THE COMPETITIVENESS OF THE EUROPEAN CHEMICAL INDUSTRY

A joint study by:

cefic

advancy
Driving strategy to results

The Competitiveness of the European Chemical Industry

January 2025

Foreword

Dear readers,

This competitiveness report, developed by Advancy, delves into the current state of the European chemical industry and its competitiveness on the global stage. It makes clear, through a wealth of data and comparative illustrations, that the time to act is now.

The European chemical industry is an integral part of the European industrial fabric, and is vital for Europe's climate-neutrality and circularity ambitions; whether you look at the supply chains for microchips, battery materials for electric vehicle or medicines, all of them are heavily relying on chemistry and chemical products. However, over the past years, our industry has faced significant challenges. Increased competition from regions like the USA and China, lack of demand, rising energy costs, and stringent regulations, among other factors, have added considerable pressure, leading to a decline in Europe's market share on the global scene.

Despite the challenges, our European industry remains a key player in innovation and sustainability. This study highlights the importance of investing in new technologies and supporting policies that can help us transition to a low-carbon and circular economy. More importantly, it emphasises the urgent need for a clear industrial policy that supports business and manufacturing in Europe, reduces administrative burden, and fosters a level playing field.

The study outlines both the risks and opportunities ahead. Already more than 11 million tons worth of capacity have been announced to be closed in Europe in 2023 and 2024 combined. Without proactive measures, our industry risks further decline. However, with the right support, our EU industry can regain its global competitiveness, and also grow profitably in areas like low-carbon technologies, more sustainable products and circular economy practices. Bold and decisive action is needed now to restore competitiveness, support innovation, and ensure the long-term future of the European chemical industry.

I hope this study serves as a valuable resource for understanding the challenges and opportunities facing our industry today. There should be no more plant closures and job losses as a consequence of Europe's heavy, costly and slow system. We must work together quickly and efficiently to make Europe the best place to do business.

Your sincerely,

Marco Mensink
Director General Cefic

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1 Summary

1.1 **European Chemicals, an Essential Industry for Europe** – detailed in section 2

Key Points

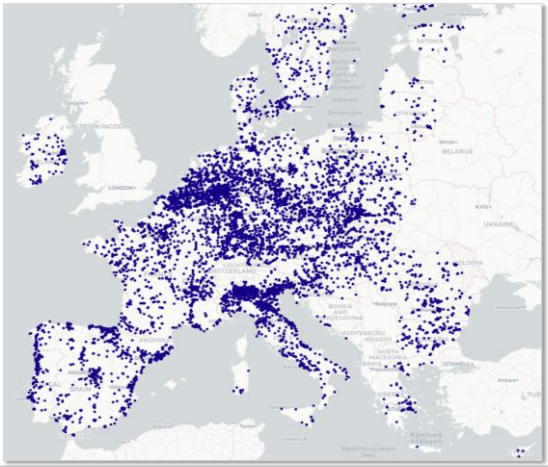
- **Chemicals are a fundamental building block of everyday life,** used in most manufactured goods and for the supply of strategic sectors for Europe (pharmaceuticals, electronic chips, defence).
- **Chemicals are an integral part of the European manufacturing industry:** they represent 5-7% of EU manufacturing turnover and include around 31,000 companies, 97% of which are small and medium-sized enterprises (SMEs).
- **Chemicals are among the leading manufacturing exporting sectors in Europe.**
- **Chemicals are an important contributor to European innovation & differentiation:** Europe is the second region in terms of chemical patents filed worldwide.
- **Chemicals are essential to meeting Europe's climate neutrality and circular economy goals,** by finding solutions to reduce the carbon footprint of materials.

(1) From petrochemicals to specialty pharmaceuticals, chemicals are a fundamental building block of everyday life. Most manufactured products contain chemicals. In Europe, the chemical sector represents about 655 billion euros in turnover and nearly 165 billion in added value (2023). The chemical value chain is complex, with many interdependencies, joint development in R&D, integrated companies along the value chain, and deep and broad ecosystems of manufacturers.

(2) The chemical sector is an important economic sector within the industry. In Europe, it represents 5-7% of total industry sales, more than 1.2 million direct jobs, 3-5 times more indirect jobs, and a dense network of 31,000 companies, 97% of which are SMEs.

FIGURE 1.1
European chemical sites spread throughout Europe

Chemical industrial sites tracked by the EEA, 2023



Europe chemical plants are spread across its territory (13,000 are included in the EEA[1]'s emissions monitoring)

Plants are major employment hubs and essential local growth drivers

Plants contribute to local economies through local taxes and direct and indirect jobs

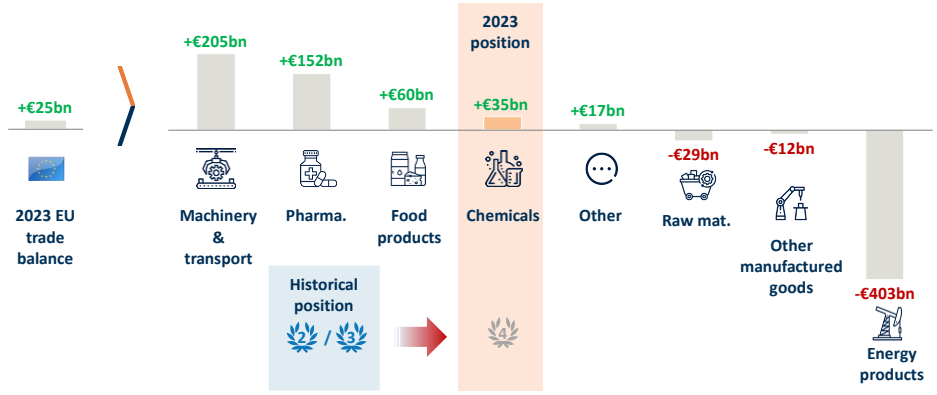
● European chemical sites tracked by the European Environment Agency (EEA)

Note: 13,000 companies are monitored in terms of emissions by the EEA out of 31,000 companies in Europe
Sources: EEA, Advancy analysis

(3) The chemical sector is a leading exporter for Europe. Chemicals contribute significantly to the European trade balance, with 35 billion euros of positive trade balance in 2023, it ranked #4th. Historically, chemicals were ranked #2nd/#3rd, after machinery & transport and pharma.

FIGURE 1.2
European manufacturing trade balance

€bn, nominal sales, Europe, 2023, Eurostat, Cefic chemicals trade data



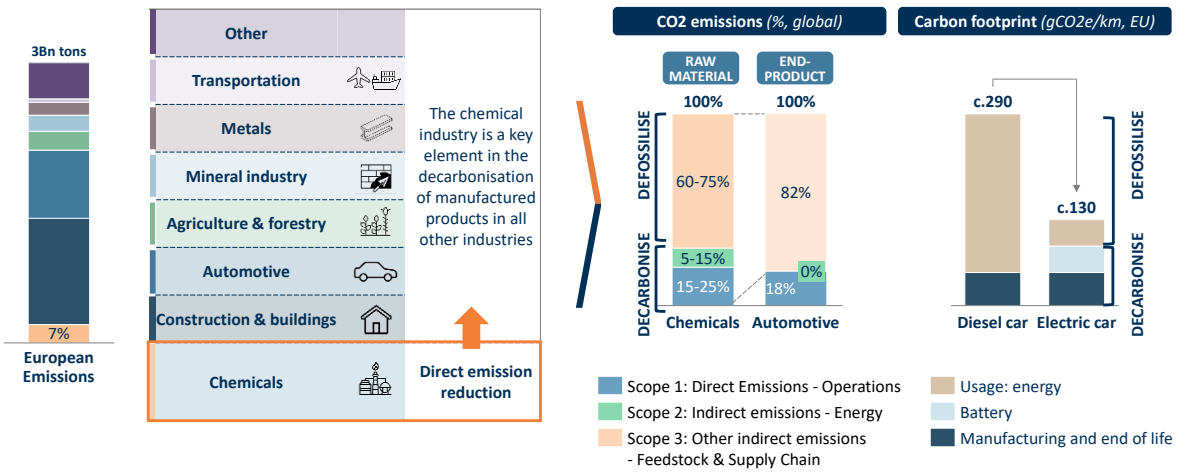
Sources: Eurostat adjusted by Cefic (-10bn adjustment compared to Eurostat 2023 Chemicals trade balance, resulting in -€10bn in total manufacturing trade balance)

(4) Europe is a leading region for innovation in chemicals with among the highest shares of chemical patent applications and grants in 2022.

(5) Chemicals are a key solution in European climate neutrality and are essential for moving towards a circular economy. In most manufactured products, chemicals can help reduce the carbon footprint of the materials used: new production processes, mechanical and chemical recycling, more durable products using innovative chemical additives.

FIGURE 1.3
European emissions and role of chemicals

Bn tons, %, 2022, EU-27



Sources: Cefic, Eurostat, Carbon 4, Advancy analysis

1.2 2023-2024, The European Chemical Industry at a breaking point – detailed in section 3

Key Points

- **Europe's chemical industry, which has long been a cornerstone of Europe's prosperity, is at a "*breaking point*, […] *jeopardising its future on the continent*". Plant closures representing over 11 million tons of capacity have already been announced for 2023-2024, affecting 21 major sites. The European chemical industry is experiencing a weak demand:** annual average production volumes in 2023 have decreased by around -14% percent since 2021 in 2023 and recovery remained weak in 2024.
- **The sector faces a global supply capacity surplus**: utilisation rates are currently (especially in Europe) around 75%. Despite the expected global increase in demand in the coming years, this is being offset by additional supply from further investment outside Europe. This makes it difficult to achieve better utilisation rates unless capacities are closed.
- **The competitiveness of the European chemical industry is under pressure. Europe is at a disadvantage in energy prices**: Gas and electricity prices have declined since the 2021-23 crises. However, the gas price currently remains 4-5 times higher compared to the US. A decline is expected in the medium term, yet remaining 2-3 times higher. Due to the current energy framework, this implies a competitive disadvantage in producing energy-intensive basic chemicals in Europe based on natural gas and electricity. When it comes to energy from crude oil naphtha and ethane used in organic chemicals, the US also has a competitive edge in ethane. Meanwhile, China and India have gained an advantage by getting discounted crude oil (naphtha) from Russia by circumventing sanctions.
- **Adding to this competitive pressure are more complex, more costly, and more changing administrative and environmental regulations, which lead to additional costs and create uncertainty for future investments.**
- **In this context, an urgent change of EU (industrial) policy is needed.** The current policy: 1) is mainly focused on regulation rather than incentives, 2) does not create a competitive environment in terms of operating costs, and 3) is too complex compared to other major regions.

(1) The European chemical industry is at a "*breaking point*" (Cefic press release November 30 2024), going through a period of unprecedented crisis due to weak demand, low utilisation rates, competitiveness under pressure and complex and costly policies compared to other regions.

(2) On the demand side, the recovery remains weak and uncertain. In Europe, this situation is the result of weak domestic demand from client industries and a decline in exports. The export market is impacted by weak demand globally and increased competition: 1) China's growth is slowing, due to difficulties in its real estate market and, more structurally, its demographic

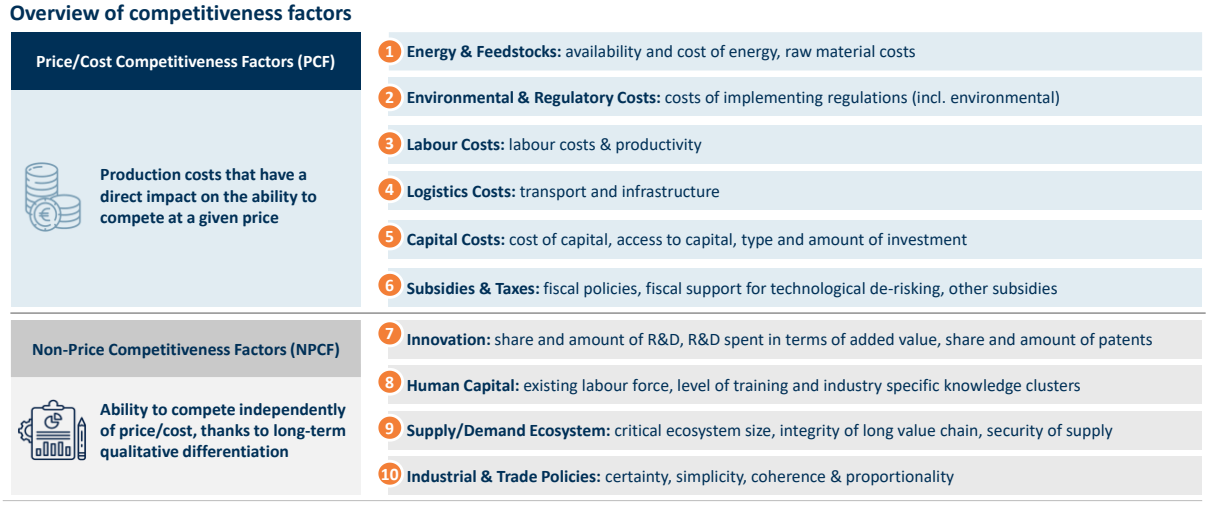
trends and current saving glut, 2) chemical demand growth in the United States remains positive, but does not primarily benefit Europe, 3) increased competition in other regions.

(3) **On the supply side, global capacities outside the EU continue to expand despite low utilisation rates and low profitability, creating an uncertain environment.** This has led chemical companies to review their footprint. There are **already around 11 million tons of announced capacities to be closed in Europe in 2023-2024, which is 10 times above the annual variation of the last 10 years.** Site closures risk further reinforcing vulnerabilities, destabilising the European industry and local clusters. **Once closed, a site will not reopen** due to the high capital costs required and, in some cases, local oppositions.

(4) **From a competition perspective, Europe's competitiveness has weakened comparatively to other regions on price/costs competitiveness factors (PCF) and on non-price competitiveness factors (NPCF).**

In terms of PCF, **energy costs have renormalised significantly but remain currently and prospectively higher in Europe compared to other regions:** coming from currently even higher differences natural gas is expected to remain 2-3 times higher compared to the USA in the future, and electricity 1.5-2 times higher. On crude oil, a gap exists compared to China and India due to a 5-10% discount on oil supply from Russia. Europe is also impacted by other higher raw material costs (bioethanol, sugar, starch), due to local subsidies and differing tariff duties. **European chemical companies are affected by increasing environmental and regulatory costs compared to other regions.**

FIGURE 1.4
Competitiveness factors (1/2)



Note: See detail on scoring in section 3.3
Sources: Advancy analysis

FIGURE 1.5
Competitiveness factors (2/2)

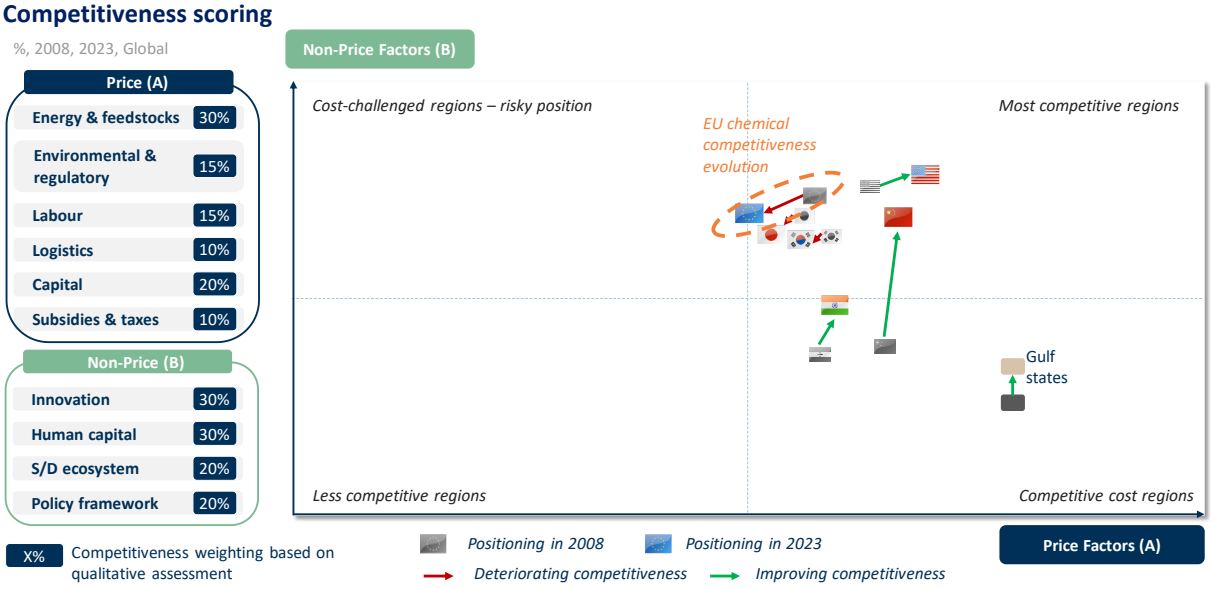
					GULF STATES			
Price/ Cost Competitiveness Factors (PCF)	1 **Energy & Feedstocks:** availability and cost of energy, raw material costs	--	++	+	++	-	-	-
	2 **Environmental & Regulatory Costs:** costs of implementing regulations (incl. environmental)	-	Neutral	+	++	Neutral	Neutral	++
	3 **Labour Costs:** labour costs & productivity	-	--	+	+	-	Neutral	++
	4 **Logistics Costs:** transport and infrastructure	++	+	++	+	+	+	Neutral
	5 **Capital Costs:** cost of capital, access to capital, type and amount of investment	+	++	+	+	Neutral	Neutral	-
	6 **Subsidies & Taxes:** fiscal policies, fiscal support for technological de-risking, other subsidies	-	++	++	++	-	Neutral	Neutral
Non-Price Competitiveness Factors (NPCF)	7 **Innovation:** share and amount of R&D, R&D spent in terms of added value, share and amount of patents	++	++	+	-	++	++	Neutral
	8 **Human Capital:** existing labour force, level of training and industry specific knowledge clusters	++	++	+	--	++	++	Neutral
	9 **Supply/Demand Ecosystem:** critical ecosystem size, integrity of long value chain, security of supply	+	++	++	-	Neutral	Neutral	Neutral
	10 **Industrial & Trade Policies:** certainty, simplicity, coherence & proportionality	-	+	+	+	Neutral	Neutral	Neutral

Positive impact ++ → -- Negative impact

Note: See detail on scoring in section 3.3
Sources: Advancy analysis

In terms of NPCF, **Europe has competitive advantages in terms of innovation, human capital, and a robust chemical manufacturing ecosystem**. However, companies **encounter administrative hurdles and complexities that create uncertainty,** often resulting in delayed investments or decisions to invest outside of Europe. Additionally, other regions are catching up and growing to become leading champions in innovation and human capital with a dense ecosystem of supply and demand.

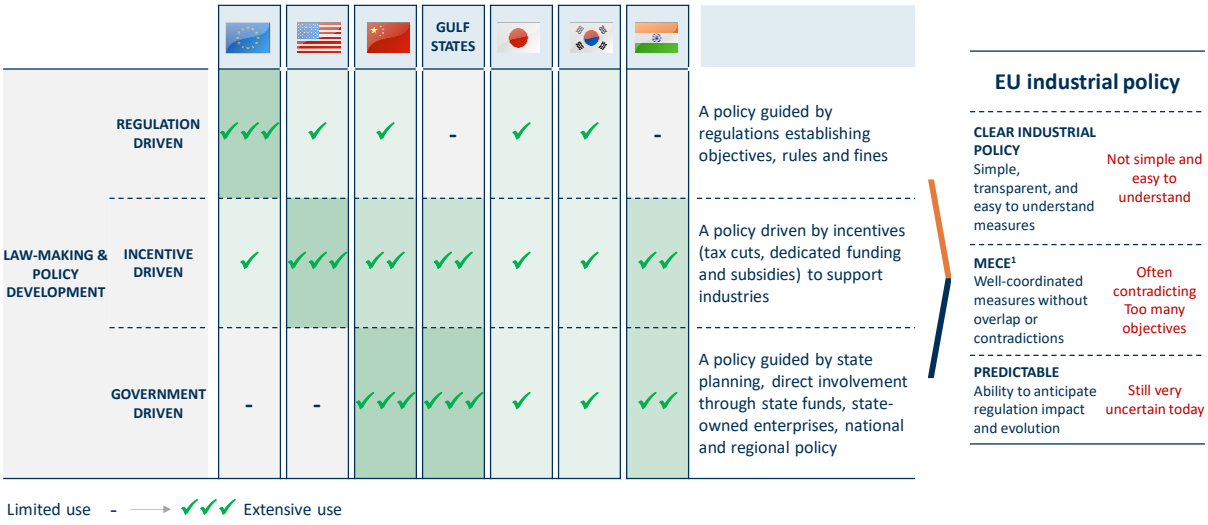
FIGURE 1.6
Competitiveness scoring



Note: See detail on scoring in section 3.3
Sources: Advancy analysis

(5) **From a regional policy perspective**, there are a growing number of **measures and initiatives aimed at supporting local industries** in the USA, China, India, and other regions (for example targeted subsidies, restriction on imports/exports). At the same time, European chemical companies are facing increased unfair competition: an estimated 24% of all active trade defence measures in force in the EU concern chemicals. Ongoing anti-dumping measures have increased. Meanwhile, **companies in Europe face increasing European regulations that impose new, incompressible costs on European players, which non-European competitors do not face or can avoid. Enforcement of EU legislation at the EU borders lacks coherence and consistency. European industrial policy often appears complex and less predictable** when compared to that of its counterparts. **European policy is regulatory-driven instead of incentivising, while other regions have a more business-friendly approach, creating an environment for more competitive operating costs.**

FIGURE 1.7
Policy comparison



Notes: (1) Mutually Exclusive, Collectively Exhaustive
Sources: Jacques Delors Institute, Bruegel Institute, Brook Law, Itif, Draghi report, Advancy analysis

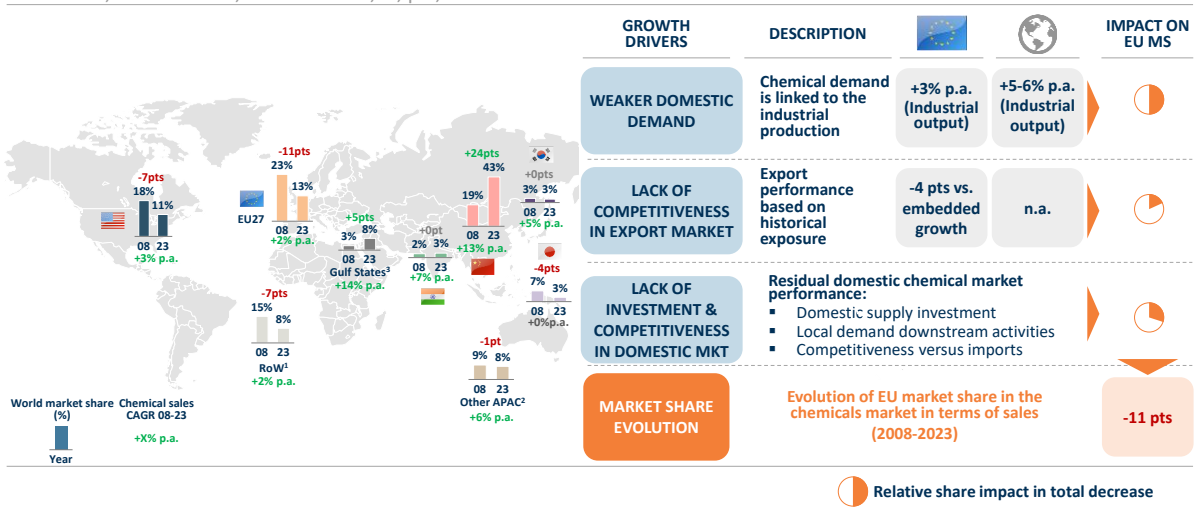
1.3 Over The Past 15 Years, Europe Has Lost Ground – detailed in section 4

Key Points

- **The European chemicals sector lost 11 points market share between 2008 and 2023, driven by 3 factors:**
- **European chemical demand has been structurally weaker: the European economy is more mature, and its industrial production grew by +3% per year over the period 2008-2023 versus global growth of 5-6% per year**.
- **European chemical exports underperformed**: exports captured a lower share of international growth compared to their historical level.
- **Moreover, the European chemical industry lacked investment and competitiveness in the domestic market**.

FIGURE 1.8
Chemical market shares

2008-2023, market share, nominal sales, %, pts, World



Notes: (1) Rest of the world includes: LATAM, outside EU27, Africa, Mexico, Canada - (2) Other APAC includes all Asian and Oceanian countries excluding China, India, Japan, South Korea - (3) Including GCC countries, Israel, and Iran. Rounded figures, i.e. a decrease of -11pts corresponding to -10.7% from 23.3% in 2008 to 12.6% in 2023 for Europe. Sources: Cefic, Oxford Economics, Advancy

Europe's market share in sales has declined by around 11 percentage points over the past 15 years, from 23% to 13% between 2008 and 2023, driven by:

a. Weaker growth of domestic demand,
b. Weaker growing export markets and lack of export competitiveness,
c. Lack of investment and competitiveness in the domestic market.

Europe experienced a slow market share erosion from 2008 to 2018. Since 2018, the global economy and the chemical sector have been under severe stress. The situation has particularly deteriorated since 2022 where the European chemical industry faced a sharp slowdown, stronger than that of the general economy: volumes have decreased by around 14% compared to 2021. Chemical activity remains at historically low levels, which have been maintained for a longer period than at any time in the past 30 years.

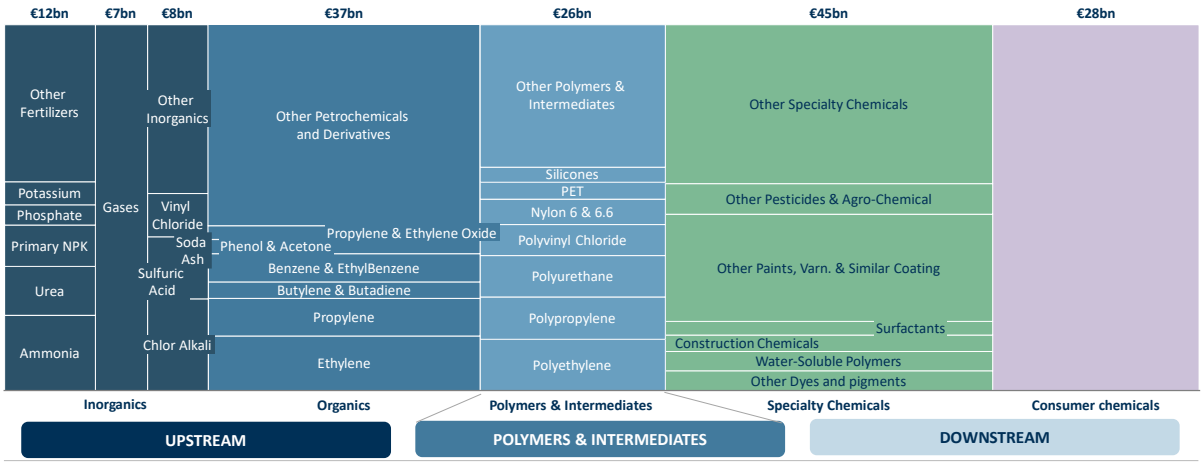
1.4 **The Competitiveness Gap, In Depth** – detailed in section 5

Key Points

- **The chemical industry is structured into upstream, polymers & intermediates, and downstream segments,** starting with raw feedstocks, production of base chemicals and progressing towards specialty chemicals, which are used in various end-markets.
- **The upstream sector manufactures large volumes of organic and inorganic chemicals:** this segment was the most directly impacted by the increased energy costs and low global utilisation rates due to its high fixed cost base. **It is at the forefront of low carbon technology development**.
- **The polymers & intermediates sector starts from upstream chemicals to manufacture polymers (used in plastics and composites especially) and intermediates for downstream products:** this segment was impacted by feedstock costs and increased competition. **It is at the forefront of circular economy**.
- **The downstream sector manufactures smaller volumes, often tailored to customer needs, providing in many cases complex ingredients and unique combinations of ingredients:** it has been less impacted and has maintained its relative competitiveness. **It is at the forefront of new performance-oriented ingredients and materials.**

FIGURE 1.9
European chemicals overview

Added value, €bn, 2023, decimal digits rounding



Note: Consumer Chemicals: personal care, home care, fragrances
Sources: Cefic, Advancy analysis

(1) The European chemical industry generated around €165 billion of added value in 2023 from a complex and diversified chemical value chain. Nine examples of chemicals were selected to illustrate the risks and opportunities the chemical industry faces (see section 5).

(2) The upstream level of the value chain is the most energy and capital intensive. It produces the building blocks of all chemicals. These segments are impacted by rising energy costs, weak demand, and overcapacity. In these segments, plant closures have been announced to

restore utilisation rates and therefore profitability. **These industries are also at the heart of Europe's decarbonisation with significant ongoing investments made by chemical companies.** Time and resources are needed for the chemical industry to transition and modernise.

(3) **Polymers and intermediates production is less energy intensive. It relies mostly on local demand.** It often faces **extra-European competitors, which are more integrated (upstream or downstream)** and which are able to compete both on prices and innovation over time. Additionally, **new competitors tend to invest in larger and newer sites,** more than existing European sites. **These segments are particularly important for the development of the circular economy, with for example recycled, bio-sourced and biodegradable polymers.**

(4) **The downstream level of the value chain is more influenced by** labour costs and relies more on non-price competitiveness factors such as innovation and human capital compared to the two segments mentioned above. **Europe stands out in this segment and has historically maintained market shares**. Yet, a domino effect of upstream shutdowns can impact the downstream segment.

The nine examples depicted in section 5 illustrate the strengths and weaknesses of the European chemical industry. They highlight the dense network of companies producing essential products for Europe, innovating to stay ahead, and transitioning to reduce their emissions. They show, especially for the upstream, the impact of energy competitiveness and new regulation. For the downstream on the other hand, they indicate the risks of outsourcing too much production and lacking integrated value chains and industrial policies. They also show that European chemical companies face an increasingly uneven playing field within other regions which receive more support and face less administrative burden. For example, the IRA helps to develop low-carbon hydrogen in the US, China's Target 2025 drives strategy supporting heavy investments in silicones up to photovoltaic panels and the Indian government strongly supports the development of its fine chemical industries (pharmaceuticals, agrochemicals).

1.5 **Next Steps: A Call for Action** – detailed in section 6

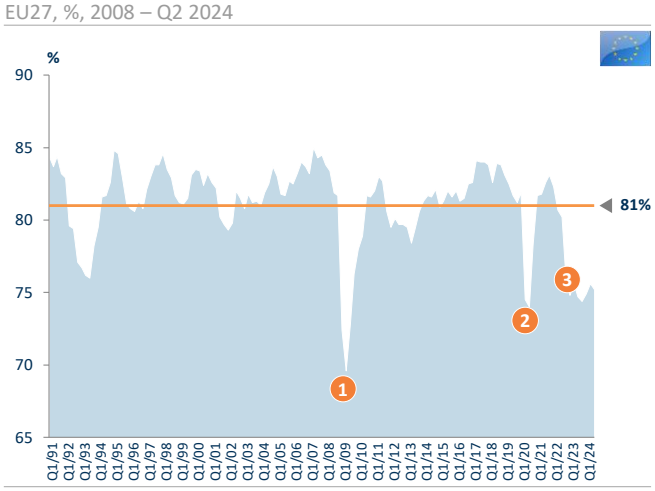
Key Points

- **The European chemical industry is at a crossroads**: the European chemical industry has faced a sharp slowdown, stronger than the general economy, driven by lower demand, increasing supply, downgraded competitiveness and increased competition. **The downturn is unprecedented in its depth and length.**
- **There are risks ahead, but also significant opportunities to be seized in low carbon technologies and innovative technology developments.**
- **The chemical industry creates jobs and wealth, is crucial for all industrial value chains, is indispensable for the green transition to achieve climate neutrality and adds to Europe's strategic autonomy.**
- **Urgent and concrete actions are required to create a business environment that allows business to leverage their strengths and enables Europe to achieve its objectives**. The Antwerp Declaration and the Draghi report show the way forward.

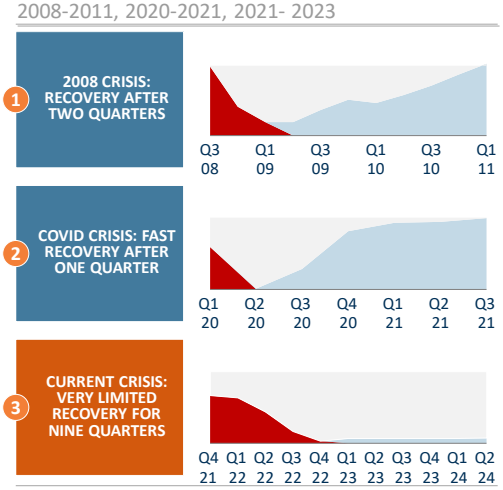
(1) Europe is at a crossroads. The significant slowdown of the European chemical industry has been outpacing that of the general economy due to reduced demand and eroded competitiveness. The trend of global excess in capacity results in the low utilisation rate of the industry, at only 75% for the past nine quarters. The depth and duration of the slowdown is unprecedented.

