KPMG

REACTION

Chemicals & Materials Magazine

Thirty-eighth edition

Articles include:

The chemistry of the energy transition

Chemical combinations

Chemicals enter a new era of green investment

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Foreword

Welcome to the 38th edition of REACTION magazine. It's hard to believe that the first quarter of 2023 has passed, and we're now well into Q2. At this rate, it won't be long before everyone contemplates their summer holidays.

A highlight of the year for me has been attending one of the premier events in the chemicals calendar — the World Petrochemical Conference in March in Houston, Texas. With some 1,500 delegates from chemicals businesses worldwide, it was an excellent opportunity to gauge the mood in the industry and reflect on some of the key themes and issues occupying executive minds.

In particular, I was privileged to participate in a session with around 30 CEOs of prominent industry players, in which three discussion areas stood out.

The first of these was industry expectations for 2023. It is clear that the year will be a challenging one. Most of the sector came into 2023 knowing and expecting that Q1 would be difficult, but there was a hope that by the second half, conditions would have picked up, and we might see something of a return to growth. However, with continuing uncertainty around the economic outlook and with inflation and interest rates still high at the end of April in many major economies, I think there is an acknowledgment now that 2023 will be a year to ride out as best as possible — with recovery more likely for 2024. Businesses that come out with flat or stable performance will have done well, all things considered. The only caveat to add is that with China now having scrapped its zero-COVID policy, we're likely to see renewed economic growth and activity there, which could filter through into some of the chemicals sectors, providing a late boost for some.

The second area of the CEO discussion was the energy transition and sustainability agenda. This has become an essential item in the Boardroom as the industry looks to decarbonize and contribute to the collective global effort to achieve net zero. The industry has already made significant strides in its sustainability practices — and indeed, I often feel it doesn't get the credit it deserves for this from the outside world. At the session I attended, there was a consensus that what's critical now is to stop debating the best mix of tools and technologies and apply them in practice to see what works. In the medium term, it was felt that the most realistic pathway would probably be a combination

Most of the sector came into 2023 knowing and expecting that Q1 would be difficult, but there was a hope that by the second half, conditions would have picked up, and we might see something of a return to growth.

of blue hydrogen, carbon capture and continued reliance on natural gas. Other technologies, such as modular nuclear, may come into play further down the line and form part of the mix.

A second strand of the energy transition discussion was circularity. This is rapidly becoming an area of increased focus and interest to the sector as awareness grows that creating a circular economy with increased recycling and reuse rates is one of the keys to uncoupling from fossil fuel dependence. But there are issues to overcome, with limitations in recycling industry capacity, technical sorting challenges, and logistical challenges due to recycling plants needing to be co-located with big chemical plants. As a result, we're starting to see some chemicals businesses thinking about actively engaging in the value chain themselves, perhaps by making a targeted acquisition. This would be a new departure and is certainly an area to watch.

Finally, the CEOs at WPC also reflected on the topic of regulation. In particular, there was a discussion of the Inflation Reduction Act (IRA) in the US — which was widely seen as a substantial piece of market-driven legislation that creates significant incentives to make large-scale green investments. Because its eligibility rules and criteria are clear, it provides businesses with investment confidence. Some compared it with the EU's Green Deal, which was deemed less clear-cut. I can't help but feel that the differential between the two will likely drive incremental investment to the US over Europe. However, one issue that needs to be addressed in the US and EU is the ability to obtain permits for large projects.

With these three issues dominating the discussion, I am pleased that this issue of REACTION very much follows the executive agenda. This magazine has an in-depth examination of the energy transition for chemicals and considers the roadmap to net zero; regulatory and tax professionals zoom in on IRA and the new era of green investment that it could herald, as well as surveying the regulatory picture in other parts of the world like the EU. In contrast, deals professionals analyze the outlook for M&A in the sector — it has been quiet, but will it necessarily stay that way?

I hope you enjoy this issue of the magazine. As always, please don't hesitate to get in touch if you have any feedback or would like to discuss a particular topic in more detail.

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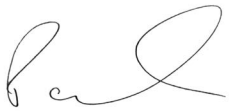

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The role of chemicals in achieving net zero

By

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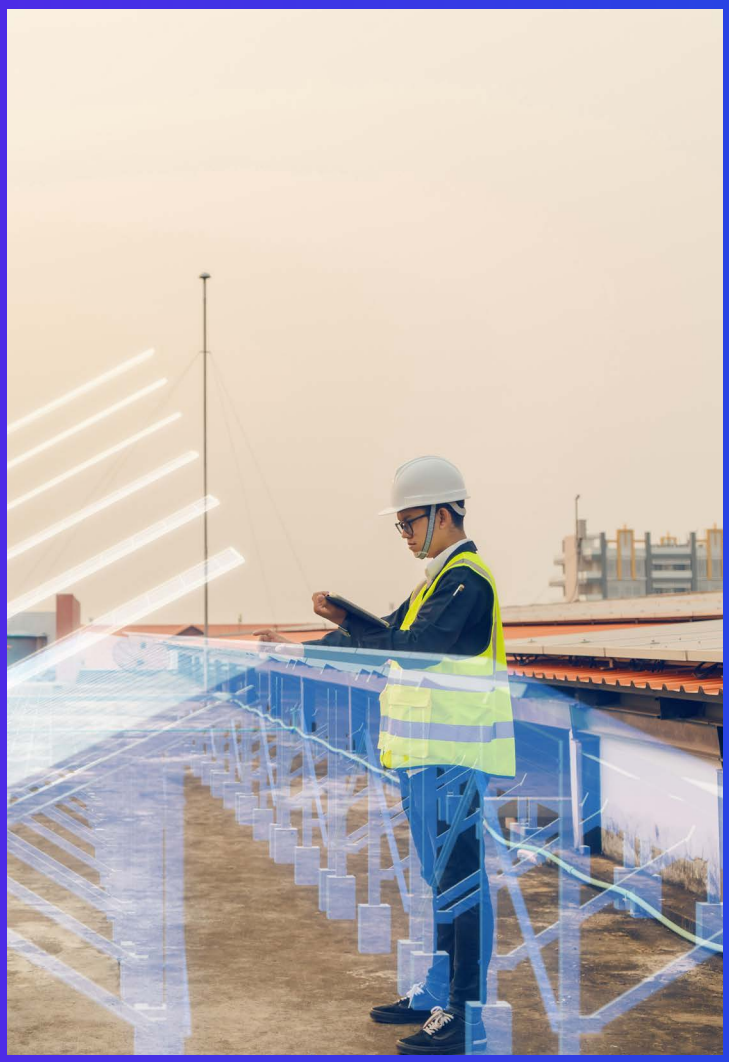


As the world strives to meet net zero targets, the chemicals sector has a key role to play, by reducing its emissions and helping other sectors do the same.

The very nature of the processes within chemicals makes it a significant producer of CO_2. In 2021, direct CO_2 emissions from primary chemical production were 925 Mt, a 5 percent increase on 2020 levels. Chemicals are the third largest emitter amongst all industrial sectors — and if the chemicals sector were a country, it would be the fifth largest emitter of direct CO_2 in the world.[1]

Notwithstanding its own high carbon output, the sector has significant relevance to the carbon footprints of many other industries. Over 95 percent of manufactured products rely on chemicals, making the sector a considerable Scope 3 factor for other businesses.[2] Reducing the carbon emissions of the chemicals process would have a substantial positive impact beyond the industry itself.

Decarbonization has been a live agenda item for some time, and the chemicals sector has been making considerable efforts to advance sustainability. The industry has long adopted leading practices around safety processes and the protection of the environment. It has implemented advanced systems in areas such as wastewater recycling. It increasingly embeds cutting-edge technologies into processes to maximize safety and minimize environmental impact.

But like a host of other sectors, there's no question that taking carbon and other gases like methane out of the footprint at the scale (and speed) needed presents a challenge. Chemicals are notoriously hard to decarbonize, not least because much of the feedstock it uses comes from fossil fuels. At the same time, about a third of its carbon emissions are inherent in the chemical reactions required to produce compounds like ammonia and petrochemicals.[3] More large-scale technological investments are needed for fuel and process emissions to be reduced on a large scale.

As the net zero agenda increases in strategic priority, there is growing pressure on chemicals companies from governments, regulators, investors, NGOs, and other stakeholders to develop credible and detailed energy transition plans. The window for doing this is now — because only if real momentum is established this decade will the various targets set for 2030 and beyond remain feasible.

1 IEA Chemicals Tracking Report, September 2022
2 IEA Chemicals Tracking Report, September 2022
3 SBTi, Chemicals Scoping Document, December 2020

Given the urgency — and the size — of the issue, how can chemicals businesses best drive a decarbonization strategy that will deliver the needed transformation?

2020

- Total emissions from the chemical sector were at 1.3Gt[4]
- Energy consumption by the chemical sector was at 46 EJ and >99% of energy was obtained from fossil fuels[4]

2030

- Many companies like BASF, Dupont, SABIC, and Air Liquide have Scope 1 and 2 emission reduction targets of up to 30%[6, 7, 8, 9, 12]
- According to IEA NZE, total emissions from the sector are projected to be 1.2Gt. The sector will recycle 27% of plastics produced and 70 Mt CO_2 is captured through CCUS[4]
- IEA projects that average CO_2 price for advanced economies will reach US$ 130 per ton[4]
- 15% share of electricity in the energy consumption in the chemical sector is projected[4]

2050

- Major companies such as BASF, SABIC, Mitsubishi Chemicals, and Dow have committed to reaching Net-Zero by 2050[7, 13]
- IEA NZE projects that the total emissions from chemical sector will fall to 65Mt. The sector will have a plastics recycling rate of 54% and 540Mt of CO_2 will be captured through CCUS[4]
- Fossil fuel use does not fall to zero due to its utility as petrochemical feedstock Production of petrochemicals is coupled with large-scale CCUS[4]
- CO_2 price may reach US$250 per ton[4]

Today

- Policy and regulatory mechanisms are in place to control emissions from chemical sector: EU Green Deal, US Inflation Reduction Act, emission trading schemes
- LCET: Key players in the chemical sector and World Economic Forum have entered an agreement to upscale low-carbon emitting technologies (LCET)[5]
- Major companies like BASF, FMC, and Dow chemicals have announced Net-Zero targets[6, 7, 8, 9]
- Electricity has a 10% share in chemical sector energy consumption[10]
- United Nations plastic pollution treaty: Development of legally binding instrument to end plastic pollution by addressing the entire plastic life-cycle, targeted to be put in motion by 2024[11]

2040

- Deployment of electric steam crackers and green hydrogen is projected to be at commercial scales[4]
- All unabated coal plants are phased out and emissions from electricity generation reach Net-Zero[4]
- Average CO_2 price for advance economies is projected to reach US$ 205 per ton[4]

4 IEA, Net Zero by 2050
5 WEF, Low carbon emitting technologies initiative
6 ExxonMobil, Advancing Climate Solutions Progress Report 2023
7 BASF, The climate is changing, so are we
8 FMC, Climate change and water statement
9 Dow, Addressing climate change
10 IEA, World Energy Outlook 2022
11 UN Environment Programme, Intergovernmental Negotiating Committee (INC) on Plastic Pollution
12 S&P Global, SABIC to rely more on renewables amid 2050 net zero pledge
13 Mitsubishi, A new future, together

Three lenses

This piece will look at the issue from three essential perspectives:

1 Firstly, it will consider how the chemicals industry can reduce emissions. This remains the overriding strategic priority.

