



GREENHOUSE GASES

Can Europe's chemical industry survive net zero?

The burden of cutting greenhouse gas emissions could diminish Europe's role as a global chemical leader

by **Alex Scott**

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The availability of renewable energy is key to the European chemical sector's ability to transition to net zero, but that energy is in short supply.

IN BRIEF

Europe's chemical industry is facing an existential crisis. It may not be able to raise the hundreds of billions of dollars that the region's sector will require to transition to zero greenhouse gas emissions by 2050. Small-scale studies show that some European chemical companies may already be falling behind on their commitments. Part of the problem is that Europe's supply of renewable energy is not growing fast enough to meet the chemical industry's demands. If Europe's chemical sector is to survive intact, industry experts say, it will need substantial subsidies from European governments.

About 5 years ago, most of the world's biggest chemical companies updated or reset their goals for reducing greenhouse gas (GHG) emissions to a simple but compelling target: net zero by 2050. Executives at companies from across Asia, Europe, and the US congratulated themselves on setting a goal that was more ambitious than the partial reductions they had targeted in earlier plans.

But for firms in Europe, the calculus is already starting to change. Europe has the strictest regulations when it comes to GHG emission reductions. European chemical companies also have the highest costs and the least profits to pay for the technology upgrades needed for zero-carbon production.

CLIMATE TRANSITION TRAJECTORY IN 2050

Planet Tracker predicts that of seven leading chemical companies it evaluated, only Air Liquide and Incitec Pivot are close

An additional challenge for European chemical firms is that they are struggling to access the volumes of affordable renewable energy and green hydrogen that a net-zero transition requires. Even if Europe's chemical industry succeeds, it remains unclear whether companies can compete on the world stage by selling expensive net-zero chemicals when no other region's industry is.

Key levers that the global chemical industry can pull to transition to net zero are replacing fossil fuels with renewable energy; substituting fossil fuels as a raw material with recycled material, biomaterial, or green hydrogen; and adopting low-energy-consuming electrochemical, catalytic, and fermentation processes. Carbon capture, utilization, and storage (CCUS)—although not yet proved at scale—can also help chemical firms transition to net zero.

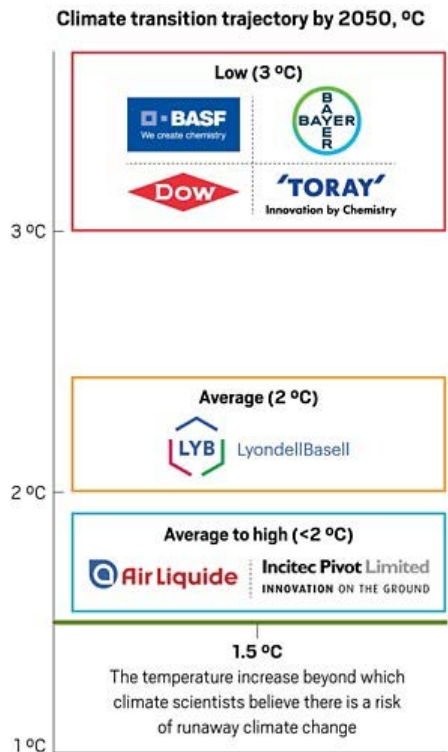
“Europe is at a point where it has to decide whether a major chemical industry making commodity products through to specialty chemicals can be supported,” says Bernd Elser, global head of chemicals for the consulting firm Accenture. He says the sector's survival requires government support as well as alignment with equipment manufacturers, the renewable energy sector, the green hydrogen sector, and others.

“Companies around the world, including those in Japan, Middle East, and the US, are also in the process of reducing their greenhouse gas emissions, but they might not face the same ambitious green agenda as companies in the European Union,” Elser says.

Among European chemical firms, commodity petrochemical producers are affected most by the transition to net zero. This is because the carbon footprints of key petrochemicals, including ammonia and ethylene, account for 80% of all emissions the chemical sector generates, Elser says.

Direct emissions—often referred to as scope 1 emissions—from the global petrochemical industry were 1.8 giga-metric tons of carbon dioxide equivalents (GtCO₂e) in 2020, or about 4% of all anthropogenic GHG emissions, according to a study by Lund University.

to being on a trajectory for net-zero emissions by 2050, which is required if global warming is to be limited to 1.5 °C above the pre-industrial average temperature. Planet Tracker expects the other five companies to be on course for a climate that would be 2–3 °C hotter.



Source: Planet Tracker, *Tomorrow's Chemistry*, April 24, 2024.



