Litmus test for chemical sector decarbonisation

The chemical sector is a 'hard-to-abate' industry seeking a clear pathway to decarbonisation. Joanne Beatty explains how we are engaging with companies in this sector, identifies some of the key challenges and opportunities, and signposts the road to a low carbon transition.

Setting the scene

The chemical sector accounts for 5.8% of global anthropogenic emissions.[1] It is the third largest industrial sub-sector for direct CO_2 emissions behind iron, steel and cement.[2,3] It is also the largest industrial consumer of oil and gas, due to its energy requirements and the need for feedstock for product synthesis.[4] The emissions resulting from the use of feedstock are later released downstream in other sectors such as agriculture and waste. The sector is also playing a key role in the low carbon transition due to the increased demand for chemicals in low carbon and energy-saving technologies.[5]

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British meat producers and soft drinks manufacturers warned of major product shortages back in September 2021, as wholesale gas prices spiked. Farmers feared having to slaughter their own animals as abattoirs closed, while consumers worried about a lack of turkeys for Christmas.[6]

The problem was partly due to a shortage of carbon dioxide, a by-product of fertiliser plants, which had been forced to close in the face of rising feedstock energy prices. CO_2 is needed to stun animals before they are killed, helps to keep food fresh for longer through its use in vacuum packaging, and puts the fizz into drinks. The crisis shone a spotlight on the hidden work of the chemical sector and underscored the fact that globally, over 95% of manufactured products rely on chemicals.[7]

Chemicals are essential inputs for many industries, with chemical use pervasive and entrenched in the modern world.[8]

[1] Slow-Reactions-Chemicals-and-Climate.pdf (shareaction.org)
[2] Abate and switch: steel seeks low carbon solutions | UK Institutional (hermes-investment.com)
[3] The Future of Petrochemicals (windows.net)
[4] Chemicals – Fuels & Technologies – IEA
[5] SBTi-Chemicals-Scoping-Document-12.2020.pdf (sciencebasedtargets.org)
[6] https://www.reuters.com/world/uk/uk-meat-industry-warns-some-firms-have-just-five-days-co2-supply-2021-09-20/
[7] Slow-Reactions-Chemicals-and-Climate.pdf (shareaction.org)
[8] Energy Information Administration (EIA)- Manufacturing Energy Consumption Survey (MECS) Steel Analysis Brief

Of the thousands of chemical products manufactured each year, fewer than 20 account for 80% of the chemical industry's energy use and 75% of its greenhouse gas emissions.[9] The energy-intensive chemical products used in plastics and synthetic fibres, fertilisers, paints and water treatment chemicals account for around two-thirds of the energy used by the global chemical industry.[10]

Like the steel industry, the chemical sector is considered "hard-to-abate", meaning that the solutions to reduce emissions are either technically challenging, prohibitively expensive, or both. As with all energy-intensive industries, the sector is under growing pressure to transform. ShareAction's 2021 report *Slow Reactions*, found that the sector had been slow to decarbonise despite NGO and investor pressure about the high emissions, which have barely fallen over the last 10 years.

To align with a net-zero emissions by 2050 scenario, the sector's direct emissions will need to peak as soon as possible and decline almost 10% from current levels by 2030.[11] This reduction needs to be achieved alongside a projected 25% increase in demand for primary chemicals over the same period.[12] According to ShareAction, fully decarbonising the production of chemicals by 2050 is technically feasible and is becoming more economically viable.[13] But getting to net zero will require the sector to decarbonise its energy consumption and feedstock inputs simultaneously.

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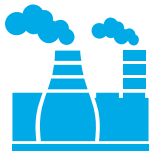
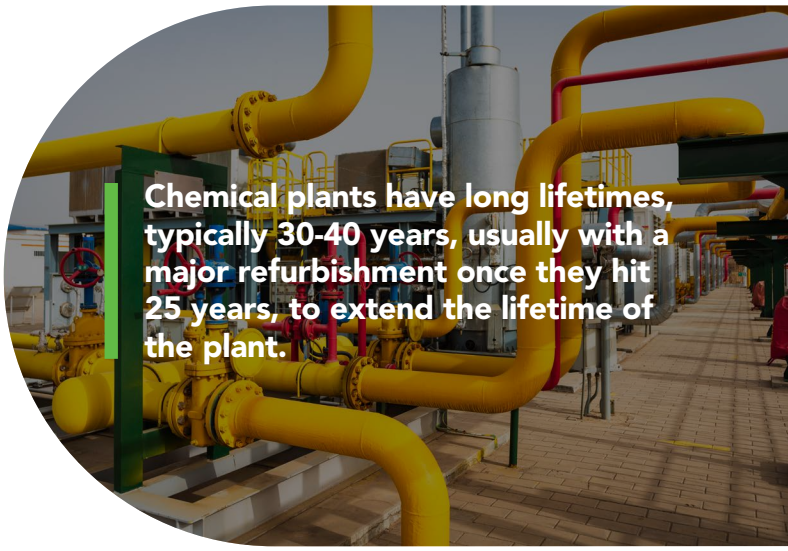


of the chemical industry's energy use

Decarbonisation challenges and risks

Decarbonisation of the energy sources used by the sector to generate the heat, steam and power needed for compression, cooling and other processes in chemical manufacturing will require access to abundant, reliable and cheap alternative sources of energy. However, alternatives to fossil fuels, such as green hydrogen and electrification, are not yet cost competitive compared with current production processes.