2 Secondly, it will also consider how chemicals businesses can help enable the production and adoption of renewable energy more widely. This is to the potential benefit of all business sectors and communities at large.

3 Thirdly, it will examine how chemicals can enhance energy and material efficiency and benefit the value chain.

This article will then conclude by briefly considering other aspects, such as the broader ESG agenda and the regulatory landscape.

Reduction of own emissions

As a highly energy-intensive industry, reducing the GHG impact of the energy the chemicals sector uses — and using less — is crucial to the transition. Ultimately, success will likely lie in a combination of a reduction in both **fuel emissions and process emissions**.

Fuel emissions

For fuel, this means moving to renewable energy (RE) sources wherever possible instead of conventional fossil-fuel-derived electricity and gas. To a significant extent, the chemicals industry depends on the decarbonization and transition progress of the energy sector from which it draws its supply.

The growth in energy generation from wind and solar is encouraging — but may not be enough on its own. Alternative fuel sources are needed — one of which is **hydrogen**. This has vast potential as a clean fuel source to replace oil and conventional gas — whether blue or grey in the short term or potentially green in the medium term.

Green hydrogen is expected to break even with grey hydrogen in terms of its levelized cost by 2030.[14] But there are some uncertainties here. Certain key factors are expected to primarily drive an acceleration in the reduction of the cost of green hydrogen:

1. Faster scale-up of electrolyzers and increasing investments in renewable power globally will decrease Capex requirements.
2. Plans of large-scale RE projects which will offer high utilization rates for electrolyzers.
3. Declining levelized cost of energy (LCOE) of RE.

Therefore, how far and fast green hydrogen becomes commercially attractive at scale remains to be seen. Some observers believe a mixture of natural gas, blue hydrogen and carbon capture storage is the most viable route forward. Whatever the case, the chemicals sector needs to partner up and down the value chain to enable and accelerate the transition.

A further cornerstone of the net zero roadmaps could be **small modular reactors** to generate power and process heat if governments are willing to provide approvals. These are smaller than traditional nuclear reactors, typically producing less than 1,000 MWth (thermal) or 300 MWe (electric). Compared to conventional reactors, they are expected to be safer, more efficient and require less on-site construction, reducing financial and safety barriers to nuclear reactors. The US DoE has supported SMRs since 2012. Still, several technical and regulatory obstacles must be overcome to be widely adopted — including safety, waste management, the regulatory framework for nuclear energy and preventing nuclear proliferation.

However, chemical businesses should do more than wait for solutions from their power-generation cousins. A significant and growing array of new methods and technology options need to be explored, invested in, and developed at a pace to facilitate an energy transition.

A key area for chemicals businesses to develop is **biomass and alternative feedstocks** to use in steam crackers and other chemicals processes derived from renewable sources such as agriculture waste, forest residues, energy crops and algae. If these can be brought to commercial scale and viability, it could break the dependence on fossil fuel feedstock and significantly lower the carbon footprint. Some commercial-scale bio-refineries already convert biomass feedstocks, such as sugar and lignocellulosic materials to chemicals and energy (biofuels, power, and heat). However, further development and scaling up require additional research and policy support.

LCOE:

US$65/MWh vs.

US$129–198

for an unsubsidized new conventional nuclear,

80-85%

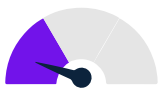
of which is CAPEX.

[14] Hydrogen Council — Insights 2021

Another promising advancement is petrochemical producers' growing use of **pyrolysis oil (pyoil)** — can be produced from plastic waste through advanced recycling. It can potentially become a truly 'circular' element of the petrochemical industry.

Further, the industry should continue to invest in equipment electrification, including **steam crackers**. Steam crackers have become the foundational facility for the chemical process — so electric solutions need to be a priority for development, even if they are more likely a medium-term than short-term reality. Work here is expected to be a combination of retrofitting existing steam crackers to convert them to electric and of building a new generation of 'e-cracking' systems. In addition to being greener, e-cracking will lead to efficiency and flexibility gains as electric heating can be more precise and responsive than steam-based systems. Dow, Shell and two other partners are already collaborating to develop this technology in their operations, including receiving some funding from the Dutch government. They plan to pilot retrofitting existing crackers by 2025, and a new e-cracker is expected by 2027.[15]

[15] Shell Global, Shell and Down to start up e-cracking furnace experimental unit, June 2022

	Biomass feedstock	Small modular reactor (nuclear)	Electrification of Steam Cracking
Problem	Biomass feedstock	Small modular reactor (SMR)	Electrification of Steam Cracking
Technology	• Biomass feedstock is derived from renewable sources such as agricultural waste, forest residues, energy crops, and algae. • Biomass feedstock also offers a way to decouple the chemical sector from fossil fuel dependency, which can help mitigate supply chain risks and increase resilience. • Commercial scale bio-refineries are present that convert biomass feedstocks such as sugar and lignocellulosic materials to chemicals and energy (biofuels, power and heat). However, further development and scaling-up requires additional research and policy support.[16] • Abatement cost for biofuels: US$ 0-121.66 per tCO_2-eq[17]	• SMRs are nuclear reactors with a smaller size than traditional nuclear reactors, typically producing less than 1,000 MWth (thermal) or less than 300 MWe (electric). As compared to conventional reactors, they are expected to be safer, more efficient and require less on-site construction thereby reducing financial and safety barriers for nuclear reactors.[18] • US DoE has been supporting SMR since 2012, recently in Dec 2020, they announced US$ 30m support to five US teams with an aim to lower the technology development risks.[19] • LCOE: US$ 65/MWh vs US$129-198 for an unsubsidized new conventional nuclear, 80-85% of which is CAPEX.[20]	• Retrofitting existing steam crackers (Brownfield): This involves replacing the traditional fossil-fuel fired burners with electrical heating systems. • E-cracking (Greenfield): Innovating new technologies for replacing steam with electric cracking. In addition to being greener, it will lead to efficiency and flexibility gains, as electric heating can be more precise and responsive than steam-based systems. • Dow, Shell and two other partners are collaborating in developing this technology for their operations. They have even received a funding of US$ 4.6m by the Dutch government. In terms of timeline, retrofitting existing crackers will pilot by 2025 and the new e-cracker is expected by 2027.[21] • Abatement cost: Depends on source of electricity.[22]
Challenges	The use of biomass feedstock in the chemical industry will necessitate continuing investment in research and development and regulatory assistance. Availability of feedstock will also be a challenge since using biomass for chemicals will divert resources from the agri-food sector.	There are several technical and regulatory challenges that must be overcome before SMRs can be widely adopted. These include issues related to safety, waste management, the regulatory framework for nuclear energy and preventing nuclear proliferation	Electric heating systems typically require a significant amount of electricity, which can be expensive and may require upgrades to local power grids. They may also require significant modifications to existing steam cracker infrastructure, which can be costly and time-consuming.
Technology maturity[22]	**High** 	**Medium** 	**Low** 

Note: According to IEA, maturity of biomass feedstock depends on the end-product. Technology maturity of ammonia is medium, while that of ethylene, methanol, and HVCs is high.

[16] IEA Bioenergy, Bio-based chemicals
[17] IEA, GHG abatement costs for selected measures of the Sustainable Recovery Plan
[18] World Nuclear Association, Small modular nuclear reactors-1
[19] altenergymag, Advancements in Nuclear Energy Technology (Small Modular Reactors)
[20] UNC Kenan-Flagler Business School, Small Modular Reactors – A Viable Option for a Clean Energy Future?
[21] Process Worldwide, Progress on E-cracking
[22] IEA, Energy Technology Perspectives, Clean Energy Technology Guide

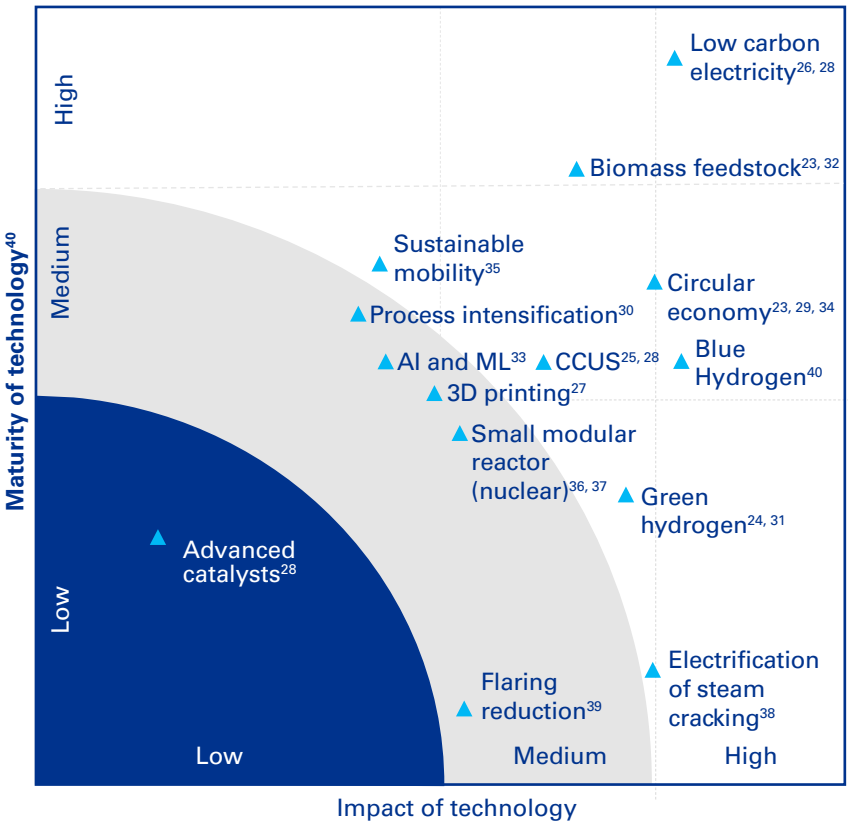
There are barriers to be overcome. Electric heating systems typically require significant amounts of electricity, which can be expensive and may require upgrades to local power grids. They may also require substantial modifications to existing steam cracker infrastructure which can be costly and time-consuming.

