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ASIA EDITION

The Race to Greener Pharma

September 1, 2026 | Analysis | By Ayesha Siddiqui

A greener pharmaceutical industry will not be built through sustainability reports alone. It will be built in the factories where medicines are made. Across Asia-Pacific (APAC), this is becoming an increasingly important test for the industry as rising resource costs, climate risks, customer expectations and regulatory scrutiny converge. For Contract Development and Manufacturing Organisations (CDMOs), the challenge is particularly significant: the choices made on the factory floor â?? from energy and water use to solvents, waste, production technologies and sourcing â?? can determine the environmental footprint of medicines long before they reach patients. With manufacturing estimated to account for around 80 per cent of a pharmaceutical companyâ??s environmental footprint, the stakes are high. So, what does greener pharmaceutical manufacturing actually look like in practice? We have examined the latest Environmental, Social and Governance (ESG) and sustainability reports of eight leading APAC CDMOs to find out where the industry is making real progress, and where the biggest challenges remain.

For years, sustainability in pharmaceuticals was largely discussed in terms of commitments, targets and disclosures. That is changing. As regulators demand more detailed climate information, pharmaceutical customers put greater pressure on suppliers, and the environmental cost of manufacturing comes under closer scrutiny, sustainability is increasingly becoming an operational issue — one that is being decided inside the factory.

This matters particularly for CDMOs, which sit at the centre of pharmaceutical supply chains and influence how medicines are made, from the solvents and energy used in production to water consumption, waste generation and emissions. Manufacturing accounts for approximately 80 per cent of a pharmaceutical company’s environmental footprint, making the factory floor one of the most important places to look for meaningful change.

Across the APAC region, leading CDMOs are therefore moving beyond broad sustainability commitments and beginning to change how their plants consume energy and water, manage waste and emissions, and design production processes. The shift is also changing what companies measure: carbon is no longer limited to a factory’s own emissions, while water, waste, suppliers, raw materials and product-level footprints are increasingly entering the equation.

In this story we have reviewed the latest standalone ESG and sustainability reports of eight leading APAC CDMOs to examine what companies are measuring, where manufacturing practices are changing, and what these developments reveal about the next phase of sustainable pharmaceutical manufacturing.

Why is sustainability necessary?

The pharmaceutical industry's environmental footprint is well documented, spanning energy and chemical use, greenhouse-gas emissions, wastewater and waste. Relative to its revenue, the industry produces 55 per cent more greenhouse-gas emissions than the automotive sector, while greenhouse-gas emissions associated with pharmaceutical consumption increased by 77 per cent over 24 years, according to a Leiden University study published in *The Lancet Planetary Health*.

The pressure point, however, is not simply the amount of emissions generated by the industry; it is where those emissions are generated and how deeply sustainability is embedded in the manufacturing process.

A significant part of this footprint comes from manufacturing. Active Pharmaceutical Ingredient (API) production can be particularly energy- and resource-intensive, with some product-specific life-cycle assessments showing APIs accounting for up to 96 per cent of a drug's carbon footprint per unit, according to World Courier. This makes manufacturing a critical intervention point for companies seeking to reduce the environmental impact of medicines.

At the same time, sustainability is moving from voluntary ambition towards a more formal business and regulatory requirement across APAC.

According to the APAC regulatory overview from Socious, Japan, Australia, Singapore, Hong Kong, South Korea, India, Thailand and Malaysia are all moving towards more structured sustainability or climate reporting. Japan is introducing Sustainability Standards Board of Japan (SSBJ) standards, Australia is implementing International Sustainability Standards Board (ISSB)-aligned reporting, Singapore is phasing in climate disclosures including Scope 3 for its largest listed companies, and South Korea is moving towards national standards aligned with ISSB.