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Scope 2 emissions—those resulting from the petrochemical industry's use of energy—and scope 3 emissions—those resulting from the downstream use of petrochemicals—accounted for an additional 3.8 GtCO₂e. The EU is responsible for about 5% of the petrochemical industry's emissions, according to the study.

The EU is committed to transitioning all industry in the region to net-zero emissions by 2050 to help keep the average global temperature rise to 1.5 °C above preindustrial levels—beyond which climate scientists forecast the world would face a greater risk of catastrophic effects from climate change. But there is a problem. Some European chemical companies are not on a trajectory to reach net zero by 2050.

“There is a gap between the plans and the climate projections,” says Florie Gonsolin, director of industrial transformation projects at the European Chemical Industry Council (Cefic), Europe’s leading chemical industry association. “The more we see this gap, the more difficult it will become later on to meet the objectives.”

SHORT OF CASH

One of the obstacles to net zero is the cost of building low-carbon facilities and purchasing low-carbon energy and raw materials. “To transition to net zero in Europe, chemical companies will need to increase their capital expenditure by 70% and maintain this level of investment annually until 2050,” Elser says. “There is no magic cash pool to support this, so the money would likely have to come from EU or national government subsidies.”

Accenture estimates that between 2021 and 2050, the European chemical industry will have a total decarbonization funding gap of \$550 billion. In a **survey** published by Accenture in 2023, 60% of chemical industry executives also said they couldn’t afford further investment in decarbonization in the current economic climate.

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— **Bernd Elser**, *global head of chemicals, Accenture*

Beyond the transition-related costs, many European petrochemical producers face the cost to replace relatively small, old, and inefficient ethylene crackers, which convert fossil fuels such as naphtha into the building-block chemical ethylene. In a **report published in May**, the consulting firm Wood Mackenzie concluded that about a quarter of global ethylene capacity is at risk of closure by the end of the decade because of oversupply; in Europe, that figure is about two-thirds.

A greater percentage of crackers in Europe are at risk of closure because Europe is experiencing unprecedented supply fragility amid subdued demand and rising energy prices caused by the Russia-Ukraine war, according to Mohamed Chilmeran, a research analyst at Wood Mackenzie.

And not only are European petrochemical firms paying higher energy prices to make the same molecule as their global competitors, says Tobias Lewé, a partner at the consulting firm Kearney. They are also exposed to additional costs because of EU regulations. “European regulation on sustainability is not the only reason for the challenge that we see here, but obviously it’s a major trigger,” Lewé says.

Under the Emissions Trading System (ETS) of the European Commission (EC), owners of major European chemical plants must pay for each metric ton of CO₂ they emit beyond an allowance given to them by the EC. Over time, the EC will reduce the number of allowances for each plant, a tightening that is widely expected to push up the price of each metric ton of CO₂ traded on the ETS.

That current price is around \$70. This fee is already adding millions of dollars to the cost of running some major chemical plants in Europe, such as **Solvay's synthetic soda ash plants**, which generate 1 t of CO₂ for each metric ton of soda ash produced.



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Despite the additional cost, Solvay has been able to invest in low-carbon technologies and says its net-zero transition is well underway. “We are strongly progressing to realize our energy transition and achieve carbon neutrality by 2050,” says Etienne Galan, president of Solvay's soda ash and derivatives business.

Integral to its transition is an electrochemical soda ash process named e.Solvay, which the company expects to start rolling out by 2030. The process will cut CO₂ emissions from the company's soda ash production by 50%, reduce water and salt use by 20%, and lower limestone consumption by 30%, Galan says. The technology has come neither quickly nor cheaply: Solvay has invested about \$44 million over the past 30 years in soda ash technology development, Galan says.

Evonik Industries, one of Europe's biggest specialty chemical firms, is also working on electrochemical processes, including its Rheticus project—featuring both electrochemistry and a fermentation step—for converting CO₂ into a wide range of products. They include hexanoic acid, an intermediate for paint additives, cosmetics, and lubricants. Evonik recently produced several metric tons of hexanoic acid in a single run at its pilot facility.

The Austrian petrochemical producer OMV's response to the EU's net-zero drive is to gradually **replace ethylene from fossil fuels** at its sites in Berghausen, Germany, and Schwechat, Austria, with feedstocks including oil derived from plastic waste. The company says that replacing fossil fuels substantially cuts its products' carbon emissions.

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— **Etienne Galan**, *president of the soda ash and derivatives business,*
Solvay

OMV currently produces 200,000 t per year of low-carbon ethylene from such renewable or circular feedstocks. It expects to increase that to around 1.4 million t by 2030 and 2 million t thereafter. OMV recently disclosed that it is working with the Swiss chemical company Clariant to develop technology for converting biobased ethanol to ethylene.