FIGURE 1.10
European chemicals utilisation rate

EU27, %, 2008 – Q2 2024



2008-2011, 2020-2021, 2021- 2023

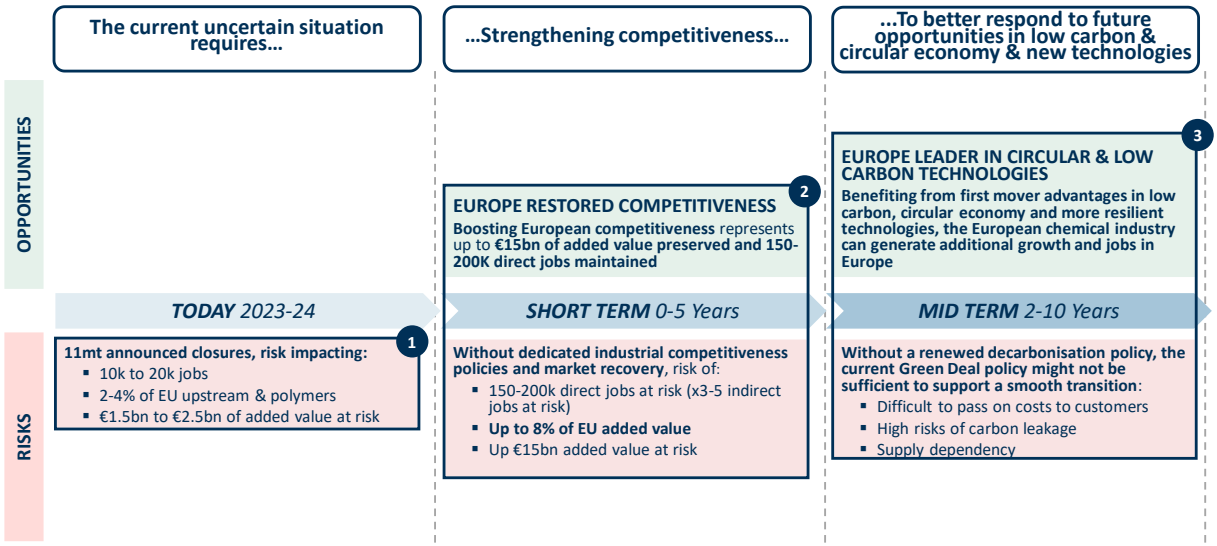


Sources: CEFIC, Advancy analysis

(2) Without active policies to improve the competitiveness of the EU chemical industry and better support its green and digital transition, "*the industry that has long been a cornerstone of Europe's prosperity is at risk of further decline, jeopardising its future on the continent*" (Cefic December 1st press release source 1.11).
This is already happening, resulting in the permanent closure of around 11 million tons of capacity in Europe in 2023-2024, representing €6.5-11 billion in revenue at risk, or 2-4% of

the European upstream chemical and polymer industry at risk. A closed site will not reopen due to the generally high capital costs required and, in some cases, local oppositions.

FIGURE 1.12
European risks and opportunities



Sources: Advancy analysis

With dedicated industrial policy and support for downstream market recovery, the chemical industry can avoid the risks of further shutdowns, with up to 8% of the chemical value chain's added value at risk.

At the same time, the European chemical industry has a key role in innovation and sustainability development, supporting decarbonisation and circular economy in Europe. Provided it regains competitiveness, the European chemical industry will continue to seize medium-term opportunities in sustainability and transversal innovative technology growth areas.

(3) The chemical industry contributes to Europe's strategic autonomy, supports the economy, and promotes the green transition to achieve climate neutrality. The chemical industry fosters European economic and social resilience: preserving local jobs, often in less dynamic regions, and enabling the green transition.

(4) Urgent and concrete actions are needed to achieve a business environment that allows business to leverage their strengths and enables Europe to achieve its objectives. Such actions may include sufficiently competitive energy for energy-intensive sectors such as the chemical industry, a lighter environmental and regulatory burden, and a more incentive-based industrial policy to foster investment and innovation as set out in the Antwerp Declaration and the Draghi report.

The Transition Pathway of the EU Chemicals Industry includes a list of actions to support the green and digital (twin) transition of the sector and its resilience, to be developed by EU, Member States, and industry. **In February 2024, the Antwerp Declaration adopted at the**

European Industry Summit proposed ten critical points to support the industry (antwerp-declaration.eu). The Letta report and the Draghi report have further underlined these points. They call for action in the coming months:

1) To develop a clear industrial policy supporting business and manufacturing in Europe,
2) To reduce administrative burden and current uncertainties around policy costs to incentivise future investment,
3) To restore the energy competitiveness and have competitive feedstocks,
4) To finance the transition, innovation, and support modernisation of existing assets,
5) To foster a level playing field versus other regions,
6) To support strategic autonomy and security of supply,
7) To boost customer industries and end consumer demand, particularly for high end-, added value-, net-zero, low-carbon and circular products.

[*more detailed recommendations are beyond the scope of this report*].

A game changer policy could trigger investment by alleviating unilateral burdens and isolated EU policy moves. Policies must be adapted to close the gap between Europe and competing regions. **With the right policies in place, the European chemical industry can leverage its numerous strengths to drive growth and enhance its global standing**.

ENDNOTES

Figure 1.1: European chemical sites spread throughout Europe – *EEA, Advancy analysis*

Figure 1.2: European manufacturing trade balance – *Cefic, Eurostat, Advancy analysis*

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Source 1.11: Press Release

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2 Section 2 – European Chemicals, an Essential Industry for Europe

From petrochemicals to specialty pharmaceuticals, chemicals are a fundamental building block of everyday life: agriculture, food, construction, materials in transportation and consumer products, in appliances and industrial equipment, ingredients for pharmaceuticals, personal care and fragrances. **Most manufactured goods contain chemicals. Chemistry plays a vital role in a multitude of innovative products**: for example, at the heart of electric vehicle batteries, solar and wind technologies, sustainable fuel, and new pharmaceutical products.

In Europe, the chemical sector represents about 655 billion euro in turnover and 165 billion in added value (2023). The upstream, polymers & intermediates, and downstream segments structure the chemical industry, starting with raw feedstocks and progressing to specialty chemicals. **The chemical value chain is complex with interdependencies** from upstream to downstream, joint development of R&D, companies integrated along the value chain, and deep and broad ecosystems of manufacturers. The upstream sector manufactures large volumes of organic and inorganic chemicals. The polymers & intermediates sector starts from upstream chemicals to manufacture polymers (used in plastics and composites especially) and intermediates for downstream products. The downstream sector manufactures smaller volumes, often tailored to customer needs, providing potentially complex ingredients and specialty combinations of ingredients.

The chemical sector is an integral part of the industrial sector. It represents 5-7% of the total industry turnover. Chemical companies employ more than 1.2 million direct jobs and 3 to 5 times more indirect jobs, making the chemical sector an important contributor to European social welfare. There are about 31,000 companies operating in the chemical sector in Europe. 97% of those companies are small and medium sized enterprises (SMEs), with a dense network of interlinked companies. European plants are spread across the EU territory. They are vital to local economies, providing jobs and generating significant financial benefits locally. In Europe, the chemical sector is particularly important in Germany (33% of the value added of the chemical sector in Europe), France, (17%), Italy (9%), the Netherlands (7%), Spain (7%), and Belgium (6%).

The chemical sector is a leading export sector for Europe. Chemicals contribute significantly to the European manufacturing trade balance, accounting for 35 billion euro of positive trade balance in 2023. It ranked #4th in 2023, but historically ranked #2nd or 3rd after machinery and transport (aircraft & defence) and pharmaceuticals (strongly linked to chemicals). Within the chemical segments, polymers and intermediates as well as downstream components, contribute positively to the positive trade balance with exports of specialty materials, personal care ingredients, coatings, adhesives, pharmaceutical intermediates, etc... The upstream segment is a net importer.

The chemical sector is a significant contributor to European innovation and differentiation. Europe is a leader in innovation in the chemical field with among the highest shares of chemical patent applications and grants in 2022, at a similar level to the USA. Chemical companies spend around 6% in R&D yearly in terms of added value, the highest percentage globally.

The chemical sector is an essential pillar of European climate neutrality and the circular economy. **In most manufactured products, chemicals help reduce the carbon footprint of materials**. For example, 1) they are the backbone of sustainable fuels where Europe's existing capacities and capabilities are a strength. 2) Chemicals are also key enablers for the development of renewables such as solar and wind – Europe retains a strong presence in wind power manufacturing, while being limited in solar. 3) Chemicals are also key to the climate neutrality of agriculture through the production of green nitrogen fertilisers (from green ammonia – green hydrogen) and through the reduction of animal emissions through innovative gut health solutions. 4) Chemicals are essential to reducing greenhouse gas emissions in the construction sector. They are a key ingredient in insulation materials and are essential to improving the lifespan of most building materials.

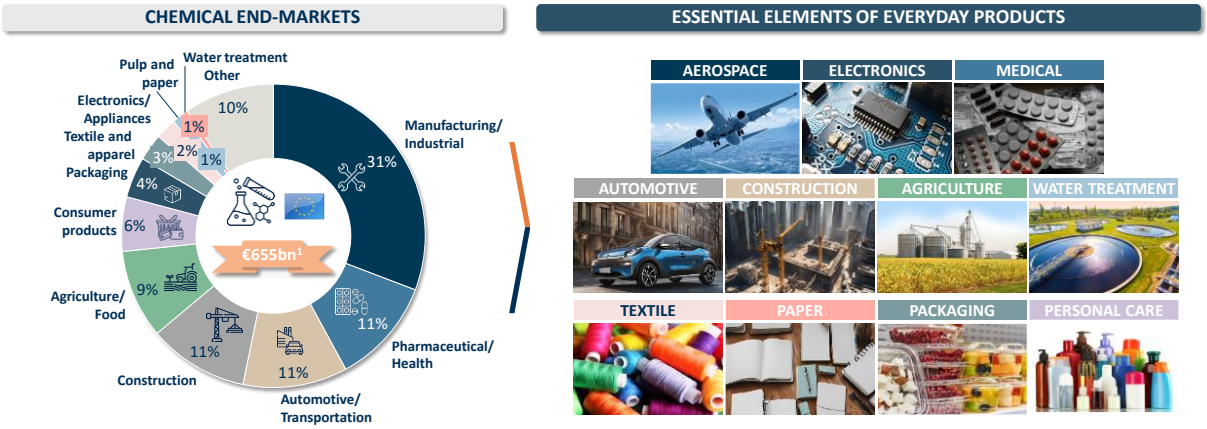
Chemicals are also key to moving towards the circular economy developing recycled, bio-based, or bio-degradable products. Europe is among the leading regions in terms of bio-based, bio-degradable, and recycled plastics: 21% of recycled plastics and 27% of bio-based and bio-degradable plastics are produced in Europe. European chemical companies are at the forefront of developing chemical recycling solutions.

2.1 From petrochemicals to specialty pharmaceuticals, a fundamental building block of everyday life

The European chemical industry represents around 655 billion euro in turnover and is an essential element of most everyday products. The chemical industry is a major supplier to key sectors such as automotive, construction, electronics, agriculture, pharmaceuticals, healthcare, and personal care – highlighting its fundamental role in European industrial value chains.

FIGURE 2.1
Chemical sales in Europe by end market served

%, €bn, 2023, Europe, nominal value



Note: (1) Nominal value
Sources: Cefic, Eurostat, Oxford Economics, Advancy analysis

In its applications, the chemical industry provides materials for (split of chemical sales per sector of use) (non-exhaustive):

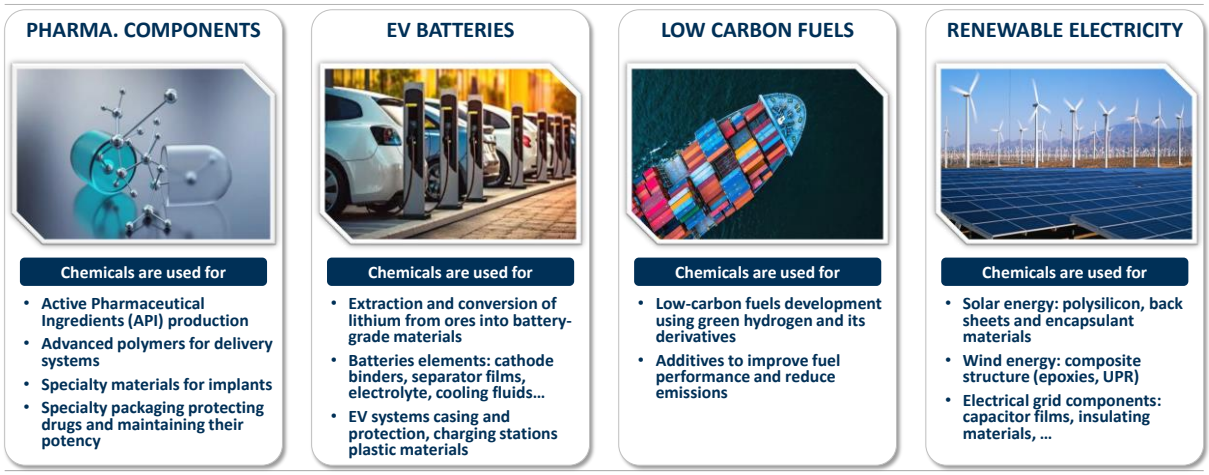
- **Manufacturing/Industrial (31%):** various additives and polymers, used in manufacturing processes or in the manufacture of parts,
- **Pharmaceuticals & healthcare (11%):** intermediates and active pharmaceutical ingredients (API), medical devices' parts,
- **Automotive/Transportation (11%):** Lightweight and durable materials plastics, engine additive, battery materials,
- **Construction (11%):** coatings, adhesives, sealants, and elastomers (CASE), plastics, and construction additives,
- **Agriculture & food (9%):** crop protection and crop nutrition, food & beverage additives,
- **Consumer Products (6%):** personal care functional and active ingredients, household cleaning agents,
- **Packaging (4%):** plastics that protect goods during transport and ensure food safety,
- **Textile and Apparel (3%):** fibres, dyes, and treatments,
- **Electronics/Appliances (3%):** solvents, high specialty polymers,
- **Pulp and Paper (1%):** paper and packaging materials,
- **Water Treatment (1%):** treatment and purification of water,
- **Other sectors (10%).**

Each application requires different chemicals, from the most standard to the most complex.

The chemical industry plays a vital role in the development of innovative products in various sectors. In each application, European chemical players are striving to develop innovative and higher value-added products such as more sustainable packaging, specialised textile formulations, high performance polymers for medical devices, and innovative recycling for batteries. This diversity underlines the significant role chemical industry plays in European industry.

The following case studies illustrate this role in four critical sectors:

FIGURE 2.2
Chemicals play a vital role in innovative products: illustration in four sectors



Sources: Advancy analysis

Pharmaceuticals: Chemicals are essential in the production of active pharmaceutical ingredients (APIs), which are essential compounds used in medicines. The chemical industry also develops advanced polymers for delivery systems that improve the efficiency of drug absorption in the body. Specialty materials are also used in the production of implants and packaging, which are specifically designed to safeguard drugs and preserve their potency, thereby ensuring the efficacy and safety of pharmaceutical products.

EV Battery: Chemicals are essential for extracting and converting lithium ores into quality battery materials, as well as in the recycling of those materials. Key components of electric vehicle batteries, such as cathode binders, separator films and electrolytes, are manufactured using advanced chemicals. Additionally, chemicals contribute to the production of materials used in the casings, shields and charging stations of electric vehicle systems, all of which ensure the safety and efficiency of electric vehicles.

Low-carbon fuels: The development of low-carbon fuels depends on chemical innovations, for example, in the production of green hydrogen and its derivatives (e-kerosene, biofuels, e-methanol and green ammonia). Chemicals are also used in fuel additives that improve fuel performance while reducing emissions. This allows industries to shift to more sustainable energy solutions, supporting global efforts to mitigate climate change.

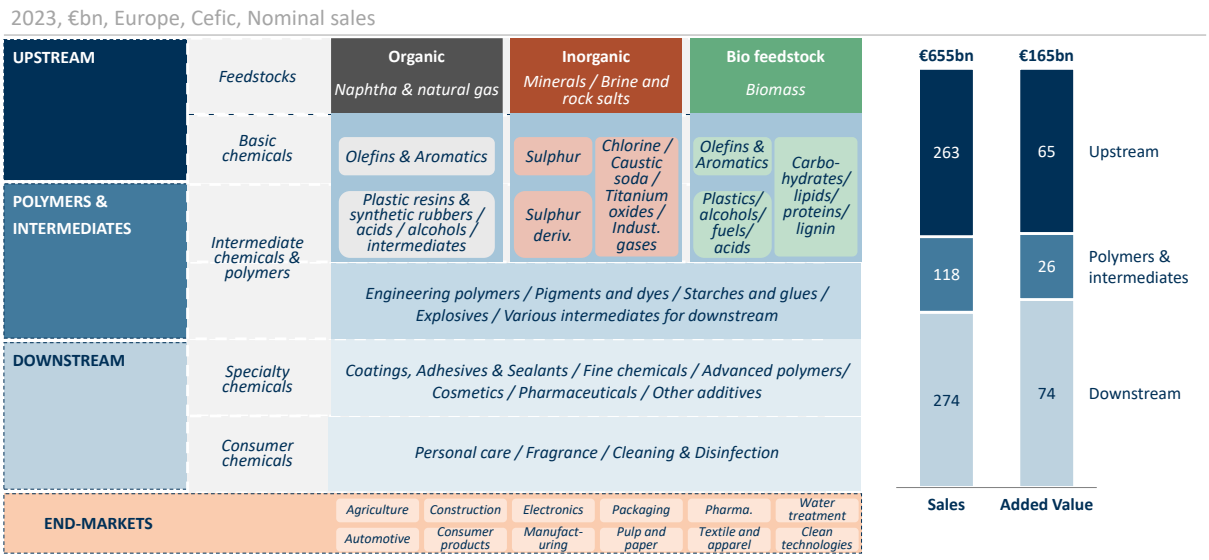
Renewable electricity: In solar energy, chemicals are the main materials used for polysilicon, back sheets, and encapsulation parts of photovoltaic panels. For wind energy, polymer materials such as epoxies and unsaturated polyester resins form the backbone of turbine blades. Additionally, chemicals play a crucial role in the development of power grid components, such as capacitor films and insulating materials, which ensure the reliability and efficiency of renewable energy systems.

This is just a glimpse of the essential role of chemical materials.

To go further, in 2023, the European chemical industry generated around 655 billion euro in revenue and contributed 165 billion euro in added value, covering a wide range of chemical products from petrochemicals to specialty consumer chemicals. The chemical value chain can be separated in three main segments:

- **Upstream, €263bn in sales and €65bn in value**: manufacturing (very) large volumes of organic and inorganic chemicals from energy and basic feedstocks, by cracking, electrolysis, and mineral extractions, and multiple other different chemical processes and reactions.
  - Upstream supports the entire chemical value chain through (i) production of organic and inorganic chemicals, (ii) investment in chemical parks, (iii) skills development and (iv) critical role in supporting decarbonisation of chemicals.
    - **Upstream – Basic Organic Chemicals** (Upstream, **26% of sales, 23% of added value**): These are carbon-based chemicals derived from petroleum or natural gas through cracking, including petrochemicals such as ethylene, propylene, and their derivatives.
    - **Upstream – Basic Inorganic Chemicals** (Upstream, **14% of sales, 17% of added value**): Unlike organic chemicals, these chemicals are primarily non-carbon based, based on minerals and natural gas through processes such as electrolysis, steam methane reforming, etc. This subsegment includes products like fertilisers, chlorines and caustic soda, sulphur.
- **Polymers & Intermediates, €118bn in sales and €26bn in value**: starts with upstream chemicals to make polymers for plastics and other intermediates and ingredients for downstream products
  - Polymers & intermediates are essential for (i) the European plastics and parts industry (automotive, manufacturing…), (ii) innovative and differentiated polymers (biopolymers, advanced polymers), (iii) downstream ingredient production and cost differentiation, (iv) downstream raw material reliability and (v) investment in innovation, (vi) exports.
    This subsegment includes products like plastics, synthetic rubbers, and fibres.
- **Downstream, €274bn in sales and €74bn in value**: manufacturing mid to small volumes, tailored to customer needs, providing ingredients for most everyday products (food, construction…) and very specialty unique solutions for specialty applications (cosmetics, pharma, …)
  - It contributes to the differentiation of the European economy thanks to (i) skills and innovation (pharmaceuticals, cosmetics, specialty materials, agrochemicals, industrial uses …), (ii) higher value exports, (iii) consumption of upstream materials and supply to manufacturing goods.
    - **Specialties** (Downstream, **27% of sales, 27% of added value**): specific applications with unique properties. It includes chemicals used for coatings, agrochemicals, additives, etc.
    - **Consumer Chemicals** (Downstream, **15% of sales, 17% of added value**): primarily focused on end-products used by individuals, such as detergents, fragrances, and personal care products, critical for maintaining the function and effectiveness of everyday household.

FIGURE 2.3
Value chain and key categories of the chemical space

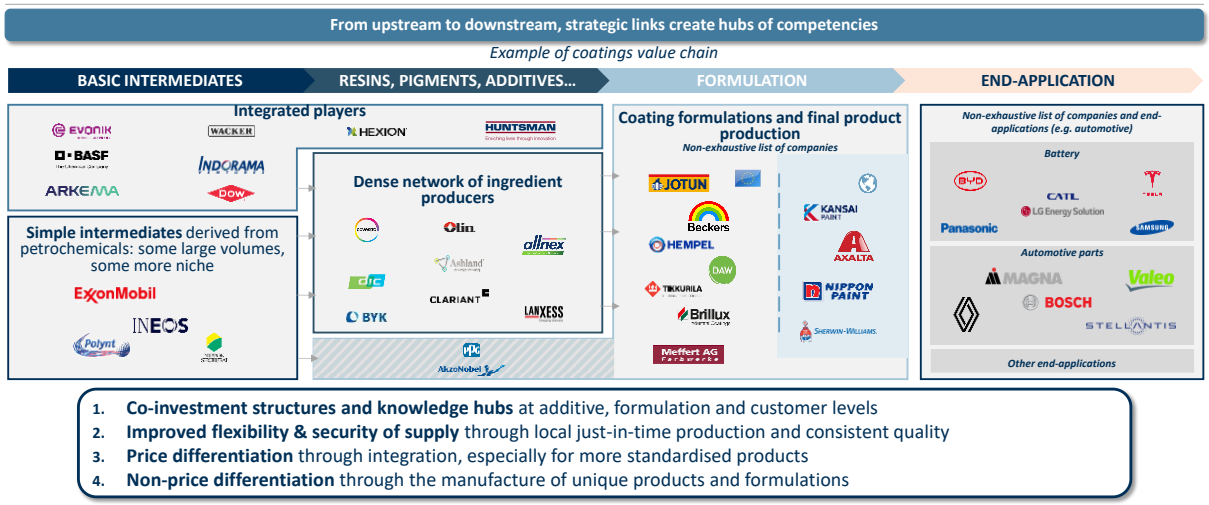


Sources: UNEP Global Chemicals Outlook, Cefic, Advancy analysis

The segmentation reflects the complexity and diversity of products offered by the chemical industry, which serves a wide range of sectors, from basic industrial applications to high-demand consumer markets**.**
Beyond the general classification of chemicals into upstream, polymers & intermediates, and downstream categories, a closer look at specific value chains reveals how closely interconnected these segments are.

In the coatings industry, the chemical value chain relies on complex collaborations and specialised processes to deliver essential products. In the middle of the chemical coatings value chain, there is a dense network of producers of additives, resins, and pigments. Some companies are integrated upstream or downstream and directly formulate final coatings. The integration, linkage, and proximity of activities between these stages create competence clusters that improve the industry's ability to innovate and meet customer demands. These coatings are then essential to ensure the safety and durability of the products (construction elements, furniture, ships, automotive, packaging).

FIGURE 2.4
Zoom - Upstream to Polymers to Downstream interconnections: Coatings value chain



Sources: Advancy analysis

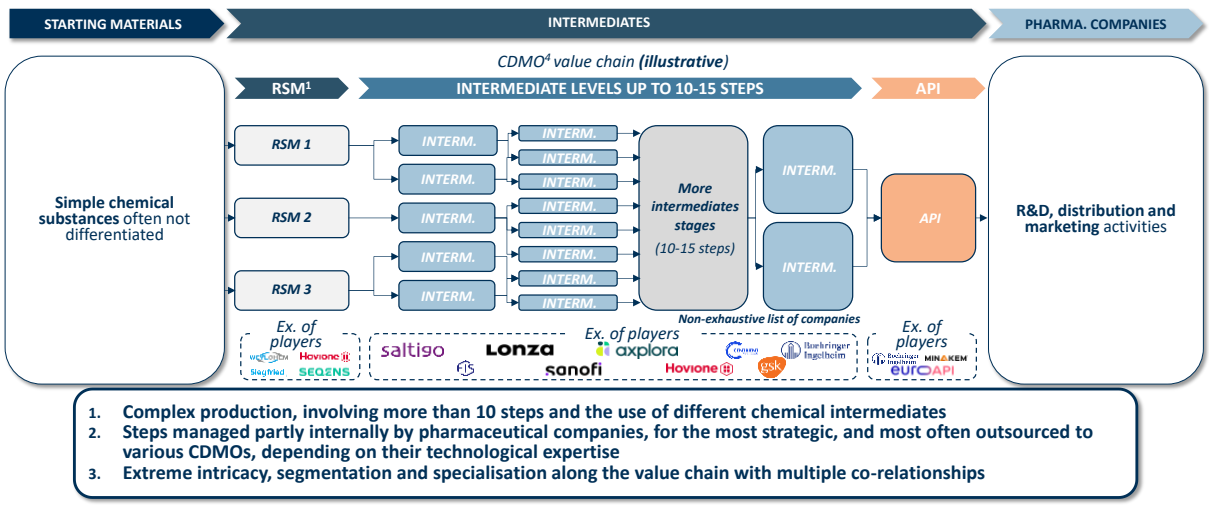
The pharmaceutical chemicals sector is another relevant example of the industry's interconnectedness. It is a highly fragmented value chain, with specialised players involved in the production of intermediates and active pharmaceutical ingredients (APIs). From upstream to downstream, strategic linkages are necessary to ensure the flexibility, safety, and efficiency of the pharmaceutical value chain:

- **Co-investment structures and knowledge hubs**: pharmaceutical companies collaborate with Contract Development and Manufacturing Organisations (CDMOs) to pool resources and share expertise in API production.
- **Enhanced flexibility and security of supply**: CDMOs ensure the availability of starting materials and intermediates, securing the supply chain for pharmaceutical products.
- **Cost differentiation**: Pharmaceutical chemicals, particularly for commoditized products, require cost-effective production to remain competitive. Specialisation and co-investment allow companies to focus on niche segments of the value chain.

From simple chemicals, the chemical pharmaceutical value chain progresses to intermediate compounds involving more than ten steps and several CDMOs along the value chain. Each CDMO masters a specific set of technological chemical pathways. Some steps, particularly the most strategically important ones, are managed by pharmaceutical companies and specific CDMOs in Europe, while standardised steps are already outsourced worldwide (notably in China and India). The main pharmaceutical companies manage distribution and marketing activities, part of the production (notably the manufacturing of finished drugs) and part of the R&D.

FIGURE 2.5

Zoom - Upstream to Polymers to Downstream interconnections: Chemical pharmaceutical value chain



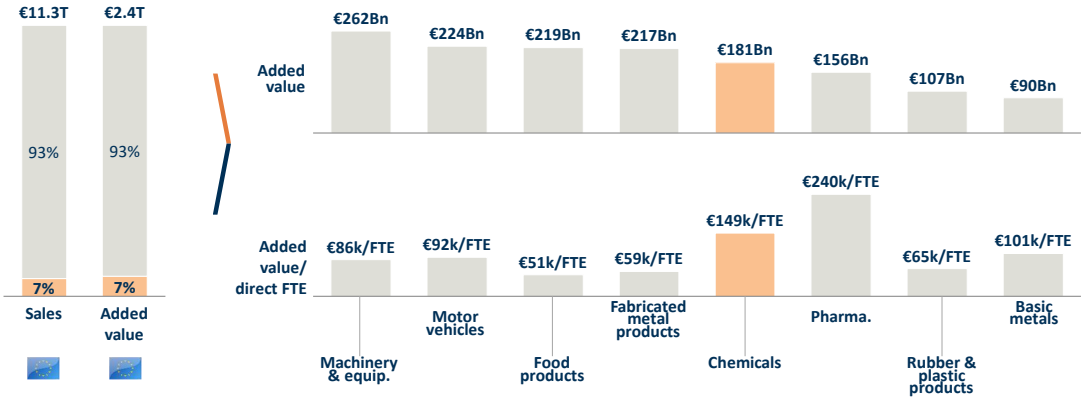
Notes: (1) Regulatory Starting Materials, (2) Good Manufacturing Practice intermediates, (3) Active Pharmaceutical Ingredient, (4) Contract development and manufacturing organizations
Sources: Advancy analysis

2.2 An integral part of the European manufacturing industry

FIGURE 2.6

EU27 top 10 manufacturing sectors ranked by added value

Europe, nominal added value, €bn, €k/FTE, 2022, EU27



Sources: Cefic, Eurostat, Advancy analysis

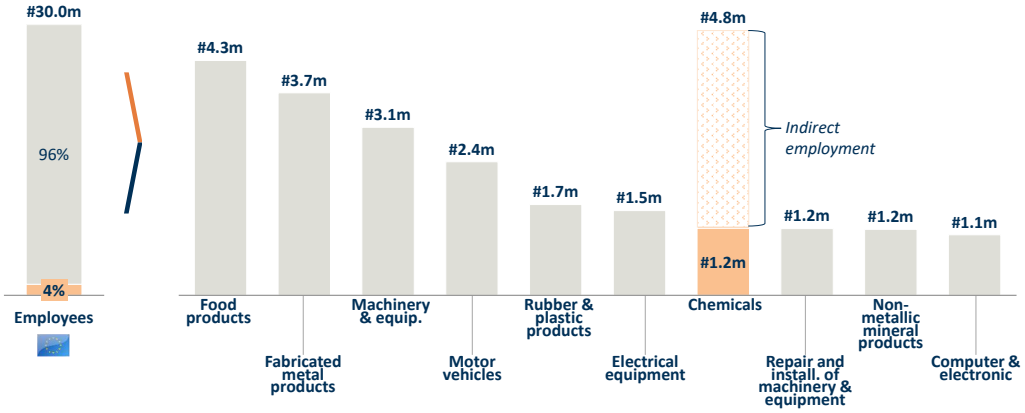
The chemical industry is a major sector in Europe, representing 7% of industrial production in 2022. In 2022, the chemical industry ranked sixth in terms of contribution to manufacturing value added, and second in terms of value added generated by direct FTEs.

The chemical industry employs over 1.2 million people (direct) within 31,000 companies. There are about 3-5 times more indirect jobs related to the industry, making the chemical sector an important contributor to European social welfare. Based on a Cefic assessment in 2022, the chemical industry accounts for around 3.6 million indirect jobs.

FIGURE 2.7

EU27 manufacturing sector employees

Millions of direct employees, 2022, EU27



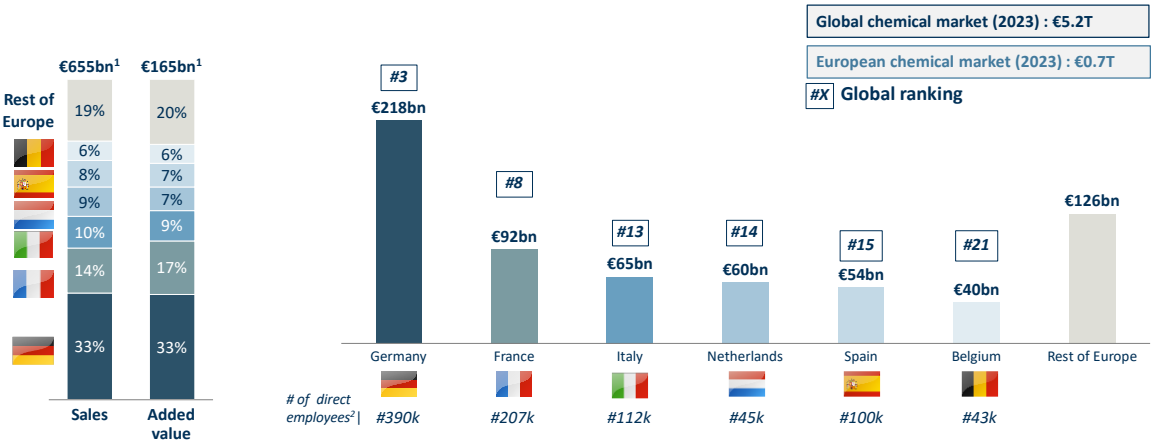
Sources: Cefic, Eurostat, Advancy analysis

In 2023, within the 655 billion euro of European sales, a substantial portion of the market is in the largest manufacturing countries. Germany, France, Italy, Netherlands, Spain, and Belgium represent approximately 80% of the sales generated.