In India, the top 1,000 listed companies already report under Business Responsibility and Sustainability Reporting (BRSR), while BRSR Core brings quantitative disclosures covering areas such as greenhouse-gas emissions, water, waste and value-chain performance. In Malaysia, ISSB-aligned climate reporting is being phased in for Main Market companies from financial year 2025, while Thailand is moving towards ISSB-aligned climate reporting in phases from financial year 2027. Australia began mandatory sustainability reporting for the first reporting cohort for financial years beginning on or after January 1, 2025, with further cohorts being phased in. Singapore requires all listed companies to report Scope 1 and 2 emissions from financial year 2025, with Scope 3 initially applying to Straits Times Index (STI) constituents from financial year 2026.

The regulatory focus is also moving beyond corporate disclosure to the environmental footprint of medicines themselves. In July 2026, the World Health Organization (WHO) launched its first global framework to help regulators advance greener pharmaceuticals, with practical actions aimed at reducing the climate footprint of medicines while maintaining quality, safety, efficacy and equitable access. This followed the Global Regulators Summit on Greener Pharmaceuticals held at WHO headquarters in June 2026, which focused on how regulation can support sustainability-driven innovation and international collaboration.

For CDMOs, this creates a second layer of pressure. They must not only demonstrate their own sustainability performance but increasingly meet the environmental expectations of the pharmaceutical companies they serve.

The result is a shift from sustainability as a reporting exercise to sustainability as a manufacturing challenge — and increasingly, as a business requirement.

How is sustainability measured and reported?

Pharmaceutical manufacturers use a combination of reporting frameworks, target-setting initiatives, disclosure platforms and external sustainability assessments to measure and communicate their progress. The most common are:

- **Greenhouse Gas Protocol (GHG Protocol):** The main framework used to calculate greenhouse-gas emissions. Companies report Scope 1 emissions from their own operations, Scope 2 from purchased energy and Scope 3 from their wider value chain, including suppliers and logistics.
- **Science Based Targets initiative (SBTi):** This is not a reporting framework. It validates whether a company's emissions-reduction targets are aligned with climate science. For example, a company may set a target to reduce Scope 1 and 2 emissions by a specific percentage by 2030 and have that target validated by SBTi.
- **CDP:** An environmental disclosure platform and scoring system. Companies disclose information on areas such as climate change, emissions, water and forests. CDP then assesses the quality of the company's disclosure and management.
- **International Sustainability Standards Board (ISSB) / International Financial Reporting Standard S2 (IFRS S2):** A sustainability disclosure standard focused particularly on climate-related risks and opportunities. It covers

governance, strategy, risk management, metrics, targets and emissions.

- **Global Reporting Initiative (GRI):** A broader sustainability reporting framework covering environmental and social impacts, including energy, emissions, water, waste, employees and communities.
- **Business Responsibility and Sustainability Reporting (BRSR):** India's ESG reporting framework for listed companies. It covers areas including energy, emissions, water, waste, workforce and value-chain sustainability.
- **EcoVadis:** This is not a reporting framework. It is an external sustainability assessment and rating system. Companies are assessed across four broad areas: environment, labour and human rights, ethics, and sustainable procurement. The result can include medals such as Platinum, Gold, Silver or Bronze. So, if Samsung Biologics reports an EcoVadis Platinum Medal, it is evidence of its external sustainability assessment, not a measure such as its Scope 1 emissions.
- **S&P Global Corporate Sustainability Assessment (CSA):** An external ESG assessment that evaluates companies across environmental, social and governance factors. Companies with strong performance may be recognised in the S&P Global Sustainability Yearbook.

These mechanisms measure different aspects of sustainability and should therefore not be treated as interchangeable. A company's emissions inventory, a science-based target, a disclosure score and an external ESG rating answer different questions. Together, however, they provide a picture of how sustainability is being governed, measured and acted upon.

Across the eight APAC CDMOs analysed for this story — Samsung Biologics (South Korea), WuXi AppTec (China), Asymchem (China), Syngene International (India), Sai Life Sciences (India), Bora Pharmaceuticals (Taiwan), Porton Pharma Solutions (China) and Bushu Pharma (Japan) — the reporting goes well beyond carbon emissions.