A less considerable, but still significant, aspect of the chemicals sector's fuel emission footprint centers on **mobility, logistics and distribution**. As with other industries, chemicals businesses need to invest in green fleets of low-emission vehicles, greener enabling infrastructure, and logistics optimization to reduce mileage and environmental impact. AI and data and analytics technology have a significant role in facilitating this smart logistics approach.

Process emissions

As well as addressing the power sources for chemicals processes as discussed above, it will also be essential to achieve **process intensification** through new techniques that require less energy and resources, resulting in lower emissions. A range of factors, including microreactors, process optimization and the integration of chemical processes, can enable this. It's an area where **advanced catalysts** will also help, increasing the efficiency of existing processes and supporting the switch to renewable feedstocks such as ammonia and CO_2. The impact could be as high as 1.0-1.8 $GtCO_{2eq}$ by 2050.[41]

Meanwhile, just as **AI and ML** can help drive smarter logistics, as discussed above, they can also make a difference to process efficiency — by predicting the behavior of chemical reactions helping to optimize process conditions to minimize emissions.



[23] Springer Nature Limited, Biomass feedstock and circular economy
[24] Royal Society of Chemistry, Large-scale hydrogen production via water electrolysis: a techno-economic and environmental assessment
[25] Carbon Recycling International, Projects
[26] IEA, Energy and GHG Reductions in the Chemical Industry via Catalytic Processes
[27] National Library of Medicine, A review of 3D printing techniques for environmental applications
[28] IEA, CCUS technology innovation
[29] WEF, Implementing Low-Carbon Emitting Technologies in the Chemical Industry: A Way Forward
[30] Creative Energy, European roadmap for process intensification
[31] Springer Nature, Renewable hydrogen for the chemical industry
[32] OECD, Industrial biotechnology and climate change
[33] Nature Portfolio, Harnessing AI for decarbonization
[34] Science Direct, Technology readiness level assessment of composites recycling technologies
[35] IEA, ETP Clean Energy Technology Guide
[36] Dow, X-energy to drive carbon emissions reductions through deployment of advanced small modular nuclear power
[37] Reuters, EU parliament backs labelling gas and nuclear investments as green
[38] Science Direct, Electrified steam cracking for a carbon neutral ethylene production process: Techno-economic analysis, life cycle assessment, and analytic hierarchy process
[39] World Bank, Global Gas Flaring Reduction Partnership (GGFR)
[40] MDPI, The Role of Green and Blue Hydrogen in the Energy Transition—A Technological and Geopolitical Perspective
[41] Technology Roadmap, Energy and GHG Reductions in the Chemical Industry via Catalytic Processes, 2013

Resource stewardship

Alongside the reduction of fuel and process emissions, resource stewardship also has a vital role to play.

Flaring to burn away off-gases still occurs in the chemicals and other industrial sectors. Every year 144bn cubic meters of natural gas is flared — enough to power sub-Saharan Africa.[42] Small-scale, modular gas utilization technologies can help reduce flaring-based emissions.

Carbon capture, utilization, and storage (CCUS) is a further important area. Captured CO_2 can be used as a feedstock to produce chemicals, for example, by converting carbon emitted as CO_2 during the production process into liquid fuels such as methanol. A barrier here is the high capital cost of carbon capture technology — but, like green hydrogen, the hope is that these costs will fall as new techniques are developed. The scaling of CCUS brings the investment required down to commercially viable levels.

Finally, the development of the **circular economy** holds significant potential. This is discussed more fully in section 3.

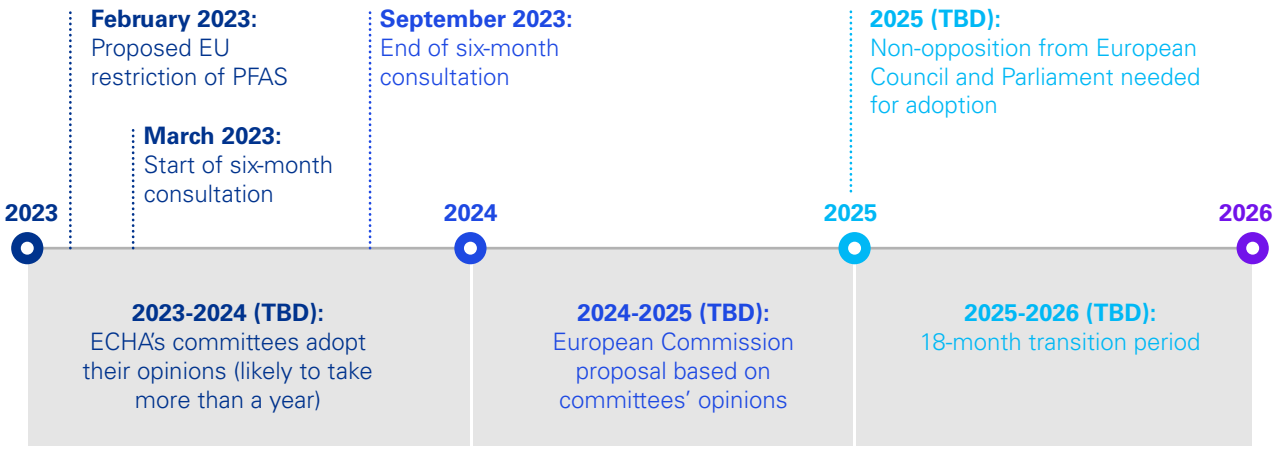
A barrier here is the high capital cost of carbon capture technology — but, like green hydrogen, the hope is that these costs will fall as new techniques are developed.

[42] World Bank, Global Gas Flaring Reduction Partnership

Enabling renewable energy

The chemicals sector plays a vital role in enabling the production of renewable energy infrastructure, such as adhesives and silicon carbide, in the technical ceramics of wind turbines. PFOA (Perfluorooctanoic Acid) and PFOS (Perfluorooctanesulfonic acid), the most common of the PFAS "forever chemicals" family, are **required components in every significant industrial electric membrane used in hydrogen production** — both are in the process of being banned in the US and EU which necessitates further collaboration between industry and government. The industry needs to continue to enable improvements in renewable energy by producing lighter, cheaper, and better material components of the energy transition.

Tentative timeline for the EU's proposed ban on "forever" chemicals



Sources: ECHA, Lexology, Eurasia Group

With batteries for EVs set to move into mass production as the world moves away from internal combustion engines, this would make a considerable contribution to the low-carbon future. Some chemicals could also be a key component in new, cleaner battery technologies, such as lithium-iron-phosphate (LFP), replacing the dependence on critical minerals such as cobalt and nickel.

There are also important initiatives and coalitions helping to develop low-carbon technologies, such as **Low-Carbon Emitting Technologies (LCET)** and the **Mission Possible Partnership (MPP)**. LCET is a collaboration of ten major chemicals companies and 70-plus senior chemicals executives with the World Economic Forum (WEF) to develop the upscaling of low-carbon technologies and accelerate progress towards net zero by 2050. It involves collaboration with policymakers, value chain partners and financial institutions to:

- Identify policies that support the deployment of LCET
- Develop R&D in low-carbon strategies
- Develop finance gap models for optimum finance allocation

As part of the MPP initiative (a partnership amongst hard-to-decarbonize industries, including transport and heavy industries), LCET is also developing transition strategies in two key value chains in the chemicals sector that contribute to 44 percent of its emissions:

- Olefin production
- Ammonia production

Contributing to greater energy efficiency

As was mentioned earlier, the chemicals sector can lead in developing the **circular economy and material recovery** as a BAU operational model. This has the double potential benefit of lowering consumption of the world's resources and reducing the energy needed to process or convert them into other products and substances.

Globally, only 7.2 percent of our world is circular.[43] Resource consumption is projected to increase two-fold by 2050 compared to 2020, underlining the issue's urgency.

In the chemicals sector, circular economy approaches will see mechanical recycling, which often leads to downcycling (value loss), moving to chemical recycling which enables upcycling (added value). The broader development of circular economy techniques can significantly decarbonize the chemicals sector by changing the business model to decouple economic growth from chemical consumption.

Three key principles lie behind the circular economy, all driven by design:

Eliminate waste and pollution

Circulate products and materials

Regenerate natural systems

For chemicals, **eliminating waste and pollution** can be achieved by transitioning from fossil fuel-based feedstocks to renewable, recycled or bio-based feedstocks. This lowers the carbon footprint and avoids waste at the end of product life. It also avoids toxic chemicals being used in the first place, further contributing to sector decarbonization and safety.

There is increasing investment in **circulating products and materials** such as pyoil from plastic waste, recycled oil, and recycled/sustainable polymers. New plastic materials made from recycled polypropylene (PP) are also being developed for use in industries such as automotive. Bio-based, compostable, and recyclable bioplastics are another big growth area, with businesses such as Total Energies and Novamont investing in their production.

Another hot area for investment is bio-based chemicals, which include fermentation products such as ethanol, lysine and citric acid, sorbitol, and glycerol, as well as pine chemicals and bio-diesel (which can be used as a sustainable aviation fuel). Bio-based chemicals can significantly lower GHG emissions — for example, compared to fossil fuel-based methanol, renewable methanol results in a reduction of up to 95 percent.[44]

Globally, only 7.2 percent of our world is circular. Resource consumption is projected to increase two-fold by 2050 compared to 2020, underlining the issue's urgency.