Feedstock use, whereby fossil fuels are incorporated into chemical products rather than consumed for energy, can lead to high end-of-life Scope 3 related emissions.[14] These are a challenge for the industry, with estimates dependent on assumptions such as the portion of materials that are recycled, incinerated or sent to landfill.

For example, plastic and chemical waste is often incinerated, releasing the embedded carbon in these products. The long and dispersed value chains associated with plastics make it challenging to reduce these emissions with more circular solutions. Few companies in the sector have a credible strategy to mitigate all Scope 3 emissions by 2050. The use of fossil fuels as feedstocks to create a wide range of everyday products such as plastics, fertilisers, detergents or tyres will require the sector to decarbonise these inputs, while developing strategies to manage the demand side for these products.[15]

The sector is also a substantial user of carbon-intensive grey hydrogen, which is produced using natural gas as an input, particularly in ammonia production and the refining industry.[16] A 1.5°C aligned world would mean eliminating the reliance on grey hydrogen in preference for more sustainable alternatives. Green hydrogen, produced by electrolysis, a process using an electrical current to split water into hydrogen and oxygen, is viewed as a viable alternative for the sector.[17]

For the chemical industry, 2050 is only one investment cycle away. Chemical plants have long lifetimes, typically 30-40 years, usually with a major refurbishment once they hit 25 years, to extend the lifetime of the plant. Most chemical plants will reach the end of their next investment cycle in the next 10-15 years.[18] Retiring plants early to switch to alternative technologies is expected to incur significant costs. The challenge is to ensure that the innovative near-zero emissions technologies currently at the scaled prototype and demonstration stage are ready for market in the next 10 years.

[9] Infographic: Chemical Industry's Energy Use and Emissions – Global Efficiency Intelligence
[10] Slow-Reactions-Chemicals-and-Climate.pdf (shareaction.org)
[11,12] Chemicals – Analysis – IEA
[13] Slow-Reactions-Chemicals-and-Climate.pdf (shareaction.org)
[14] SBTi-Chemicals-Scoping-Document-12.2020.pdf (sciencebasedtargets.org)
[15] The challenge of decarbonizing heavy industry (brookings.edu)
[16,17] Slow-Reactions-Chemicals-and-Climate.pdf (shareaction.org)
[18] https://www.iea.org/articles/the-challenge-of-reaching-zero-emissions-in-heavy-industry

Policy and regulatory certainty will be critical to help accelerate the sector's decarbonisation efforts. Access to abundant, reliable and cheap renewable energy will be key, along with an international level playing field, significant capital investment and demand shifts for end products and the way they are used.

The World Economic Forum's collaborative Low-Carbon Emitting Technologies Initiative (LCET) has identified key policy priorities to enable the development and upscaling of low-carbon technologies in the chemical sector and its related value chains.[19] The April 2021 paper Towards Net Zero signed by Air Liquide, BASF, Dow, Linde, and SABIC, among other leading chemical companies with which we are engaging, identifies seven policy areas as critical to supporting large-scale deployment of low carbon technologies.[20]

In addition to these challenges, the sector is facing the following risks:

- Upstream companies may face stranded asset risks if they retain assets with higher emissions.
- End markets for chemical products are committing to net-zero targets that apply across their supply chains due to changing customer behaviour and emerging technologies. This is increasing competitive pressure on the sector to supply lower carbon solutions for customers.
- The sector is at risk of escalating carbon prices. The UK Chemical Industry Association has reported that energy prices have increased by at least 500% for many companies since 2021, with raw material prices increasing by 30% on average amidst ongoing shipping delays.[21] At the same time, the EU Emissions Trading System (EU ETS) is seeking to phase out its free allocation of pollution permits for the industrial sectors. This is an attempt to align them with Europe's higher 2030 climate targets and Paris Agreement objectives.
- Regulatory requirements for net zero are occurring in many chemicals producing countries. The top five countries (China, US, Ireland, Germany and Switzerland) accounting for 44.2% of all chemicals exported in 2020 each have net-zero commitments in law, in proposed legislation or set out in a policy document.[22,23]
- Chemical companies are under increasing consumer pressure to accelerate the transition to the circular economy by enabling maximum durability in end-use products and by reusing and recycling existing molecules. Some 15 countries, including Switzerland, have proposed the creation of a science policy panel to deal with the threat of chemical waste and plastic pollution, which could lead to increased regulation and reduced demand in western economies.[24] The sector faces continued climate-related physical risks that could disrupt operations and supply chains as well as shifting customer demands. Other sustainability trends will affect the chemicals sector, such as issues linked to water scarcity, product toxicity and pervasiveness ("forever or persistent chemicals"), as well as waste.