FIGURE 2.8

EU27 top countries by chemical sales

€bn, 2023, nominal sales and added value



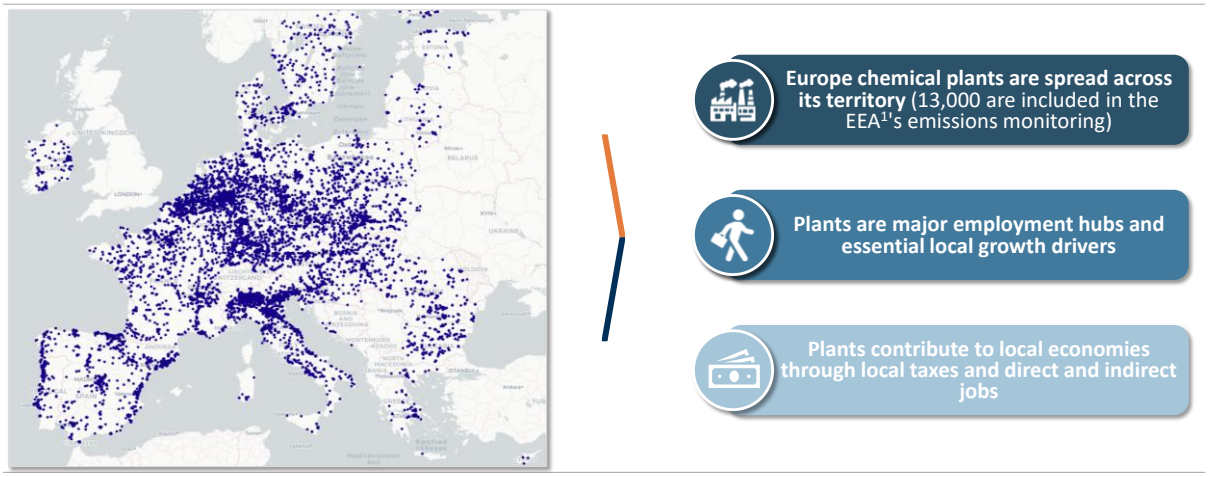
Notes: (1) Nominal value, (2) 2021 data

Sources: Cefic, Advancy analysis

Chemical sites are scattered across Europe. Europe is home to 31,000 companies, 97% of which are SMEs. The three Member States with the highest number of chemical SMEs are France, followed by Italy and then Spain. More than 13,000 chemical plants are tracked by the European Environment Agency (there are smaller sites with limited emissions not tracked by the EEA), **spread across its territory and vital to local economies, providing jobs and generating significant financial benefits.**

FIGURE 2.9
European chemical sites

Chemical industrial sites tracked by the EEA, 2023

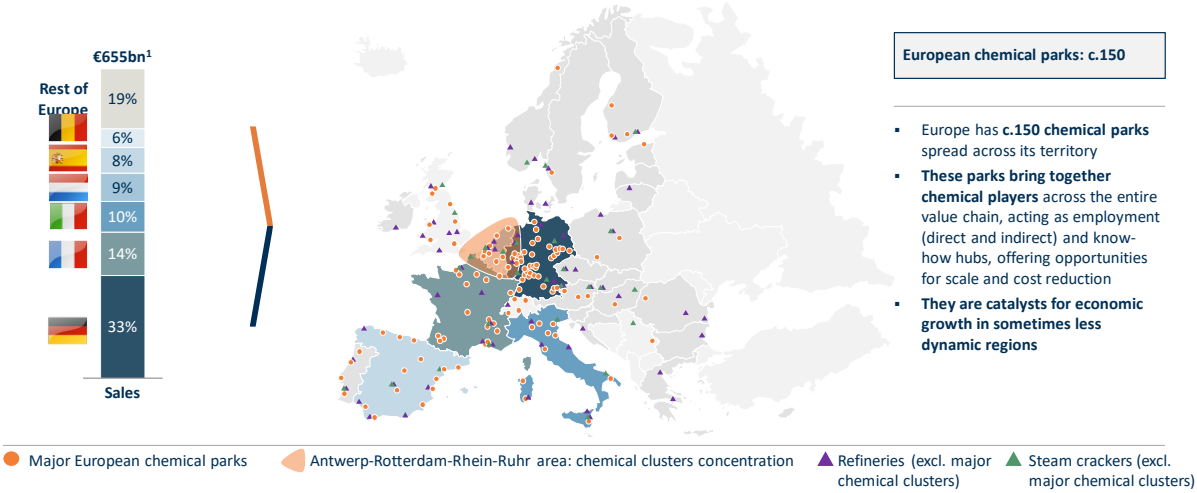


Note: (1) 13,000 plants monitored in terms of emissions by the EEA out of 31,000 companies in Europe
Sources: EEA, Advancy analysis

The European chemical industry is organised into 150 chemical parks spread across the territory, serving as a relay for regional dynamism. These parks bring together chemical players along the value chain, acting as employment (direct and indirect) and knowledge hubs, while also providing growth and cost reduction opportunities for industrial players.

FIGURE 2.10
European chemical parks overview

2023, €bn, nominal sales, %, Europe, CEFIC, ECSPP, Petrochemicals Europe, Advancy



Note: (1) Nominal value / Sources: Cefic, National Chemicals Associations, Advancy analysis

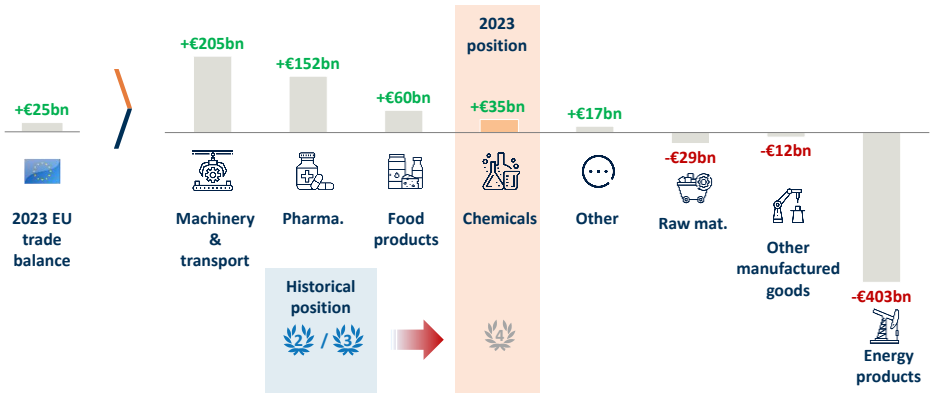
2.3 Among the leading exporting sectors in Europe

Chemicals are a key contributor to Europe's trade balance, accounting for 35 billion euro of positive trade balance in 2023. The chemical sector ranks as the fourth-largest sector in the European manufacturing trade

balance. Historically it ranked #2nd or #3rd before the energy crisis increased the costs of imports and, to a lower extent, exports, resulting in lower net trade for the chemical industry in 2022-23.

FIGURE 2.11
European manufacturing trade balance

€bn, nominal sales, Europe, 2023, Eurostat, Cefic chemicals trade data



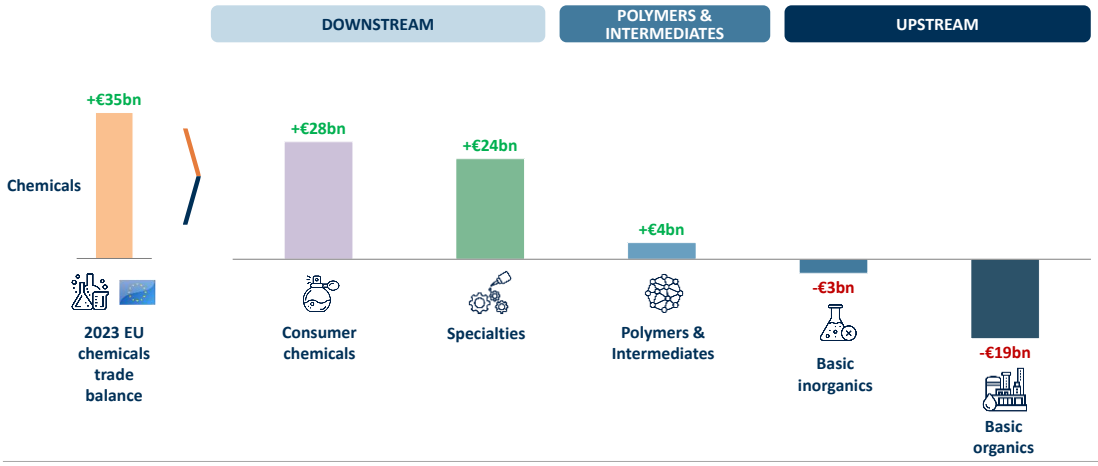
Sources: Eurostat adjusted by Cefic (-10bn adjustment compared to Eurostat 2023 Chemicals trade balance resulting in -€10bn in total manufacturing trade balance)

The indirect contribution of the chemical industry to the European trade balance is even higher. Sectors such as machinery & transport and pharmaceuticals rely heavily on chemicals for manufacturing processes and product development, which amplifies the importance of the sector beyond its direct trade figures.

The chemicals sector's trade surplus can be attributed to the downstream segments (consumer and specialty chemicals) and polymers & intermediates. In contrast, the upstream segments have been in deficit since 2011, reflecting Europe's dependence on imported raw materials and the impact of rising energy prices.

FIGURE 2.12
European chemicals trade balance by segment

€bn, nominal sales, Europe, 2023, Cefic chemicals trade data

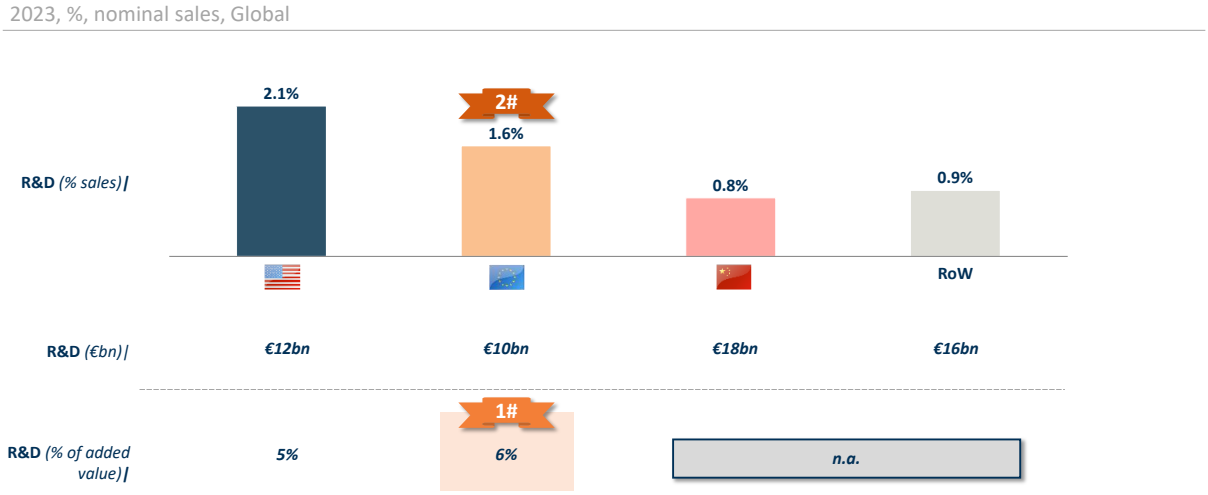


Sources: Cefic, Eurostat, Advancy analysis

2.4 A contributor to European innovation and differentiation

Europe is among the leading regions for research and development (R&D) spending in chemicals, ranking as the second-largest regional investor in the chemical industry (in terms of R&D spending as a percentage of total chemical sales). European chemical players allocate 1.6% of their sales to R&D, behind the U.S. at 2.1%. However, they lead by one point in terms of the R&D share of added value (6% compared to 5% in the U.S.). Compared to an EU target of 3% of GDP in R&D expenditure, the European chemical sector is investing above this level.

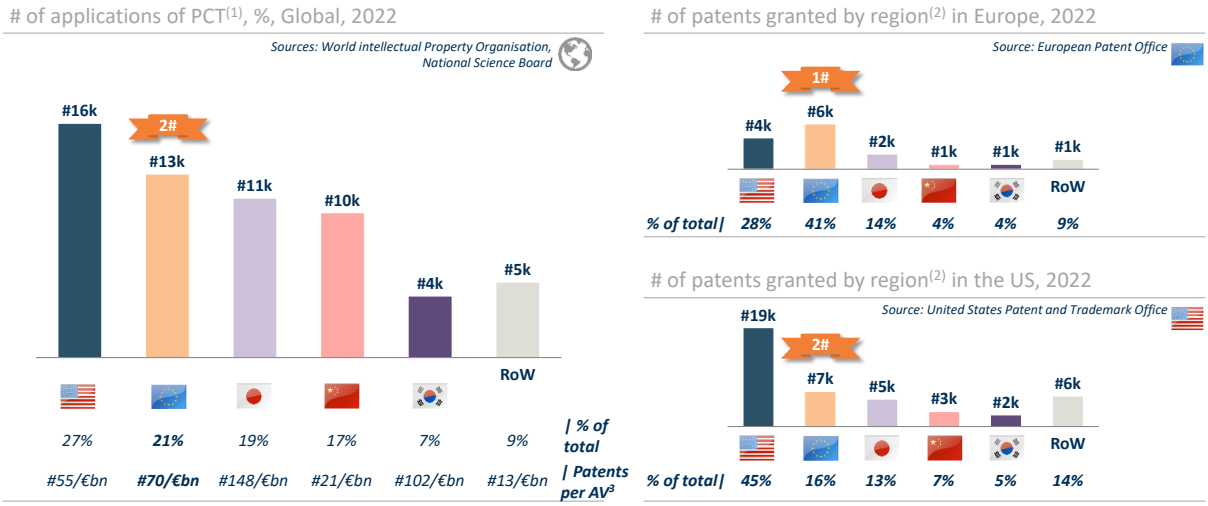
FIGURE 2.13
R&D spending in chemicals by region



Note: (1) Added value / Sources: Cefic, Advancy analysis

Europe is a leading region for innovation in the chemical industry, as indicated by its share of chemical patent applications and grants in 2022. It recorded approximately 6,000 patents granted in 2022 by the European Patent Office. It is also active abroad, ranking second for chemical patents granted in the United States in 2022, as well as for chemical PCT applications worldwide that same year.

FIGURE 2.14
Chemical patent overview by region

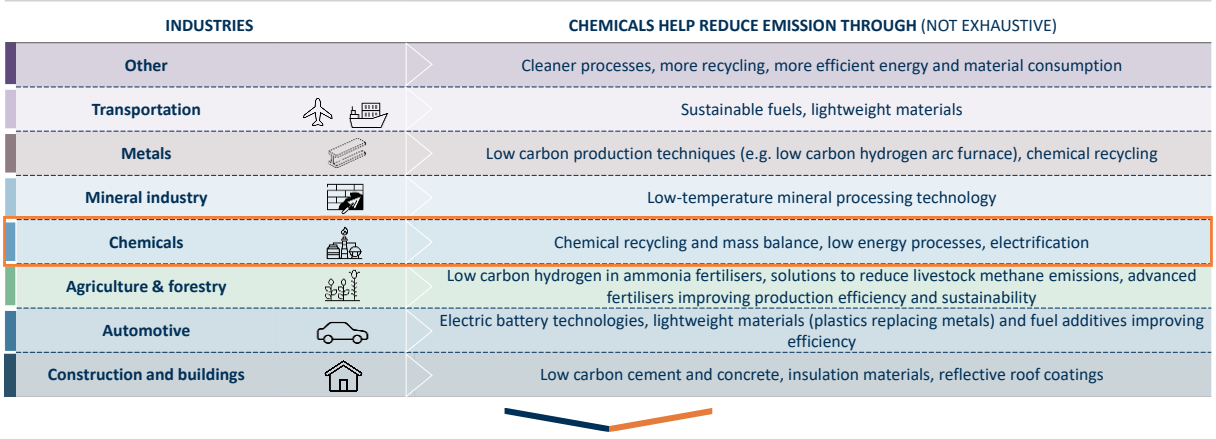


Note: (1) Patent Cooperation Treaty, (2) Patent origin based on country of residence of the first applicant listed on the application form, (3) Added value/ Sources: EPO, USPTO, Cefic, National Science Board, Advancy analysis

2.5 An essential pillar of European climate neutrality & circular economy

Chemicals are essential to meeting Europe's climate neutrality goals. The importance of the chemical industry goes beyond reducing its own greenhouse gas emissions, as it also provides essential solutions that enable other sectors to decarbonise:

FIGURE 2.15
Role of the chemical industry



The chemical industry is essential to achieve climate neutrality, both in terms of direct emissions and in terms of solutions for other sectors.
Most of the technologies highlighted in the Net Zero Industry Act (NZIA) rely on chemicals and chemical innovation to thrive.

Note: NZIA: Net Zero Industry Act
Sources: Eurostat, European Commission, Advancy analysis

1. **Construction and building:** development of low-carbon cement and concrete, insulation materials, reflective roofing coatings,
2. **Automotive**: development of electric battery technologies, lightweight materials (plastics replacing metals), and fuel additives improving efficiency,
3. **Agriculture and Forestry**: Development of low carbon hydrogen, solutions to reduce livestock methane emissions, advanced fertilisers improving yield and production sustainability,
4. **Chemicals**: development of chemical recycling & mass balance, low energy processes and electrification,
5. **Mineral industry**: Development of low-temperature mineral processing technologies,
6. **Metals**: Development of low carbon production techniques (arc furnace with green hydrogen) and chemical recycling (lithium battery recycling),
7. **Transportation**: Development of sustainable fuels and lightweight materials,
8. **Other industries**: Development of various solutions for lightweighting, cleaner processes, more recycling, more efficient energy/material consumption…

Below are some examples to illustrate the significant role of the chemical industry.

Zoom on chemical solutions to reduce maritime emissions

The development of methanol (CH_3OH) and ammonia (NH_3) as alternative fuels offers promising solutions to reduce the carbon footprint of the maritime industry. Both fuels are under development due to their lower emissions compared to traditional marine fuels such as heavy fuel oil. They can be produced from renewable hydrogen, produced by electrolysis, and produced from low-carbon hydrogen using biowaste.

Zoom on chemical solutions to reduce emissions from aviation

The aviation industry is focusing on sustainable fuels such as sustainable aviation fuel (SAF), e-hydrogen, and e-methanol (derived from e-hydrogen) to reduce its carbon footprint. These fuels are all produced through

chemical pathways. In addition, lightweighting using special composites in aircraft construction improves fuel efficiency, further contributing to the sustainability of aviation.

FIGURE 2.16
Chemicals' role in reducing transport emissions

- **The development of methanol (CH_3OH) and ammonia (NH_3) as alternative fuels** offers promising solutions to reduce the maritime industry's carbon footprint
- **Both fuels are being explored for their lower emissions compared to traditional fuels such as heavy fuel oil**
- **Methanol and ammonia can be produced from renewable hydrogen**, produced via electrolysis

Examples of players: BASF, Borealis, Perstorp, Yara, Fertiberia, Maersk

- The aviation industry is focusing on **sustainable fuel options such as Sustainable Aviation Fuel (SAF), e-hydrogen, and e-methanol** (from e-hydrogen) to lower its carbon footprint
- **Lightweighting aircraft using polymers and composites improves fuel efficiency**, further contributing to the sustainability of aviation

Example of players: TotalEnergies, moeve, UPM, Neste

To support the transition, substantial volumes will be necessary, requiring significant investment in assets ranging from electricity generation to chemicals production

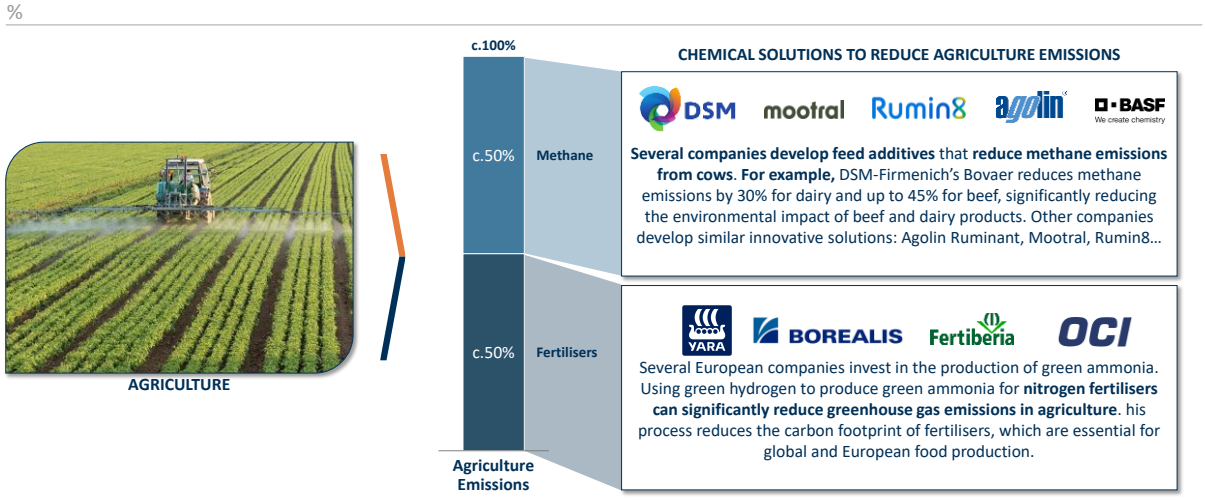
Sources: Advancy analysis

Zoom on chemical solutions to reduce agricultural sector's emissions

Half of agricultural emissions comes from fertilisers, while the other half results from methane emissions produced by livestock. The chemical sector can reduce emissions from fertilisers by using clean, low-carbon hydrogen to produce clean, low-carbon ammonia for nitrogen fertilisers. Clean ammonia technologies reduce the carbon footprint of fertilisers, which are essential for global and European food production.

Methane emissions from livestock, which account for about half of agricultural emissions, are also a major challenge. Companies are working on feed additives that reduce methane emissions from cattle.

FIGURE 2.17
Chemicals' role in reducing agricultural GHG emissions



Sources: Company websites, Advancy analysis

Beyond the examples cited above, the chemical industry also plays a vital role in the development of renewable energy technologies such as solar and wind power. Chemicals provide essential materials that improve the performance, efficiency, and sustainability of renewable energy systems.

Zoom on chemical solutions to support solar energy

The solar industry relies heavily on chemicals like polysilicon, adhesives, and coatings for the construction and efficiency of photovoltaic modules (95% are polycrystalline or monocrystalline silicon modules). Specialised encapsulants, such as EVA (ethylene vinyl acetate), are used to protect solar cells from environmental damage, while anti-reflective coatings improve light absorption and energy conversion.

Zoom on chemical solutions to support wind energy

The wind energy sector relies on chemicals/materials: for example, wind turbine blades, which account for 30% of the total cost of a wind turbine, are primarily made of epoxy resins to provide strength and flexibility while specialised coatings protect the blades from harsh environmental conditions, extending their life and performance.

FIGURE 2.18
Chemicals role in building materials in reducing end-use emissions

- **Insulation is an key material for energy savings in construction**
- Chemicals enable the **bonding of insulation materials** (acting as a **glue**), and **better application of insulation materials** (e.g., **sprays**)
- Other chemicals also improve the performance (e.g., fire retardants for wood insulation) and life of the product
- In addition, some **insulation materials are entirely chemical based** (e.g. PU[1], PS[2], …)

Examples of players: Kingspan, SAINT-GOBAIN, BASF We create chemistry, covestro, INEOS, TRINSEO, prefere resins

- **Coatings are used to improve the durability of materials**
- Applying white coatings to roofs reduces the energy needs of buildings, thereby reducing overall energy demand
- **Adhesives used to bind materials together help make building materials lighter and emit fewer GHGs during their production than their steel counterparts (e.g. nails, screws, etc.)**

Example of players: Henkel, 3M, H.B. Fuller, ARKEMA, DOW

To support the transition, chemicals are essential ingredients in building materials, providing greater sustainability and better emission profiles

Note: PU: polyurethane, PS: polystyrene
Sources: Company websites, Advancy analysis

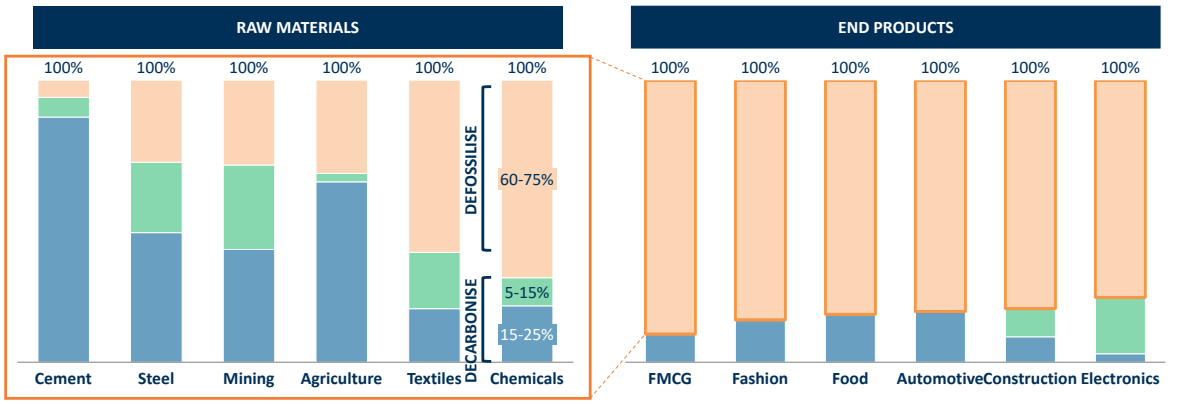
Zoom on chemical solutions to reduce construction emissions

Chemicals in building materials help reduce CO_2 emissions. They are indispensable in insulation materials. Chemicals glue rock wool and fiberglass insulation. Chemicals are the main component of other insulation materials (PS, PU). Many additives are used to improve the performance and lifetime of products: for example, surface coatings. Other additives help reduce cement emissions, which are the materials that contribute the most to emissions in the construction sector.

Chemistry is key to decarbonising manufactured goods and thus reducing European emissions. As Figure 2.20 shows, most emissions from finished products come from the materials they use, which are impacted both by the energy used and the process used to make these materials. In many cases, chemicals are key to decarbonising the production processes of these materials.

FIGURE 2.19
Chemicals essential to emission reduction

%, 2023, Global



The majority of end-product emissions comes from their feedstock, as chemicals are present in most downstream industries, reducing their emissions is essential to have a global impact

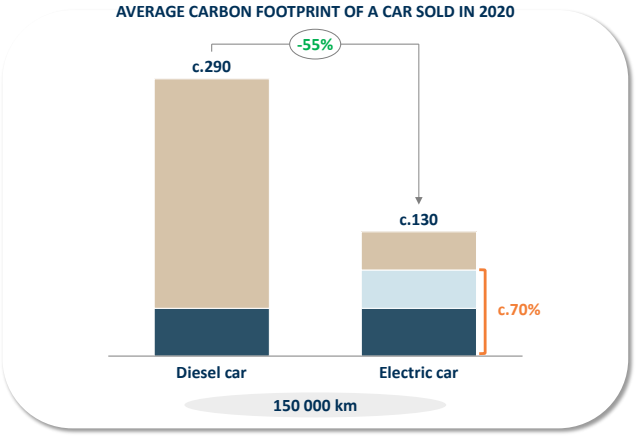
Scope 1: Direct Emissions - Operations | Scope 2: Indirect emissions - Energy | Scope 3: Other indirect emissions - Feedstock & Supply Chain

Note: Scope 3 upstream and downstream
Sources: CDP, Advancy

Figure 2.20 illustrates this further. To fully decarbonise electric cars, low-carbon and recycled materials are needed, which will rely on innovation in the chemical industry notably: for example, the development of lithium-ion battery recycling.

FIGURE 2.20
Carbon footprint reduction in automotive

%, gCO2e/km, EU



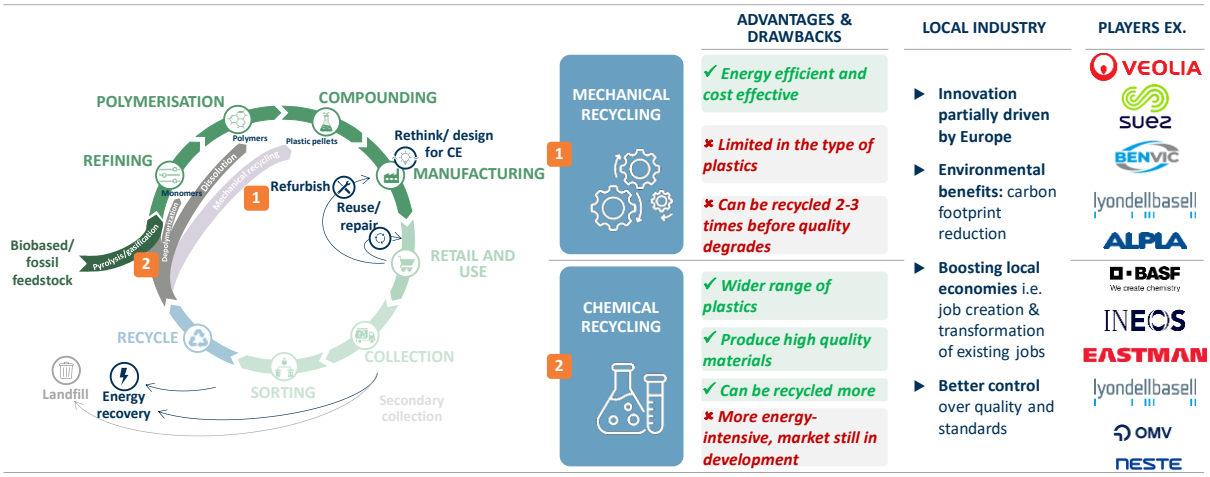
- The transition to electric vehicles will reduce emissions related to energy consumption, especially with the widespread adoption of low emission electricity
- The remaining emissions are primarily linked to materials (70-90% of remaining emissions)

Usage | Battery | Manufacturing and end of life

Sources: Carbon 4

The chemical industry is also at the forefront of addressing another environmental challenge: recycling. Recycling, both mechanical and chemical, is essential to reduce the impact of waste. Innovative solutions are currently being developed in Europe. For example, in the case of plastic waste, recycling is essential to achieve a circular economy in which materials are reused and transformed instead of ending up in landfills or incinerated. Innovative technologies and products are being developed in Europe to improve the amount of recycled plastics.

FIGURE 2.21
Chemical & mechanical recycling in plastics (1/2)

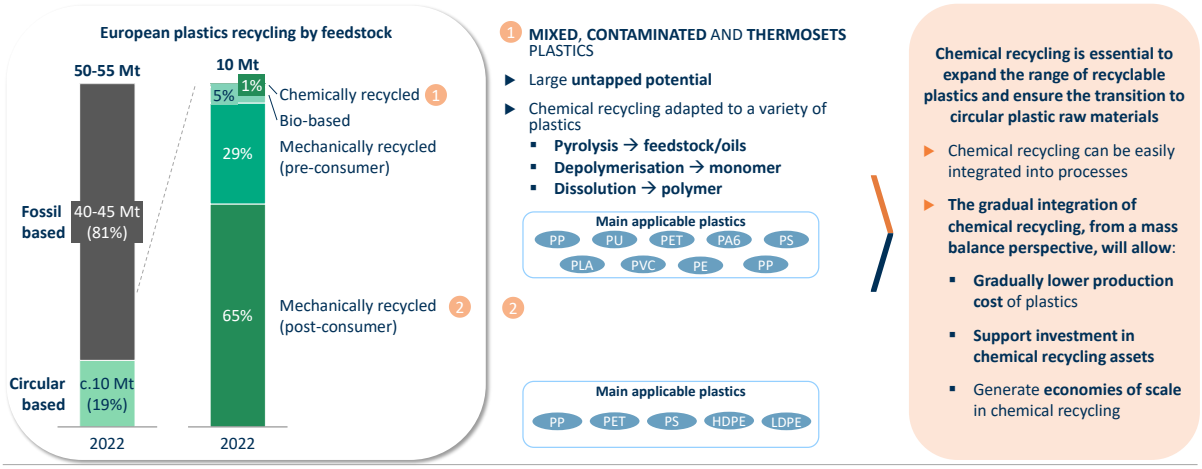


Sources: Plastics Europe, Advancy analysis

Mechanical recycling (which also uses chemicals to improve recyclability) is energy-efficient and cost-effective. It involves sorting, cleaning, and remelting plastic waste into new materials without altering the polymer structure. This method is widely used for common plastics such as PET. However, it is limited in terms of the types of plastics it can process, and the quality of the recycled plastic tends to degrade after several cycles. The easiest plastics to recycle mechanically are already being used today. However, increasing recycling volumes with additional sources is more costly due to the added expenses of collecting, sorting, and cleaning these additional plastic sources.