Companies are tracking energy consumption and renewable-energy use, Scope 1, 2 and 3 emissions, emissions intensity, water withdrawal and reuse, wastewater discharge, hazardous and non-hazardous waste, recycling and landfill diversion, as well as air pollutants such as Volatile Organic Compounds (VOCs), Nitrogen Oxides (NOx) and particulate matter.

The reporting also reaches deeper into manufacturing itself, covering solvent use, process efficiency, green chemistry, continuous manufacturing and energy-saving initiatives. Companies are increasingly disclosing supplier emissions, sustainable procurement, biodiversity risks and environmental targets, while using frameworks and assessments such as GHG Protocol, SBTi, CDP, GRI, ISSB, EcoVadis and S&P Global CSA to measure or communicate their sustainability performance.

What is changing inside pharmaceutical manufacturing?

The most important finding from the analysis is that sustainability is no longer confined to corporate sustainability teams. It is beginning to influence decisions made inside manufacturing plants — from the choice of energy source and solvent to the design of production processes and the treatment and reuse of water.

Please note that, for this analysis, we have considered the latest standalone ESG or sustainability reports published by the selected CDMOs. The analysis primarily covers FY2025 data, with details reported for 2025, with each company's reporting period following the financial year applicable in its respective country. The exception is Bushu Pharma, for which the latest available standalone report is the FY2024 report covering the 2024 reporting period. We have included only CDMOs that publish a separate ESG or sustainability report and excluded companies that report ESG information only as part of their annual reports.

Across the eight APAC pharmaceutical manufacturers and CDMOs analysed for this story, companies are making changes in how they use energy and water, manage waste and emissions, and run manufacturing processes. The reports point to a common direction: renewable electricity, energy efficiency, water recycling and reuse, waste recovery, green chemistry, solvent reduction and continuous manufacturing are increasingly being considered as part of manufacturing strategy rather than as stand-alone environmental initiatives.

Companies are also using digital systems to monitor environmental data and are beginning to include suppliers, raw materials and Scope 3 emissions in their manufacturing plans.

Energy, water and waste

One of the most common ways companies are implementing sustainability inside pharmaceutical plants is through energy efficiency, water reuse and waste reduction. While these may appear to be conventional sustainability measures, the scale and integration of these interventions show how environmental performance is becoming increasingly connected to plant efficiency and operating costs.

WuXi AppTec expects equipment upgrades, variable-frequency drives and operational changes to save about 4,937 megawatt-hours (MWh) of electricity and 3,890 tonnes of steam annually, while heat-recovery projects are expected to save a further 2,585 MWh of electricity and 19,104 tonnes of steam. Porton Pharma Solutions uses variable-frequency controls, steam-condensate recovery, efficient blowers and electric forklifts. Asymchem reported a 16.6 per cent reduction in energy consumption per unit of small-molecule output in 2025 compared with 2023, including an air-compressor retrofit that reduced electricity use by 49 per cent.

Water management is similarly moving from a traditional ‘use and discharge’ model towards recovery and reuse.

Sai Life Sciences and Syngene operate zero-liquid-discharge (ZLD) systems. Sai reused or recycled 47 per cent of total water withdrawal in FY2025, while Syngene recycled or reused 53 per cent of its water. Bushu Pharma reuses treated wastewater as cooling water at its Kawagoe factory after microbial treatment and membrane filtration.

Waste management is another area where companies are focusing on reduction, recycling, recovery and compliant disposal. Asymchem uses a cradle-to-grave approach covering waste identification, classification, storage, transport and disposal. In 2025, it achieved zero landfill of primary hazardous waste from production and reported no solid-waste pollution accidents. It also conducted 16 onsite audits of third-party hazardous-waste disposal units and more than 10 waste-management training sessions.

