. Plus, it serves as one of the easiest one-to-one transitions for the pharmaceutical industry – addressing key environmental challenges, while keeping packaging lines the same. Its benefits encompass a reduced reliance on non-renewable resources, lower greenhouse gas emissions and responsible water usage (all when compared to standard SBS). When considering the complete lifecycle of their packaging materials, pharmaceutical brands can actively contribute to building a greener future, while maintaining a competitive edge in the market. The proven benefits of Nosco's **Sustainable**

Paperboard Solution for Pharmaceutical Applications compared to standard SBS include:

- Reduced fossil fuel consumption
- Lower greenhouse gas emissions
- Responsible water usage.

Pharmaceutical brands interested in learning more about their specific use case may request a custom analysis and side-by-side comparison of their current packaging to Nosco's sustainable material options by contacting Stacy Falconer, Business Development Manager, at SFalconer@Nosco.com.

Experience the Difference with Nosco

When it comes to printed packaging for the pharmaceutical industry, actions often speak louder than words. To encourage brands to experience the benefits of Nosco s sustainable paperboard firsthand, Nosco is offering a complimentary test run of its **Sustainable Paperboard Solution for Pharmaceutical Applications**. This risk-free opportunity empowers brands to witness how their cartons will perform firsthand, encouraging confidence in their decision to embrace eco-friendly packaging solutions.

In addition to promoting its sustainable material portfolio, Nosco will continue to support pharmaceutical customers through its leadership in digital print, sustainable business practices and strategic partnerships with organizations such as the Sustainable Forestry Initiative, Forest Stewardship Council, EcoVadis, and more.

Gain a sustainable edge for your pharmaceutical brand. Contact Nosco today at Nosco.com/Grow-with-Us to request samples and coordinate your complimentary test run today. Together, let's embark on this transformative journey towards a more sustainable and responsible future.

About Nosco

Nosco is a full-service packaging solutions provider serving over 400+ customers in the healthcare space. With more than 115 years of experience, Nosco brings together business resources and

technical expertise to better understand packaging challenges and deliver customized solutions. The company focuses on service to help continuously improve efficiencies related to supply chain, cycle times, lean initiatives, and product launches.

Nosco is a subsidiary of Holden Industries, Inc., and is 100% employee owned. The company employs 650+ employee owners, and specializes in printed packaging for the pharmaceutical, natural health, personal care and CPG markets with four core product lines: **cartons, labels, inserts** and **flexible packaging.**

Interested in Learning More?

Contact Stacy Falconer, Business Development Manager, at SFalconer@Nosco.com or 224.804.7145.

Dr.Reddy's

DR. REDDY'S: Dr. Reddy's demonstrates its commitment to Good Health for People and the Planet

Sustainability has always been core to our purpose, way of work, and thinking. In 2004, we published our first Sustainability Report based on GRI standards. We also began voluntary disclosures on social and environmental aspects. In 2022, we integrated sustainability with our business strategy and strengthened our ESG vision. With this integrated approach, we are working daily to expand access to medicines, reduce the global disease burden, and improve people's lives while minimizing our carbon footprint. Our purpose as an organization is driven by the goal of touching 1.5 billion lives in 2030 through our products and working with partners through the supply of our broad portfolio of active pharmaceutical Ingredients (APIs) and services.

On the environment

Climate change is one of the most pressing global challenges, impacting health, natural habitats, livelihoods, ecosystems, and weather patterns. We aim to achieve carbon-neutral growth because businesses must coexist with the environment. The future belongs to those who can achieve this balance.

We remain committed to the energy transition and are on the pathway to carbon neutrality.

Our renewable power source mix comprises rooftop solar, joint venture for captive power, solar and hydel third-party power purchase agreements (PPAs), and *GDAM RECs (green day-ahead market Renewable

Selected sustainability goals and our progress during the last year focused on efficiency, protection, and conservation. Reference: Dr. Reddy's Integrated Annual Report 2022-23

Energy Certificates). During the last year, a 690 KW rooftop solar plant was installed, and 1.8 MW hydel power supply and 7.4 MW solar power supply were started. The total rooftop capacity has become 6 MW, 59 MW third-party PPAs (solar and hydel), 7.7 MW Cogen plant on biomass fuel, and 15 MW solar plants through JVC. Other projects we implemented include switching from furnace oil to natural gas-fired industrial boilers and installing biomass boilers. We used cogeneration with rice husks and multi-fuel at our API manufacturing plants, which led to a reduction of approximately 15,320 TPA of CO_2 emissions from the boilers. We also implemented an operational excellence diagnostics program to identify high-potential energy efficiency projects. Eight of our global formulations manufacturing sites are ISO 14001 certified.