Opportunities for the sector

Chemical companies face a challenging transition, although the sector may benefit by developing processes and products that are less carbon dependent or intensive. Many low-carbon technologies rely on innovations in chemistry to become more efficient, affordable and scalable – for example the sector provides materials for solar photovoltaic (PV) systems and wind turbines.

The use of chemical products and solutions downstream can help to address a wide range of climate-related challenges.

Other products, such as insulation, sealing barriers and composite materials, can improve the efficiency of new and existing buildings and of road transportation, including electric vehicles. The sector also has an important role to play in enabling the transition to a circular economy. Bio-based and renewable feedstocks, mechanical and chemical recycling and energy recovery are all actions that can reduce the sector's dependency on fossil fuels.

The use of chemical products and solutions downstream can help to address a wide range of climate-related challenges. A study by Ecofys estimated the chemical sector's contribution across key value chains could reduce emissions by over nine gigatons of carbon dioxide equivalent ($GtCO_2e$) per annum up to 2030, a reduction greater than the total annual emissions of the United States.[25]

Some

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countries have proposed the creation of a science policy panel to deal with the threat of chemical waste and plastic pollution.

[19] Low-Carbon Emitting Technologies Initiative (LCET) | World Economic Forum (weforum.org)
[20] WEF_LCET_Policy_Priorities_2021.pdf (weforum.org)
[21] CO_2 supply agreement reached as chemicals sector suffers climbing costs – News – The Chemical Engineer
[22] Chemical Exports by Country 2020 (worldstopexports.com)
[23] Net Zero Coalition | United Nations
[24] U.N. draft resolution shows countries aim to create chemical waste body | Reuters
[25] Essential-Role-Chemicals-Quantifying-Global-Potential_Ecofys_Brochure-ICCA.pdf (cefic.org)

How we are engaging

We engage with some of the world's largest chemical companies on their decarbonisation pathways and ambitions. We co-lead collaborative engagement with LyondellBasell and Air Liquide as part of Climate Action 100+ and have participated in ShareAction's recent campaign to accelerate climate action for European chemical companies. We also engage with companies on end-market demand.

- **LyondellBasell** first published sustainability disclosures and CDP reports in 2017. These disclosures were useful but did not set targets. Given the company's reliance on hydrocarbon value chains, the materiality of energy expenses, and its role in scaling solutions to global plastics pollution challenges, we wanted the company to set ambitious climate targets.

  In 2019, we raised our concerns regarding the lack of forward-looking targets for energy efficiency, carbon emissions, effluents, water efficiency and waste, and any meaningful solutions for sustainable plastic use. In Q2 2020, in a meeting with senior executives, the company acknowledged our request for forward-looking targets, including science-based targets, and said it was investing in energy efficiency projects. Together with other Climate Action 100+ investors we met the company's CEO in Q2 2021 to discuss the company's progress in disclosing sustainability targets, including planned science-based targets and a net-zero ambition.

  In order to accelerate progress, EOS, as the Climate Action 100+ lead for the company, used a legal mechanism to propose a discussion on climate change at the company's 2021 annual meeting. EOS led contributions by a group of eight institutional investors who questioned the company's climate progress, leading to over 45 minutes of shareholder-board discussion on the company's climate change strategy. During the meeting the company indicated its willingness to make further commitments. A few months later, it set a net-zero goal and short, medium and long-term greenhouse gas reduction targets for Scopes 1 and 2. The company is yet to set a Scope 3 target.

- **BASF** – We have engaged on climate change as a material issue for this German chemical company since 2009. We escalated our engagement from 2020, calling for the company to set net zero 2050 targets and highlighting that it lagged its European peers on this issue. In meetings with the supervisory board chair in Q3 2020 and Q1 2021, we were pleased to hear that both the supervisory board and CEO were supportive of setting these targets and understood that the company wanted to identify a clear roadmap for achievement before publicly committing.

  There was further progress at its capital markets day in March 2021, where BASF announced 2050 net-zero carbon targets for Scopes 1 and 2 emissions and a new, more ambitious, 2030 carbon emissions reduction target

for Scopes 1 and 2 (minus 25% compared with 2018, equivalent to minus 60% versus a 1990 baseline). We welcomed these targets and the underlying strategy, which is clear and appears feasible to deliver.