Sai Life Sciences diverted 98 per cent of its waste from landfill and reported 99.6 per cent waste circularity. Porton Pharma Solutions targets 100 per cent compliant waste disposal and a 10 per cent reduction in hazardous-waste intensity by 2030.

Digitisation of environmental management

Sustainability is also becoming a data problem. As plants measure more variables, digital systems are increasingly being used to capture environmental data closer to the point at which resources are consumed or waste is generated.

Technology is becoming part of how pharmaceutical plants measure and control their environmental impact. Digital systems can track energy and water consumption, chemical use, waste movement and product-level emissions, allowing companies to monitor resource use during production and identify areas for improvement.

For example, at Syngene, the move from manual waste logbooks to an online waste-declaration system means waste data is recorded when waste is generated. This can show which process, production area or material stream is creating waste. Its Supervisory Control and Data Acquisition (SCADA) system separates low-total dissolved solids (TDS) water from higher-strength wastewater before treatment. This reduced treatment load by 20–25 per cent, recovered 9.3 kilolitres (KL) of water per day and reduced energy use by 76 kilowatt-hours (kWh) per day.

The significance of this example is that digitalisation is not simply improving sustainability reporting. It is changing how the treatment system itself operates.

Another Indian CDMO, Sai Life Sciences, uses Internet of Things (IoT) flow meters and dashboards to monitor water consumption by shift. This creates a link between water use and plant operations. If consumption rises during a production run, teams can investigate leaks, cleaning practices or abnormal utility use. This supports its closed-loop ZLD system, where treated water is returned for utility use. Such a system depends on continuous measurement because water quality and volume determine whether water can be safely reused.

Taiwan-based Bora Pharmaceuticals also uses an IoT-based Chemical Cloud Management System for hazardous substances. This gives the company visibility over chemicals in storage and use and supports emergency response. The same logic appears in waste management, where Bora tracks waste movement and disposal through qualified contractors.

Green manufacturing

The next level of sustainability is not simply managing the environmental impact after it has been created. It is redesigning the manufacturing process so that less impact is generated in the first place.

Companies are therefore not only switching to renewable energy or managing waste after it is generated. They are also changing the processes, materials and technologies used in production to reduce the environmental impact at source.

This includes using safer solvents, alternative catalysts, enzymes and more efficient reaction processes. Some companies are also moving from traditional batch manufacturing to continuous production, which can reduce reaction time, energy use, solvent consumption and waste.

Syngene provides a strong example. In a rare-disease molecule project, the company replaced Class 2 solvents with Class 3 solvents, proposed solvent recovery and introduced direct crystallisation. The redesigned route cut cycle time by 50 per cent and increased yield by 26 per cent.

The significance is that a single process redesign can affect several sustainability indicators simultaneously: less time in equipment, lower solvent demand, less waste and greater output from the same raw-material input. This is fundamentally different from adding a pollution-control device after the process; it changes the process that produces the pollution.

Syngene's biocatalytic hydrogenation follows the same approach. The process uses enzymes, water-based media and glucose rather than precious-metal catalysts, hydrogen gas, high-pressure equipment and harmful solvents. It operates at ambient temperature and pressure with 10 per cent organic co-solvent. The manufacturing change therefore has implications not only for energy requirements but also for the safety and waste profile of the reaction.

WuXi AppTec and Asymchem show how these methods are being moved into larger-scale production. WuXi operates continuous manufacturing across more than 35 lines and 60 reaction categories, reporting more than 8,000 tonnes of waste-emissions reduction.

In continuous manufacturing, materials pass through equipment in a controlled flow instead of being processed as separate large batches. This can reduce repeated heating, cooling, transfers and cleaning, while also improving control over reaction conditions.

Asymchem has also applied continuous reaction technology to tonne-scale intermediates and API projects and completed a thousand-tonne-scale project covering nitration, chlorination and amination. It also combines immobilised enzymes with continuous reactors. The enzyme can be reused, while the reactor operates for a longer period. For multi-tonne applications, the company reports lower enzyme consumption and reduced wastewater and organic-solvent discharge.