In the last year, we achieved our goal of becoming a water-positive company based on our water recharge, reuse, recycling, replenishment, and sustainable agriculture principles. Our freshwater withdrawal was 1.83 million kiloliters, and we created a recharge potential of 6.07 million kiloliters of water.

We achieved this through multiple interventions, including building rainwater-harvesting structures, community watershed programs, pond rejuvenation, and sustainable agriculture efforts via our community-focused regenerative agriculture program, MITRA (Making Integrated Transformation through Resourceful Agriculture) and ACE (Action for Climate and Environment).

We regularly measure and assess the risks and impacts of hazardous substances in wastewater at all of our sites for wastewater management. At our Zero-Liquid Discharge (ZLD) facilities, all the effluents generated are treated within the premises, and treated water is recycled and reused.

Product Sustainability: Green Chemistry Principles and PMI for more sustainable APIs

We are continuously improving the API manufacturing processes. In the last year, we worked on 16 products incorporating Green Chemistry principles that help make our API processes more sustainable. Process mass intensity helps us understand a synthetic route's impact on chemical resources, cost, and sustainability. All synthetic routes are evaluated for process mass intensity, and minimizing PMI is our key priority. Along with green chemistry, we adopted life-cycle thinking to assess our environmental impact in a more comprehensive manner. Our Life Cycle Assessment (LCA) program helps us capture and analyze the environmental impact of our products and identify hotspots and improvement opportunities.

Engaging suppliers to build a resilient value chain

We were rated A- and featured on the CDP Supplier Engagement Leaderboard 2022 for the second consecutive year, recognizing our efforts to measure and reduce climate risk within the supply chain.

We are committed to engaging suppliers that make sustainability part of their business model, apply high SHE standards, and share the same vision with us to ensure access to affordable and high-quality medicines worldwide. We are working to build an

ESG-compliant supplier base across categories and aim to partner more extensively with our suppliers to help them deliver measurable improvements and significant impacts over the next several years. We are also a full member of the Pharmaceutical Supply Chain Initiative (PSCI), which aims to establish and promote responsible practices that will continuously improve social, health, safety, and environmentally sustainable outcomes for our supply chains. It brings together pharma companies to work on a common vision and leverage the value of collaborative and peer-based learning.

Applying Industry 4.0—an example where economic and ecological benefits converge

Over the last few years, we have implemented over 40 Industry 4.0 initiatives through the OpsNext program that have positively impacted various business performance parameters, including product quality, equipment efficiency, and people productivity —leading to a 30% reduction in production lead time, a 43% improvement in manufacturing costs, and 41% energy consumption reduction.

Dr. Reddy's "Lighthouse" Factory FTO3 in Hyderabad

The World Economic Forum recognized our largest manufacturing facility in Bachupally, Hyderabad, India, as part of its Global Lighthouse Network for deploying Industry 4.0 technologies.

Putting sustainability at the center—our people

We all know that an organization's people drive the strategy and how we deliver on our purpose. It goes, therefore, without saying that we put a special focus on providing an environment where everyone can thrive and develop. Some of our efforts and commitment to diversity, equity and inclusion, and development didn't remain unnoticed. In the last year in December 2022, we were awarded from the President of India on the International Day of Persons with Disabilities our work in providing placement through Dr. Reddy's Foundation. For the sixth year in a row, we were the only India-headquartered pharma company in the Bloomberg Gender–Equality Index for 2023. Science Magazine recognized us in 2022 as among the top 20 employers in pharma/biotech. The Financial Times and Statista recently named us Asia–Pacific Climate Leader in their 2023 list. Each of these recognitions is also a reminder of the efforts that went into these initiatives and the trust we build with our stakeholders. And we will continue to work hard and build on this foundation.