[43] The Circularity Gap Reporting Initiative, Circularity Gap Report 2023
[44] Methanol Institute, Renewable Methanol

One vehicle for this is chemical leasing or the chemicals-as-a-service concept whereby instead of providing a customer with a batch of chemicals, some of which may go to waste, the chemicals business gives them only the right amount — and takes the chemical leftovers back. A good example of this is in the textiles industry. A quarter of the world's chemicals are used for textile production, and it is estimated that over 8,000 chemicals are used to turn raw materials into textiles.[45] Increased initiatives to take chemicals back to be reused, recycled or disposed of in an environmentally responsible manner by the chemicals supplier can make a significant impact, therefore.[46]

The third principle of **regenerating natural systems** is focused on the increased use of compostable plastics and materials — but it also centers on using regenerative materials in the first place and directing them back into the ecosystem where possible. Alongside this, there is a growing interest in using bio-based substances instead of chemically produced ones for coloring garments.

In addition, the chemicals industry can play an important role in enabling energy efficiency across other sectors through the development of new and innovative materials, such as **lighter-weight composite materials** for use in the construction of buildings and the manufacture of cars, planes and other assets, reducing the amount of energy used both in their production and their working life.

Other key parts of the value chain

It is not only about energy usage and consumption, however. The broader **ESG agenda** has become a central corporate priority across sectors as stakeholders look to businesses to embrace ethical, equitable and sustainable values across all aspects of their operations.

These take in a wide range of areas — from protecting biodiversity and ensuring careful management of hazardous waste and water; to product safety, employee health and safety and the promotion of inclusion and diversity amongst the workforce, and community relations to increase engagement with local communities and social groups who may be concerned about the health and safety issues and environmental impacts of any proposed chemical operations in their locality.

[45] Professional Clothing Industry Association Worldwide, Toxic Textiles: The Chemicals in our clothing, November 2022
[46] Colour Connections, Chemical Circularity in Fashion, May 2020

Environment	**Biodiversity**	Wildlife populations have faced a 69% loss since the 1970s[47]. The substantial discharge of chemical waste and other pollutants can have a negative impact on various plant and animal species. Biodiversity compliance regulations are increasingly becoming more stringent around the world.
	Circularity	Globally, only 9% of fossil fuel, minerals, biomass, and metal products are recycled[48]. Resource consumption is projected to increase two-fold by 2050 compared to 2020[48]. Chemical companies have been striving to decouple emissions from resource consumption and investing in recycling and material recovery to improve circularity.
	Hazardous waste management	The EU chemical sector produces between 8-18 million metric tons of waste every year and 25-50% of this waste is hazardous[49]. Chemical waste management is also subject to heavy regulations. Companies are working on treatment of hazardous waste, limited waste generation, effective disposal, and circularity of chemical products.
	Water management	Water plays a crucial role in manufacturing of chemical products. For the manufacturing industry, water demand is expected to increase by 400% by 2050[50]. The scarcity of water can be a threat to chemical companies leading to disruptions in productivity and costs. Industries also have to comply with water quality standards and regulations.
Social	**Product safety**	The possibility of chemical products causing harm during their use can impact demand and increase regulatory risks. An estimated US$ 700 bn is spent annually on damages caused by consumer products in the US[51]. Chemical companies continually focus on alternative materials with lower toxicity levels in order to avoid negative impacts.
	Employee health and safety	Across sectors, ILO estimates ~2.8 million work-related casualties every year[52]. The workforce in the chemical sector is exposed to risks from machinery, toxic compounds, and extreme temperature and pressure conditions. HSE is a core competency and a critical area of focus of leading companies in the chemical industry.
	Community relations	The chemical sector is linked with environmental issues and human health due to emissions and release of harmful waste from chemical production. Companies are therefore involving local communities in stakeholder engagement in order to ensure smooth decision-making and to protect the rights of different social groups.
	Diversity and inclusion	Diversity in the workforce is an important factor in contributing to sustainability. Research and studies show that companies with a diverse workforce deliver stronger financial performance compared to non-diverse companies[53]. Inclusive businesses also understand their environmental footprint better and how it impacts different communities.
Governance	**Critical incident risk management**	In 2019, as per WHO, exposure to specific chemicals led to the loss of 2 million lives and 53 million disability-adjusted life-years[54]. Accidents during chemical production may lead to uncontrolled release of harmful chemicals. Companies should continue to ensure robust management of process safety in order to mitigate damages and regulatory risks, and to prevent disruptions in productivity.

There is a complete and stretching agenda — which chemicals businesses must embrace and meet head-on to retain their license to operate and the trust and confidence of the wide range of stakeholders they interact with and depend upon.

[47] WEF, 6 charts that show the state of biodiversity and nature loss — and how we can go 'nature positive'
[48] WBCSD, Why we need circularity at the heart of climate action
[49] CEFIC, Conserve Resource Efficiency
[50] BOSAQ, The water challenges of the chemical industry
[51] State of Georgia, Product safety recalls
[52] UN Global Compact, A safe and healthy working environment
[53] Catalyst, Why diversity and inclusion matter
[54] WHO, The public health impact of chemicals: knowns and unknowns

The regulatory landscape

Alongside all the factors already discussed, another critical part of the picture is the regulation being introduced to encourage, incentivize, and, where necessary, force businesses to adopt low-carbon and sustainable practices.

Some of these regulatory initiatives are, in fact, full of opportunities for chemicals — such as the Inflation Reduction Act (IRA) in the US. See page 35 for a complete discussion of IRA and the regulatory landscape in other key jurisdictions, such as the EU.

In addition, the notion of **extended producer responsibility (EPR)** is growing and may begin to be enshrined in regulation in some parts of the world. This sees the manufacturers and suppliers of products such as chemicals being tasked with the responsibility for collection and disposal/remediation of the goods they produce.

In response to the evolving regulatory landscape and to help maximize opportunities and protect against downside risks, chemical businesses should actively stay informed. KPMG professionals recommend the following actions:

- **Horizon scanning:** To help prevent any roadblocks to chemical production, companies should establish measures to anticipate and respond to any upcoming regulations and policies in respective geographies.
- **Policy scenarios:** One of the primary elements in developing a transition plan at the sector level includes conducting policy scenario analysis, which involves incorporating present regulations and potential future policies. Chemicals companies need to consider the policy environment in the countries they operate in, source raw materials from, make sales in, and find the risks and opportunities associated with transitioning to low-carbon production.
- **Opportunities:** Investing in low-carbon measures can bring many options, such as creating new carbon markets, enhancing existing ones, and generating revenue streams. It can attract investments from environmentally conscious investors. Demand for chemicals will likely also increase due to the deployment of low-carbon technologies (e.g., electric vehicles).
- **Litigation risk:** Chemicals companies face a growing threat of litigation if they fail to comply with evolving climate and environmental regulations. There could be litigation cases filed for 'greenwashing,' which could result in increased scrutiny of decarbonization strategies.

Conclusion

The chemicals sector is the largest industrial energy consumer, and its unique dependence on fossil fuels for feedstock presents challenges in the decarbonization journey. But there are multiple avenues to pursue and develop and key players in the sector are working hard towards efficient and responsible manufacturing of chemicals, while addressing the growing transitional and physical risks of climate change.

Chemicals companies must also consider broader sustainability issues, including water scarcity and toxic waste treatment in their decarbonization pathways.

Technologies such as catalyst improvements, alternative feedstocks and renewable power generation can become major levers in helping chemicals companies towards their climate targets.

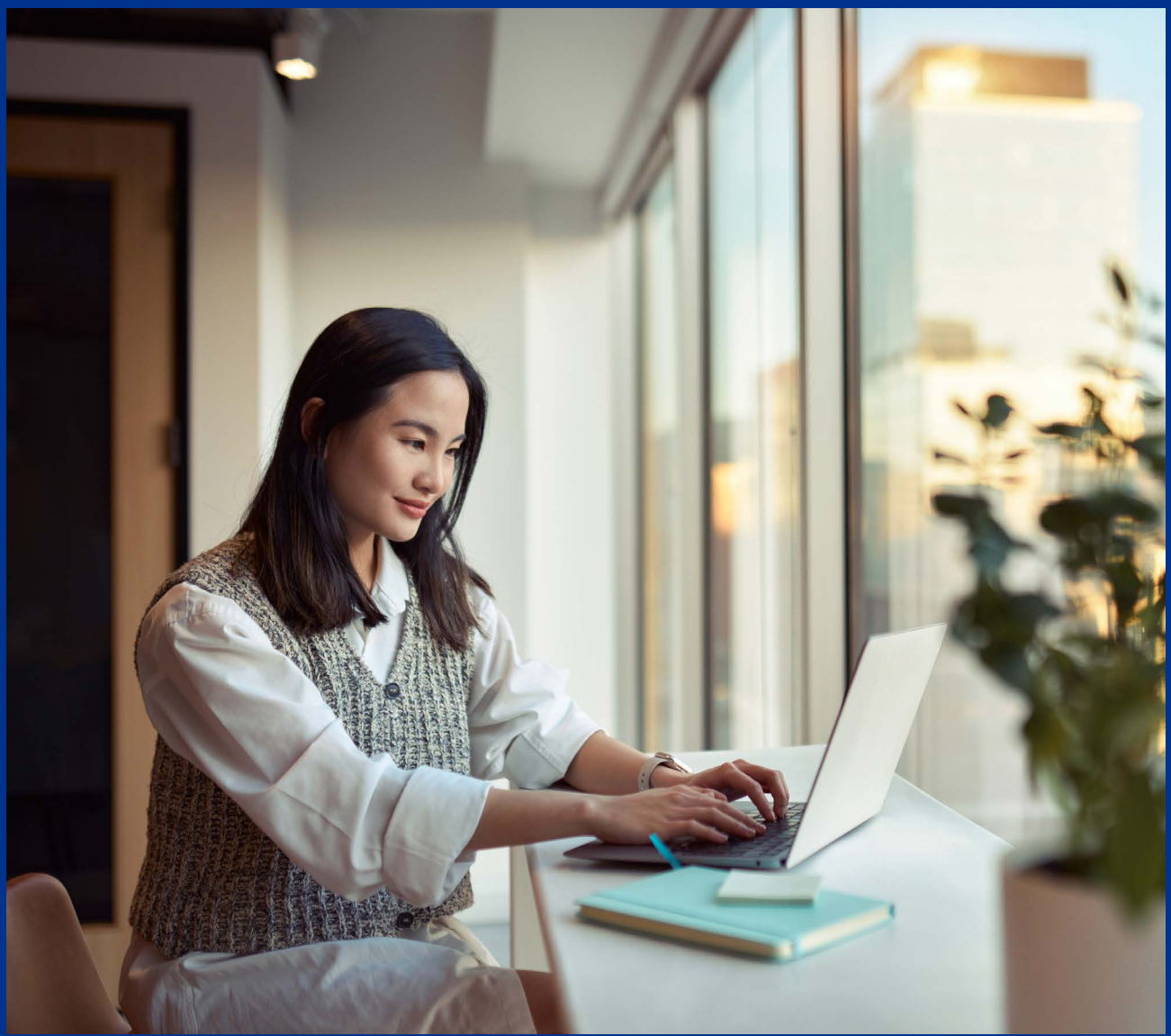
However, it is a challenging path. The industry is partly dependent on the progress of other sectors, such as power generation and development at commercially viable prices of green hydrogen, CCUS and advanced catalysts.