Seeking to spur more such projects, the EC will put several billion euros raised via the ETS over the next few years in **an innovation fund** to help chemical companies develop more low-carbon processes. The EC has also made a few billion euros available to developers of low-carbon technologies via the European Union's Horizon Europe research program.



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Still, this financial support is eclipsed by subsidies in the US, where low-carbon projects proposed by the chemical industry can qualify for some of the \$369 billion being offered under the country's **Inflation Reduction Act (IRA)**. The US government is not just offering more funding than Europe but is providing it in a way that is more useful, according to Cefic's Gonsolin. "With the IRA you can get tax breaks, and that also helps you deal with your operational expenses," she says.

In a bid to protect European producers of low-carbon products against cheaper high-carbon imports, the EC is starting to use a carbon border adjustment mechanism (CBAM), a system to tax carbon imports. Europe introduced the CBAM on Oct. 1, 2023, but the only **chemical products currently covered by the mechanism** are fertilizers, hydrogen, and cement. More products are set to be included in the coming months, although the system's effectiveness remains unclear, Accenture's Elser says.

TALKING INDUSTRY'S LANGUAGE

While companies such as Evonik, OMV, and Solvay are touting CO₂ reduction projects, they advance the region's climate goals only incrementally. Overall, a lack of public funding and cumbersome regulations continue to hold back the European chemical industry's net-zero transition.

European leaders seem to realize the drag the region's policies created. In a **July 18 speech** after being reelected for a second 5-year term as EC president, Ursula von der Leyen singled out the European Green Deal—Europe's industrial policy for net-zero emissions—as a priority policy for her next term. "I will put forward a new Clean Industrial Deal in the first 100 days," she said.



Credit: Birgit Franke

Solvay plans to replace its synthetic soda ash process in Rosignano, Italy, and its other plants with an electrochemical process that substantially reduces greenhouse gas emissions.

The vow is a welcome surprise for the chemical industry. “It’s good that the intention is there,” Cefic’s Gonsolin says. “At the same time, we need to keep our feet grounded in reality and be aware of the constraints.”

Gonsolin’s hope is that the EC can ensure that the policies making up the pieces of the net-zero regulatory puzzle are all pulling in the same direction. “Consistency” is what Cefic and its members are seeking, she says, including on things as disparate as energy policy and geopolitics.

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Plastics is a key area. “We need opportunities, outlets for clean products, but we also have to make sure that those solutions are manufactured in Europe and that we don’t start importing recycled plastic from wherever,” Gonsolin says.

The European Environmental Bureau, a collection of over 180 environmental organizations, warns that a new era of chemical-industry-friendly EU policies could bring new problems. “We are worried by the excessive stress put on simplification and cutting red tape, which would lead to a deregulatory push weakening our environmental, health, and worker protection standards,” says Riccardo Nigro, senior policy officer for zero pollution industry at the bureau.

But even as von der Leyen extends an olive branch to industry, she is sticking to some core demands. She confirmed on July 18 that the EC will be requiring industry to cut its emissions by 90% by 2040. “This is quite ambitious,” Gonsolin says, referring to the target. “The industry has already picked the low-hanging fruit.”

ARE COMPANIES FALLING BEHIND?

With the easiest emission cuts already made, some companies appear to be falling behind on their climate commitments. Of the 17 European chemical companies with sufficient data for a full analysis in Accenture’s 2023 report, only 18% were on track to hit net-zero emissions in their operations by 2050.

A **2024 study by the nonprofit Planet Tracker** looked at the sector from a global perspective and found that out of seven major chemical companies, only two—Air Liquide and Incitec Pivot—are on track to hit net zero by 2050. Those trailing behind are BASF, Bayer, Dow, LyondellBasell Industries, and Toray Industries. All five counter that they are on course to meet their GHG reduction targets.

Toray says cutting emissions in Europe is no harder than in other parts of the world. “On the other hand, there are concerns that overly strict rules and regulations could hinder efforts to realize carbon neutrality,” a spokesperson from the Japanese company says in an email.





Credit: BASF

BASF has begun testing the world's first demonstration-scale electric ethylene reactor—an approach that could replace fossil fuel-powered production—at its site in Ludwigshafen, Germany, in partnership with Sabic and Linde.

LyondellBasell says it has accelerated its efforts in the past 2 years and introduced a 2030 target to reduce total scope 1 and 2 GHG emissions by 42% and scope 3 emissions by 30% relative to a 2020 baseline. The company plans to use the four reduction levers of energy efficiency, renewable electricity and electrification, the use of hydrogen, and the potential deployment of CCUS.