FIGURE 2.22
Chemical & mechanical recycling of plastics in 2022 (2/2)

Mt, 2022



Sources: Plastics Europe, Advancy analysis

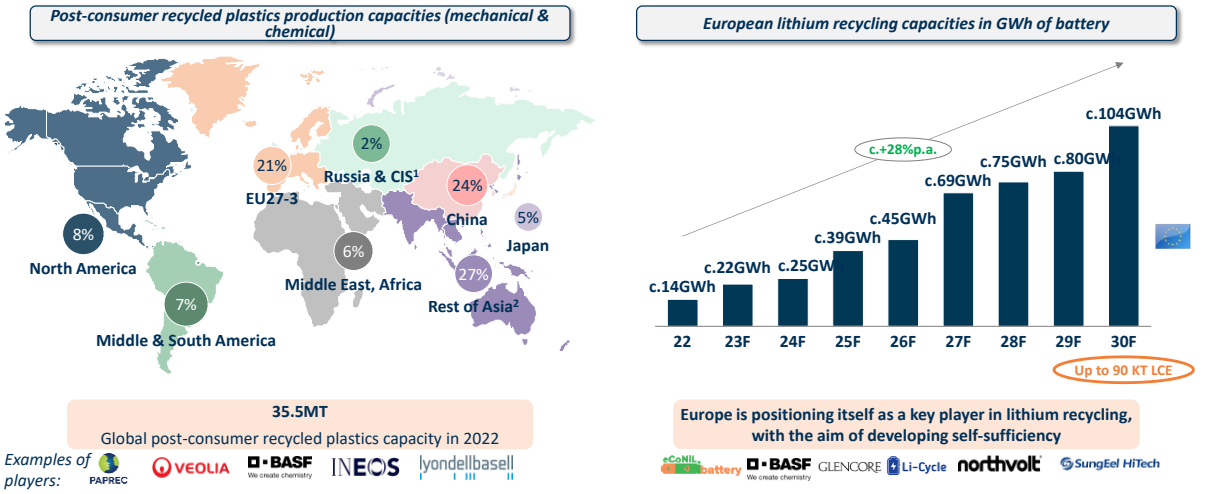
On the other hand, **chemical recycling** allows for the recycling of a wider range of plastics, including more complex plastics that cannot be recycled mechanically, and it produces high-quality materials that can be used in the manufacture of new products. However, producing these high-quality materials currently requires more energy compared to mechanical recycling. **The chemical recycling market is in early development compared to mechanical recycling; chemical recycling requires further technological advances to scale up. There is significant development potential in Europe.**

Europe is a global leader in recycling. With an ambitious regulatory environment (Circular Economy Action Plan and Packaging and Packaging Waste Regulation) strong circular production capabilities and investments in new recycling markets, Europe is positioning itself as a global leader in sustainability and resource efficiency. In 2022, Europe accounted for 21% of global post-consumer recycled plastics production capacity, alongside regions such as North America (8%) and China (21%).

Beyond plastics, Europe is also for example rapidly expanding its lithium recycling capacity, driven by the growing demand for electric vehicle (EV) batteries and energy storage systems. European lithium recycling capacity is expected to increase significantly from around 14 GWh in 2022 to 104 GWh by 2030, with an expected annual growth rate of +28%. This expansion aims to increase Europe strategic autonomy in critical materials for battery production.

FIGURE 2.23
Examples of EU share of global circular production capacities: recycling & lithium recycling

%, mt, 2022, World



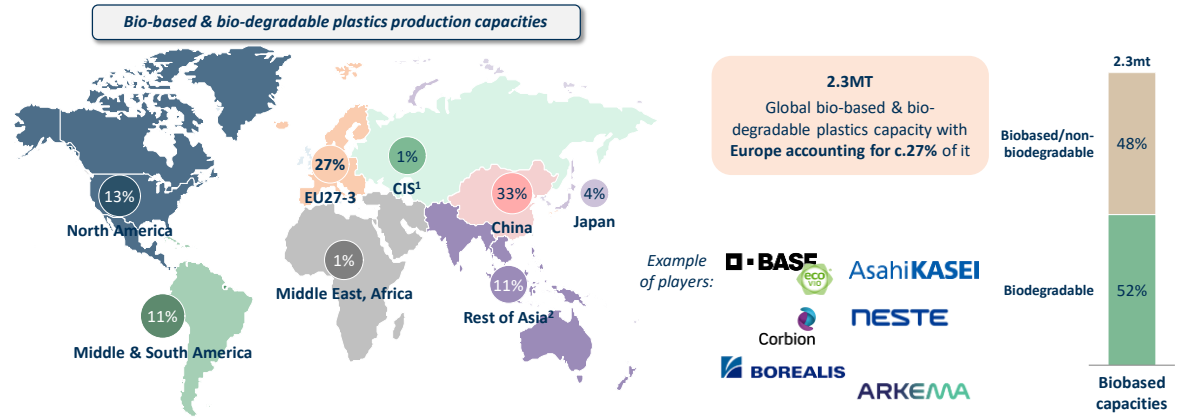
Notes: (1) Commonwealth of Independent States (Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Turkmenistan and Uzbekistan (2) incl. Oceania, Türkiye and Ukraine
Sources: Cefic, Plastics Europe, Battery Atlas 2022, Advancy analysis

In addition to its leadership in recycling, Europe is also a leader in bioeconomy development, e.g. in bio-based/biodegradable products, which are essential for reducing dependence on fossil-based materials and promoting a more sustainable future. In 2022, Europe accounted for 27% of the global capacity for bio-based and biodegradable plastics, positioning itself as a leader alongside regions such as China (33%) and North America (13%).

FIGURE 2.24

Bio-based & biodegradable plastics capacities by region

%, mT, 2022, World



Notes: (1) Commonwealth of Independent States (Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Moldova, Russia, Tajikistan, Turkmenistan and Uzbekistan (2) incl. Oceania, Türkiye and Ukraine
Sources: World Economic Forum, World bioeconomy forum, Bio-based industries consortium, European bioplastics, Cefic, Plastics Europe, Advancy analysis

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In conclusion, the European chemical industry plays an indispensable role in the region's economy, not only as a major contributor to industrial production, but also as a key driver of innovation and circularity across a wide range of sectors. With a diverse portfolio ranging from basic chemicals to highly specialised materials, the industry supports applications in a vast number of sectors. Its contribution to Europe's trade balance, employment and innovation ecosystem underlines its strategic importance.

ENDNOTES

Figure 2.1: Chemical sales in Europe by end market served – *Cefic, Eurostat, Oxford Economics, Advancy analysis*

Figure 2.2: Chemicals play a vital role in innovative products – *Advancy analysis*

Figure 2.3: Value chain and key categories of the chemical space – UNEP Global Chemicals Outlook, *Advancy analysis*

Figure 2.4: Zoom – Upstream to Polymers to Downstream interconnections: Coatings value chain – *Advancy analysis*

Figure 2.5: Zoom – Upstream to Polymers to Downstream interconnections: Chemical pharmaceutical value chain – *Advancy analysis*

Figure 2.6: EU27 top 10 manufacturing sectors ranked by added value – *Cefic, Eurostat, Advancy analysis*

Figure 2.7: EU27 manufacturing sector employees – *Cefic, Advancy analysis*

Figure 2.8: EU27 top countries by chemical sales – *Cefic, Advancy analysis*

Figure 2.9: European chemical sites – *Advancy analysis*

Figure 2.10: European chemical parks overview – *Cefic, National Chemicals Associations, Advancy analysis*

Figure 2.11: European manufacturing trade balance – *Cefic, Eurostat, Advancy analysis*

Figure 2.12: European chemicals trade balance by segment – *Cefic, Eurostat, Advancy analysis*

Figure 2.13: R&D spending in chemicals by region – *Cefic Advancy analysis*

Figure 2.14: Chemical patent overview by region – *EPO, USPTO, Cefic, National Science Board, Advancy analysis*

Figure 2.15: European Greenhouse gases (GHG) emissions and role of the chemical industry – *Eurostat, European Commission, Advancy analysis*

Figure 2.16: Chemicals role in reducing transport emissions – *Advancy analysis*

Figure 2.17: Chemicals role in reducing Agricultural GHG emissions – *Company websites, Advancy analysis*

Figure 2.18: Chemicals role in building materials in reducing end-use emissions – *Advancy* analysis

Figure 2.19: Chemicals essential to emission reduction – *CDP, Advancy analysis*

Figure 2.20: Carbon footprint reduction in automotive – *Carbon 4*

Figure 2.21: Chemical & mechanical recycling in plastics (1/2) – *Plastics Europe*, *Advancy analysis*

Figure 2.22: Chemical & mechanical recycling in plastics (2/2) – *Plastics Europe*, *Advancy analysis*

Figure 2.23: Examples of EU share of global circular production capacities: Mechanical & chemical recycling & lithium recycling – *Cefic, Plastics Europe, Battery Atlas 2022, Advancy analysis*

Figure 2.24: Bio-based & biodegradable plastics capacities by region – *Cefic, World Economic Forum, World bioeconomy forum, Bio-based industries consortium, European bioplastics, Plastics Europe, Advancy analysis*

3 Section 3 – 2023-2024, The European Chemical industry at a breaking point

The European chemical industry, which has long been a cornerstone of Europe's prosperity is at a breaking point, jeopardising its future on the continent.

On the demand side, recovery remains weak and uncertain. Growth in China is slowing overall, due to the challenges in the real estate market and, more structurally, the demographic trend. A growing demand in volumes has been observed in the United States in 2024 after a decline in 2023, yet the impact of the policies of the new Trump presidency are uncertain. In Europe, production remains weak, driven by domestic demand, increased imports and a decline in exports. **Demand for more sustainable products continues to grow, but the market is not always ready to pay the premium price for these products**.

On the supply side, **global capacities continue to expand outside of the EU, despite low utilisation rates and profitability, which is creating an uncertain environment for many players in Europe**. Current low utilisation and low profitability of operations are leading chemical companies to reconsider their footprint. There are **around 11 million tons of announced capacities to be closed in Europe in 2023-24**. **Once closed, a site will not reopen** due to the generally high capital costs required and, in some cases, local oppositions. **This number of site closures is well above the historical level observed in Europe in recent years (10 times more).**

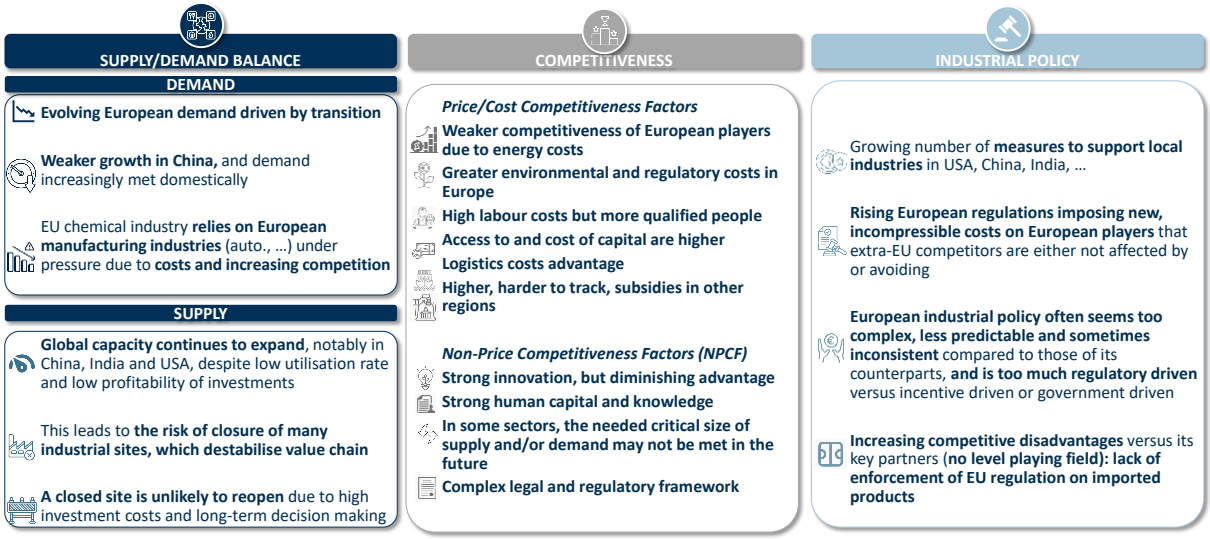
From a competition perspective, Europe's competitiveness has weakened in terms of price/cost competitiveness factors (PCF). Energy costs have renormalised significantly but are expected to remain higher in Europe compared to other regions: natural gas prices are projected to be 2-3 times higher than in the USA, electricity costs 1.5-2 times higher, and crude oil prices will have a gap compared to China and India due to discounted oil supply from Russia, estimated to be of 5-10%. **Europe is also impacted by increasing environmental and regulatory costs compared to other regions.** The challenges faced by chemical companies in Europe in obtaining permits are an illustration of this: according to recent surveys, it takes between 1 and 3 years longer than in other regions**. Labour costs are high even as they come with a more skilled workforce**. **The cost of capital and access to capital can be an issue when chemical players must invest heavily to achieve climate neutrality in a context of low profitability**.

In terms of non-price competitiveness factors (NPCF), Europe has competitive advantages in terms of innovation, human capital, and manufacturing ecosystem. However, companies **encounter numerous administrative hurdles and difficulties to scale up innovation, which creates uncertainty,** often resulting in delayed investments or decisions to invest outside of Europe. This trend has intensified in recent years and is likely to continue unless corrective actions are implemented in terms of policy framework.

From a regional policy perspective, a growing number of measures are aimed at supporting local industries in the United States, China, India, and other regions. Meanwhile, **companies in Europe face increasing European regulations that impose new, incompressible costs on European players, which non-European competitors do not face or can avoid. European legislation often appears complex, not harmonised between European countries, and less predictable when compared to that of its counterparts**. **European policy is mainly regulatory-driven, while other regions are more incentives-driven** or through state planning and state (in)direct interventions.

These negative competitiveness drivers occur in parallel. Together, they have a multiplying effect that creates an unprecedented situation for the European chemical industry.

FIGURE 3.1
Overview



Sources: Advancy analysis

3.1 Weak recovery in Europe and weakening growth globally

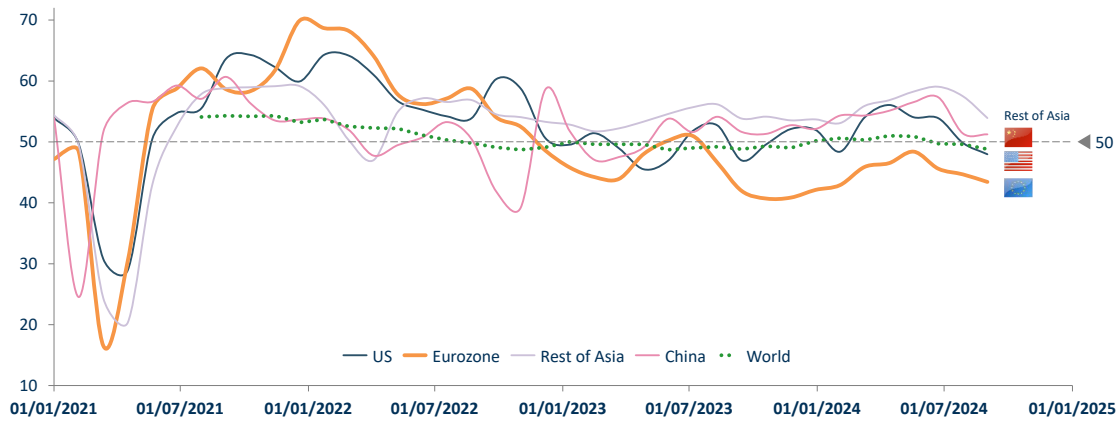
European and worldwide demand recovery in 2024 has been very moderate. Different economic trends are occurring:

1. European demand has been weak. This is driven by multiple factors including, the inflationary environment of the past years which is putting pressure on household spending, low construction levels impacted by high interest rates, and, more generally, weak demand in durable manufactured goods.
2. US chemical demand is still comparatively strong, though slowing down.
3. China's economy has been impacted by its real estate crisis and weak household consumption.
4. Other regions are also impacted by higher interest rates and continued, though weakening, inflation.

Compared to other regions' purchasing manager index (PMI), Europe's PMI remains considerably more negative and has been declining further since May.

FIGURE 3.2
Regional PMI

From Jan-2021- Aug-2024, Europe, USA, China, Rest of Asia, World



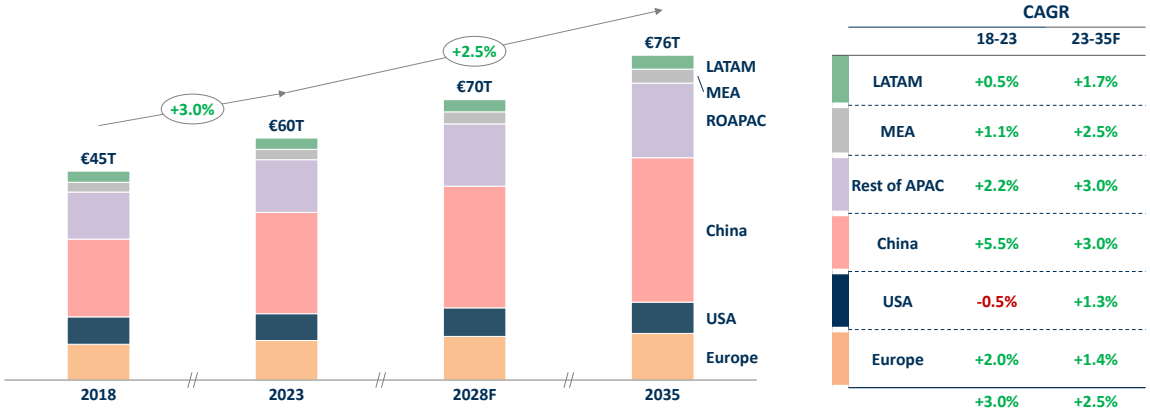
Sources: S&P Global, Advancy analysis

Based on Oxford Economics' manufacturing forecast, the global industrial growth rate is anticipated to slow down in the coming years. Industrial real gross output, excluding construction, is forecast to grow at an annual rate of 2.5% between 2023 and 2035. This slower growth trajectory, compared to historical performance, will impact all regions across the globe, and is partly driven by China, which holds a substantial share of global industrial output.

Growth in sustainable products is much higher, benefiting from regulation and consumer demand in various applications, resulting in many cases in double-digit growth, but starting from a small share of the market in volumes. The market is not always willing to pay a higher price for these products, which makes their growth more uncertain

FIGURE 3.3
Industrial production growth forecast by region (excl. construction)

2018-23-35F, excluding construction, real gross output, 2015 prices, rounded figures, Oxford Economics

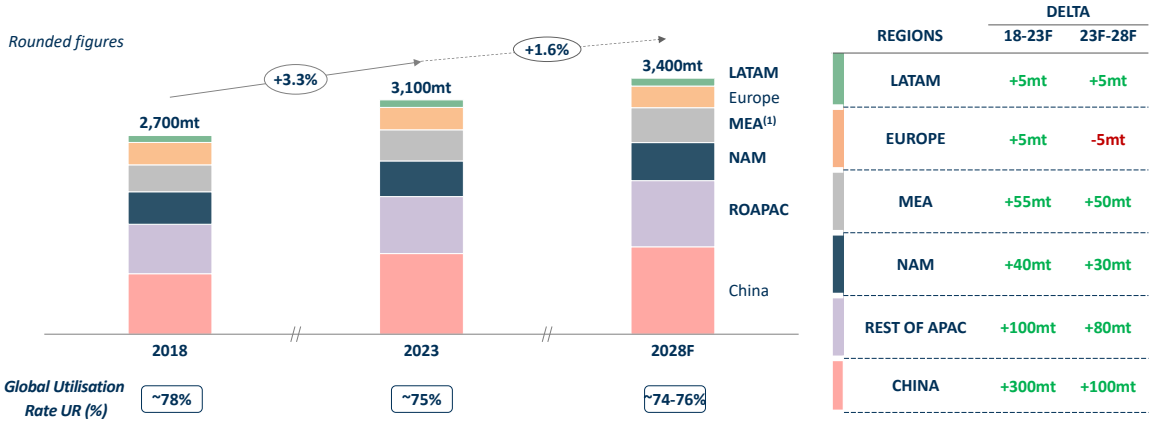


Sources: Oxford Economics

3.2 Low utilisation rate impacting supply

FIGURE 3.4
Chemicals capacity by region

2018-23-28, Capacity, million tons



Notes: Top 35 products (global product capacity >16Mt) excl. Ethanol; (1) The MEA capacity increase is significant due to the very large upstream capacities of basic organic and inorganic chemicals (sulfuric acid, ammonia, ethylene, etc.)
Sources: ICIS, IHS, Polyglobe, Advancy analysis

The growth trajectory of demand must be considered in relation to the evolution of supply. Further capacity expansions are expected in the coming years, with a growth in line with that of the underlying manufacturing industry, which will result in a continued low utilisation rate for the industry, unless specific projects are cancelled, or capacities are closed. Capacity utilisation rates for chemical sites allow to assess the volumes produced in relation to the sites' nominal capacities. Lower utilisation means lower profitability for the industry. This is particularly the case for upstream manufacturing and polymer and intermediate manufacturing sites.

Indeed, for them, fixed costs represent a significant share of costs, which means that lower production volumes translate into higher costs. The higher the fixed costs, the more difficult the situation is.

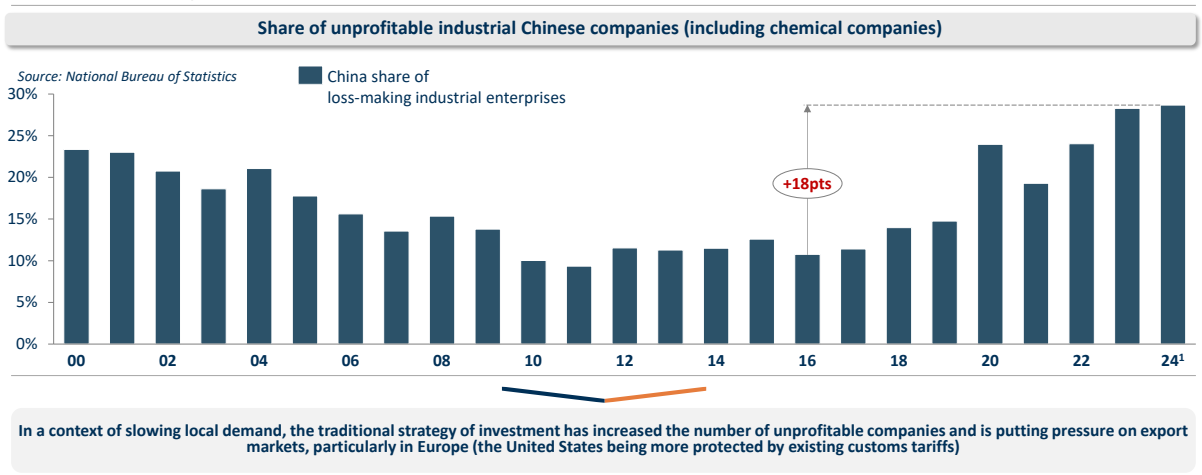
The worldwide chemical industry utilisation rate for the top chemical products has been decreasing in recent years and is already 3 points lower in 2023 versus 2018, reaching a level of approximately 75% utilisation rates in 2023. **Europe experienced a much stronger decline (minus 5 to 10 points) since 2022 (see figure 1.9).**

Capacity expansions are planned in the following regions: China, Rest of Asia-Pacific (ROAPAC, particularly India), Middle East and the USA. In contrast, capacities in Europe remain notably stable compared to other regions (see figure 3.4). **Given growing supply and slowdown of demand growth, the global utilisation rate is expected to remain at the low levels of 74-76% by 2028, unless more market restructuring occurs, or demand recovers more strongly than anticipated**.

The current low utilisation rate in the industry has increased the number of unprofitable industrial companies. For example, those levels reached an historical high at around 30% (including chemical companies) by July 2024 in China (Figure 3.5). Data for Europe and USA are not available.

FIGURE 3.5
Share of unprofitable industrial Chinese companies (including chemical companies)

%, China, 2000- July 2024



Sources: National Bureau of Statistics, Advancy analysis

The capacity build is the most important long-term parameter imposing several million tons of trade to find new markets. This is impacting Europe. Already more than 11 million tons of plant closures have been announced over the past 2 years of 2023 and 2024. These closures are not limited to one specific area of the chemical chain.

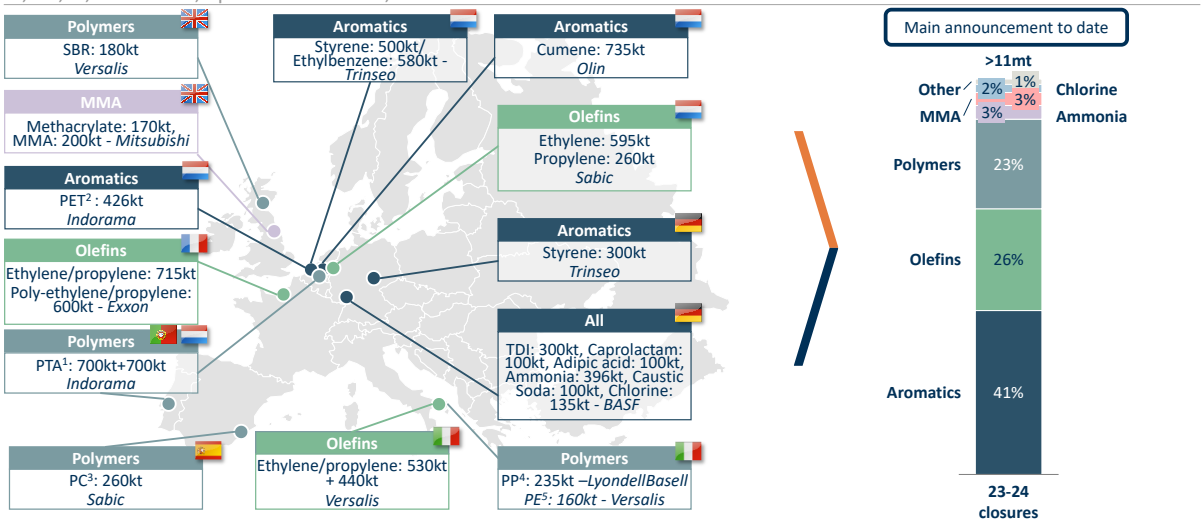
- **Organic aromatics** represent the largest share of capacity reductions (41% of the total) — including closures in cumene, styrene, ethylbenzene, and toluene di-isocyanates.
- The **olefins segment** also faces capacity reductions, accounting for 26% of the planned closures, including closures of ethylene/propylene naphtha cracker capacities.
- The **polymers segment**, representing 23% of the closures announced, is also seeing reductions.

It must be stressed that the closure of a naphtha cracker is a very difficult industrial decision to take, as the cracker is the link between refining and petrochemicals, with possible synergies upstream and downstream. The closure of almost 3 million tons of crackers in the EU and the closures of major players are a sign of urgency.

FIGURE 3.6

Main European capacity closure announcements

kt, mt, %, 2023-2024, up to October 2024, non-exhaustive list



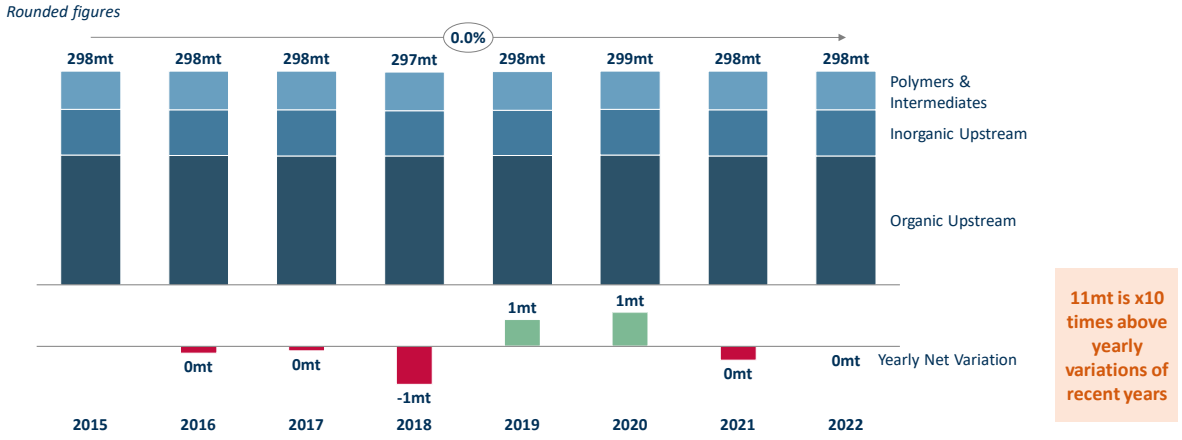
Sources: Companies website, S&P, Chemical Week, Advancy

Moreover, these 11 million tons of capacity closures are well above the annual variations that have occurred in recent years, by a factor of 10.

FIGURE 3.7

Capacity variation in Europe compared to current capacity closures

mt, 2015-22, Europe, top 35 chemicals in volumes



Sources: ICIS, IHS, Polyglobe, Advancy analysis

3.3 The competitiveness of European chemistry under pressure

In an environment of weakened demand and low utilisation rates, Europe's competitiveness is under pressure driven by a range of price and non-price competitiveness factors. The following factors have been assessed for the chemical industry, comparing Europe's chemical industry positioning to other regions both quantitatively and qualitatively.

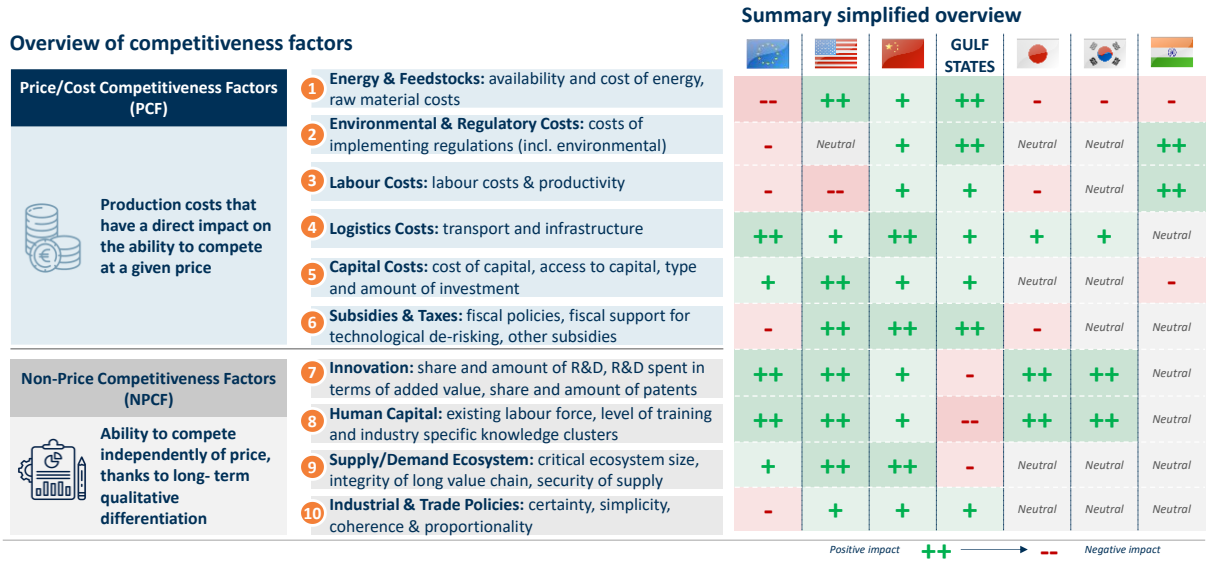
Price competitiveness factors (PCF):

1. **Energy**: availability and cost of energy (electricity, gas, oil) and raw materials,
2. **Environmental and regulatory costs**: costs of implementing environmental and other regulations and cost of carbon emissions,
3. **Labour costs**: labour costs and productivity,
4. **Logistics costs**: transport and infrastructure,
5. **Capital costs**: cost of capital, access to capital, type and amount of investment,
6. **Subsidies & tax policies**: tax policy, fiscal support for technological de-risking, other subsidies.