KPMG professionals' recommendations of key steps against a range of critical pathways across the short-, medium- and long-term are:

	Short-term	Medium-term	Long-term
Value Chain	• Quantify emissions released at different stages of production • Identify emission-intensive processes across the value chain	• Engage with suppliers and downstream consumers to reduce scope 3 emissions • Enhance the circularity of products, especially plastics, through chemical recycling	• Address residual carbon emissions through offsets and CCUS
Policy and regulatory environment	• Leverage the existing regulatory environment to invest in clean energy and alternative feedstocks • Disclose category-wise emissions in accordance with established standards	• Collaborate with companies and associations to develop robust climate strategies	• Scanning the long-term policy horizon and implementing transition plans accordingly
Technology	• Adopt mature and cost-effective technologies such as RE power generation, use of biomass feedstocks • Switching from coal to natural gas in the near term, along with CCUS and blue hydrogen	• Technological partnerships with key industry players • Deploying clean technologies being implemented at commercial scales	• Embedding emerging low-carbon emitting technologies into climate strategy
Wider ESG considerations	• Embed broader ESG considerations into the transition planning approach	• Strategically implement ESG initiatives into a transition plan	• Horizon scanning for addressing climate risks and impact on workers and communities
Levers and tipping points	• Leverage existing government incentives for a clean transition	• Develop infrastructure for the deployment of alternative feedstock, such as green hydrogen	• Develop adaptation strategies addressing long-term climate change
Metrics & targets	• Set science-based targets aligned to a 1.5-degree scenario • Increase the share of renewable feedstock	• Scenario analysis impacts of physical risks of climate change on business operations	• Ensure that the net zero target includes emissions beyond scopes 1 & 2

How KPMG professionals can help

KPMG teams of chemicals, decarbonization and ESG specialists can help you with any of the issues discussed in this article. They have extensive experience working with chemicals companies and businesses in related sectors on the challenges, opportunities and critical decision points relating to the energy transition journey.



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Chemical combinations

Forecasting the 2023 chemical industry M&A landscape

By

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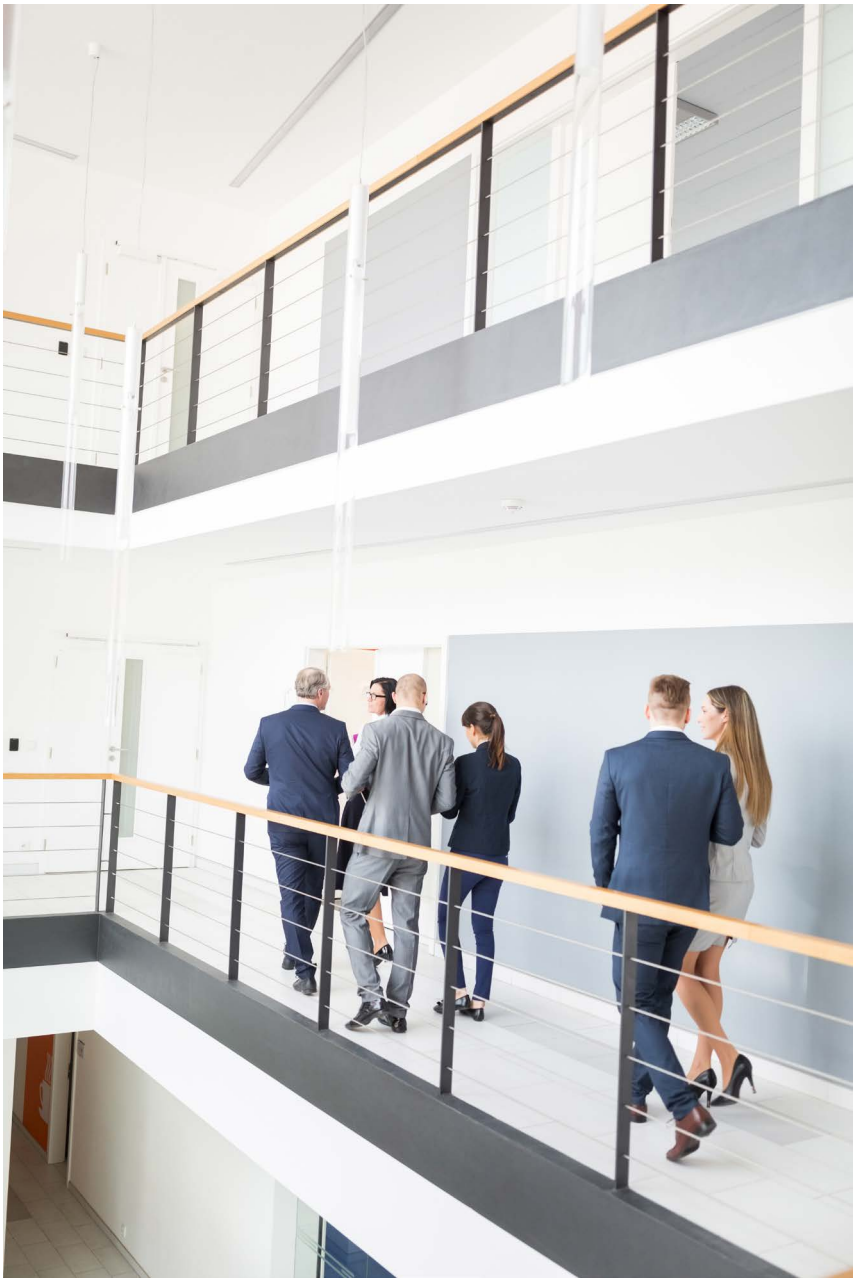
The past few years have been turbulent for almost every business sector. The COVID pandemic gave way to dramatically rising costs and spiraling inflation, fueled by the economic ripple effects of the Russia/Ukraine conflict. The chemicals industry has been heavily impacted by many of these factors, particularly the volatile effects on the price of oil and gas.

Following a post-pandemic spike in 2021, the global economy slowed through 2022 — with most major economies expected to see only modest growth or even contraction in 2023.[1] This has significantly affected businesses and economies worldwide, with the period of slow growth expected to continue until at least 2024.[2]

In line with other sectors, the chemicals industry is braced for what could be a tough year. While there have been some notable deals, and a handful of sizeable transactions could come to fruition and boost wider market confidence, overall, the pipeline of activity has thinned, and the outlook remains subdued.



[1] IMF, World Economic Outlook, April 2023
[2] KPMG International, Global Economic Outlook H1 2023, March 2023

The chemicals business outlook

Before diving deeper into the M&A prognosis, it is worth first assessing the business conditions the chemicals industry will likely encounter this year for context. Some of the KPMG chemicals leadership team recently attended the World Petrochemical Conference in Houston. It was clear from the 'mood in the room' amongst industry leaders that 2023 will likely to be challenging. Unlike previously anticipated conditions in 2022, today's leaders expect the conditions to remain 'lower for longer,' with no top-line growth for the year as the probable best-case scenario.

It is not difficult to see why they feel this way. As per the IMF's forecast, major economies like the US and the Eurozone are expected to see a fall in growth this year compared to 2022. Some economies like the UK and Germany are predicted to see a contraction. Even China is only expected to achieve 5.2 percent growth, albeit this would be almost a doubling of the rate of growth it achieved in 2022 when it was still in the grip of COVID lockdowns.[3]

With chemicals businesses so dependent on activity and demand in other sectors, a general slowdown spells a similar story for the industry.

Working with preliminary data, an analysis that KPMG professionals have conducted of chemicals business performance in the US in Q4 of 2022 — which is believed to be indicative of the industry across major regions — appears to bear out this downbeat trend. Amongst public North American companies that disclose price and volume data, this analysis finds that while there was an overall 8 percent increase in organic sales compared to the same period a year previously, this was due to price increases, not higher volumes. Driven by inflation, prices rose by an average of 15.7 percent — while volumes fell by -7.7 percent. The volume declines were broad-based — of the 41 companies that broke out sales increases by price and volume, 35 reported declines in volumes.[4]

As per the IMF's forecast, major economies like the US and the Eurozone are expected to see a fall in growth this year compared to 2022.

[3] IMF, World Economic Outlook, April 2023
[4] KPMG Corporate Finance LLC, Chemicals & Specialty Materials Q4 2022 Price & Volume Trends by Sub-sector, December 2022

There are likely several reasons for these weak volume numbers, including:

- Inflation and the attendant inverse correlation between price and demand
- A broader pullback across the economy, capital discipline, and focus on working capital management
- Key end-use markets in construction and automotive continue to face volatility and uncertain demand. KPMG's global automotive survey finds that 76 percent of leaders are concerned that inflation and high interest rates will adversely affect their business in 2023[5], while in the construction industry, the after-effects of COVID-19 are still apparent, with 45 percent of respondents to KPMG's Global Construction Survey saying they've experienced a pandemic-related schedule delay or cost impact of more than 20 percent.[6] Nevertheless, better conditions are expected at the end of the year, which could create an uplift in output and volumes.
- Anecdotal evidence from conversations with industry participants during the World Petrochemical Conference in March who have said their customers over-ordered earlier in the year to get ahead of potential supply chain disruptions only to find themselves sitting on excess inventory.

