Decarbonisation tips for the pharma industry

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Where to begin with decarbonisation?

Until recently, the pharma industry's manufacturing priorities were speed, reliability, profitability and product quality. Now, growing pressure to reduce its environmental impact and meet net zero targets has moved decarbonisation higher up the sector's agenda.

Making pharmaceuticals is a complex and energy-hungry process, demanding huge volumes of water, creating large quantities of waste and contributing significantly to greenhouse gas emissions. As the planet's temperature rises, the pharmaceutical industry and its supply chain are responsible for:

- 4.4% of net global greenhouse gas emissions.
- 48.55 tons of CO2 equivalent for every $1 million generated in 2019 alone – exceeding the automotive industry.
- Almost 25% of global water usage.

To remain sustainable, the pharma industry must reimagine its processes and realign its priorities. The sector also faces pressure from its customers. Services like the UK NHS set environmental standards for their supply chains as they strive to meet decarbonisation targets.

But where should individual companies start? For most businesses the change begins with their facilities and processes, making quick wins through improved circularity and recycling, renewable energy and reducing or eliminating waste to landfill. From this baseline, they can advance to the adoption of greener technologies, upgrade for process intensification, and extend their impact to the supply chain.

This guide offers tips for decarbonising industrial manufacturing through improving physical processes, digitalising processes, improving carbon monitoring, and improving the sustainability of facilities.

Understand Scope 1, 2 and 3 emissions

The Greenhouse Gas (GHG) Protocol provides a standard global framework for emissions measurement and management. It identifies three groups of emissions:

Scope 1 – direct emissions. These come from operations or processes your business has full control over, such as exhaust gases from vehicles and smoke from industrial machinery.

Scope 2 – indirect emissions from your energy usage. These are generated through things like electricity, steam, heating and cooling.

Scope 3 – indirect emissions from your supply chain, upstream and downstream, with the exception of what's covered under Scope 2. This includes all your suppliers, employees, product end-of-life and distribution networks.

To be considered **carbon neutral**, a company must neutralise at least Scope 1 and Scope 2 emissions, either by reducing the amount it produces or by reabsorbing atmospheric carbon dioxide. To qualify as n**et zero**, it must neutralise its Scope 1, Scope 2 and Scope 3 emissions.

Adopt low-carbon manufacturing processes

Shifting from batch manufacturing to continuous processes like CDC (continuous direct compression) significantly reduces waste and takes up a smaller physical footprint. Continuous manufacturing has no minimum batch size and adds flexibility so manufacturers can adapt to demand.

Adopting green chemistry reduces the use and production of hazardous chemicals by adapting or rethinking media and processes. This could mean using greener solvents such as biosolvents, or replacing solvents with aqueous chemistry. Replacing traditional catalysts with biocatalysts can help save energy and improve productivity, while flow chemistry and mini reactor technologies lower emissions while making new kinds of reactions possible.

Increasing circular practices can help make resources go further and keep them out of landfill. This might mean reusing, repurposing or otherwise extracting additional value from packaging, plastics and other materials.

Case study: 'Just in time' for clinical trials

Our Medicines Manufacturing Innovation Centre developed 'just in time' manufacturing to supply clinical trial medication. Using smart data management, our GMP-compliant platform provides real-time cross-site visibility and responsive control of the supply chain. It streamlines processes and runs them in parallel, so production, bottling, labelling and storage are faster and more efficient.

Watch the video: (QR code)

Digitalise processes and simulate to save resources

Digitalising means increasing automation and robotics to cut costs and improve flexibility. In pharma, it can be applied to managing data, operating physical processes, and scheduling to avoid overproduction. The information captured by these digital systems can be used to create a feedback loop of insight and improvement.

Digital twins allow you to innovate without using physical resources. It can speed up drug development time and give scientists the freedom to experiment and optimise.

Process analytical technology (PAT) monitors machinery in real-time, providing feedback on every component. It can be combined with model predictive control to maintain consistent output, even when variables change.

Traditional integrated supply chains require complex organisation and can create waste. Unifying your data streams into a single view with the help of machine learning and AI gives you more visibility and flexibility, cutting back on administration and streamlining decision-making.

Case study: Continuous Direct Compression

Combining continuous process and digital twinning, CPI helped optimise the production of solid oral medication, saving time, space and resources compared with traditional batch manufacture and drug development. It delivered a ~70% reduction in number of experiments, a carbon saving of <92T CO2 equivalent, and 50% reduction in floor space.

Watch the video: (QR code)

Monitor carbon across your supply chain

More than 50% of healthcare emissions can come from the supply chain, and up to 80% of these emissions relate to extraction and manufacture. So aligning with suppliers and customers on decarbonisation goals and understanding their position is essential. You can also stay connected with relevant NGOs for data on decarbonisation commitments and incentives.

To make sure low-carbon solutions are performing well, invest in advanced and integrated analyses like life cycle assessments and techno-economic analysis. Carbon reporting organisations can help you understand your obligations and what is required to maintain compliance.

Case study: Medicines Manufacturing Innovation Centre carbon evaluation

CPI's Medicines Manufacturing Innovation Centre and its supply chain are monitored for carbon impact. We are measuring Scope 3 emissions including purchased goods and services, waste generation and waste management. This data, combined with direct and indirect emissions, is being added to a visual carbon accounting system to establish a carbon reduction plan.

Visit the Medicines Manufacturing Innovation Centre webpage (link to https://www.uk-cpi.com/about/national-centres/medicines-manufacturing-innovation-centre)

Reduce the carbon footprint of your facilities

The operations of your manufacturing facilities consume energy, at an industry cost of over $1 billion annually. Heating, cooling, ventilation and machinery are all potential targets for carbon reduction.

Measuring your carbon footprint is often the best place to start, as it will provide a starting point for improvement. Tools like the McKay Carbon Calculator can help you develop a holistic view of your carbon footprint.

Explore the potential impact of advanced energy technologies like intelligent HVAC systems, photovoltaic panels, air-source and ground-source heat pumps, heat pipes and biomass boilers for manufacturing facilities. These low- and no-carbon technologies can improve quality and cut costs as well as reduce environmental impact. Intelligent HVAC systems, which heat and cool spaces only when they are in use, have shown energy use reductions of up to 70%.

Case study: Medicines Manufacturing Innovation Centre building

CPI's Medicines Manufacturing Innovation Centre is a state-of-the-art facility with decarbonisation in its DNA. While not yet carbon-neutral, its energy consumption is reduced by using low carbon district heating, which is 90% greener than gas boilers, and photovoltaic panels which can save 15kg of CO_2 annually. A demand-based HVAC system alters air-flow rates to reduce energy consumption.