Non-Price Competitiveness Factors (NPCF)

7. **Innovation**: share of R&D, R&D spent in terms of added value, % & amount of chemical patents,
8. **Human capital**: existing labour force, level of training, and industry specific knowledge clusters,
9. **Supply/demand ecosystem**: critical ecosystem size, integrity of long value chain, security of supply,
10. **Policy framework (Industrial & Trade policies)**: certainty, simplicity, coherence and proportionality of the industrial and trade policies.

FIGURE 3.8
Overview of competitiveness factors by region



Sources: Advancy analysis

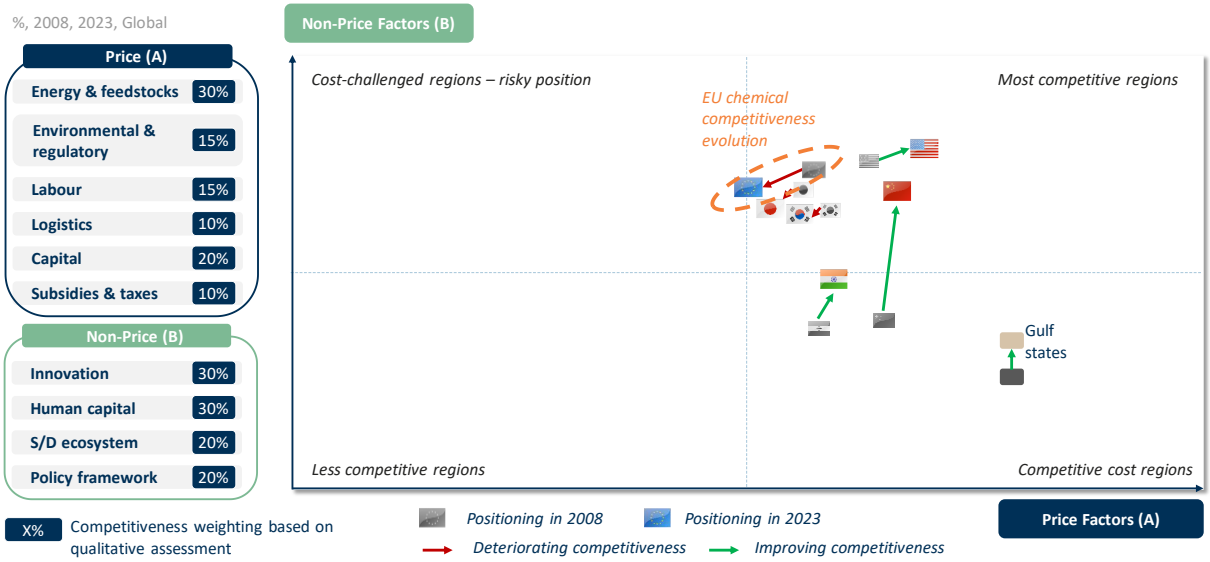
Figures 3.8 and 3.9 summarise the current positioning of the European chemical industry relative to other regions for the competitiveness factors mentioned above.

- First, **differences in energy costs have the strongest impact as a singular factor**, with a clear cost gap compared to other regions.
- Second**, the European industry faces increasing regulation and environmental costs that hamper its competitiveness,** both in the export market and in the local European market.
- Third, **the current industrial policies can create complexity and in some cases uncertainties.**

This has led to a decline in Europe's competitiveness, mainly in price competitiveness and, to a lesser extent, in non-price terms, placing the European chemical industry in a less advantageous positioning compared to its peers. During this period, the US chemical industry improved its price competitiveness, mainly in terms of the energy factor. China, India, and the Gulf States, to a lesser extent, improved their non-price competitiveness.

FIGURE 3.9

Overview of competitiveness evolution for the main producing regions

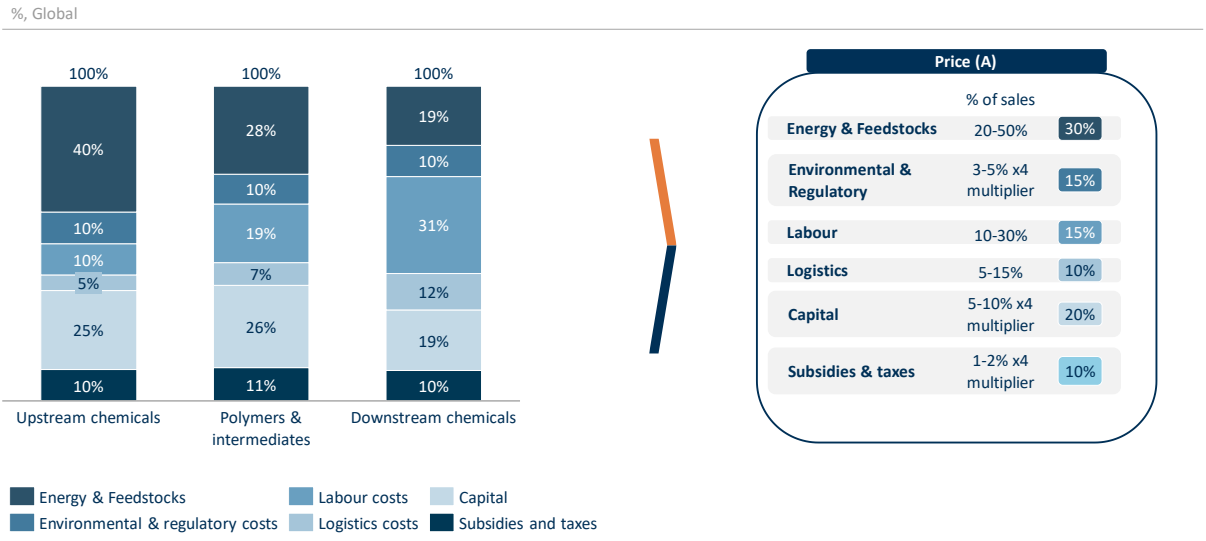


Sources: Advancy analysis

Each factor is evaluated based on several parameters detailed in the following pages and in the summary table in Figure 3.12. Summary Figure 3.9 is based on qualitative weights assigned to each factor that reflect three aspects: 1) the importance of each cost factor in the cost structure of chemical producers, 2) the complexity and long-term costs resulting from certain factors ('multiplier adjustment'), 3) the relative influence of each factor in overall competitiveness based on interviews with experts.

FIGURE 3.10

Weight calculation



Sources: Advancy analysis

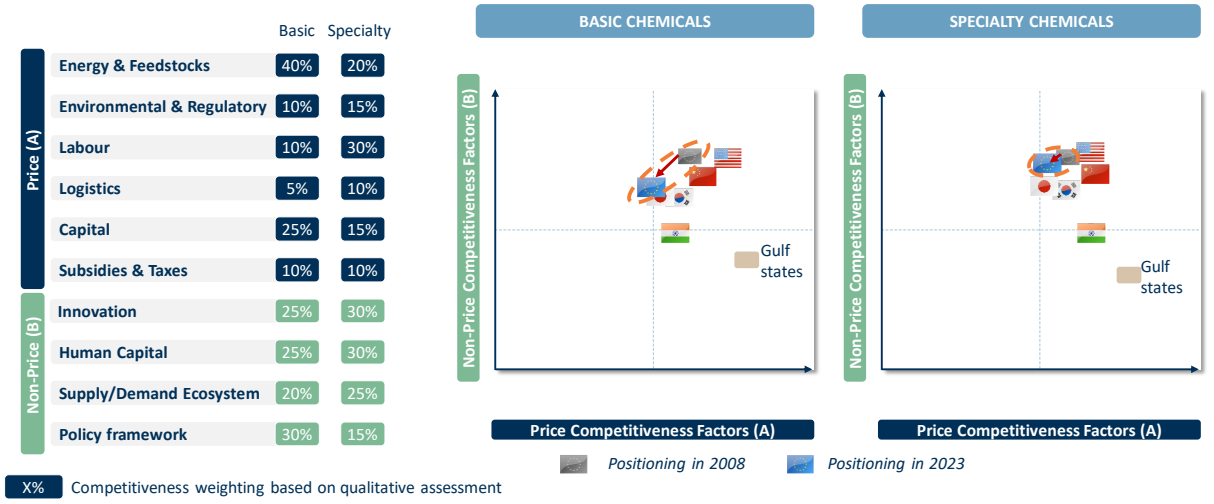
As seen in Figure 3.10, these weights differ between upstream and downstream chemicals: upstream chemicals are basic chemicals, more capital and energy intensive, while downstream chemicals costs are driven by more labour-intensive specialty chemicals.

The positioning of the European chemicals sector remains stronger in specialty chemicals, more influenced by non-price competitiveness factors. It is mainly affected by higher environmental and regulatory costs, more difficult access to capital for developing projects, and a deteriorating policy framework (more regulation, not enough incentives). The positioning in basic chemicals is influenced by deteriorating energy costs especially. Basic chemicals influence the competitiveness of specialty chemicals, particularly through raw material costs and security of supply.

FIGURE 3.11

Basic versus specialty chemicals competitiveness overview

%, 2008, 2023, Global



Sources: Advancy analysis

FIGURE 3.12

Summary score & figures

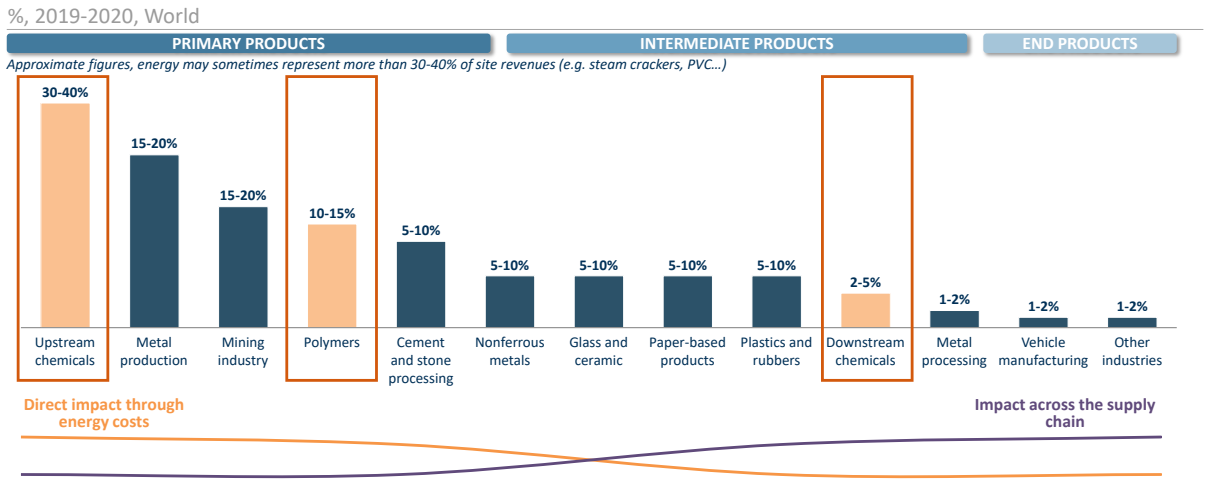
Factor	Sub-factor	EU	US	China	Gulf States	Japan	Korea	India
Energy & Feedstocks	**Score**	--	++	+	++	-	-	-
	Gaz *(€/MWh, 2030)*	30	12	30-35	5	15	15	15
	Electricity *(€/MWh, 2030)*	90	70	60	25	75	77	95
	Naphtha *(€/t, 2030)*	620	620	600	610	620	620	600
	Ethane *(€/t, 2030)*	240	140	n.a.	80	n.a.	n.a.	n.a.
Environmental & regulatory	**Score**	-	*Neutral*	+	++	*Neutral*	*Neutral*	++
	CCA[1] (% added value, 2023)	10-12%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
	ETS price based on coverage *(€/t, 2023)*	80-90	30 Limited coverage	8 Limited coverage	n.a.	n.a.	8 Limited coverage	n.a.
Labour	**Score**	-	--	+	+	-	*Neutral*	++
	Salary *(k€/FTE, 2023)*	70	110	30	25	70	70	15
	Productivity *(Real sales/#FTEs, 2023)*	MID	MID-HIGH	LOW-MID	n.a.	MID-HIGH	HIGH	LOW
Logistics	**Score**	++	+	++	+	+	+	*Neutral*
Capital	**Score**	+	++	+	+	*Neutral*	*Neutral*	-
	Capital spending in chemicals *(€bn, 2023)*	32	24	125	n.a.	7	8	5
	Cost of capital *(%)*	10%	7%	10%	n.a.	9%	10%	10%
Subsidies & taxes	**Score**	-	++	++	++	-	*Neutral*	*Neutral*
	Subsidies & tax support *(% of GDP, 2019)*	0.5%	0.4-1.4%	1.7%	n.a.	0.5%	0.7%	n.a.
Innovation	**Score**	++	++	+	-	++	++	*Neutral*
	R&D spending *(% of sales, 2023)*	1.6%	2.1%	0.8%	n.a.	4.3%	2.3%	1.6%
	R&D spending *(% of added value, 2023)*	6%	5%	3%	n.a.	16%	9%	6%
	PCT[2] ***application per added value*** *(#apps/€bn AV*[3]*, 2022)*	1.4%	1.8%	4.8%	10.0%	0.7%	1.0%	1.8%
Human Capital	**Score**	++	++	+	--	++	++	*Neutral*
	Direct employees *(million FTEs)*	1.2	0.6	6.5	n.a.	n.a.	0.2	1.0
	Share of science graduates *(%, 2022)*	8%	7%	n.a.	n.a.	n.a.	5%	16%
Supply & Demand Ecosystem	**Score**	+	++	++	-	*Neutral*	*Neutral*	*Neutral*
	Total chemicals market size *(€bn)*	655 Increasing criticality of supply	585	2 238	441 Mostly upstream	146	135	134
Policy framework	**Score**	-	+	+	+	*Neutral*	*Neutral*	*Neutral*
	Regul. burden *(# policy UNPRI, 2023)*	466	16	33	15	14	n.a.	n.a.

Methodology: Each region's score is based on qualitative and quantitative elements. The figures in the table above enable the assessment of regional disparities and have been complemented by interviews and expert evaluations from Advancy.
Sources: see detail below by item

Energy:

The chemical sector is an energy-intensive sector, and this is particularly the case for upstream chemicals. Access to a reliable and competitive energy source is essential to maintain competitiveness. Upstream basic organic and inorganic chemicals, such as ethylene, propylene, ammonia, chlorine, and alkalis, are based on energy-intensive processes. Polymers are less influenced by energy, but energy costs remain a significant share of direct and indirect costs. Downstream chemicals are more labour-intensive and have therefore been comparatively less affected by the growing energy cost gap in Europe.

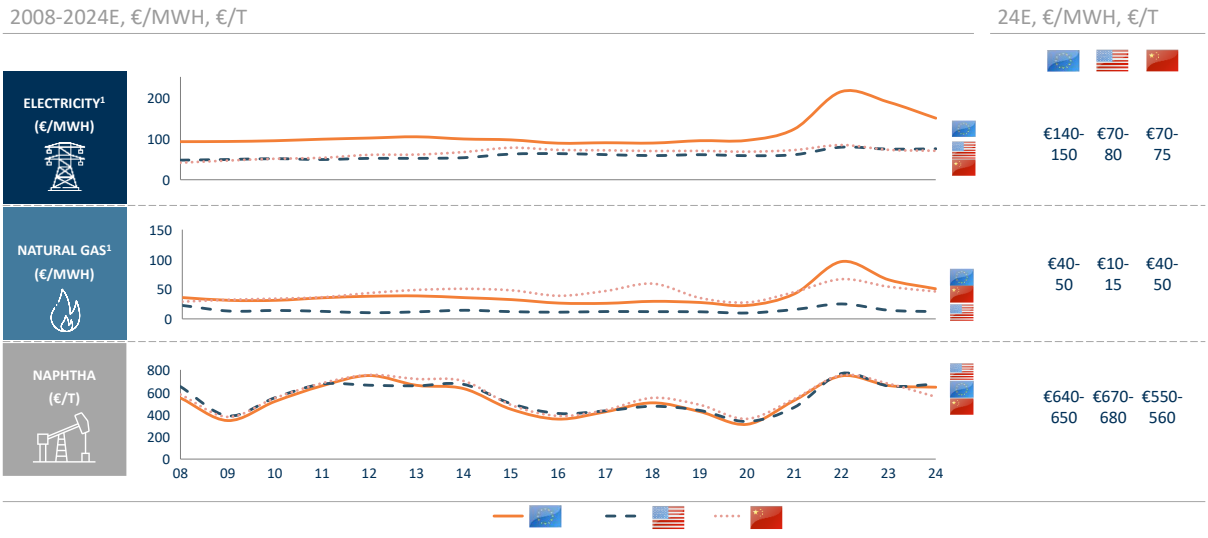
FIGURE 3.13
Energy intensity of main industries (% of revenues)



Sources: Advancy

After a period of relative stability in gas prices from 2008 to 2021, the gas crisis with Gazprom in and the war in Ukraine in 2022 led to a sharp rise in energy prices, with Europe hit harder than other regions. This was due to reduced supply from Russia and the comparatively higher costs of imported natural gas from other regions, particularly in the form of liquefied natural gas (LNG). The limited LNG infrastructure led to a tight market with higher prices in Europe for LNG for two main reasons: (1) Competition with East Asia, where high demand from countries like Japan and South Korea drove global LNG prices up, and (2) a risk premium linked to supply uncertainties, especially following Russia's invasion of Ukraine, which increased fears of supply disruptions.

FIGURE 3.14
Energy prices by region



Note: (1) European electricity and gas data are Eurostat prices paid by final customer including taxes and levies (data codes

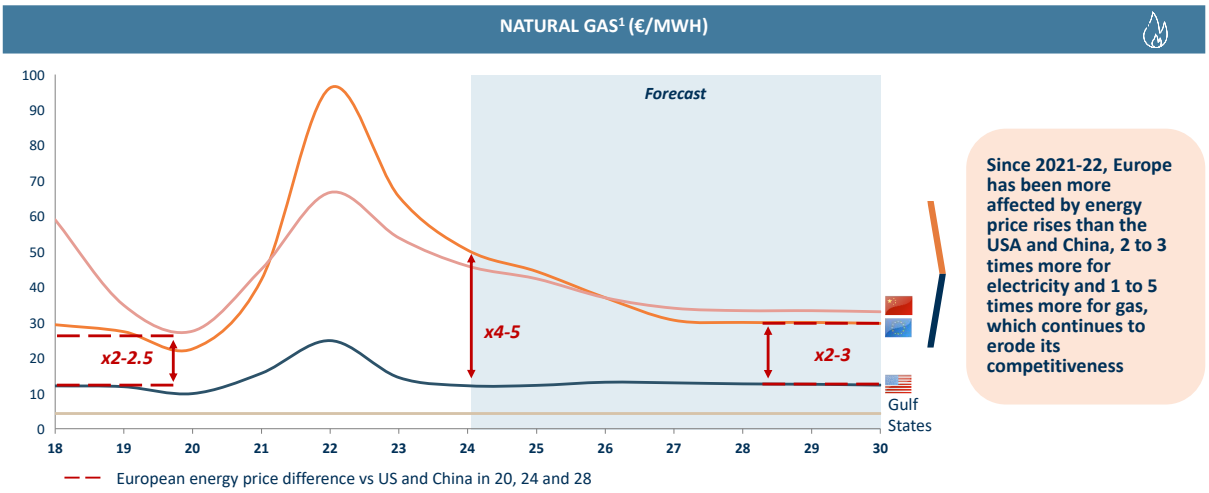
nrg_205 and nrg_pc_205) for non-household consumers with >20,000 MWh annual consumption for electricity and >100 000GJ annual consumption for gas, American electricity and gas data are based on EIA prices paid by the final consumer, including taxes for the industrial sector, Chinese gas data are based on IEA data for industry and the JKM index
Sources: Eurostat, US Energy Information Agency, International Energy Agency, Advancy analysis

Since then, natural gas prices have re-normalised, but the gap to the US is higher than historically: now prices are 4-5 times higher than in the USA (2024) compared to 2-2.5 times in the period 2010-2020. The gap is forecast to remain 2-3 higher, given current European energy framework and policy.

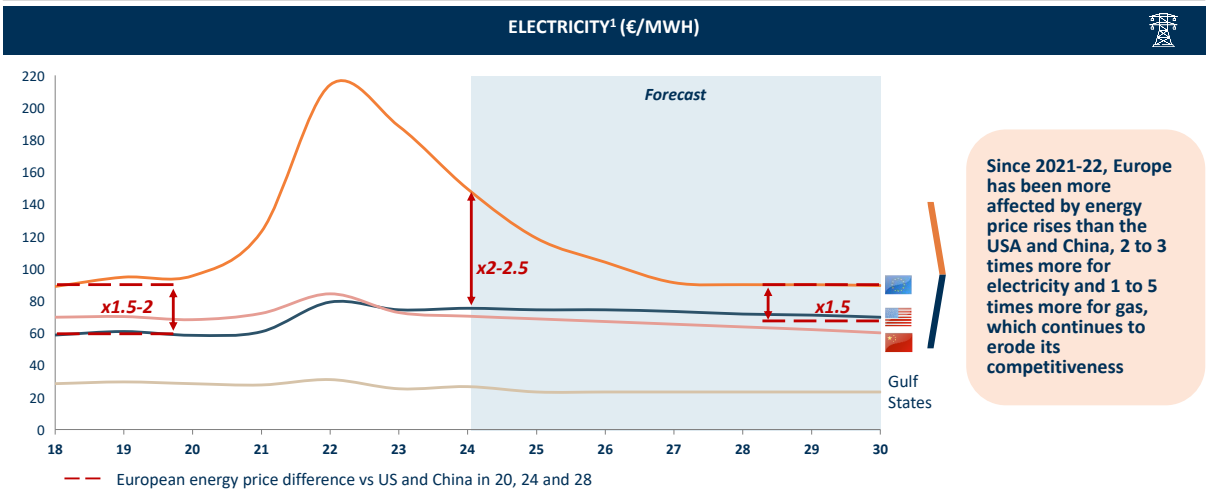
FIGURE 3.15

Energy prices by region (2018-2024 focus): electricity & natural gas

2018-2024E-2030, €/MWH, €/T



2018-2024E-2030, €/MWH, €/T



Note: (1) European electricity and gas data are Eurostat prices paid by final customer including taxes and levies (data codes nrg_205 and nrg_pc_205) for non-household consumers with >20,000 MWh annual consumption for electricity and >100 000GJ annual consumption for gas, American electricity and gas data are based on EIA prices paid by the final consumer, including taxes for the industrial sector, Chinese gas data are based on IEA data for industry and the JKM index
Sources: Eurostat, US Energy Information Agency, International Energy Agency, Advancy analysis

This is due to three factors:

1. LNG supply will remain structurally more expensive than natural gas transported by pipeline: due to the operating and investment costs related to the liquefaction and deliquefying and the transportation costs.
2. In most cases, European companies were so far not able to conclude long-term purchase agreements, which means that European players buy spot and have faced more volatility recently. Draghi's report

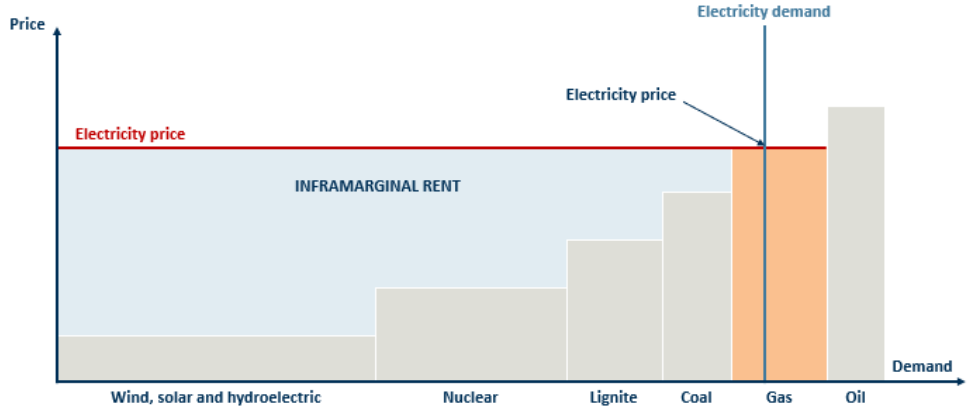
estimates a cost premium linked to spot indexation around half of production and transport costs in December 2023. "*This premium accrues mostly to large energy companies and commodity traders who manage the transport of gas from the US to Europe*" (Draghi Report box 7, page 27).

3. Oversupply of gas in the US is dampening US gas prices.

The increase in the cost of natural gas has partly impacted the cost of electricity in Europe. This is due to the electricity pricing system in Europe (*see figure 3.16*). The spot electricity pricing system in Europe ranks electricity generation sources according to their marginal costs, from the cheapest (such as renewables excluding hydroelectric which are priced against gas generators) to the most expensive (such as oil power plants). The price is determined by the last (most expensive) power plant needed to meet demand. The cheapest producers receive the market price set by the most expensive plants, earning an "inframarginal rent," which is the additional profit they make since their production costs are below the market price. In volatile market conditions, this fair market mechanism creates even more volatility and significantly higher prices. This is because currently and in the near future, the price is set by natural gas power plants which are the marginal price setters in the market. The future prices are based on the evolution of the average spot price and a risk premium.

FIGURE 3.16

Simplified view of the merit order supply demand (illustrative)

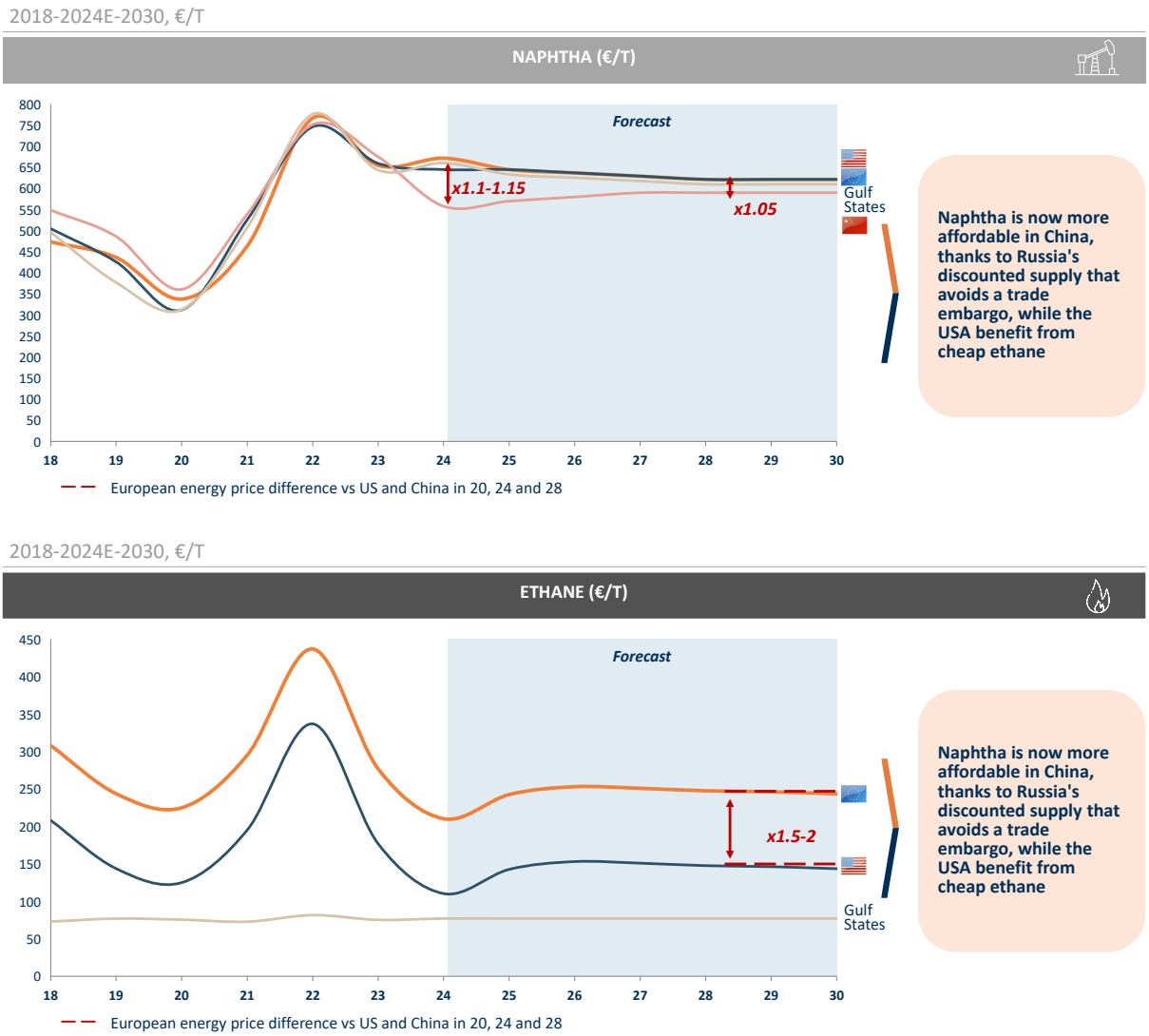


Sources: Advancy analysis

Today, the cost of electricity is 2-3 times higher than other regions and will only further renormalise to a gap of 1.5-2 times higher, given current energy policy. Europe has strengths in this regard: strong solar exposure in southern Europe like in Spain, positive hydropower in the Nordic countries, positive onshore and offshore wind. This could lead to a competitive edge in energy cost in the coming years. However, this will require increased investment (in the new generation capacity for low carbon energy from renewable and nuclear electricity grid network and storage) as well as improved market mechanisms that reward long-term investments, rather than relying on volatile spot markets burdened by excessive layers of intermediation, as is currently the case.

FIGURE 3.17

Energy prices by region (2018-2024 focus): naphtha and ethane



Sources: Eurostat, US Energy Information Agency, International Energy Agency, Advancy analysis

Regarding oil-related energy costs, crude oil is traded globally at price levels historically comparable to those in other regions. European crackers buy naphtha. By cracking naphtha, crackers produce various organic derivatives: propylene, ethylene, and other aromatics. Historically, **Europe's naphtha cracker costs have not differed from those of other regions** (except for integrated oil producers). However, producers in China and India have been able to purchase discounted Russian oil, avoiding sanctions against Russia, **providing them an advantage over Western countries that comply with oil sanctions**. Additionally, Europe is facing important competition from ethane crackers from the USA benefiting from competitive shale gas (competitive ethane crackers).

Other feedstocks which impact the competitiveness of the European chemical industry include bioethanol, sugar and starch. Raw material prices for these naturally derived products are in some cases much higher in Europe than in other regions: 2 times higher than compared to the US, Brazil and Canada. Other regions may in some cases benefit from a duty-free policy on these raw materials, for example China. This translates into more competitive costs in some production chains for some bio-based chemicals: biopolymers, vitamins, and amino-acids for example.

Environmental & regulation costs:

The chemical sector is key to the green transition. Decarbonisation efforts in the chemical industry can help Europe achieve its ambitious environmental targets, not only by enabling emissions reductions for the chemical sector but also by supporting emission reduction across various other industries (*see section 2.5*).

Europe is at the forefront of environmental regulation. Protection of the environment often comes with stringent and multiple regulations, leaving companies operating in Europe faced with greater complexity and increased costs of production and general business expenses. These higher environmental and regulatory costs are difficult to track, but industry feedback and existing quantitative information indicate a growing gap compared to other regions. This disadvantage makes it more difficult to produce in Europe, creating a handicap for local production and negatively impacting exports from the European chemical industry, while giving an advantage to imports.