Meanwhile, Bayer is making “good progress” in achieving its GHG targets and aims to achieve climate neutrality at all its sites by 2030, says Matthias Berninger, the firm's head of public affairs and sustainability.

Planet Tracker identifies BASF as relying too heavily on unproven technologies such as CCUS and plant electrification. The group also flags as problematic BASF's membership in 14 trade associations that do not align with the United Nations' Paris Agreement on climate change.

BASF has made significant progress in cutting its CO₂ emissions in recent years, says Sebastian Bray, a chemical stock analyst at Berenberg, but he acknowledges challenges ahead for the allocation of capital expenditures. “There may be a tension between the firm's likely desire to reduce capex in the mid-2020s following years of heavy spending in China and the need to invest in decarbonization plans that may not yield an attractive economic return for several years,” he says in an email.

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BASF says it continues to be committed to achieving its GHG emission targets by deploying novel technologies and investing in renewable energy. “The replacement of grey by green energy will have the largest impact on reducing our emissions in the coming years,” a company spokesperson says in a email. With this strategy in mind, the company is **working with Sabic and Linde** to develop an ethylene cracker heated and powered by renewable electricity rather than fossil fuels.

ELECTRIFICATION IS KEY

Chemical companies like BASF aren't the only ones looking to renewable energy to help transition to net zero. Most every other heavy industry in Europe sees green electricity as the answer to its GHG problems, but that electricity is still mostly an ambition.

“The way to achieve net zero is—simply speaking—electrification,” Accenture’s Elser says. “What appears to be missing at the moment is sufficient renewable or net-zero electricity at competitive prices.” Generating all the clean energy required by European industry will require an additional 836 average-size nuclear plants, solar panels covering an area the size of Ireland, or onshore wind turbines covering an area the size of Spain, according to Accenture’s analysis.



Credit: Philipp von Dittfurth/picture-alliance/dpa/AP Images

European Commission president Ursula von der Leyen says she will lay out a new industry-friendly green transition strategy by Oct. 26.

Individual companies are acting. LyondellBasell, for example, is signing deals with third-party suppliers. “We have increased our renewable electricity volumes, primarily through power purchase agreements (PPAs). These PPAs now represent nearly 90% of our 2030 target to secure at least half of global electricity from renewable sources,” a company spokesperson says in an email.

In contrast, rather than wait for the European renewable energy sector to grow, BASF is building its own supply of clean electricity. In April, the German firm agreed to acquire 49% of Nordlicht 1 and 2, two huge wind farms with a combined output of up to 1.6 GW that the Swedish energy firm Vattenfall is building in the German North Sea. This move follows **BASF’s purchase** in 2021 of almost half the 1.5 GW Hollandse Kust Zuid wind farm in the Dutch North Sea for \$1.7 billion.



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But in a **2023 study** of more than 1,000 global companies, Accenture found that 81% of leaders in heavy industry expect it will be at least 20 years before they have access to sufficient zero-carbon electricity to decarbonize their companies. Meanwhile, 95% “expect to need at least 20 years to deliver net zero products or services at or close to price parity with high-carbon alternatives, and just over half (54%) say that manufacturers’ future purchasing intentions give them enough confidence to invest in decarbonization,” an **Accenture news release** says.

With benefits from decarbonization not immediately forthcoming and the economy in Europe anemic, the region’s chemical companies have instead opted to invest in areas such as making their supply chains more resilient. “I’ve seen a significant slowdown in green investments,” Kearney’s Lewe says.

An effective renewable energy strategy is 1 of the 10 policy changes Cefic has been calling for as part of its **Antwerp Declaration** for a European Industrial Deal to support the European Green Deal, published in February and supported by 25 industrial sectors. EC president von der Leyen indicated in her July 18 speech that she is now listening to **industry’s call for change**. Whether von der Leyen can overhaul European industrial policy in her 5-year term—including adding financial support to help chemical producers transition to net zero—remains to be seen.

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Although using public funds to move the chemical industry to zero carbon emissions is not a possibility, the EC remains committed to net zero by 2050. “Then the key question is ‘Who is paying for the transition?’” Lewe says. “Do we find anyone in the market who is willing to pay for decarbonized products? I only see very rare examples where consumers are willing to pay for that,” he says.

Lewe reckons that whatever happens at a political level, Europe is destined to lose at least some of its petrochemical capacity. “In general, the chemical industry landscape in Europe will shift towards more specialties,” he says.

But as Stephanie Jamison, Accenture’s global resources industry practices chair, warns in the company’s 2023 report, the cost of doing nothing to help Europe’s chemical industry will be high: “If heavy industry is burdened with the full cost of decarbonization and fails to meet net zero targets, all industries will fail.”

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