76%

of automotive executives are concerned that inflation and high interest rates will adversely affect their business in 2023.

Source: KPMG International, 23rd Annual Global Automotive Executive Survey

45%

of global construction executives have reported pandemic-related schedule delays or cost impacts of more than 20%.

Source: KPMG International, 14th Annual Global Construction Survey

[5] KPMG International, 23rd Annual Global Automotive Executive Survey, December 2022
[6] KPMG, 14th Annual Global Construction Survey, May 2023

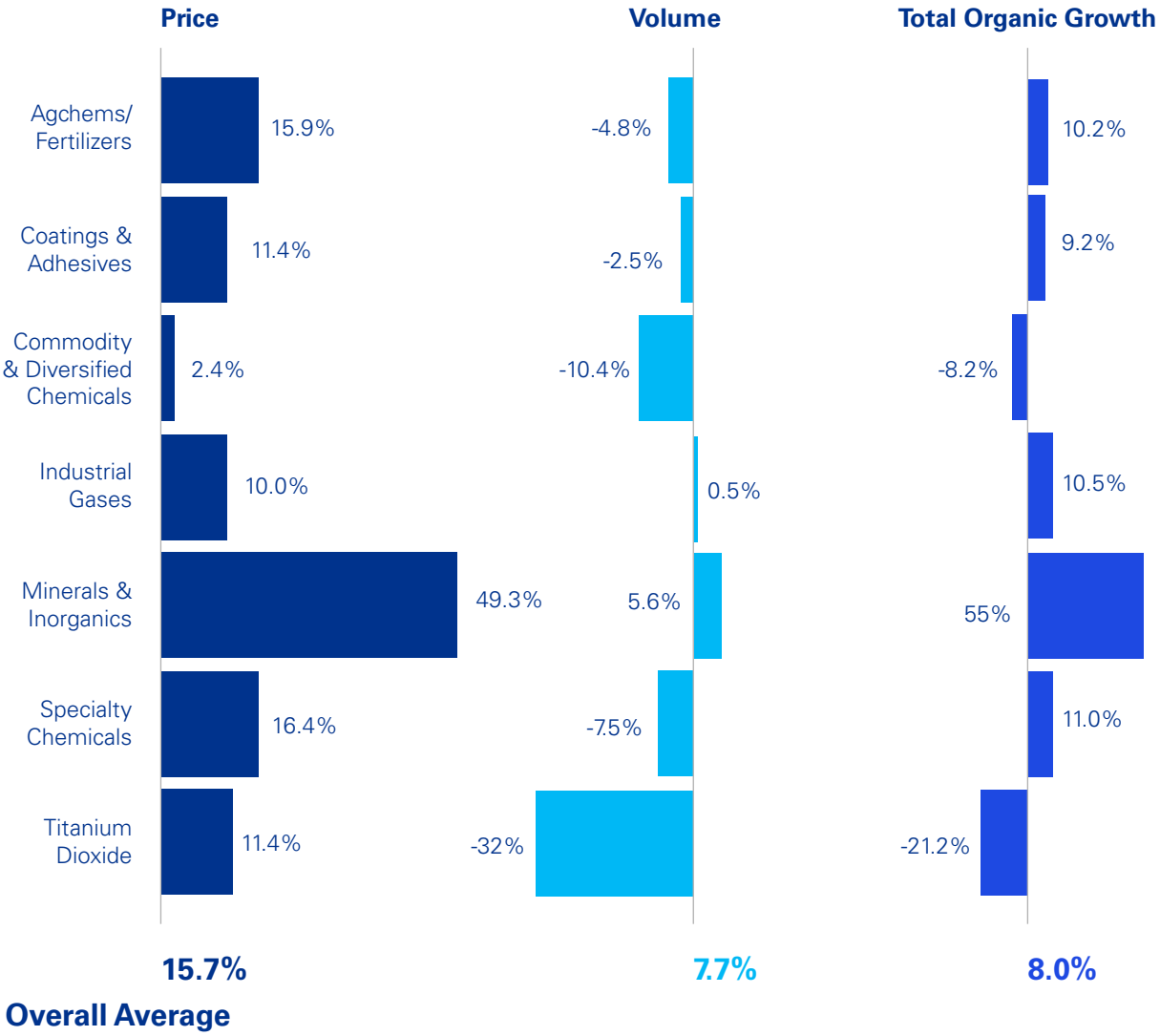
Q1’23 chemicals highlights

60 Deals ▼ **28%** Decrease QoQ

$6.7 Billion deal value ▲ **22%** Increase QoQ

KPMG professionals’ analysis shows that certain sub-sectors are more affected than others. For example, titanium dioxide (TiO2) has suffered more than most, perhaps because demand from building and construction has dropped. Coatings and adhesives, while being further downstream, experienced much smaller declines in volume. There are specific nuances within the data and an interplay of numerous factors. But the overall message is that the more specialized or differentiated a business’ products are, the more they are insulated. However, that insulation is relative, given that the overall picture is one of demand decline.

Year-over-year organic growth within the chemicals industry

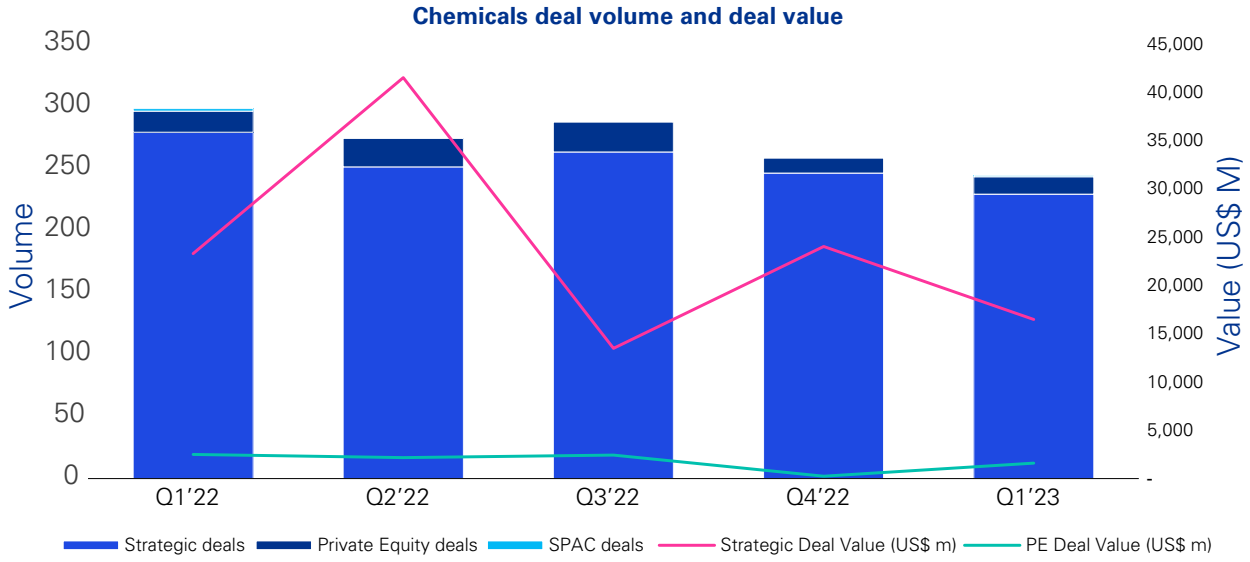


Deals market forecast

Prevailing headwinds

Turning to the deals landscape specifically, these conditions are expected to produce a subdued market — although activity could pick up quickly again at short notice, and preparedness will be essential. Companies that have managed to take a long-term focus and have their finances in order will be well-positioned to take advantage of the opportunities that will arise.

KPMG's professionals' analysis of the global chemicals M&A market shows that activity is moving on a downward trend:[7]



This analysis shows a consistent deal drop-off across all sectors starting in Q3 2022. Commodity chemicals, agricultural and fertilizers, and specialty chemicals have all seen deal value and volume falls. There has also been reduced Private Equity (PE) activity due to economic conditions and the cost of financing.

There are various headwinds holding activity back. It has been challenging to stimulate buyer appetite for big transformational deals due to the increased cost of debt as interest rates have risen, together with the general perception that market conditions have become unfavorable. There has been a shortage of big buyouts, and debt raises, with investor appetite low and pricing high. Performance has been a key factor: companies for sale are struggling to meet the projections laid out in marketing materials, while buyers have become more cautious and skeptical of seller projections.

[7] Data was sourced from Capital IQ, Refinitiv, Pitchbook, and KPMG analysis. The values and volumes data cited are for deals announced between 1 January 2022 and 31 March 2023. Deal values are only presented based on publicly available deal data and are not exhaustive. Previously published statistics may be restated to incorporate new data and/or changes in deal volumes

Enabling factors

However, it is not all gloom. As noted, there have still been some significant deals, and from conversations we have had with industry leaders, more sizeable acquisitions could be on the horizon. These could kickstart increased market confidence and activity. Several players have assets they want to divest in order to become operationally leaner. Furthermore, it is not only about the headline-grabbing mega-deals - sound businesses with healthy balance sheets should not be discouraged from pursuing mid-sized targets given the recent fall in EBITDA multiples.

Recent chemicals deals

Acquirer	Target	Value (billions)
Apollo	Univar	$8.1
Solenis	Diversey Holdings, Ltd.	$4.6
DuPont	Spectrum Plastics	$1.7
CF Industries Holdings	Waggaman Ammonia Production Facility	$1.7
Cinven	MBCC Admixture portfolio	$0.8

Those businesses with proven track records of delivering on acquisitions and cash on the balance sheet resulting from strong 2021/22 trading performance or recycling capital from upcoming divestments remain in a good place to pursue their deal ambitions. And at a time when valuations are likely to have fallen, they may be even better placed to secure strategically beneficial assets at an attractive price, creating additional shareholder value.