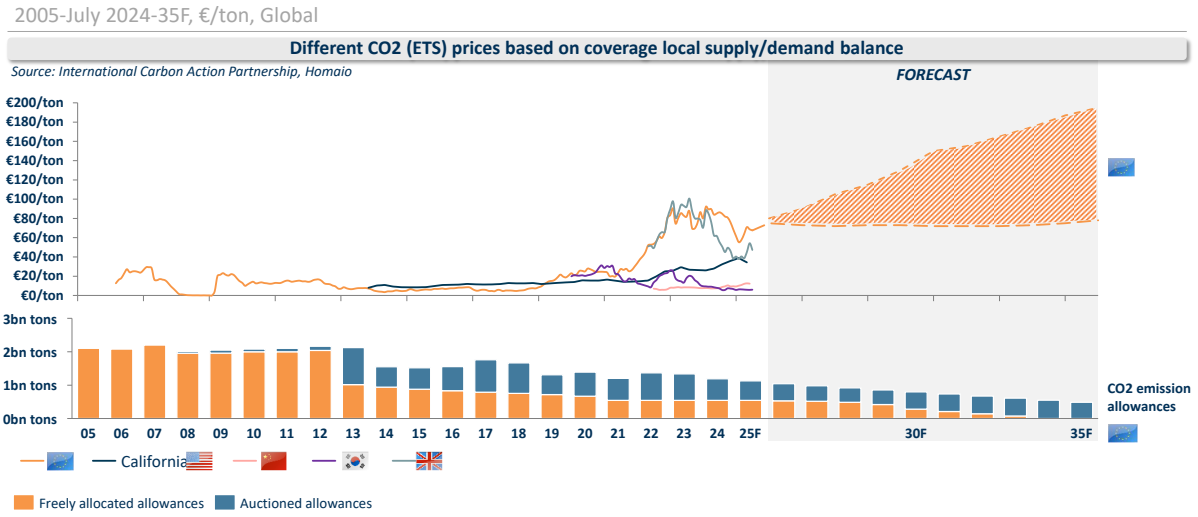
One of the existing costs that will have a significant impact on the industry in the coming years is the cost of carbon emissions and the reducing amount of free allocations. Among the various measures aimed at reducing GHG emissions, the EU Emissions Trading System (ETS) will have a strong impact on chemical producers based in Europe.

The EU Emissions Trading System (ETS), launched in 2005 as the first major carbon market, has since become the most mature and comprehensive carbon market in the world. In contrast, the USA operates only regional programmes, with the California ETS launched in 2012. China launched its national ETS in 2021, following regional pilots that began in 2013. Additionally, Japan introduced its ETS in 2023, encouraging decarbonisation efforts through tax incentives for R&D and capital investments under its GX programme.

The scope of the EU ETS is significantly broader than that of other regions. It covers over 10,000 installations in the energy and manufacturing sectors plus emissions from aircraft operators and maritime transport: these categories alone account for 40% of total EU GHG emissions. By comparison, the USA system only covers just over 400 installations, regulating emissions from the electricity, industry, transport, and buildings sectors. China's ETS oversees over 2,000 companies, in the electricity sector, which account for around 40% of the country's CO_2 emissions.

In recent years, ETS prices have seen significant increases and have shown volatility, creating uncertainties for long-term investments in decarbonisation. The carbon price set by the European emissions allowance system is expected to continue rising, further widening the gap between other regions. This will increase the already substantial environmental costs for producers operating in Europe.

FIGURE 3.18
ETS prices - evolution by region



Sources: European Commission, International Carbon Action Partnership, Advancy analysis

However, with the deployment of the necessary enabling conditions, carbon pricing can trigger emission mitigation options and investment decisions of companies and sectors in the emissions trading scope.

Today, and even more so tomorrow, the carbon emissions costs of the ETS are impacting chemical companies' margins, unless they can pass the price on to their customers.

It should also be noted that products imported from other regions have higher CO_2 emissions per ton of products due to: 1) the energy used as an input (coal-based energy is especially much more emitting) and 2) the emission abatements in place at the chemical production level. This results in imported products with 2 to 4 times more CO_2 per MWh of energy used than in the EU. Figure 3.19 shows the gap between Europe and other regions considering only the impact of electricity emissions (i.e. impact 1.).

FIGURE 3.19
Electricity emissions by region

Factor	Sub-factor				Gulf States			
Emission by region	**Gap versus Europe**		**1.3**	**2.1**	**2.3**	**1.8**	**1.6**	**2.6**
	Electricity emission by region (tCO2 eq/MWh**)**	277	369	582	623	485	431	713

Note: European emissions calculated based on the weight of the main countries in terms of sales of chemical products (Germany, France, Italy, Spain, Netherlands)
Sources: Energy Institute - Statistical Review of World Energy Advancy analysis

This is due to emissions from electricity production processes:

- Coal-fired plants emit around 1 tCO_2 equivalent/MWh.
- Gas turbine plants emit around 0.5 tCO_2 equivalent/MWh.
- Nuclear plants emit around 0.01 tCO_2/MWh.
- Wind energy emits 0.01 tCO_2/MWh.
- Solar energy emits 0.04 tCO_2/MWh.

Different energy mixes lead to different electricity emissions in different regions.

The costs of complying with European regulations have been increasing for 20 years and even more in recent years due to additional regulations and stricter constraints impacting the chemical industry. These increased costs are driven both by stricter regulations at the European level, as well as discrepancies that may exist between the various countries of the European Union when they implement those regulations (disharmonised implementation).

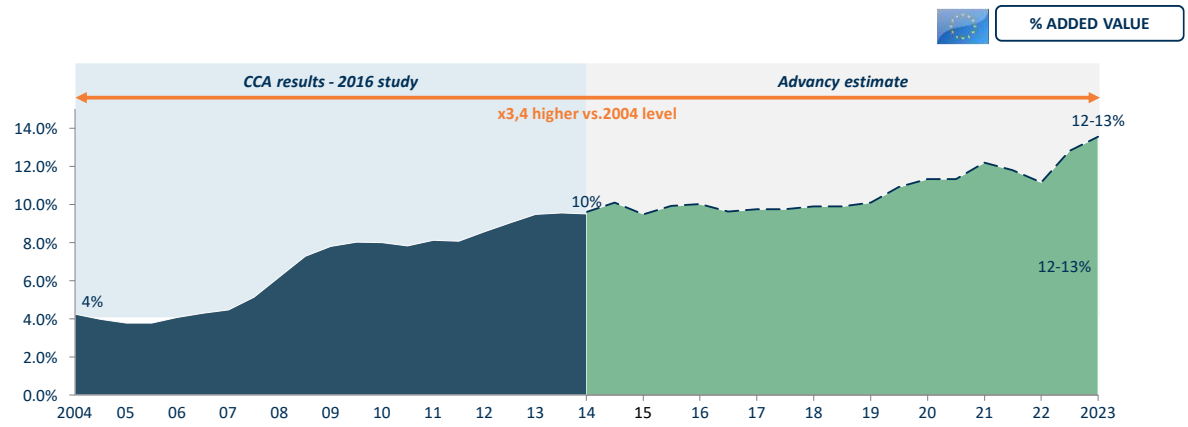
Chemical companies often refer to the complex and heavy regulatory burden as a factor negatively impacting their competitiveness. In the past fifteen years, the industry has come under increased competitive pressure. At the same time, much regulation has been adopted. Regulatory updates have been frequent and numerous, often not allowing legislation to be fully implemented before another change is made. This has inflated the feeling of unpredictability among potential investors.

A cumulative cost assessment conducted for the Commission in 2016, thus before the EU Green Deal, showed that Europe's complex regulatory framework poses a significant burden on EU chemical companies, amounting to around 10 billion euro per year between 2004 and 2014. The three main drivers of regulatory costs are the regulations on industrial emissions (generating 33% of the cost), chemicals, (30%) and worker safety (24%).

FIGURE 3.20

Regulatory costs evolution in Europe

% of added value, 04-23, EU27



Sources: Cefic, UNPRI, Advancy analysis

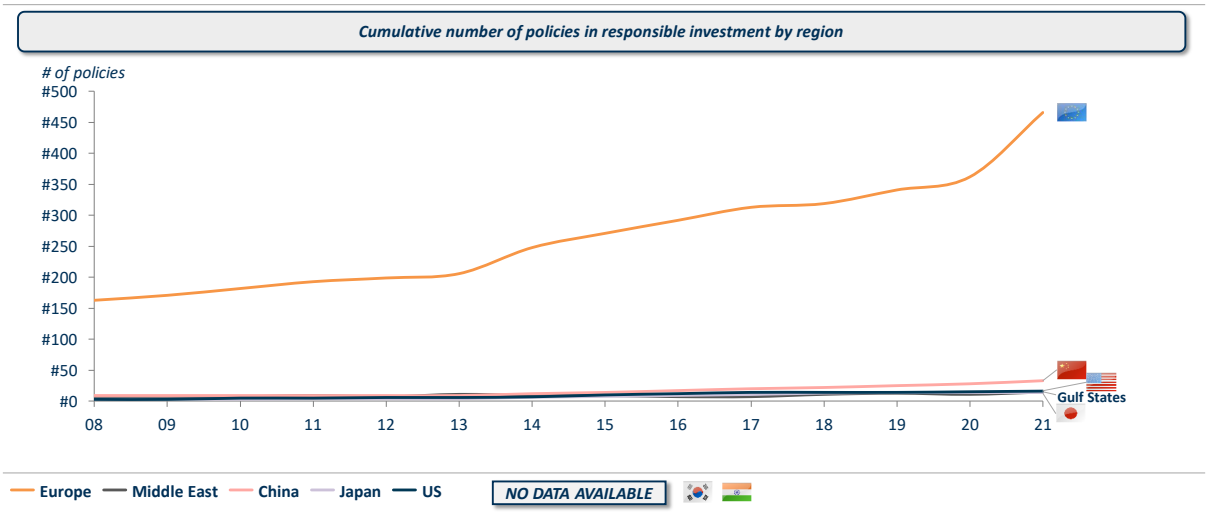
Since then, costs have continued to rise and are now estimated to be around 12-13% of total added value (up to 2 times greater than R&D expenditure in % of added value), driven by a sharp acceleration in the development and implementation of regulation. The evolution of costs is estimated by comparing the evolution of the number of policies related to responsible investment in the EU27 with the evolution of total EU27 added value in recent years. It was also discussed with several chemical companies that confirmed the continuous increase in costs, though they have difficulty in quantifying them. These constraints can be even more difficult to manage for SMEs that do not have sufficient resources to deal with these complexities and must outsource these services at higher costs.

These regulatory constraints have a significant impact on the operating expenses and capital expenditures of European chemical companies, **limiting their flexibility particularly in times of crisis.**

FIGURE 3.21

Evolution of environmental regulations in Europe compared to other regions

Cumulative # of policy interventions, 2008-2021

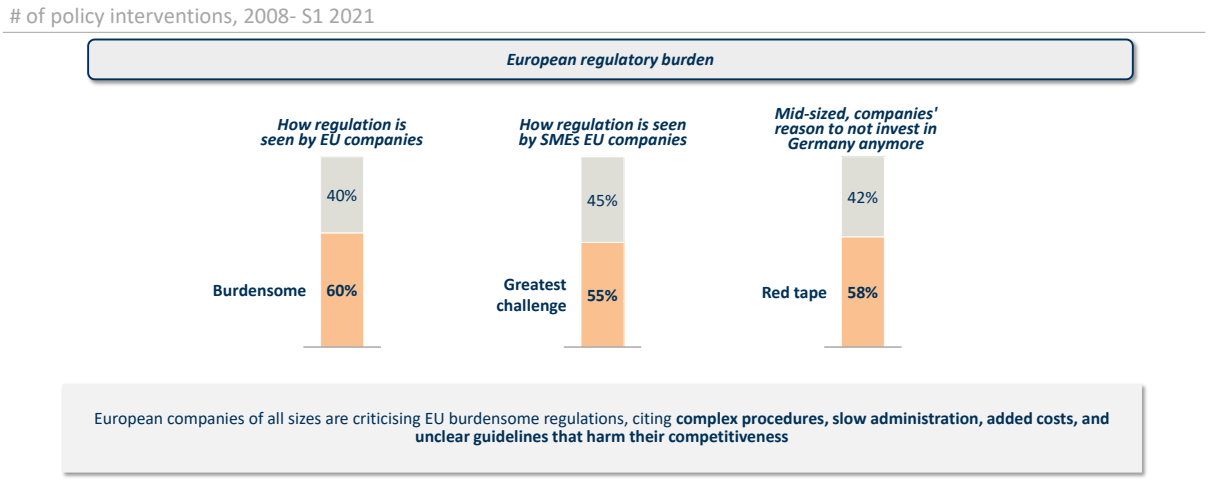


Sources: Cefic, , Advancy analysis

Overall, sustainability reporting and due diligence legislation are associated with a disproportionate burden. While the objective is justified, these burdens, which are not encountered in other regions, are costly. These

challenges highlight the need for clear and consistent regulatory frameworks to support the industry's transition to more sustainable practices while maintaining competitiveness, security of supply and local production in Europe.

FIGURE 3.22
European legal and regulatory burden



Sources: UNPRI, Der Spiegel, European Policy Centre, Draghi report, Advancy analysis

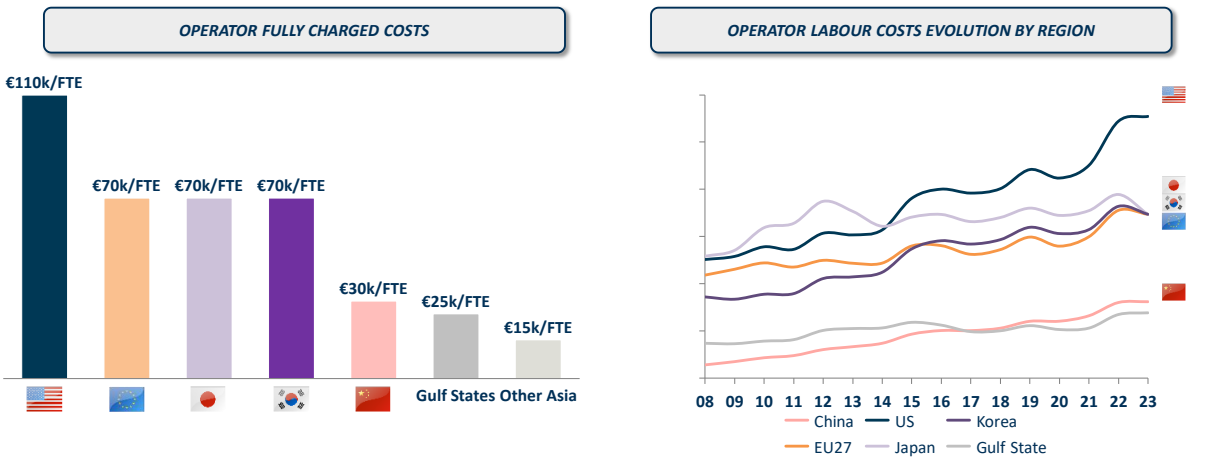
The increasing regulatory burden is one of the main problems in Europe and is very often mentioned by chemical companies. In a survey conducted in Germany, **60% of European companies consider regulation as burdensome, citing the complexity of procedures, additional costs and unclear guidelines which have a negative impact on their competitiveness**. For small and medium-sized enterprises (SMEs), 55% identify regulation as the main obstacle to growth and competitiveness in the European market. Finally, in Germany, 58% of the medium-sized companies (Mittelstand) cite bureaucracy as the main reason for not investing in the country.

Labour costs:

FIGURE 3.23

Chemical labour costs by region

2024, 2008-2023, €k/FTE



Note: (1) Population weighted average / Methodology: operator costs based on standard chemical industry costs in 2024. Cost evolution based on manufacturing labour cost evolution from World Bank. Sources: World Bank, Eurostat, Advancy

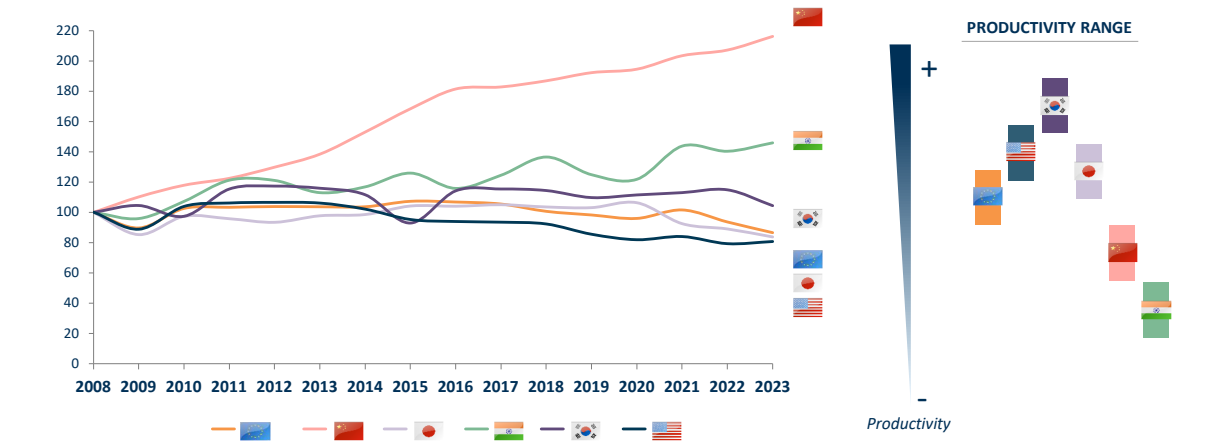
The European chemical industry faces higher labour costs than China, India, and the Middle East: twice as expensive as China or the Middle East, and five times more expensive than the rest of Asia. **Costs in Europe are lower than in the United States**: 1.6 times cheaper.

The European chemical industry has experienced a decline in productivity, which has weakened its competitiveness against major competitors such as China and emerging competitors such as India. China has significantly improved its productivity over this period, while other regions, such as Europe, have seen stable or slightly declining productivity. In absolute terms, the measure is dependent on the assessment of the chemical sector workforce, which requires further analysis not performed in this study. Nevertheless, preliminary results show that the USA, Korea, and Japan have higher productivity than Europe, while China has significantly reduced its gap with Europe.

FIGURE 3.24

Chemical labour productivity

Productivity= Real sales/#FTEs, base=100, 2008-2023



Methodology: productivity was estimated based on actual sales divided by the number of direct employees per region; however, the number of direct employees is not measured the same way in all regions; therefore, the comparison of productivity is not conclusive at this stage and requires further analysis of the employee accounting methods of each region.

Sources: Cefic, VCI, Advancy analysis

Logistics costs:

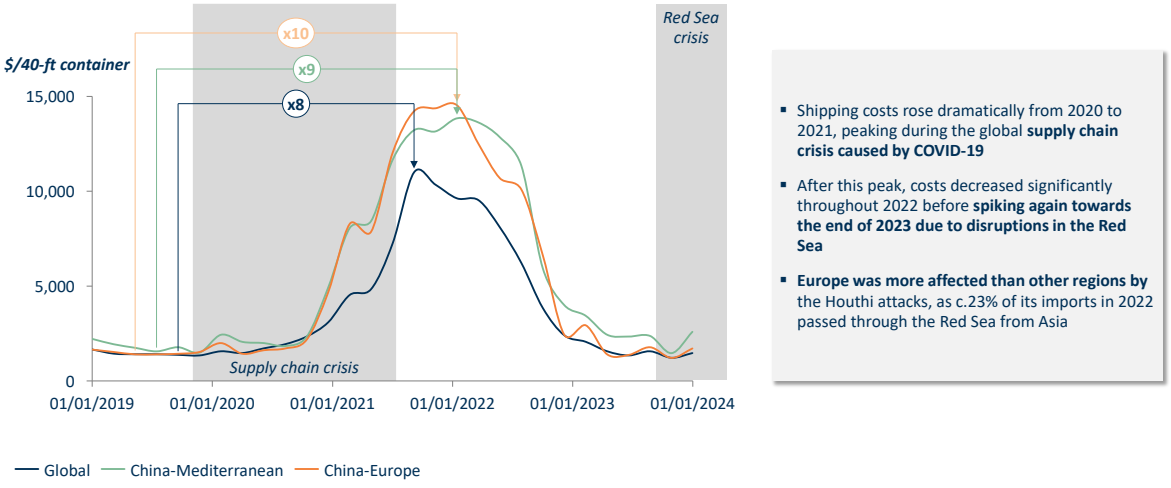
European chemical companies still benefit from a comparatively well-functioning infrastructure in Europe, providing a competitive advantage versus other regions (US, India, Middle East). Europe invests more in its infrastructure than the USA thanks to its multiple programmes: multi-annual financial framework (1.2 trillion euros), the NextGenerationEU (806.9 billion euros) recovery fund and REPowerEU (an additional 25 billion euros to NGEU) (*source 3.25*). This strength of Europe is also stressed in the World Economic Forum reports. **Nevertheless, these infrastructures do not operate as a single market**: different rules and equipment are required for rail transport in each European country, and the same applies to truck transportation (higher volumes can be transported also in the USA). **Moreover, European investments hide disparities between countries.**

In recent years, the chemical industry, like many trade-dependent industries, has been impacted by variations in transportation costs. Between 2021 and 2022, Europe, and other parts of the world, experienced a substantial increase in transport costs.

Disruptions to the global supply chain caused by the COVID-19 pandemic led to a tenfold increase in European maritime transport prices. This sharp increase contributed to the inflationary environment in Europe. After a significant decline in costs throughout 2022, a smaller increase occurred in late 2023, driven by disruptions in the Red Sea, where around 23% of European imports transit. In 2023, Panama shipments also faced some difficulties. Transport is gradually returning to historic levels, although the Suez situation continues to affect transit times and insurance premiums. **The disruptions of recent years highlight the weaknesses of the global chemical value chains.**

FIGURE 3.26
Evolution of container shipping costs on different major global shipping routes

$/40-ft container, 2019-2023



- Shipping costs rose dramatically from 2020 to 2021, peaking during the global **supply chain crisis caused by COVID-19**
- After this peak, costs decreased significantly throughout 2022 before **spiking again towards the end of 2023 due to disruptions in the Red Sea**
- **Europe was more affected than other regions by** the Houthi attacks, as c.23% of its imports in 2022 passed through the Red Sea from Asia

Sources: European Commission, Advancy analysis

Capital:

In terms of investment, Europe remains well positioned in its cost of capital and access to capital globally. However, access to capital and the cost of capital are an issue compared to the United States, according to recent interviews with chemical companies. This is especially the case in the scale-up stage of new products/technologies.

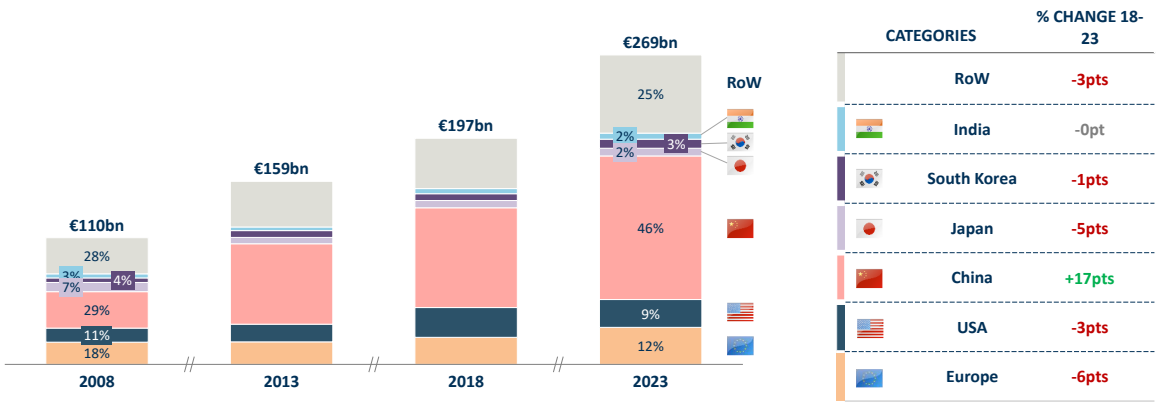
Draghi's report highlights these aspects by taking the example of clean technologies: "*For example, regarding hydrogen and fuel cells, the EU represented 65% of global early-stage VC and 43% of late-stage VC from 2015 to 2019. However, this share declined to 10% and 26% globally, respectively, from 2020 to 2022*" (page 130, Draghi Report). A study by the Real Instituto Elcano (*source 3.27*), considering more broadly the factors of competitiveness between Europe and the United States, estimated that American investment in venture capital as a percentage of GDP was 0.7% in 2021 compared to 0.1-0.2% for most European countries.

Nevertheless, and looking at aggregated capital expenditure, based on Cefic data, the European chemical industry has been investing at a level similar to the United States. Investments in Europe are mainly aimed at compliance and not at new capacities or the modernisation of assets, which leads to assets in the EU that are less competitive in terms of productivity over time.

Other regions have outpaced them. Since 2008, the European Union's global share of investment expenditure has been steadily declining, reaching only 12% of the global share in 2023 (18% in 2008). In contrast, China has seen a sharp increase in its capital investment, with its global share rising from 29% in 2008 to 46% in 2023. Inflation costs (energy, raw materials, building, transport, workforce, …) after the pandemic and the energy crisis have impacted capital spending in Europe and the USA, and to a much lower extent other regions.

FIGURE 3.28
Evolution of capital spending in chemicals by region

2008-2023, €bn, nominal, capital spending



Sources: Cefic, Advancy analysis

Subsidies & taxes:

Subsidies and favourable tax policies further enhance the competitiveness of businesses. These financial incentives help reduce operational costs, foster innovation, and attract investment. Different regions use different strategies to support their industries, combining tax breaks, government subsidies and borrowing at below-market rates. As chemical companies invest in decarbonisation, these policies are particularly important. They also support nascent industries in specific regions such as the Middle East or India and play a broader role in China to support the industrial policy.

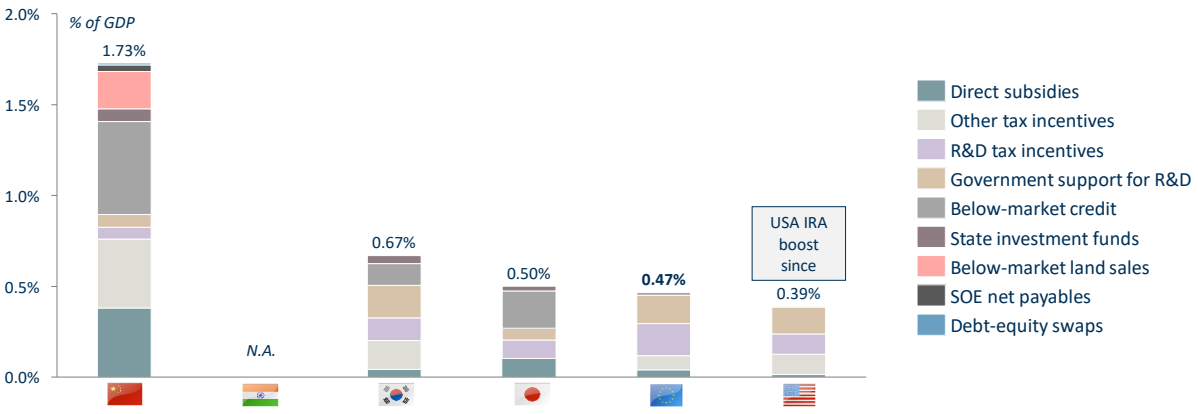
A 2019 study (see figure 3.29) places Europe behind in subsidies and tax policies. According to interviews, chemical companies confirm that aid is easier and sometimes more substantial in other regions, particularly in terms of below-market credits and direct public funding, while support for R&D is strong in Europe.

Below are examples of subsidies and tax benefits impacting chemical companies:

1. **China** has adopted **lenient tax policy** to support the industrial, and therefore chemical, sector (e.g. Since 2008, the **High and New Technology Enterprises** (HNTE) status offers companies a 15% corporate tax reduction and the ability to carry forward losses for up to 10 years). **The Made-In-China 2025 policy provides additional support** to specific companies operating in targeted areas deemed strategic for China's future growth.
2. **India** has implemented various initiatives such as the **Production Linked Incentive** (PLI) **scheme**, which provides financial incentives to encourage manufacturing in key sectors, aiming to boost exports and reduce imports. India's initiatives often focus on specific areas (i.e. API).
3. **The USA** introduced **the Inflation Reduction Act** (IRA), which focuses on supporting domestic manufacturing, especially for green technologies, offering tax credits, grants, and subsidies to stimulate local investments and reduce reliance on imports. **In addition, the United States has implemented in recent years the Buy American Act for public procurement and the "Made in USA" labelling rule directing support to companies operating in the USA**.
4. **The Middle East**, particularly Saudi Arabia and the UAE, is diversifying its economy through plans like Vision 2030 and Operation 300bn. These strategies include reduced corporate taxes, subsidized energy, and government-backed financing to stimulate industrial growth.
5. **Japan** supports its industrial sectors through tax incentives for R&D, capital investment, and digital transformation. The Green Transformation (GX) Program promotes decarbonisation & energy efficiency.
6. In **Europe**, while there is a diverse set of both European support programmes (Recovery and Resilience Facility, Innovation Fund, Horizon, etc.) and National funding schemes (Grants and Loans under the Recovery Plans, IPCEIs/State Aid). The overall framework for subsidies and tax incentives, such as exemptions, credits, deferrals, reliefs, or allowances, is more limited, fragmented, and complex.

FIGURE 3.29
Subsidies and tax benefits by region

% of GDP, 2019



Sources: Red Ink Estimating Chinese Industrial Policy Spending in Comparative Perspective, DiPippo et al., 2022, Advancy

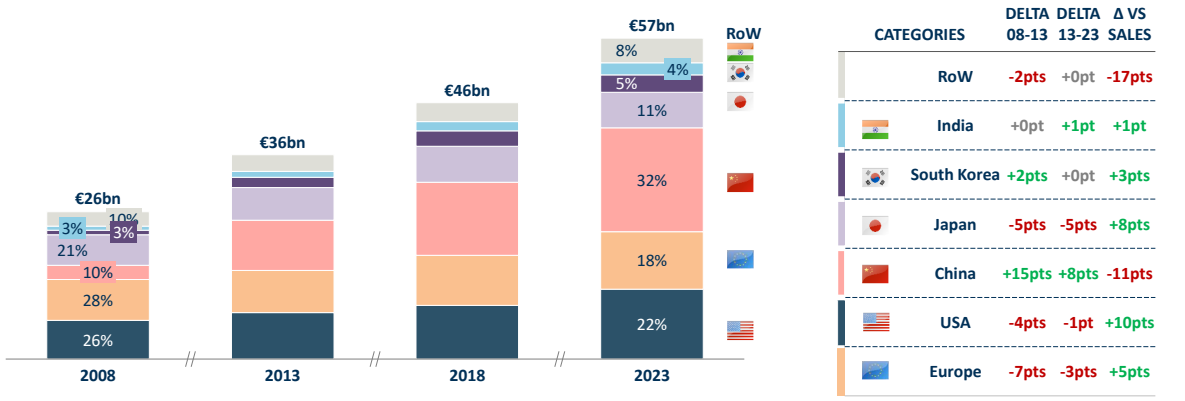
Innovation:

Research and Development (R&D) spending is a critical driver of long-term competitiveness. Over the last 15 years, the EU's share of global R&D spending in chemicals has lost ground (-8pts since 2008). This corresponds to about 18% of total R&D spending in 2023 in the chemical sector. The share of the United States also declined during this period, although to a lesser extent. China was the region that saw the largest increase in R&D.

Figure 3.30

Evolution of R&D spending in chemicals by region

2008-23, €bn, %, Global, R&D



Note: (1) Delta between % R&D spending vs. % Sales / Sources: Cefic, Advancy analysis

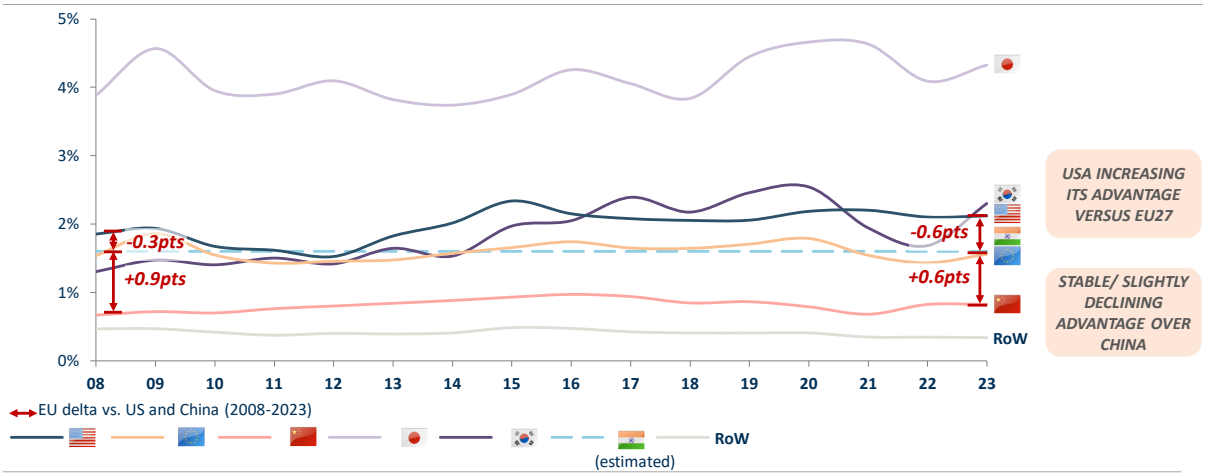
In terms of the share of R&D expenditure in sales between 2008 and 2023, the gap between Europe and the USA has widened, with the chemicals R&D expenditure in the USA increasing versus Europe and now exceeding it by more than 0.6 points. **Meanwhile, R&D expenditure in China has increased**. European R&D expenditure is now more than 0.6 points above expenditure in China compared to 0.9 points 15 years ago. Japan stands out in terms of R&D spending with a much higher level compared to other regions in terms of share of chemical sales.