Bora Pharmaceuticals and Porton Pharma Solutions are also incorporating green chemistry into their manufacturing approaches, showing that sustainability can be addressed through both targeted process changes and newer production technologies. Their approaches include changes in solvents, catalysts and production processes to reduce resource use and waste.

Carbon management

Carbon management is perhaps where the shift from sustainability reporting to manufacturing strategy becomes most visible. The question is no longer simply how much carbon a factory emits, but where those emissions sit across the product and supply chain — and what companies can realistically influence.

Carbon management in pharmaceutical manufacturing is moving from site-level energy reporting to decisions about products, suppliers and capital investment.

Companies still focus on Scope 1 and 2 emissions from fuel, steam and purchased electricity, but Scope 3 emissions are now shaping manufacturing and procurement strategies. At WuXi AppTec, Scope 3 accounts for 82.14 per cent of total emissions, and purchased goods and services account for 82.04 per cent of Scope 3.

This illustrates a central challenge for pharmaceutical manufacturing: renewable electricity can reduce emissions associated with a factory, but it cannot by itself address the carbon embedded in raw materials, solvents, intermediates and supplier operations.

Companies are responding by collecting supplier data and calculating product carbon footprints. WuXi is collecting primary emissions data from suppliers and using product and service carbon footprints in supplier evaluation. Syngene surveyed 250 suppliers in FY2025 and is seeking SBTi-aligned commitments from suppliers responsible for 81.6 per cent of its Scope 3 emissions by FY2028. Asymchem has completed an externally verified value-chain inventory and applies energy, water and carbon requirements in its supplier ESG policy.

Carbon is also entering investment decisions. Samsung Biologics uses an internal carbon price of KRW 156,549 per tonne of carbon dioxide equivalent (tCOâ??e) in capital-expenditure and climate-risk decisions.

This means a boiler, heating, ventilation and air conditioning (HVAC) upgrade, solar installation or heat-recovery project can increasingly be assessed not only on energy cost and payback period, but also on the emissions it avoids.

Bushu has identified future carbon pricing in Japan as a business risk, while Asymchem's life-science subsidiary is already covered by China's carbon-emissions trading system.

APAC CDMO Sustainability Snapshot

The APAC pharmaceutical companies reviewed showed measurable progress towards green manufacturing through emissions reduction, renewable-energy adoption, water conservation, waste recycling, process optimisation and digital monitoring.

Several companies have achieved strong results, including Syngene's 92 per cent renewable-electricity share and 95 per cent waste recycling, Sai Life Sciences' 98 per cent landfill diversion, and Samsung Biologics' 94.6 per cent waste-recycling rate. However, the comparison also shows that sustainability performance remains uneven across the region, particularly in renewable-energy adoption, Scope 3 emissions reporting, water reuse and supplier-data coverage.

