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# Chemicals

Pathways to decarbonization

# Key enabling role of the chemical sector

The chemical sector contributes 3%<sup>1,2</sup> of global carbon emissions and is one of the major industrial emitters of greenhouse gases (GHG). But it also plays a key role in the industrial value chain by providing critical products for many industries, such as automotive, construction, electrical and electronics, and consumer businesses.

With its carbon-based products and partially high-energy-intensive processes, it is without doubt one of the hard-to-abate (HTA) sectors on the path to net-zero. But in addition to its own target goal of becoming net-zero, the chemical industry is delivering key sustainability-enabling processes, products and services to its customers, while driving knowledge and innovation.

The successful transformation of the chemical industry toward net-zero is therefore a critical step on broader society's road to carbon neutrality.

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<sup>1</sup> IEA, World Energy Outlook 2022, p. 63, October 2022, URL: [World Energy Outlook 2022 \(windows.net\)](#), Accessed: December 2022

<sup>2</sup> IEA, Tracking report Chemicals, September 2022, URL: [Chemicals – Analysis - IEA](#), Accessed: December 2022

# Net-zero technologies

The chemical industry involves a variety of production processes that emit carbon dioxide and other GHGs. Some of the most common sources of carbon emissions are the consumption of fossil feedstock, fossil fuel energy and electric energy. Others include process-related carbon emissions and end-of-life emissions from downstream products.

In contrast to other HTA sectors, there is no straightforward, uniform set-up in place to abate these emissions. The chemical industry can apply different sets of technological measures depending on the region, type of chemical activity, and individual company.



**Increasing overall operational efficiency is a long-standing endeavor and should continue to contribute to GHG reduction.**



**Switching to low-carbon electricity is a comparatively easy step for replacing high-carbon electric demand, subject to the availability of sufficient green electricity supply.**



**Bio-based feedstocks and the use of hydrogen are not new to the industry; however, scale, application alignment and penetration may reach new levels, and resource availability may therefore be the critical issue.**



**Carbon capture, utilization, and storage (CCS) technology is being implemented at varying speeds, depending on the region and the state of discussions on suitable storage locations and costs. CCS is also being considered as a bridging technology to help reduce CO<sub>2</sub> output in the near- to mid-term, while CCU and other technologies advance.**



**Advanced electrification still faces limitations due to a lack of technological maturity, but is nevertheless the subject of major ongoing effort (e.g., in steam cracker conversions).**



**Circularity has a pronounced impact on end-of-life emissions, and is being strongly pushed by many customers and legislators alike; ongoing progress in collection and advanced recycling is beginning to help drive its expansion.**

# Geographical and policy aspects

As in other industries, the chemical industry is regulated according to the frameworks of the jurisdictions in which its companies operate. With all major countries and regions having accepted and committed to achieving carbon neutrality by 2050-2060, this is setting a binding framework for the industry.

## Key insights

Regulatory landscapes setting out pathways to net-zero can differ not only in their timelines, but also in the effects they will have on the industry. Matters such as the impending tax-free environment by the EU are adding further challenges. Together with the uncertainty surrounding future regulatory moves (e.g., Carbon Border Adjustment Mechanism), the industry lacks the certainty that it needs to help drive investment and portfolio strategies.



**Figure 1:** 2022 has been the first time that the overarching political framework for achieving the NDC of the Paris Agreement had been tightened worldwide

# Challenges

## Transformation challenges

The transformation of the chemical industry toward net-zero faces multiple challenges. A significant short-term roadblock is the availability and the competition for green electricity/ green hydrogen with other sectors, and the associated risk of insufficient and non-cost-competitive supply. Additionally, high returns remain in fossil-based value chains, which can complicate the business case for green investments.

Another important factor is carbon leakage management, for example, through the levy of a carbon premium on the import price of products produced in countries with lower sustainability standards. There is still no level playing field globally; the market in base and intermediate chemicals is typically very competitive and can be hard to pass on additional energy costs, particularly when faced with less sustainable low-priced competitor products.

Consumers in some applications are beginning to demand products with a low-carbon footprint, helping drive investments in sustainable consumer goods, and in innovation in the chemical industry to provide the supporting products. Sustainability issues, such as establishing standardized and unified rules for measuring and reporting carbon emissions, are high on the industry's agenda.

Realizing a fully circular value chain can require new perspectives and business models for driving value generation, as well as the development of full-scale chemical recycling.

New technologies are also needed to help mitigate, abate, capture, and use emissions on a commercial scale. In this and other areas, the industry faces challenges from qualified suppliers' limited capacities, as well as a general shortage of skilled workers. The skills gap extends to green technology (e.g., electro-chemistry), digital and AI.