More information on our sustainability efforts can be found in our latest report here.

nanoform
small is powerful®

NANOFORM: SMALL IS GREEN: UTILIZING INNOVATIVE NANOPARTICLE TECHNOLOGIES TO BUILD A MORE SUSTAINABLE PHARMACEUTICAL VALUE CHAIN

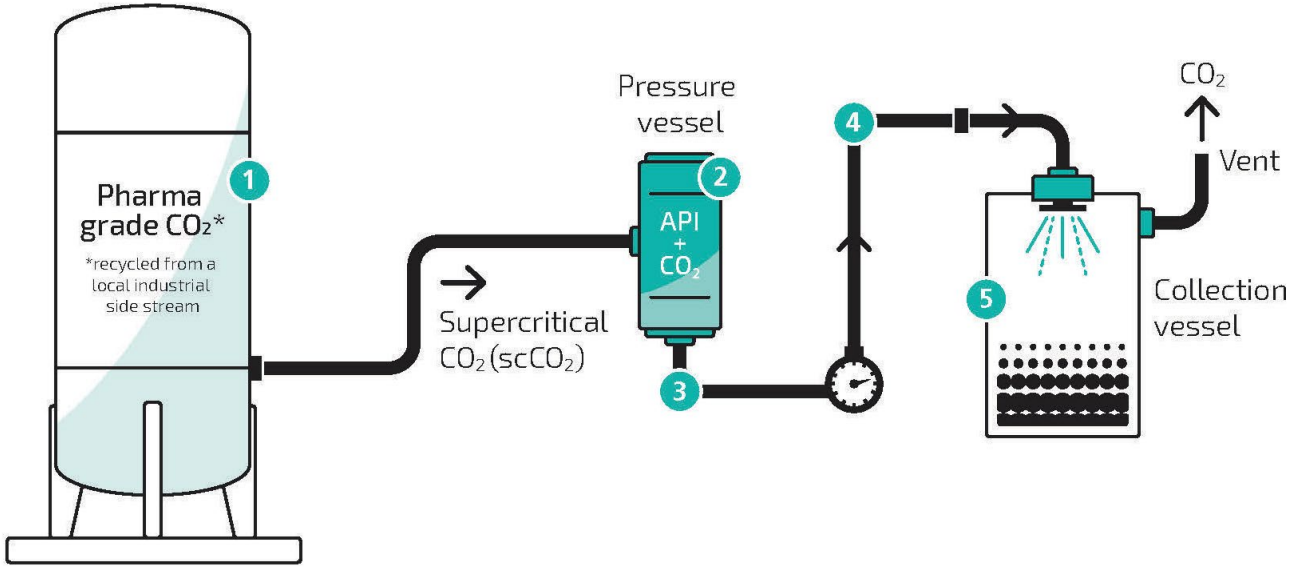
Climate change isn't just an environmental crisis, it's also a global health crisis. The healthcare sector accounts for nearly 5% of global greenhouse gas emissions—the equivalent of a small country. Patients are also increasingly seeking out treatments that align with their planet-conscious values. In response to this, the pharmaceutical industry is seizing the agenda and identifying new ways to make processes more sustainable. Merck, for example, has set an ambitious goal to achieve carbon neutrality across its operations by 2025. An Open Letter calling for suppliers to commit to joint, minimum climate and sustainability targets and to play their part in decarbonizing the healthcare value chain has also been signed by the CEOs of AstraZeneca, GSK, Merck, Novo Nordisk, Sanofi, Samsung Biologics, and the Chairman of Roche. By adopting transformative technologies that reduce waste and emissions, the pharma industry can help to forge a greener, healthier future for all.

Enhancing both sustainability and bioavailability

Nanoparticle engineering technology can both empower sustainability goals and lead to better patient outcomes. By increasing the bioavailability (referring to the extent and rate at which a drug substance reaches systemic circulation and its site of

action) of any given active pharmaceutical ingredient (API), the amount required to achieve the same therapeutic effect can be reduced, lowering dosages and thereby the overall manufacturing footprint of the given pharmaceutical.