The stable R&D/sales ratio in Europe creates a growing competitiveness gap, as innovation spending begets value added over time.

Figure 3.31

Evolution of share of R&D spending in total chemicals sales by region

2008-2023, €bn, %, Global, R&D as a % of sales

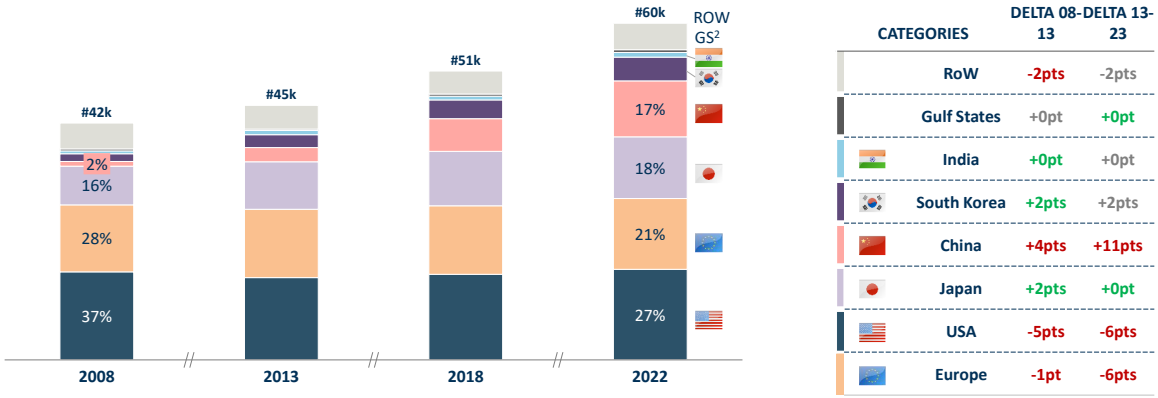


Note: (1) Delta between % R&D spending vs. % Sales
Sources: Cefic, Advancy analysis

Europe and the United States remain leaders in chemical patents, but their relative leadership has eroded over the last decade.

FIGURE 3.32
PCT[1] applications overview: Applications by region

# of applications, %, Global, 2008-2022

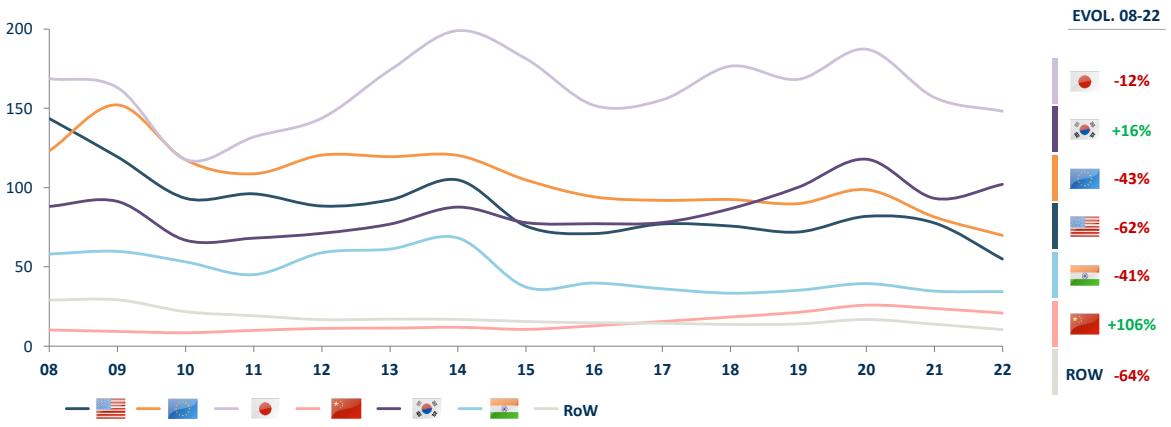


Note: PCT: Patent Cooperation Treaty
Sources: National Science Board, Advancy

In recent years, China has become a major player in chemical patent applications under the Patent Cooperation Treaty (PCT), accounting for 17% of the global total of chemical patent applications in 2022. This is a significant increase from 2008, when China's share was only 2%. In contrast, Europe's share of PCT chemical patent applications has fallen from 28% in 2008 to 21% in 2022, a decrease of 7 percentage points, while the United States has seen a similar decline, from 37% to 27% over the same period.

FIGURE 3.33
PCT[1] applications overview: number of applications per added value

patents/€bn of added value, Global, 2008-2022



Note: PCT: Patent Cooperation Treaty / Sources: National Science Board, Advancy

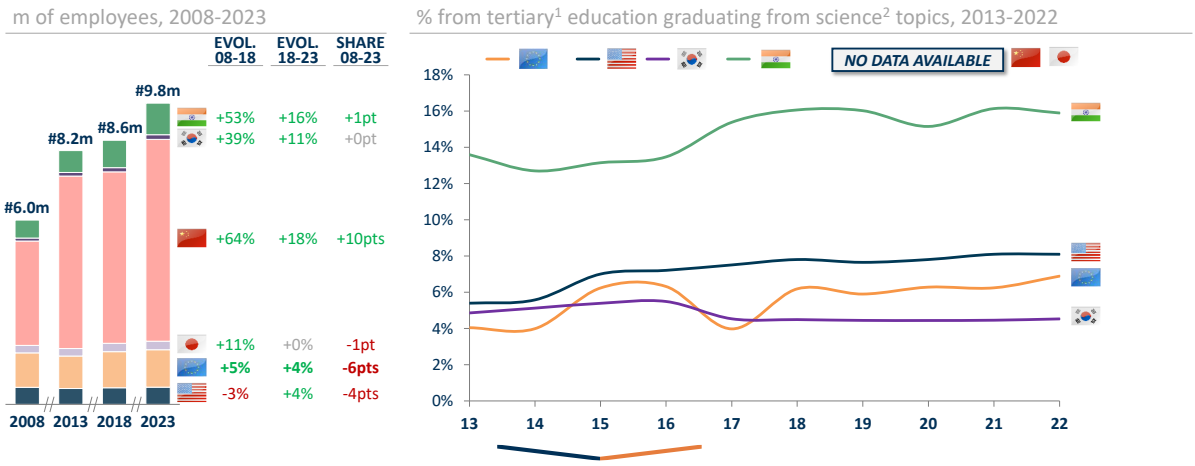
Measured relative to value added, the number of chemical PCT applications per billion euro of value added decreased in Europe (-43%), the United States (-62%), and Japan (-12%), while China saw a strong increase of +106%.

Human capital:

The European chemical industry benefits from a highly skilled workforce, supported by a strong education system that produces graduates in science-related fields. Employment trends in the sector are changing globally, with Europe facing challenges in maintaining its competitive edge in the global labour market for chemical professionals.

FIGURE 3.34

Chemical employees by region



European chemistry segment has access to a pool of workers pursuing science-related studies allowing it to maintain total employment in chemicals with employment numbers fluctuating between 1.1 and 1.2m from 2008 to 2022

Notes: (1) Tertiary education refers to all formal post-secondary education, including public and private universities, colleges, technical training institutes, and vocational schools, (2) Including Natural Sciences, Mathematics and Statistics programmes

Sources: VCI, World Bank, OECD, UNESCO, Advancy

The European chemical industry still benefits from a good base of skilled workers. However, the region faces increasing competition from Asia, particularly China and India.

Supply/demand ecosystem:

The chemical industry operates in a highly interconnected global ecosystem, where supply chain disruptions can occur. The COVID-19 pandemic highlighted significant challenges in global supply chains, particularly in sectors such as pharmaceuticals.

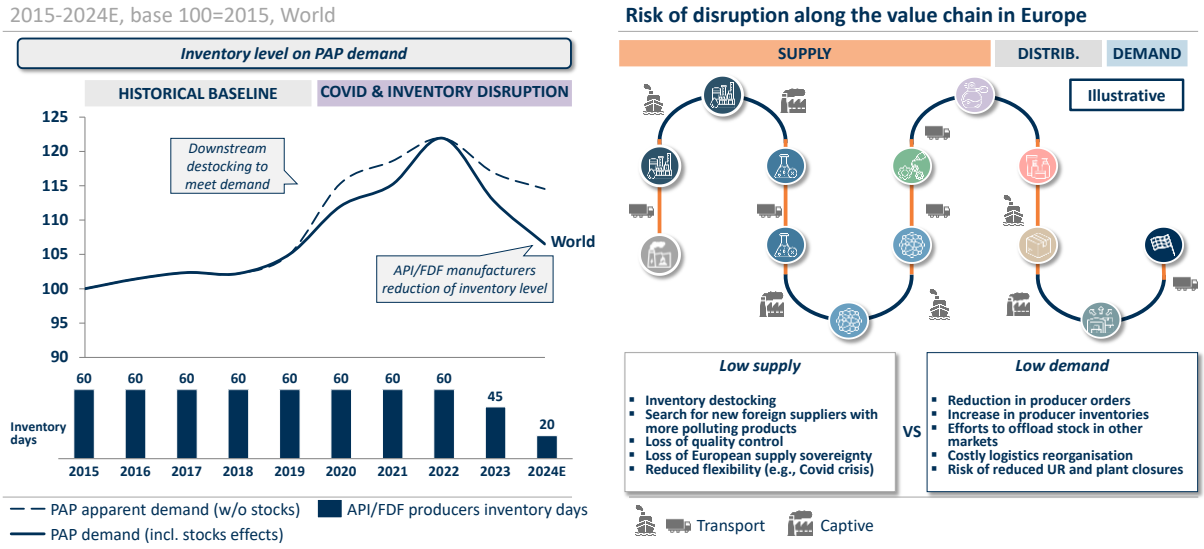
The case of paracetamol (PAP) illustrates the impact of stockouts and supply chain disruptions on production in different regions of the world.

During the pandemic, downstream sectors destocked to reduce inventory costs and meet emergency demand levels, leading to shortages throughout the supply chain. Indicated in the above chart, inventory levels of active pharmaceutical ingredients (APIs) and finished dosage forms (FDFs) have declined significantly. By 2024, inventory levels recovered, but the overall reduction in inventory during the pandemic has highlighted weaknesses in the global supply chain, particularly in the face of unexpected demand spikes and supply disruptions.

The pandemic has highlighted the interdependencies within the chemical value chain, showing that disruptions can cause significant bottlenecks. The pandemic has reinforced the importance of maintaining a minimum level of local supply and demand to avoid cascading failures across the entire value chain for the pharmaceutical industry and more generally for downstream chemicals relying on various and sometimes quite unique ingredients.

FIGURE 3.35

Para-aminophenol business case: Inventory level evolution and impact on PAP demand



Note: (1) Para-aminophenol Sources: Advancy analysis

The assessment of EU imports concentration analysis (CDI analysis) aims at **quantifying the concentration of EU imports with respect to the rest of the world**, in order to capture the risk of disruptions faced by the EU due to low diversification of extra-EU sources. This indicator **identifies products for which EU imports** (in values) **are highly concentrated in a few extra-EU countries.**

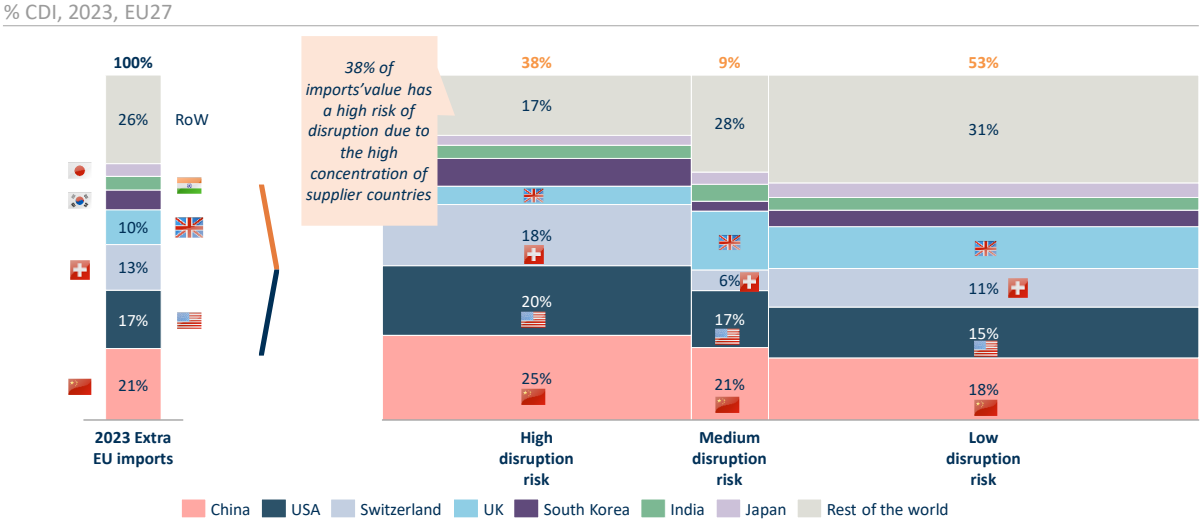
$$CDI = \sum_{i=1}^{n} (s_i^2)$$

where s represents the market share of the extra-EU supplying country in the EU's imports, and n is the total number of extra-EU supplying countries.

This work identified that approximately 38% of the total EU imports by value are exposed to disruption risk (CDI > 40%). The analysis is based on more than 3000 imported products reviewed by Cefic, highlighting dependencies on materials such as silicon, in ethylbenzene, sulphur, and polymers such as nylon and PVC.

FIGURE 3.36

Supply criticality: value at risk and countries of origin



Note: CDI > 40% = high disruption risk. 30%<CDI<40% = medium disruption risk. CDI < 30% = low disruption risk
Sources: Cefic

Policy framework (see more detailed section 3.4):

Europe remains a strong place to invest based on its rule of law and market-driven approach. Yet, the European regulatory environment has become increasingly challenging for chemical companies to operate in:

- There is legislative instability and an endlessly growing set of rules and regulations, some of them not consistent with one another.
- The lack of harmonisation between EU member states is adding to the impact.
- Europe faces more complex procedures and slower administrative processes than other regions: illustrated in permitting timing below.

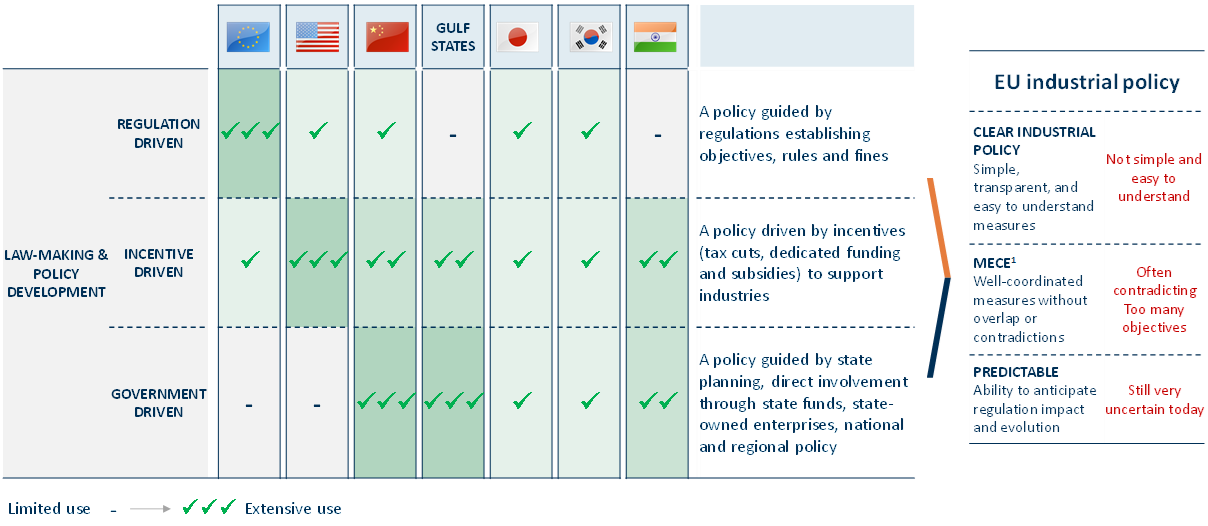
One example of those difficulties is the permitting process. Two recent studies have shown that the permitting process is more complex and lengthier in Europe. Business Europe conducted a survey from March to December 2023 among around 240 companies, particularly in the chemical sector. The permitting period lasts on average between 1 and 6 years in Europe, with the involvement of several competent authorities. Around 53% of companies consider this a "serious problem" when making an investment decision and 83% consider it an obstacle. The study highlights the following problems: 1) response time, 2) understaffed authorities, 3) complexity between national and European legislation, 4) lack of coordination between the different authorities, 5) multiple authorities involved. (*source 3.37*). In comparison, obtaining a permit in the US takes around 4.5 years and between 2 and 5 years on average in China (based on additional interviews with experts).

A second study conducted by the World Economic Forum on energy projects confirms this observation and shows that around 81% of European renewable capacities are "blocked at various stages of authorization", while this figure is 79% for the United States, 74% for China and 64% for India. (*source 3.38*)

3.4 Regional policies an increasingly unlevel playing field

Policies play a crucial role in supporting competitiveness. **Since 2018, major economies have implemented stronger economic security initiatives and industrial policies amid increased tensions** caused by (i) larger fluctuations in the business cycle (COVID-related and post-COVID) and (ii) the onset of the trade war and increased tensions between the USA and China. **During this period, Europe implemented its core Green Deal policy but reacted slower to increased tensions and did not articulate a clear industrial policy.**

FIGURE 3.39
Policy comparison



Note: (1) Mutually Exclusive, Collectively Exhaustive
Sources: Draghi Report, Jacques Delors Institute, Bruegel Institute, Brook Law, Itif, Advancy analysis

European industrial policy often appears complex and less predictable. European policy is regulatory-driven, while other regions have a more business-friendly approach, either through incentives (the USA) or through state planning and state (in)direct interventions (China).

3.4.1 Europe: An Ambitious Green Deal policy, but weak industrial competitiveness and economic security policies

The European Green Deal policy is a comprehensive policy aimed at supporting the decarbonisation of European industry.

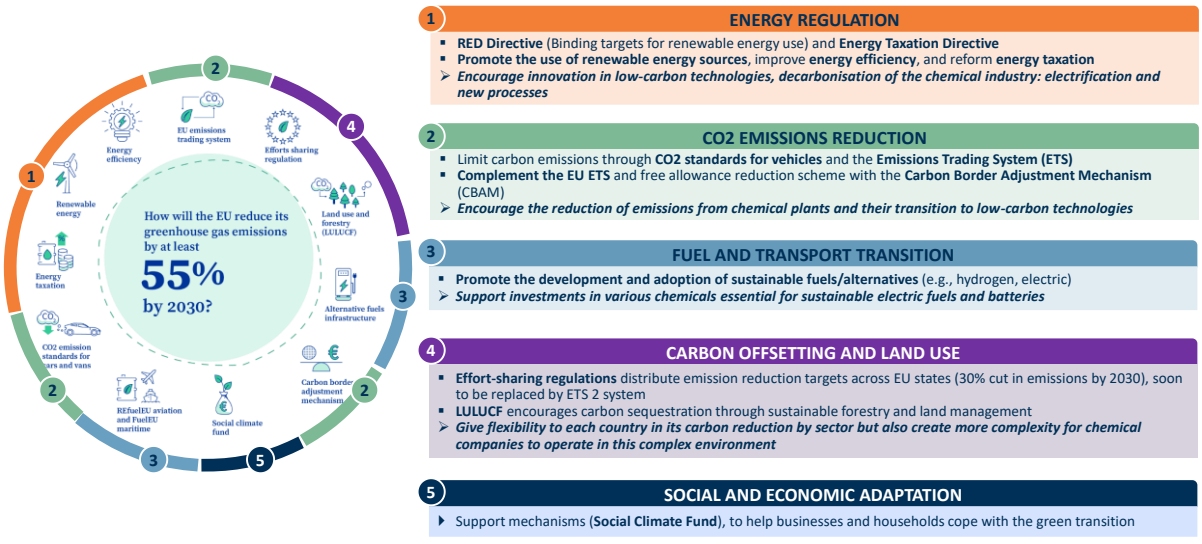
To decarbonise the (chemical) industry, the Green Deal develops in particular: (i) investments, (ii) specific rules and regulations, (iii) an extension of the carbon emission system with an increase in the cost of emission.

(i) **European decarbonisation requires massive investments, unprecedented since the Marshall Plan.** The European chemical industry needs easier access to capital and additional support to de-risk its decarbonisation trajectory.

(ii) **It also needs more support and simplification to reduce regulatory costs**. Instead, they have increased. This is putting chemical companies at a disadvantage compared to the rest of the world and limiting their ability to invest in crisis situations, as is the case today.

(iii) **Europe is at the forefront in monitoring carbon emissions from its industries** and in setting a price for carbon emissions through its Emissions Trading System (ETS)**. The cost of emissions will increase significantly in the coming years. This positively supports the economics of low-carbon projects.** However, the cost of carbon emissions should **be more predictable (less volatile) and must not lead to deindustrialisation.** The **CBAM (Carbon Border Adjustment Mechanism) aims to reduce carbon leakage but currently has four shortcomings**: 1) impact on export competitiveness, 2) risk of circumvention by importers to Europe, 3) failure to account for "carbon leakage" in the value chain due to limited coverage of downstream products, and 4) highly bureaucratic procedures.

FIGURE 3.40
Green deal overview

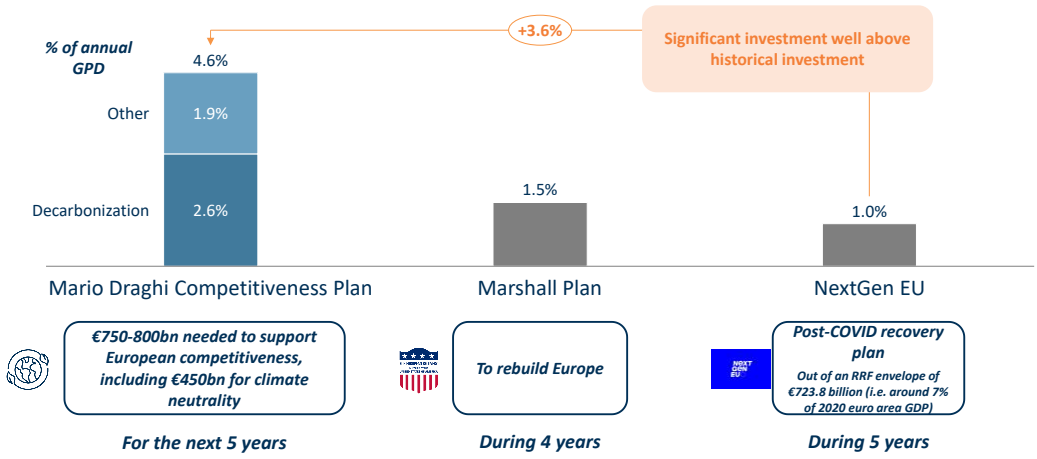


Sources: UNFCCC, European Commission, Advancy analysis

Through its various targets, the Green Deal policy pushes the chemical sector to innovate by developing innovative solutions and supporting European climate neutrality. **To achieve its climate neutrality goal, Europe will have to invest massively in the coming years, at higher levels than the Marshall Plan.** Draghi's report estimates that the energy transition will require 450 billion euro of investment per year. It also foresees additional investments to strengthen Europe's competitiveness, amounting to 150 billion euro in digital technologies, 50 billion euro in defence and security capabilities and 100-150 billion euro to boost productivity through disruptive innovations.

FIGURE 3.41
Climate neutrality investment & other competitiveness investments

2024, % of GDP

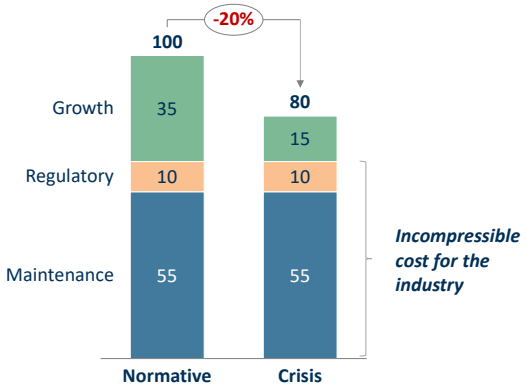


Sources: Draghi Report, Advancy analysis

In total, this means that around 4-5% of European GDP needs to be invested to support European competitiveness and the transition. In the context of greater investments needed to support the decarbonisation of the chemical industry and more generally the manufacturing sectors, regulatory costs weigh more heavily on European chemical players. This limits their ability to invest when their profitability is low, as is the case today.

FIGURE 3.42
Regulatory cost impact on investment

Capital Spending, Base 100, EU27



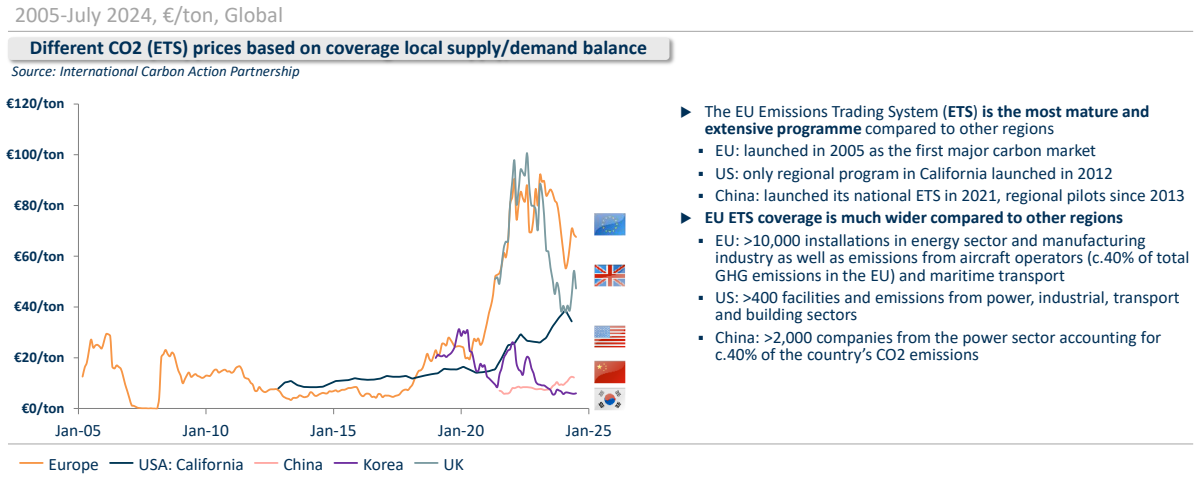
- **Up to 10%** of a chemical company's **capital expenditure goes to regulatory costs**
- **A 20% drop in industry revenues significantly limits investment capacity**
- **In 2023-24, volumes are down by -15 to -20%, turnover trends vary depending on the chemical products**

Sources: Cefic, European Commission, Advancy analysis

Up to 10% of chemical companies' capital expenditures can be spent on regulation. In most cases, maintenance and regulatory capital expenditures cannot be avoided or delayed. Therefore, a decline in revenues coupled with incompressible fixed costs leads to lower margins compared to other regions and limits investment capacity in growth. Figure 3.42 shows an illustrative case with a -20% drop in turnover which is close to the situation some companies faced in 2022-23.

Another key policy impacting the chemical industry is the cost of carbon. The carbon price of the Emissions Trading System (ETS) is in principle an efficient market-based instrument to support European decarbonisation goals. The ETS price has increased significantly in recent years and is volatile; this creates uncertainty for businesses, particularly when considering climate investments. To establish an appropriate business investment environment in Europe, the ETS needs to limit price volatility and increase predictability in the long term.

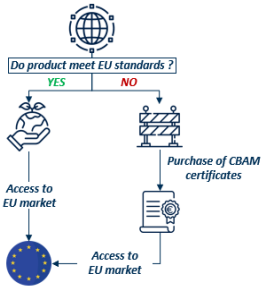
FIGURE 3.43
ETS prices evolution by region



Sources: European Commission, International Carbon Action Partnership, Advancy analysis

The second drawback of extending and increasing CO_2 costs in Europe is that it currently only applies in Europe. This can create a competitive disadvantage compared to other regions when the cost of CO2 increases**. To avoid this, the Carbon Border Adjustment Mechanism (CBAM) was developed as a defensive measure**.

FIGURE 3.44
CBAM process overview



Sources: CBAM

The CBAM is an EU policy that imposes tariffs on importers based on the carbon emissions of their products. It aims to level the playing field for EU producers, reduce carbon leakage and encourage global emission reductions, thereby supporting the EU's climate objectives. It complements the EU ETS by balancing the cost of the green transition between European and non-European producers. **However, in its current form, the CBAM**

has four main flaws: 1) impact on export competitiveness, 2) risk of circumvention, 3) failure to consider "carbon leakage" in the value chain due to its limited coverage, and 4) excessive bureaucracy.

1. **Export competitiveness**: CBAM and the EU ETS carbon system require local production to pay their carbon emissions locally in Europe. This is placing the products manufactured in Europe at a disadvantage when exported to other regions. As shown in section 2, the European chemical industry is an important sector in terms of emissions and a net exporter in the European trade balance, therefore without an exemption on exported products (or compensation scheme), European exporters are highly impacted.
2. **Circumvention**: the current CBAM may also introduce a risk of circumvention with investments and capacities targeting the European market. Companies producing outside Europe may favour investments in low-carbon energy and processes exclusively for products intended for the European market. Non-EU producers also have the ability to spread the potential cost of the CBAM across all their sales. In addition, importers now have the possibility to deduct CO_2 emissions already paid, if they can prove that a carbon price was already paid during the production of the imported goods. With the risk that these costs are then rebated domestically. Moreover, the risk of false or partially false certifications is high, with limited powers for the EU to run extra-EU investigations.
3. **Carbon leakage elsewhere in the value chain (in downstream finished products imports):** the scope of the CBAM is still incomplete and mainly focuses on specific highly emitting upstream products (iron and steel, hydrogen, ammonia, cement and electricity). To avoid CBAM costs, there is a risk that downstream volumes are imported directly (e.g. finished cars containing iron and steel, crops grown with ammonia fertilisers, etc.). This can lead to partial relocation of value chains to other regions not covered by environmental taxes and then exporting finished products not included in the CBAM to Europe. As a result, CBAM is undermined by outsourcing production to other regions where such regulations are not in place.
4. **Highly complex calculation of carbon content at the border for imports :** the process involves evaluating the embedded emissions in imported goods to the European Union (EU) and then adjusting for any free EU Emissions Trading System (ETS) allocations. For example, in the case of ammonia, the calculation involves multiplying the embedded emissions by the tons of imports and the average weekly EU ETS price. If a carbon tax is paid in the country of origin, it is subtracted for adjustment. This complexity is further compounded by the need to account for different percentages of ammonia in various fertilisers.

FIGURE 3.45
CBAM circumvention risk

> *"Imposing tariffs on imports of raw materials or intermediate goods, but not on final goods that use those materials intensively, could lead to de-localization."*
>
> **Draghi report 2024**

Sources: Draghi Report

The CBAM measure reflects Europe's efforts to level the playing field between domestic and non-domestic entities within the EU market. The EU must enhance its measures to protect against carbon leakage. Currently, the new carbon border adjustment mechanism (CBAM) established in 2023 does not adequately shield the chemical industry and may incentivize the transfer of industrial value creation to third countries. Circumvention options must be closed, export solutions found, alongside simplification of the administrative framework.

For the CBAM to work, the sector would have to be allowed to pass on costs. This is difficult today because:

- A significant part of the products will not be covered through CBAM.
- Complex and interlinked markets and value chains will struggle to pass on their CO_2 costs.
- It risks creating a significant competitiveness gap.