Then there is PE. Many PE houses still have significant levels of capital that they are looking to deploy — some of them are still trying to make up for lost time during the COVID years — and the chemicals industry remains an area of interest. The litmus test here, however, will be whether that interest translates into concrete action when assets become available — and if a mutually attractive price can be agreed upon, particularly given the current challenging debt market environment.

You can also place cash-rich National Oil Companies (NOC) alongside PE. They have a clear mandate to diversify and move downstream. As a result of the recent rebound in oil prices, NOC balance sheets are strengthening, which could drive their interest in pursuing attractive assets, including possible international investments in the US and perhaps Europe.

China

Another reason to anticipate continuing corporate activity at some level is China. The Chinese market remains where virtually any player with credible international ambitions should have a presence. According to our estimates, the EU will have a net balance of importing chemicals from China this year— the first time this has happened.[8] China is further anticipated to account for over 50 percent of the chemicals market globally by 2030.[9] In such circumstances, chemicals players worldwide are expected to continue to look for acquisitions and JV opportunities in China as a building block for growth and a futureproofing against these economic shifts.

United States

The Biden administration's Inflation Reduction Act (IRA), published in August 2022, contains several compelling tax credits and incentives for activities, products and processes that support the energy transition towards a net zero economy — many of which could have direct relevance to the chemicals industry. This could spur increased deal-making as businesses outside the US look to establish a presence in the market, including in chemicals. The IRA is explored in detail in the article on page 35 and it is believed these measures could have a huge impact on making the US an even more attractive place to invest.

The IRA is explored in detail in the article on page 35 and it is believed these measures could have a huge impact on making the US an even more attractive place to invest.

[8] KPMG Analysis
[9] SDLookChem.com, In 2030, the output value of China's chemical industry will account for 50% of the world, and the global chemical industry chain will present a new pattern of bipolar development, January 2021

Pragmatic and prepared

Chemicals companies are well-versed in dealing with cyclicality and generally take a pragmatic approach throughout the cycle. This year, there may be a focus on running the business for cash — becoming operationally more efficient, pruning back discretionary spending where that makes sense — and staying primed for opportunities when they arise.

It is also true that because they provide so many key materials and base chemicals needed in other industries, chemical businesses are usually at the leading edge of any rebound in economic activity. The industry will likely be among the first to see a pickup in deal activity.

For all these reasons, while KPMG professionals don't expect 2023 to set the M&A history books alight, they anticipate that there will be a continuing pulse of chemicals deals activity. If broader economic conditions improve, we could see a faster pickup in chemical transactions than elsewhere. The watchwords are pragmatism and preparedness: focus on optimizing your operational model and be alert and ready to engage if an opportunity presents itself.

Get in touch

KPMG professionals are already seeing tentative signs of increased M&A activity. M&A practitioners have a chemicals-specific lens and are actively working on chemical mandates in several jurisdictions. They have a long, demonstrable track record of advising clients in the sector, a deep understanding of the industry and relationships with key stakeholders worldwide.

Your local KPMG firm would be delighted to hear from you if you want to discuss any of the themes or trends covered in this article.

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Marc specializes in large, cross-border transactions, advising businesses on their strategic options, exits and acquisitions and supporting his clients throughout planning, execution and implementation, pre-deal and post-deal.

Chemicals enter a new era of green investment

A guide to navigating the Inflation Reduction Act opportunities

By

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Although the primary purpose was to combat inflation, the Inflation Reduction Act (IRA), signed into law by President Biden in August 2022, also dramatically recast the landscape for green investment in the US. The starting gun has been fired — and players in the chemicals industry need to ensure they are positioned to take advantage of the many incentives.

The Act creates a comprehensive and substantial package of tax credits, benefits and incentives for investments that further the energy transition towards a low-carbon future as the US pursues its net zero agenda. These credits are wide-ranging and varied. They could cover an investment in a new manufacturing or industrial facility or an upgrade to an existing facility. They apply to investments in clean energy such as wind and solar. They also incentivize carbon capture technologies and energy-efficient steam, heat and power processes. Many different products and methods could be eligible, including manufacturing products that will become a component of another green asset — for example, a chemical business making a substance that will be used in an EV automotive battery.

Understanding the detail

Because it is so broad, the IRA holds enticing potential for organizations across many sectors and industries. A manufacturing or industrial business could benefit significantly from aligning with the Act's aims and provisions. If a business's existing or planned products or processes align with the Act's purposes and conditions, a chemical organization might find itself positioned to benefit from some of these incentives. This can range from production activities supporting the clean energy supply chain to investments in renewable energy sources powering its operations.

As the size of available tax credits can vary significantly based on several factors, it is critical to understand the details, such as how much the technologies and processes in question reduce greenhouse gas emissions. For example, looking at hydrogen production, the full base credit is available only for clean hydrogen processes that generate less than 0.45 kilograms of carbon dioxide equivalent greenhouse gases (CO_2e) for each kilogram of hydrogen. For those which generate 0.45 to 1.5 kilograms of CO_2e, just a third of this credit is available.[1]

The Act also significantly expands the Section 45Q tax credits[2] available for carbon capture, utilization and storage (CCUS). Carbon capture can be used to reduce emissions across a diverse range of industries and can help organizations plan toward carbon reduction goals. But again, the level of credit depends on the technology used. While the standard credit is up to US$85 per tonne of CO_2 permanently stored and US$60 per tonne of CO_2 used for enhanced oil recovery (EOR), the credit for direct air capture (DAC) increases to US$180 per tonne of CO_2 permanently stored and US$130 per tonne for used CO_2. Other factors that aim to support local economies and workers across the US, discussed below, will also significantly impact a project's tax credits.

The good news doesn't end there. In addition to the available tax credits, there are also potential grants for businesses to fund specific activities (such as opening a new factory or facility). Many of these location and expansion credits are offered at a state and local level as jurisdictions compete to attract investment and local jobs.

More than one benefit or incentive may be available on the same activity — and as the detail has been digested since the IRA was published, there has been growing interest in how incentives can be 'stacked' or layered on top of each other to supercharge the benefit.

[1] KPMG, "Inflation Reduction Act" Tax Law Changes Special Report, August 2022
[2] KPMG, Section 45Q Credit for Carbon Oxide Sequestration, January 2022

Tax credit trading

In a further innovative move, the tax credits available may also be sold to a third party or (in some cases) refundable — that is, taken as a direct cash payment from the government rather than held and offset against that year's tax liability. There could be an active market for tax credit trading. Credits will most likely trade at a discount, although it is hard to predict the exact reduction. Refundable and transferable tax credits look attractive and will make it easier for an organization to access the economic benefits of the credits. Their introduction will likely lead to growing investment in these areas, helping companies seeking financing for such projects.

However, potential participants are proceeding cautiously as many questions remain regarding the market's liquidity for trading credits. At the time of publication the Internal Revenue Service (IRS) has yet to publish details of how transferability and direct pay of tax credits will be administered, but guidance is expected later this year.

Questions of timing

Another consideration is timing. For example, to qualify for the hydrogen production tax credit and credit for carbon oxide sequestration, construction of the facility needs to start by the end of 2032. In contrast, other provisions sunset earlier or have phaseouts. Careful attention should be paid to these dates when constructing project timelines.

While tax credits will be available to all qualifying investments within the qualifying period, it is worth remembering that some of the grants available will likely take the form of a finite pool of money — available while funds last and on a first-come, first-served basis! Time may be of the essence to apply for specific grants before funding is exhausted, and there may also be a competitive element as companies effectively bid against each other for a slice of the pie.

Promoting the American economy

Meanwhile, some tax incentives are linked to the location of projects and suppliers, workers' pay and the development of apprenticeship programs as further mechanisms to support and bolster the American economy, jobs and living standards. For instance, in some cases, higher credit rates are available if credit-eligible projects are constructed using certain levels of American-made components. In addition, the electric vehicle tax credits now include new requirements for assembling and sourcing battery components and critical minerals. The way these provisions impact the US supply chain will be closely watched.

In many cases, qualifying facilities must be constructed and maintained by workers earning the prevailing wage and with a certain number of apprentices to qualify for the highest available credit rates. But compliance is likely to be a key challenge in meeting apprenticeship and prevailing wage requirements. Companies need to be able to document and demonstrate satisfaction with the rules by leveraging data of contractors and subcontractors they may have never had to track before.

Not just a tax play

The dust has begun to settle after the excitement of the initial news. Businesses are beginning to develop their understanding of the potential of IRA for them — and if they haven't done so yet, they need to catch up fast. We don't yet have guidance from the IRS on how various rules will be applied, but that will come in time and shouldn't hold organizations back from assessing the IRA thoroughly regarding its implications for future investment strategy and planning.

One critical aspect is that the impact of the Act extends much broader than the tax team. When considering IRA, it's vital that different parts of the organization are linked up and talking to each other — tax, sustainability, operations, finance, accounting, planning, investment, and indeed the C-suite. The implications — and potential benefits — are pervasive and should be a matter of internal collaboration and analysis.

One critical aspect is that the impact of the Act extends much broader than the tax team.

International perspectives

The Act's incentives only apply to activities and developments within the US itself, so they would not apply to a US company investing in a new site or operation overseas. On the flip side, the Act has increased interest from international businesses in investing in the US. Interest is genuinely global as industry leaders discussed the Act at the recent World Petrochemical Conference in Houston, where non-US executives almost universally praised it for being well-drafted, thought-out, market-based legislation. The effects of the Act could be felt for years to come in the form of an increase in international investment into the US in the chemicals sector. The US is already a premium destination for businesses worldwide — IRA looks set to cement that and take it to an even higher level.

Certainly, the IRA must be seen as legislation with global significance rather than simply as a piece of domestic rulemaking. It aims to accelerate the US's journey towards net zero and make it a global leader in tackling climate change.

EU Green Deal and cross-border carbon charges

By

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The EU has set the ambitious target of becoming the world's first climate-neutral continent by 2050. To achieve this, the European Commission (EC) has developed ambitious European Green Deal (EGD) climate targets that underpin EU member states' commitment to a green transition. These targets are enforced through various policies, regulations and legislations. One key regulatory aspect of the EGD that has significant implications for businesses outside the EU is the pending commencement of the Carbon Border Adjustment Mechanism (CBAM), which will operate by imposing a charge on the embedded carbon content of certain imports, such as iron, steel, cement, fertilizers, hydrogen, aluminum and electricity[3] that is equal to the charge imposed on the production of domestic goods under the EU Emissions Trading System (net of free permits), with adjustments being made to this charge to consider any mandatory carbon prices in the exporting country. By imposing an equivalent carbon price on covered goods imports, the playing field is leveled for both EU producers and EU importers of such goods, as partner countries are encouraged to decarbonize their production processes.