Company strengths

- **Samsung Biologics** stands out for combining decarbonisation with strong waste and water-management targets. Its Scope 1 and 2 emissions fell 9 per cent in 2025, renewable electricity reached 39.5 per cent, and waste recycling reached 94.6 per cent. Its third-party-verified product-carbon-footprint system and internal carbon price also show relatively advanced carbon-management practices.
- **WuXi AppTec** shows particular strength in renewable-electricity procurement, energy-efficiency projects, and lower wastewater and air emissions. Its continuous-manufacturing capability across more than 35 lines, along with enzyme-based production routes that can substantially reduce solvent use, demonstrates a practical focus on greener manufacturing processes.
- **Syngene** is one of the strongest overall performers in the scorecard. It achieved a 92 per cent renewable-electricity share, recycled or reused 53 per cent of water, recycled 95 per cent of waste, and sent no waste directly to landfill. Its use of biocatalysis, SCADA-enabled water management and supplier engagement further strengthens its green-manufacturing approach.
- **Bora Pharmaceuticals** has made progress through site-level water savings, solvent-emission treatment and safer chemical substitution. The elimination of acetone from a Nifedipine coating process and replacement of Methyl Cellosolve with non-toxic ink are notable examples of reducing hazardous chemical use. Its digital chemical-management system is also a strong governance measure.
- **Porton Pharma Solutions** performs well in water efficiency, wastewater compliance, renewable electricity at key sites and cleaner production technologies. Its use of biocatalysis, metal catalysis, continuous chemistry, efficient blowers, condensate recovery and electric forklifts reflects an integrated approach to operational improvement.
- **Sai Life Sciences** has strong waste-circularity performance, with 98 per cent landfill diversion and 99.6 per cent waste circularity. It also reported a 24 per cent reduction in specific greenhouse-gas emissions and uses closed-loop ZLD systems, solvent-management practices and IoT water meters to improve resource efficiency.
- **Bushu Pharma** demonstrates practical site-level decarbonisation through solar projects, boiler-fuel conversion, energy-efficient equipment and wastewater reuse. Its ISO 14001 certification across major sites and use of climate-scenario analysis show that environmental management is embedded in its operating systems.
- **Asymchem** is strongest in innovative low-impact manufacturing methods, including continuous chemistry, biocatalysis, synthetic biotechnology and Artificial Intelligence (AI)-supported enzyme development. It also achieved a 16.6 per cent reduction in energy use per unit of small-molecule output and reported zero landfill for primary hazardous production waste in 2025.

Future trends in sustainable manufacturing

The next phase of sustainable pharmaceutical manufacturing will be less about isolated environmental projects and more about integrating sustainability into how plants are designed, operated, financed and supplied.

Moving into the future, drug manufacturers will take further steps to decarbonise their operations and improve resource efficiency across manufacturing.

The next step in energy management will be to look beyond electricity use and address the carbon intensity of the entire manufacturing site, including thermal energy used in production, heating, ventilation and air conditioning, and other utilities.

As companies measure their emissions in greater detail, this carbon data will increasingly feed into commercial and operational decisions. Companies are using internal carbon pricing, product carbon footprints and Scope 3 accounting to understand the emissions associated with products, investments and supply chains. Samsung Biologics, for example, has

introduced an internal carbon price and calculated product carbon footprints for 25 products.

Suppliers will become an increasingly important part of emissions reduction. WuXi AppTec reported that 82.14 per cent of its greenhouse-gas emissions came from Scope 3, with purchased goods and services accounting for 82.04 per cent of its Scope 3 emissions. The company is developing supplier carbon-performance classifications and incorporating product and service carbon footprints into supplier evaluations.

Climate resilience will also become part of manufacturing planning. Water shortages, flooding, heat stress and energy-price volatility can affect facilities and supply chains. Companies such as Bora Pharmaceuticals use scenario analysis to assess the potential impact of water shortages and flooding on production, showing how climate risk is beginning to enter decisions around facility resilience, production planning and resource security.

From sustainability target to manufacturing standard

The eight companies reviewed in this analysis show that APAC's pharmaceutical manufacturing sector is already moving in this direction. Renewable electricity, water reuse, waste recovery, digital monitoring, green chemistry, continuous manufacturing and supplier engagement are no longer isolated sustainability experiments. They are increasingly becoming part of how pharmaceutical production is designed and managed.

Yet the transition is far from complete. Renewable-energy adoption remains uneven, Scope 3 emissions are difficult to measure, supplier data is still incomplete, and many sustainability initiatives remain dependent on site-specific investments and capabilities.

The real test, therefore, will be whether these individual interventions can be scaled across manufacturing networks and embedded into routine business decisions. The future of sustainable pharmaceutical manufacturing will not be defined by how many sustainability commitments companies make, but by how effectively those commitments change what happens inside the factory — and across the value chain beyond it.

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