Nanoform's proprietary Controlled Expansion of Supercritical Solutions (CESS®) nanoparticle engineering technology produces excipient-free, dry API nanoparticles directly from solution. The technique works by dissolving bulk API powder in supercritical



Steps involved in the CESS® nanoparticle enginering process.

carbon dioxide ($scCO_2$) and then recrystallizing under controlled temperature and pressure to produce uniform nanoparticles that are tuneable in size, shape, and morphology. By reducing the size to as small as 10 nm, which CESS® is able to achieve, specific surface area is dramatically increased. This facilitates greater contact with the solvent and improved dissolution, leading to greater bioavailability. This approach results in a high success rate, addressing a leading cause of drug development failure.

By producing API nanoparticles that are small enough to cross previously impassable biological membranes, CESS® can even open up new, local delivery routes, facilitating the creation of drug products with fewer side effects and improved compliance. Not only does this result in better patient outcomes, but it can also reduce downstream waste. With one in six US adults reporting difficulty swallowing, driving alternative delivery routes enables more patients to finish their drug courses and results in fewer discarded medicines at point of use by patients.

Nanoform supports all dosage form development, and our particles are amenable to multiple administration routes. Our pharmaceutical development team has expertise in a wide range of formulations, including oral, inhaled, injectable and ophthalmic.

Finding greener alternatives

Improving the bioavailability of APIs can help them to achieve the desired therapeutic effect at a lower dosage—cutting down on the manufacturing footprint for life-changing drugs. Particle engineering pathways such as CESS® can also help labs move away from utilizing common bioavailability-enhancing techniques such as spray drying of amorphous solid dispersions, which uses large quantities of polymers and environmentally damaging organic solvents.

Research suggests that organic solvents make up 60% of mass consumption in the pharmaceutical industry. Due to this widespread usage, they are commonly identified as an environmental concern. This is why CESS® utilizes GMP-grade CO_2 recycled from local industrial side streams as a solvent instead—it can help eliminate environmental concerns for users.

Innovative tools for the drugs of tomorrow

With recent advances in AI, interest is growing in its usage within pharmaceutical R&D. This includes roles such as identifying target proteins, de novo drug design and virtual drug screening. Only by embracing the latest game-changing technologies can API manufacturers stay ahead of the curve while also keeping sustainability at the forefront.

Digital twinning and AI can be utilized with particle engineering technologies to inform decision-making, ruling out drug design pathways that would otherwise have failed. This can reduce waste associated with drug development and de-risk the application of novel particle engineering techniques.

Nanoform's STARMAP® Online platform, for example, can be used alongside CESS® to pick winners among large libraries of candidate molecules. Our tool augments experimental results with detailed expert knowledge to drive the rational design of patient-centric drugs. STARMAP® Online ensures that labs only dedicate resources to projects with the greatest chance of success, reducing waste and minimizing the resources expended on API projects.

Selecting a partner focused on sustainability

Transitioning the pharmaceutical industry to a greener future is no small feat, but the challenge is not insurmountable with the right approach. This is why it's critical for companies to select partners who are aligned with the same environmental priorities. Patient- and planet-centricity are deeply interconnected, and one can't be achieved without the other.

Sustainability is an integral part of Nanoform—it runs through nearly everything we do. Our company roots are in Finland, a country that has committed to one of the earliest net zero targets. This steadfast obligation to a greener future is woven deeply into our company culture.

CESSilia, the patient statue at the heart of Nanoform's headquarters in Helsinki.

At the very heart of our Helsinki campus stands the bronze statue of a child reaching out to a nanoformed medicine. "CESSilia" serves as our reminder that everything we do is for our patients and their futures.

Our state-of-the-art GMP nanoforming suites have recently been expanded to triple our manufacturing capabilities. Furthermore, our GMP activities are regularly inspected by the national competent authority, the Finnish Medicines Agency, Fimea. This ensures all processes and materials produced are compliant and positioned for the manufacture of multiple clinical APIs. In June, Nanoform submitted an application to Fimea to update our Manufacturer's Authorization (MIA) to include our new production facilities and equipment, including GMP lines 2 & 3, our new GMP QC laboratory, and nanoforming of APIs to be used in products with a marketing authorization. A GMP inspection is expected to take place later this year.

To learn more about how Nanoform's suite of cutting-edge technologies can empower your environmental sustainability goals, contact us at commercial@nanoform.com

DCAT®