Although various subsidies and funding programs under the EGD support the transition to a green economy, such as the EU Green Chemistry Subsidy program that provides financial support for research, development and innovation projects in the field of green chemistry, the promulgation of the IRA prompted the EU to reassess its green industrial policies, explicitly concerning incentives and funding. Amid fears that the IRA would drive business across the Atlantic and increase EU domestic capability in clean energy technology and industries at a time of growing competition for these globally, the European Commission presented, on 1 February 2023, its Green Deal Industrial Plan (GDIP) for the net-zero age. The GDIP seeks to make it easier for sustainable companies to access tax breaks, redirect cash toward clean-tech industries and relax state aid rules.

Within the GDIP is the proposed Net Zero Industry Act (NZIA), which will focus on reducing emissions using

[3] In the early stages of CBAM's implementation, the chemicals industry is directly impacted in relation to the importation of hydrogen and chemical fertilizers to the EU. Upon importation, non-EU organizations must provide product-specific information on the embedded emissions contained within those affected goods imported

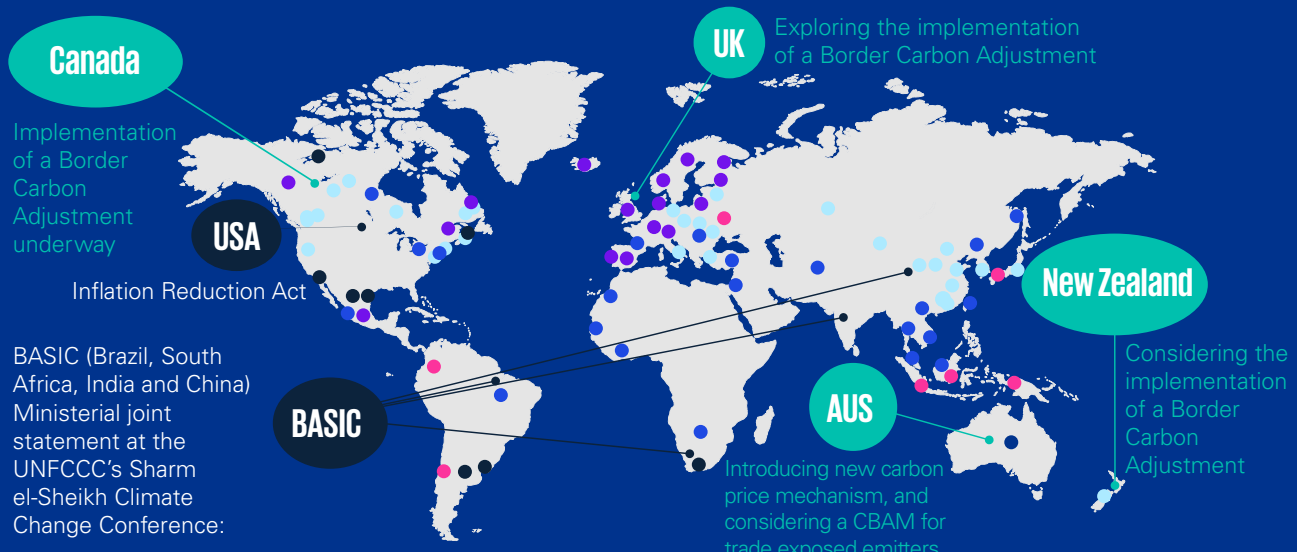
cleaner technologies and processes, such as renewable energy sources and energy efficiency measures, the promotion of green public procurement, increased support for research and development of new green technologies, and the incentivization of green investments. The NZIA also seeks to create a more circular economy by promoting the reuse and recycling of materials and encouraging the development of green products and services. To help ensure a fair transition to a net-zero economy, the Act will provide financial and technical support to those most affected by the transition, including support for retraining and upskilling workers and financial resources for businesses that need to invest in green technologies.

While there are no provisions in the proposed NZIA that are specifically geared towards the chemicals industry, it provides chemicals companies with several incentives for investment in emissions reduction and the development of clean technologies:

- Grants and loans for research and development of new technologies to reduce emissions and increase efficiency
- Tax credits for energy efficiency and renewable energy investments
- Tax incentives for businesses to reduce greenhouse gas emissions
- Financial incentives for businesses that convert to cleaner production processes
- Support for the adoption of green chemistry and sustainable materials

Although the GDIP sets out a $270 billion investment to support the European industrial sector's transition to a low-carbon economy, a direct comparison between the GDIP, NZIA and IRA cannot yet be made. The GDIP and NZIA are still in the early legislative stages and need to contain specific details regarding the nature and amount of tax credits, tax incentives and financial support.

Global movement on carbon pricing initiatives



- ETS implemented or scheduled for implementation
- ETS or carbon tax under consideration
- ETS and carbon tax implemented or scheduled
- Carbon tax implemented or scheduled for implementation
- ETS implemented or scheduled, ETS or carbon tax under consideration
- Carbon tax implemented or scheduled, ETS under consideration

GLOBAL THEMES

1. Policy levers include a mix of pricing measures and administrative directions
2. Green taxes located in major trading blocks are serving as the catalyst for domestic action

Source: Carbon pricing dashboard, World Bank, Accessed 05/07/2022

US Superfund Excise Tax

Although it is challenging to compare regulatory models between jurisdictions, when considering an investment strategy on an international or global basis, chemical businesses will undoubtedly want to consider the tax and legal frameworks in each region as a crucial part of their decision-making process.

It is also worth noting that while the IRA is almost wholly a 'carrot,' some sticks are wielded simultaneously through separate pieces of legislation. Most notably, shortly before the IRA was enacted, the US administration reinstated the long-dormant Superfund Excise Tax, which has relevance to the chemicals, gas and petroleum industries.

Many taxable chemicals and hazardous substances are listed under the law. And whereas under the original Excise Tax (which expired in 1995), substances containing 50 percent or more of a listed chemical were taxable, that threshold has been reduced to 20 percent.[4] The requirements may be more significant as an administrative burden than a financial one; to comply, companies will need to analyze the chemical composition of all their products along their supply chain and identify whether and at what point any taxable chemicals or substances are introduced.

[4] Thompson Reuters, How does the U.S's new Superfund Excise Tax impact European businesses, October 2022, https://tax.thomsonreuters.co.uk/news/tax-news/indirect-tax-news/how-does-the-new-superfund-excise-tax-impact-european-businesses/

Next steps

Through the Act, enormous opportunities lie in front of chemical companies. It is imperative to ensure that businesses are positioned to leverage this potential fully.

The first step in this is to start a dialogue and analysis across all key functions in the business which have a stake in the IRA's provisions; then, the organization needs to build a complete picture of the potential for the organization and how it will play into strategic, operational, financial, and ESG ambitions. Detailed questions may include:

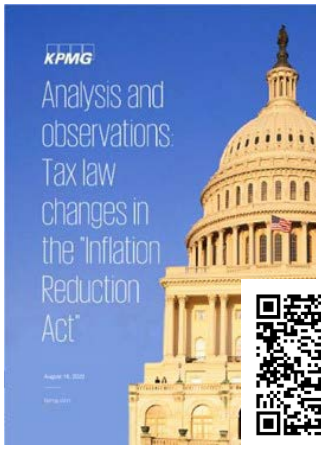
- What tax credits and incentives are available through the IRA map for activities the organization is planning?
- Do any available incentives change the thinking and bring new possible investments into play?
- Could tax credit trading hold commercial potential for the business?
- Can internal structuring and transfer pricing related to credits provide additional financial benefits?
- What grants and incentives are available, in which locations, and what are the application deadlines? Which states may be most attractive to the business to locate activities?
- How do stipulations around workers' pay and apprenticeships affect commercial operations and financial results?

The considerations should be holistic and include a view of the broader international landscape related to the organization's investment and operational choices:

- Does the IRA make the US the automatic go-to destination for future activity?
- What impact will the Superfund Excise Tax have?
- What does a comparison of the US regime with that of other regions, such as the EU show, and how does this impact future strategy?

There are many aspects to think about and important decisions to be made. KPMG firms have an extensive team of IRA and chemicals specialists who can advise US and foreign businesses on the options and choices ahead of them and some of the all-important detail that could make the difference to the decisions made.

It would be their pleasure to discuss this with you. Please get in touch if you would like to learn more about the IRA.



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KPMG Global Chemicals Institute

These are exciting times for the global chemical industry, and KPMG firms are proud to support such a vital part of modern life. Clients produce components in phones and tablets, the majority of non-metallic automotive parts, paints, coatings, personal care products, packaging, water treatment products, agrochemicals, and many other products worldwide. Equally important, KPMG professionals are committed to helping the global chemical industry maintain its unwavering focus on sustainability and products designed to help improve lives and make the planet healthier.

They also recognize the challenges involved with running a global chemical organization today. A confluence of events continues to batter chemicals supply chains around the world. The industry is experiencing a very robust deals market. Chemical organizations seek to expand their technical capabilities while maintaining cyber security vigilance appropriately. ESG is becoming more mainstream due to intensifying investor, regulatory, and consumer pressure holding companies accountable for ESG impacts. Adding to this complexity is the uncertain global economy and geopolitical risk, presenting significant challenges for chemical producers.

KPMG firms help chemical organizations to compete and thrive in this rapidly evolving business environment. Backed by a global organization of over 1,000 professionals, KPMG firms' chemical practices provide tax, audit and advisory services, a range of information resources and thought leadership to help industry executives stay informed and up-to-date on recent developments in their sector. With KPMG professionals, chemical organizations can develop new ways to create robust, sustainable, flexible strategies, teams, and operating models that quickly adapt to a dynamically unfolding future.

The KPMG Global Chemicals Institute provides the chemicals and performance technologies industry with leading insights in all key markets. You can access valuable thought leadership, webcasts, and videos on key industry topics as a subscriber.

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