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Inside The Shift Toward **Greener, Faster, Smarter Drug Manufacturing**

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The pharmaceutical manufacturing landscape is being reshaped by converging pressures, notably the need to cut costs, the volatility of global energy markets, and the growing weight of environmental, social, and governance (ESG) accountability. All of these pressures have grown steadily, and no one seriously expects this trend to change at any time in the near future.

Because of these challenges, drug companies and their suppliers are putting ever greater focus on speed, cost-effectiveness, and, of course, sustainability. Sponsors are now assessing potential partners not only on such measures as capacity and compliance but also on their ability to deliver measurable sustainability gains and operational resilience.

For CDMOs, this shift marks a redefinition of value. Competitive advantage no longer comes solely from scale; it also comes from innovation in process design. As more sponsors set net-zero or circular-economy targets, outsourcing decisions increasingly hinge on whether a partner can reduce waste, improve energy efficiency, and accelerate timelines through smarter chemistry and automation.

Momentum Toward Sustainable Manufacturing

"Sustainability is clearly a responsibility, both for us as a contract development and manufacturing organization (CDMO) and for our clients," says Dave Henderson, executive director at Asymchem Group. "Is it a competitive advantage? I think it is. It's certainly seen as a competitive advantage by many of our clients. It's imperative to the work that we do."

Asymchem is a major CDMO that offers services ranging from early clinical to commercial stage, including R&D and cGMP production of advanced intermediates, APIs, formulations, and clinical research. Since its foundation in 1999, it has worked with 16 of the world's 20 largest pharmaceutical companies, with eight collaborations running for 10+ consecutive years. It is also increasingly offering its services to emerging biotechs and smaller, specialty pharma companies.

Among the key technologies that can help meet sustainability goals are flow chemistry, biocatalysis, and high-throughput experimentation (HTE), particularly when allied with continuous production technology. All of these have strong growth potential, albeit from low bases: the global flow chemistry market, for instance, is variously put at $1.76 billion in 2023, with a compound annual growth rate (CAGR) of 11.6% to reach $3.75 billion by 2030; $1.56 billion and $3.93 billion by 2032, growing at a CAGR of 10.8%; and $2.3 billion in 2025 to $7.4 billion by 2035, at a CAGR of 12.2%.[1-3]

Various CDMOs have invested in some or all of these technologies, but Asymchem says it is one of the few organizations in the world to successfully develop and deploy continuous flow technology and biotransformation in ton-scale drug manufacturing. The company has an expansion plan in place that focuses on enhancing non-traditional technologies including continuous flow and biocatalysis as part of a strategic approach to capacity expansion and optimization. It already has flow production capacity of 1,968 m^3/day across its network of sites in China, the US, and the UK.

"Flow technology and biocatalysis can offer higher chemo- and stereoselectivity," says Henderson. "They are intrinsically safer and more energy-efficient, typically with a lower waste burden, thus improving sustainability."

Unlike batch operations, continuous systems maintain steady-state control, reducing variability, solvent use, and energy consumption, while improving reproducibility. Flow chemistry supports these outcomes by keeping reactions contained and optimized in real time, while biocatalysis introduces enzyme-driven selectivity under milder conditions, thus lowering environmental impact without compromising yield.

Continuous manufacturing, though very common in commodity chemical manufacturing, has had many false dawns in pharmaceuticals, not always living up to the promise its obvious advantages offered. Historically, flow chemistry and biocatalysis were viewed as specialist tools best suited to niche applications.

Today, however, the integration of these technologies, supported by automation and data-driven control, is redefining how modern drug manufacturing operates. There is a gradual but perceptible move away from batch production toward continuous models that merge chemistry, engineering, and digital analytics. The result is a shift from incremental process improvement to a more agile, technology-enabled approach that can accelerate development while meeting environmental and regulatory demands.

A Growing European Presence

Asymchem's European hub is at Discovery Park in Sandwich, UK, which has historically been associated with Pfizer. This features, among other things, chemistry, engineering, and analytical laboratories, high-tech HTE and solid-form screening labs, and a non-GMP large-scale lab and hydrogenation facility. A continuous flow chemistry lab has just opened, and a cGMP gram-to-kilo lab is coming soon to complement the state-of-the-art pilot plant.

> Sandwich offers clients direct access to a UK-based team of highly skilled scientists and engineers with deep pharmaceutical industry experience

, Henderson says. "Our advanced laboratory infrastructure, including automated HTE, flow chemistry, and biotransformation screening, integrate into our well-established development workflows."

The site's flow chemistry capabilities enable it to address the most challenging reactions, such as cryogenic, high-temperature, high-energy, catalytic hydrogenation, photochemical, and electrochemical reactions. The company has developed its own priority flow reactors and equipment in order to strengthen scalability, compliance, and speed.

In February 2025, the company installed lab reactors with platforms and capabilities including flow hydrogenation, immobilized enzymes, and high-mixing, plug-flow reactors at Sandwich. It is now in the process of adding continuous stirred tank reactors, work-up capabilities, and process analytical technology (PAT).

Sandwich also has access to Asymchem's global biocatalysis expertise and biotransformation screening kits for transaminases, ketoreductases, lipase and esterase, imine and ene reductases, amino acid dehydrogenases, and nitrilases. Finally, it offers a fully integrated HTE process development service as well as stand-alone HTE experimentation in material sciences, process optimization, and purification screening, amongst other things. The company is currently investing in additional gene-screening capacity at other sites.

Asymchem regards the integration of flow chemistry, biocatalysis, and automation at Sandwich as a game-changer when compared to applying them separately. Integration enables safer, faster, and greener chemistry, transforming lab-scale innovation into scalable continuous manufacturing solutions, according to Henderson.

"We are working very closely as a global organization to deliver a number of solutions for our clients, whether that's within the early phases of development or in the later phases," he says.

> There are multiple examples where Asymchem has worked on biotransformations and flow chemistry to support new solutions for our clients. We also routinely use HTE to support our clients' needs across all phases of development.

Outlook

Asymchem's activity at Sandwich is relatively new, having started just over a year ago. The current focus is mainly on the core small molecule R&D and pilot-scale manufacturing capabilities, by strengthening advanced technologies like high-throughput experimentation, flow chemistry, and biocatalysis.

However, this is just the starting point. Henderson expects considerable additions to both capacity and capabilities at the site as the market develops and the demand for sustainable solutions grows. These include further additions to our development and manufacturing capabilities via next generation HTE platform and a cGMP lab and expanding the pilot plant to introduce new capabilities like continuous flow chemistry and biocatalysis. Thanks in part to its Pfizer heritage, the region has a wide talent pool it could draw on,

"We're also investing in photochemical and electrochemistry capabilities in our lab," he says. "And looking further forward, we expect the site to evolve to support R&D and commercial manufacturing of different modalities for example, peptides as well as offering commercial-scale manufacturing for small molecules."

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