Scope 3 emissions are not yet included, which we consider to be a material outstanding area for development. Addressing this requires the development of global standards and measurement of Scope 3 emissions for the industry, and the company has indicated that it will look to include Scope 3 once these barriers have been overcome. We are asking the company to add a Scope 3 2050 net-zero target and consider an interim Scope 3 reduction target for 2030 or similar.

- **Air Liquide** – We have engaged extensively with Air Liquide on climate change as a co-lead for the company under CA100+. We asked the company to make a long-term commitment to achieving net-zero emissions in line with the Paris Agreement, and to adopt the recommendations of the TCFD.

  Air Liquide announced its ambition to achieve carbon neutrality by 2050 while deploying low-carbon solutions for its clients and focusing on the development of hydrogen. It said that the inflection point would be reached in 2025 when absolute carbon emissions would start to reduce. The company also announced an absolute carbon reduction target of 33% by 2035 relative to 2020. It has begun to disclose against the recommendations of the TCFD. The company is yet to set a Scope 3 target or enhance its TCFD reporting, and we continue to engage with the company on these elements of the carbon transition.

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Green ammonia, which is produced from green hydrogen and renewable energy (a carbon neutral process), can be used as a fuel in shipping and aviation. It may also support the transportation of stored hydrogen, making it safer and more reliable.[26] The chemical sector has an opportunity to fully explore the use of such derivatives to support the decarbonisation of other hard-to-abate sectors.

Beyond the sector itself, changes in demand for products, such as shifts in agricultural practices with respect to the use of fertilisers and a more circular economy for plastics, will help to accelerate the transition.[27]

Our engagement approach

Our expectations of chemical companies to help address the climate crisis are as follows:

- **Net-zero emissions by 2050 at the latest** – Several companies, including BASF and LyondellBasell, have made this commitment following engagement.
- **Set short and medium-term targets** – Once a long-term goal is in place, short- and medium-term targets should be set, aligning with Paris Agreement goals along the journey to net zero. This is to avoid a disorderly, late transition and chemical producers continuing to pump out high levels of greenhouse gases up until 2050, baking in catastrophic levels of global heating for decades to come. LyondellBasell and BASF have set absolute Scopes 1 and 2 emissions reduction targets of 30% (relative to 2020 levels) and 25% (compared with 2018) respectively, by 2030.[28,29] BASF has outlined a clear pathway to achieving its net zero 2050 targets.[30]

We will look at companies' capital allocation decisions, to assess whether they are investing sufficient resources to achieve net zero.

- **A strategy for how these goals will be met** – Targets should be supported by a clear strategy for decarbonisation, indicating the technologies the company will be relying upon, such as green hydrogen, electrification, or renewable energy. Capex, and research and development spend, should be aligned with the goals of the Paris Agreement. These plans should be reflective of the company's chosen strategy and demonstrate its contribution to the commercialisation of key technologies.
- **Strong governance and aligned executive remuneration** – We expect strong oversight from board directors with the skills and experience to hold management to account for delivering on the long-term climate strategy; executive pay should be tied to successful climate strategy delivery.
- **Reporting in line with the Task Force for Climate-related Financial Disclosures (TCFD) recommendations, including scenario analysis** – Financial reporting and underlying risk management processes should be aligned with the four TCFD pillars; scenario analysis should be used to test the viability and resilience of business models under regulatory and market changes, including an EU Carbon Border Adjustment Mechanism and a 1.5°C scenario.
- **Paris-aligned lobbying and policy advocacy activity** – Companies should ensure that their lobbying and public policy activities are aligned with the Paris Agreement goals, including withdrawing from industry associations where views do not align.

Chemical companies that invest in reducing carbon emissions and capitalising on the opportunities presented by the climate transition will strengthen their position and sustainability. This includes solutions such as emissions neutral feedstock, electrification, renewable energy, and green hydrogen.

Looking ahead

Now that leading chemical companies have announced ambitious Scopes 1 and 2 targets, we will be encouraging them to set similarly ambitious Scope 3 targets, to ensure there is progress in the near term. The significant asset challenges facing the chemical industry mean that it must invest and innovate to achieve carbon neutrality, with appropriate support from regulators and policymakers.

We will look at companies' capital allocation decisions, to assess whether they are investing sufficient resources to achieve net zero, as well as collaborating with their supply chain and customers. In the coming years we will seek far greater clarity on the actions taken by each entity along the chemical value chain, and the resources they have invested in pursuing net-zero solutions.

[26] Green ammonia, the new superfuel that is going to disrupt the industry (energycapitalmedia.com)
[27] Slow-Reactions-Chemicals-and-Climate.pdf (shareaction.org)
[28] LyondellBasell Announces Goal of Achieving Net Zero Emissions by 2050 | LyondellBasell
[29] BASF presents roadmap to climate neutrality
[30] Our Carbon Management (basf.com)

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