1. Switching to green electricity
2. Carbon leakage management
3. End-market demand/valuation
4. Missing transparency and disparities in carbon measurement and reporting
5. Circularity realization
6. Technology development, maturation, scaling and implementation capacity of respective technologies

**Table 1:** Summary box of the six major challenges

# Key drivers of transformation for the chemical sector

When looking at the transformation of the chemical sector to net-zero, we should not underestimate the importance of the customers' perspective. A sole focus on a regulation-focused transformation may not sustainably lead to net-zero. Sufficient market demand for sustainable products, and an interconnected focus on emissions reduction along the lifecycle, should make the transformation successful and help drive companies to integrate sustainability into their competitive DNA. Positive ESG ratings represent a good start and are already positively impacting company value and easing access to capital markets.

Investment decisions, however, are the starting point of a multi-year implementation process, and the assets have a lifetime of 20-plus years, so long-term regulatory certainty is needed to help de-risk these investments. It is also important to note that overall (portfolio) strategies, management and controlling systems—not to mention KPIs—may need to be adjusted to reflect the new realities of sustainability and becoming net-zero.

In addition to its own activities, the chemical industry should understand the challenges faced by its suppliers. The availability of green electricity and green hydrogen may be crucial for the sector. But supplies

could be limited until 2040, and there could be competing demand for green electricity from other sectors. Sustainable supply may remain a critical issue for years to come, potentially impacting the industry.

Supplies of renewable and bio-based feedstocks are also limited and cannot replace raw materials altogether. The chemical industry may remain dependent on raw feedstock for decades to come. However, the general direction is clear.

Application industries are driven by consumers' requests for green products and are increasingly looking for suppliers that give sustainable options in the form of low- or zero-carbon products and services.

In this way, they are setting the trend and dictating the pace of change for the chemical industry. This is leading to three key must-haves for the industry: Proper CO<sub>2</sub> footprint reporting, a clear net-zero strategy, and co-innovation on sustainability.

Sustainability has come to stay: Many consumers worldwide are highly knowledgeable about climate change and the importance of sustainability, and may drive change across industry sectors, with chemicals playing a critical role.

**CHEMICAL INDUSTRY WILL POSITION ITSELF** not only as fully compliant with the regulation, but as a major contributor enabling sustainability in its application industries

Sustainability came to stay – **CONSUMERS** globally are sensitive of climate change and the sustainability transformation need, however with a limited willingness to pay green premiums

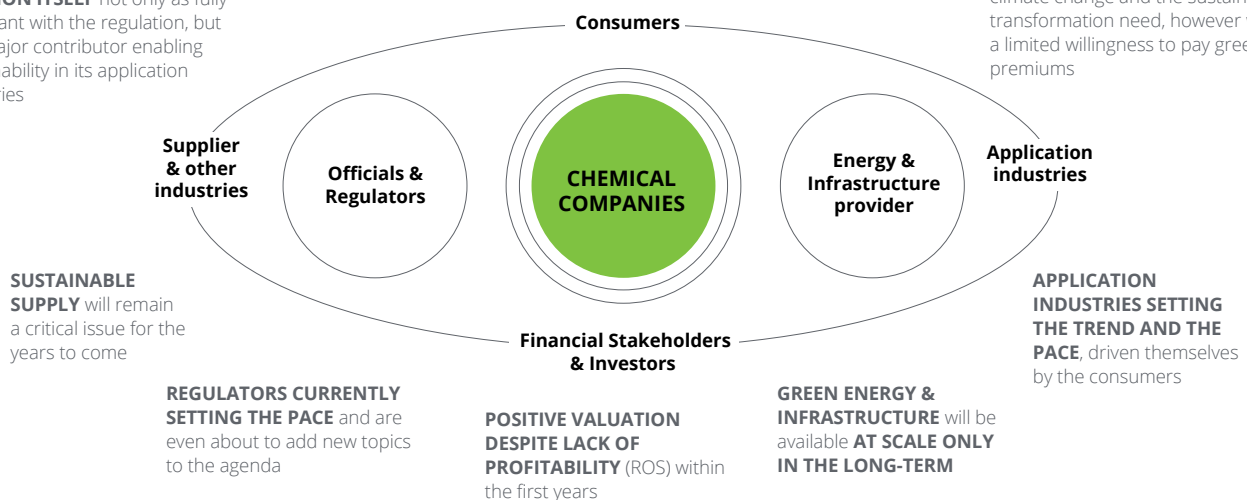


Figure 2: A variety of stakeholders will play key roles on the path to net zero for the chemical industry

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