Moreover, the CBAM is only a defensive measure. Other regions are taking more offensive measures (incentives) to support the development of low-carbon projects. The IRA offers significant incentives in the

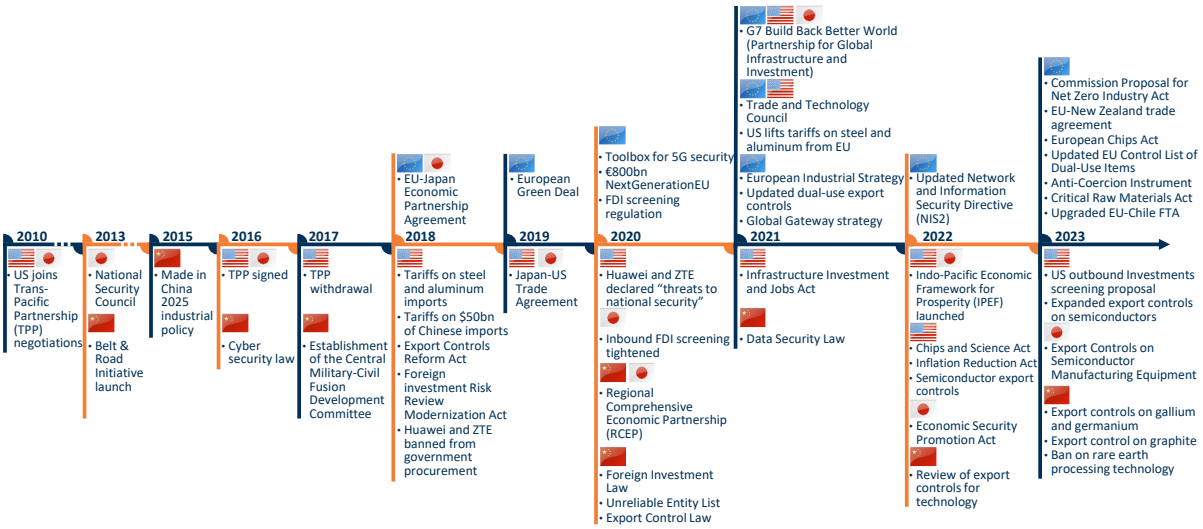
form of tax credits, which creates a gap with Europe. In CCS projects, for example, the result today is that most CCS projects are progressing faster in the United States compared to European projects.

Competition is increasing globally. This is reflected in the increasing number of economic security measures taken at international level by the United States, China, and Europe (see figure below).

FIGURE 3.46

Economic security initiatives (focus Europe, the USA and China)

2010-2023, US, Europe, China, Japan



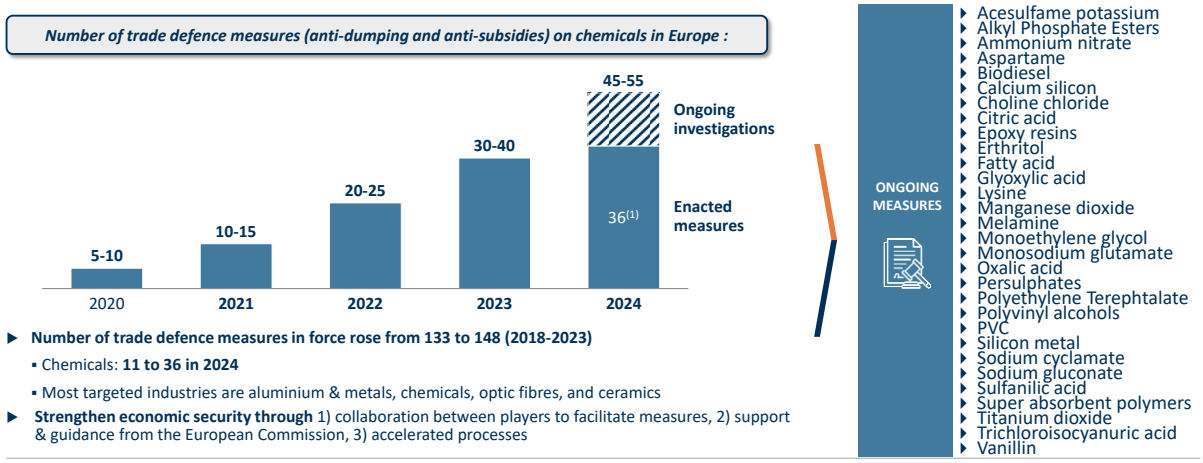
Sources: Jacques Delors Institute, Advancy analysis

Since 2018, the number of active trade defence measures has risen from 133 to 148 by the end of 2023. The main industries concerned are aluminium and metals, chemicals, optical fibres, and ceramics. Europe has increased its focus on economic security, particularly in the chemicals sector which now accounts for 24% of all active trade defence measures. Ongoing anti-dumping measures have increased. Products such as aspartame, polyvinyl chloride and ammonium nitrate have been subject to anti-dumping decisions.

FIGURE 3.47

Increasing competition and trade defence measures

#measures, EU, 2020-24



Note: (1) 25/11/2024

Sources: European Commission, Trade defence investigations website, European Economic Security: Current practices and further development report, Advancy analysis

In the chemical sector, 36 measures have been adopted. Europe is reacting more slowly than other regions of the world:

- The United States is known for its strict and swift application of anti-dumping and anti-subsidy measures. When a case is suspected, provisional measures are adopted, and it is up to the importer to prove that there is no unfair competition for them to be lifted. The U.S. government also does not hesitate to impose severe sanctions to deter unfair practices.
- India also applies provisional measures to protect its industries. This allows it to limit the damage caused by unfair imports while investigations are ongoing.
- Brazil regularly uses safeguard measures to protect its local industries. This allows for a quick response to sudden increases in imports that threaten domestic producers.

3.4.2 China: A unique multi-level support policy & self-sufficiency strategy

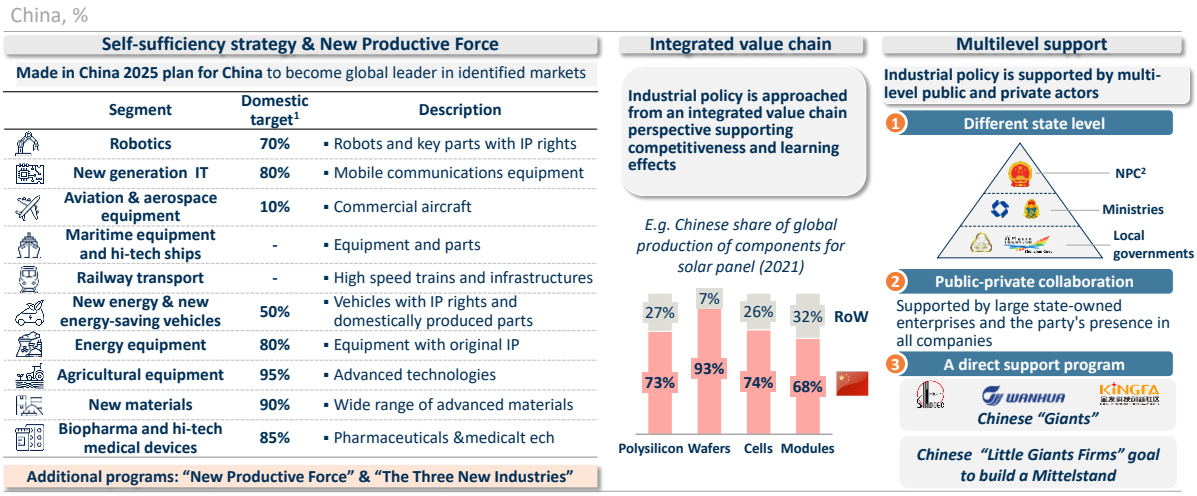
China has developed a unique multi-level support policy and self-reliance strategy, giving its chemical companies advantages over their competitors. Investment in the industry is supported through multiple levers, exemplified by the "Made in China 2025" plan, which aims to promote China's self-reliance by investing across the value chain and providing public and private support.

Chemical companies receive significant support through various measures (especially below market credits see figure 3.29); such measures are difficult to track and assess in terms of gained competitiveness, but are, nonetheless, substantial. This multi-level and integrated approach has boosted the development of the chemical industry and created a thriving ecosystem in China. It has created local leaders on par with other international companies known for having world-class innovation today.

Industrial policy takes an integrated value chain perspective which supports competitiveness and learning effects. China has emerged as a leader across the entire value chain of strategic products, with its success exemplified in the solar panel industry or more recently in the EV automotive.

Chemical industrial policy operates at multiple levels: state and local government, public and private collaboration, and direct support programmes to build a strong, winning ecosystem. This support enabled the successful development of now leading companies such as Wanhua and Kingfa in the chemical space. As part of industrial policy, the government has also encouraged the rapid emergence of medium-sized leaders based on the Mittelstand approach.

FIGURE 3.48
Made in China 2025 plan overview

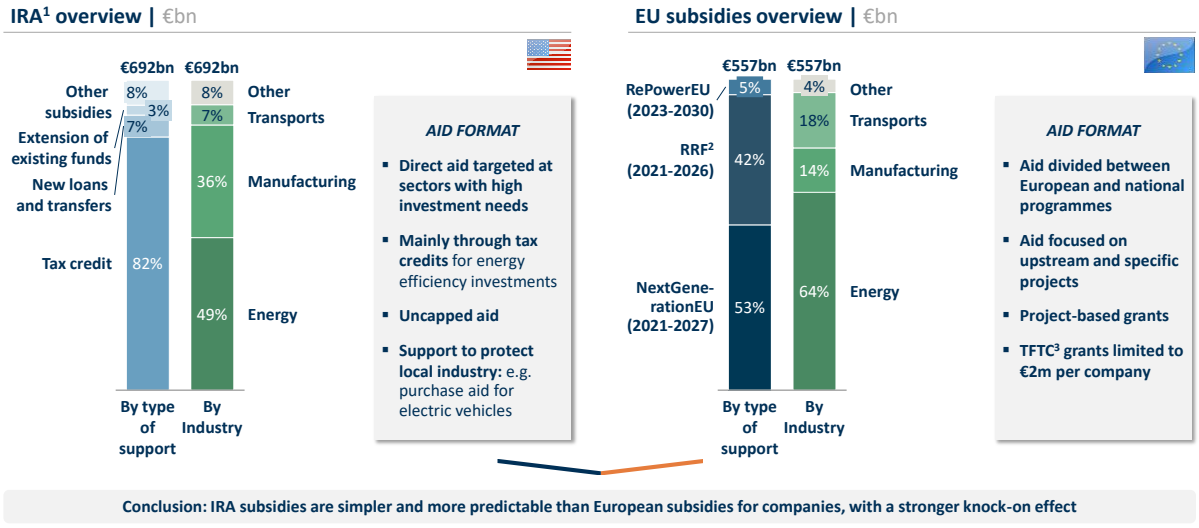


Notes: (1) Domestic market target of self-sufficiency proposed in first version of "Made in China 2025" plan, not shown in later versions, (2) National People's Congress
Sources: Office of the United States Trade Representative, Advancy analysis

3.4.3 USA: A renewed trade and industrial policy, IRA's earmarked financial support

The United States is another region that demonstrates a more supportive industrial policy. **Since the end of the COVID-19 crisis, the United States has implemented policies to stimulate economic recovery**. Chief among these efforts is the Inflation Reduction Act (IRA), signed into law in 2022. The IRA is a budget reconciliation measure designed to channel significant investments into domestic clean energy production. Representing the largest U.S. commitment to climate action, the law aims to reduce greenhouse gas emissions by approximately 40% by 2030, compared to 2005 levels. The initiative includes a 692 billion euro aid package, primarily in the form of tax credits for energy efficiency investments. These aids are structured as direct, uncapped supports primarily targeting sectors that require significant investment.

FIGURE 3.49
Comparison between IRA and EU subsidies



Notes: (1) IRA = Inflation Reduction Act; (2) RRF = Recovery and Resilience Facility; (3) TFTC = Temporary Crisis and Transition Framework
Sources: Advancy analysis

While there is some uncertainty as to whether the new Trump administration will maintain the IRA policy, it is clear that US policy has been consistent over the last two presidencies in supporting its industry, whether through investment or tariffs (though tariffs have a mixed effects).

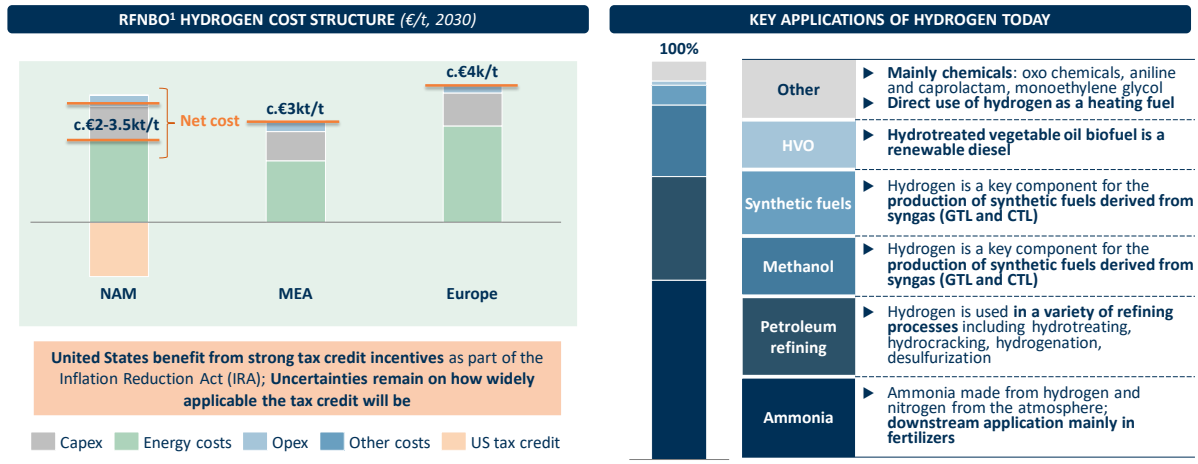
When comparing the IRA policy and the Green Deal, it is relevant to note that the two policies are similar in terms of investment size (each around 600-700 billion) but differ in their design. The IRA policy is based on tax incentives, incentives for local production and simple and significant support. On the contrary, the Green Deal support is provided through various packages, totalling 557 billion euro; such packages cover initiatives like RePowerEU, the Recovery and Resilience Facility, and Next Generation EU. These funds are allocated across European and national programmes as project-based grants, with a strong focus on sectors crucial to the transition toward a net-zero economy. Therefore, while offering similar levels of support, IRA grants are simpler, easier to access, both in terms of procedures and in terms of deadlines, they are more predictable than European grants, creating a stronger ripple effect that encourages future investment in the United States.

The resulting cost of green hydrogen in the USA versus Europe and Middle East show the impact of tax credit incentives. The specific IRA tax credits, if they materialise in the coming years, does give a good advantage to local green hydrogen production.

FIGURE 3.50

Hydrogen cost curve and applications

€/t, 2030, Global



Note: (1) RFNBO = renewable from non-biological origin
Sources: Advancy analysis

The United States has implemented the Buy American Act and the "Made in USA" labelling rule. The Buy American Act requires public agencies to procure goods made in the U.S. (above 65% sourcing in 2024), with some exceptions. The "Made in USA" rule, finalized by the FTC in 2021, mandates that products labelled as "Made in USA" must be "all or virtually all" made in the US, with penalties for non-compliance. These measures aim to support domestic industries and ensure accurate product labelling.

***

In conclusion, the European chemical industry is facing three combined impacts: 1) weak demand driven by weak manufacturing demand, low overall consumption of durable goods and increased imports, 2) high supply driven by increasing supply and strong competitive pressures in some value chains, 3) pressure on competitiveness caused by higher energy and raw material costs in Europe, higher regulatory and environmental costs and burdens, and more complex policy framework. In this context, European industrial policy is not sufficient and starkly contrasts with the much more incentivising policies of other regions.

ENDNOTES

Figure 3.1: Overview – *Advancy analysis*

Figure 3.2: Regional PMI – *S&P Global, Advancy analysis, Euromonitor, Cefic report August 2024, Advancy analysis*

Figure 3.3: Industrial production growth forecast by region (excl. construction) – *Oxford economics*

Figure 3.4: Chemicals capacity by region – *ICIS, IHS, Polyglobe, Advancy analysis*

Figure 3.5: Share of unprofitable industrial Chinese companies (including chemical companies) – *National Bureau of Statistics, Advancy analysis*

Figure 3.6: Main European capacity closure announcements – *Company announcements, Chemweek, Advancy analysis*

Figure 3.7: Capacity variation in Europe compared to current capacity closures – *Advancy analysis*

Figure 3.8: Overview of competitiveness factors by region – *Advancy analysis*

Figure 3.9: Overview of competitiveness evolution – *Advancy analysis*

Figure 3.10: Weight calculation – *Advancy analysis*

Figure 3.11: Basic versus specialty chemicals competitiveness overview – *Advancy analysis*

Figure 3.12: Summary score & figures – *Advancy analysis*

Figure 3.13: Energy intensity of main industries (% of revenues) – *Advancy analysis*

Figure 3.14: Energy prices by region – *Eurostat, US Energy Information Agency, International Energy Agency, Advancy analysis*

Figure 3.15: Energy prices by region (2018-2024 focus): Electricity & natural gas – *Eurostat, US Energy Information Agency, International Energy Agency, Advancy analysis*

Figure 3.16: Simplified view of the merit order supply demand (illustrative) – *Advancy analysis*

Figure 3.17: Energy prices by region (2018-2024 focus): Electricity & natural gas – *Eurostat, US Energy Information Agency, International Energy Agency, Advancy analysis*

Figure 3.18: ETS prices evolution by region – *European Commission, International Carbon Action Partnership, Advancy analysis*

Figure 3.19: Electricity emissions by region – *World Data, RTE, DOE, Advancy analysis*

Figure 3.20: Regulatory costs evolution in Europe – *Cefic, UNIPRI, Advancy analysis*

Figure 3.21: Evolution of environmental regulations in Europe compared to other regions – *Cefic, UNIPRI, Advancy analysis*

Figure 3.22: European legal and regulatory burden – *UNPRI, Der Spiegel, European Policy Centre, Draghi report, Advancy analysis*

Figure 3.23: Chemical labour costs by region– *World Bank, Eurostat, Advancy analysis*

Figure 3.24: Chemical labour productivity – *Cefic, VCI, Advancy analysis*

Source 3.25: Logistics investment in clean energy DWS

4 Section 4 – Over The Past 15 Years, Europe Has Lost Ground

Europe's market share has declined by around 11 percentage points over the past 15 years, from 23% to 13% between 2008 and 2023 in nominal sales. This decline in Europe's market share is due to: A) weaker growth in domestic demand, B) weaker growth in export markets, partly due to competitiveness, C) a lack of investment and competitiveness in the domestic market.

This should be considered in the broader context of: (i) the rise of cheap shale gas in the United States, (ii) China's rapid economic expansion, (iii) the economic diversification of the Gulf States, (iv) India's and Southeast Asia's growing presence in specific segments (e.g. India very strong in fine chemicals). These trends are reshaping the global chemical landscape.

Europe has experienced a slow erosion of its market share from 2008 to 2018, with an increasing share of imports and a decreasing share in the export market. Imports represented 20% of local consumption in 2008, 26% in 2018 and around 30% in 2023, an acceleration of the erosion in recent years. While Europe's market share in the international market (excluding EU27) represented 7% in 2008, 5% in 2018, and 5% in 2023.

This is driven by different developments in each chemical segment. The upstream sector has experienced a significant increase in erosion in recent years, with the share of imports rising from 23% in 2008 to 26% in 2018, and then to 35% in 2023. Polymers and intermediates have remained stable recently due to the weakness of overall domestic demand and the limited impact of additional imports at the chemical level: 15% in 2008, 25% in 2018, and 26% in 2023. The downstream sector has seen an increase in imports but to a lesser extent: 19% in 2008, 26% in 2018, and 26% in 2023.

Since 2018, the global economy and the chemical sector have been under severe stress. The chemical industry has been impacted by trade wars, COVID and the post-COVID recovery, and was then followed by the energy crisis and high inflation. **The situation has particularly deteriorated since 2022 with the European chemical industry experiencing a sharper slowdown than the general economy. This resulted in production volumes declining by around 14% versus 2021 level.**

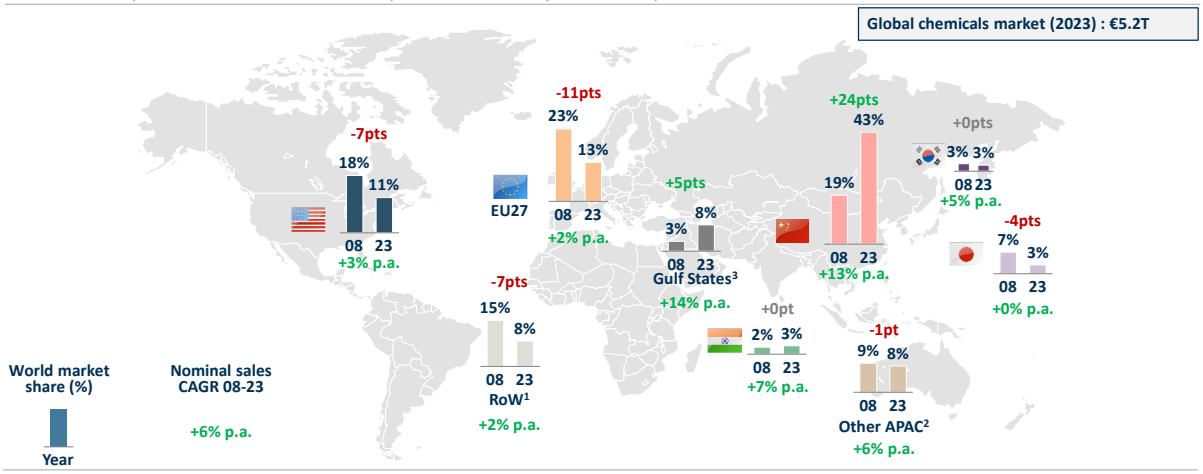
4.1 Europe reduced market share

Europe's market share in terms of nominal sales has declined by around 11 percentage points over the past 15 years, from 23.3% to 12.6% between 2008 and 2023.

FIGURE 4.1

Evolution of regional shares of the chemicals market

Nominal sales, market shares in % of sales, sales CAGR in %, 2008-2023, World



Notes: (1) Rest of the world includes: Latin America, Europe outside EU27 including UK and Russia, Africa, Mexico, Canada, 2) Other APAC includes all Asian and Oceanian countries ex. China, India, Japan, South Korea, (3) Including GCC countries, Israel, and Iran

Sources: Cefic 2023, Gulf Petrochemicals & Chemicals Association, Advancy analysis

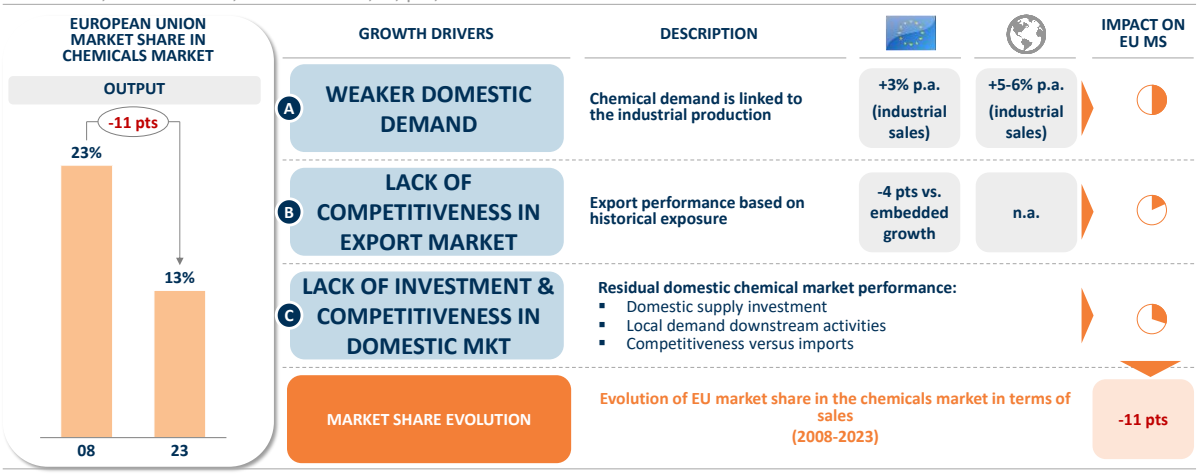
This is driven by three factors:

A. Weaker growth of domestic demand,
B. Weaker growth in export markets and lack of export competitiveness,
C. Lack of investment and competitiveness in domestic market (residual performance).

FIGURE 4.2

Factors driving the evolution of market shares

2008-2023, market share, nominal sales, %, pts, World



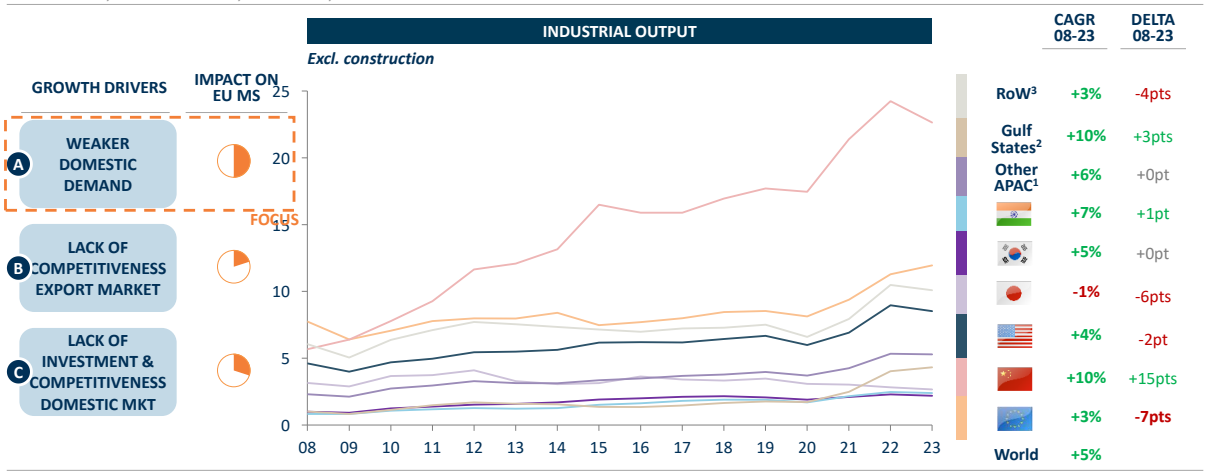
Sources: Cefic, Oxford Economics, Advancy analysis

A. Weaker growth of domestic demand:

European industrial production, an indicator of European demand for chemicals, grew more slowly than in other regions. Europe has been growing at an annual nominal rate of 3% for the past 15 years, 2-3 percentage points below global growth between 2008 and 2023.

FIGURE 4.3
Industrial output evolution

2008-2023, market share, €trillions, World



Notes: (1) Other APAC countries include all APAC countries excluding China, Japan, South Korea, India, (2) Including GCC, Israel and Iran, (3) Rest of the world includes all countries in the world excluding China, US, EU27, APAC countries and Gulf States

Sources: Cefic, Oxford Economics, Gulf Petrochemicals & Chemicals Association, Advancy analysis

The growth in industrial production is driven by the overall increase in demand, which is influenced by factors such as demographics, the level of industrialization, and the standard and quality of life. Europe is more mature than other regions (lower demographics, lower increase in standard of living). European industrial production is also impacted by general market evolution and competitiveness, indirectly impacting the chemical industry.

B. Weaker growing export markets and lack of export competitiveness:

The EU market share in chemicals exports has decreased over the past 15 years, primarily due to a decline in the EU's share compared to other regions, as measured by constant market share (CMS).

The constant market share (CMS) approach analyses competitiveness by examining how changes in the geographical and product structure of exports affect a country's export growth, relative to the world average. It distinguishes between the structural effect (differences in product mix and regions) and the competitiveness effect (changes in market share), where a declining competitiveness effect indicates a loss of competitiveness.

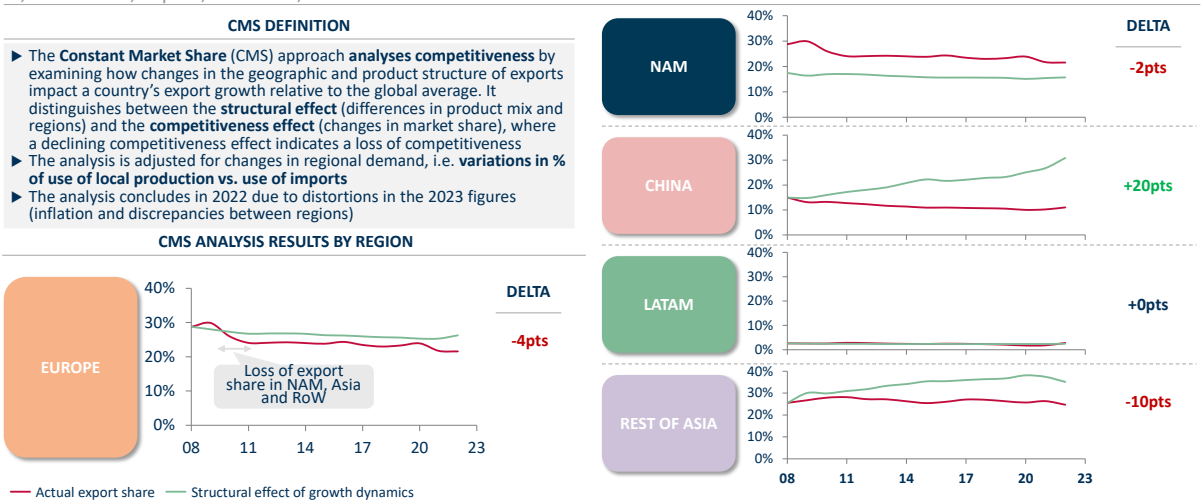
The CMS approach simply involves comparing the actual evolution of the share of European exports with the share that the European chemical sector should have had if its exports had grown in line with the growth of the countries to which it exports. **The greater the gap between the CMS and the actual share of exports, the less competitive Europe is in maintaining its market share in the countries to which it exports.**

The analysis shows a 4-percentage point decrease in the European CMS. This was both driven by weaker competitiveness versus foreign domestic markets but also growingly in recent years due to local production policies (made in USA, China, India...). Both the structural effect and the competitiveness effect contribute to the loss of global market share: the final impact in terms of effect on total market share is around 1 to 2 points.

FIGURE 4.4

Constant market share analysis

%, 2008-2022, export, real sales, World



Sources: Cefic, Advancy analysis

C. Lack of investment and competitiveness in domestic market:

The residual impact, after accounting for the lower domestic market growth and reduced lower export growth, corresponds to various mix effects:

- The influence of strategic investments and incentives aimed at bolstering domestic supply and stimulating demand: investments are primarily focused on compliance, not new capacities, or modernisation in Europe.
- The preference for domestic production versus imports, partially driven by competitiveness.

4.2 European market share evolution by segment

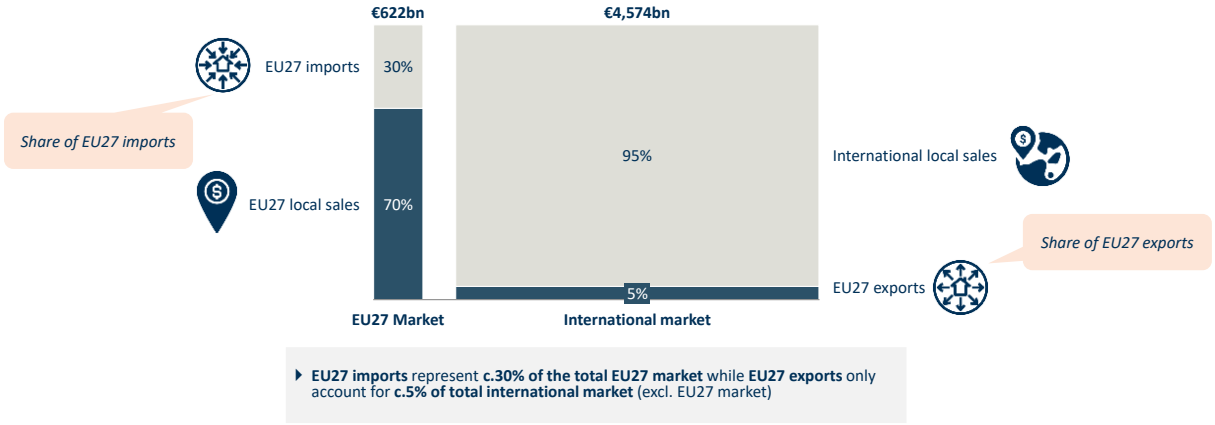
Europe's loss of market share in the global chemicals market has manifested itself differently across the three segments of the chemicals industry: upstream, polymers & intermediates, and downstream.

As shown **in Figure 4.5, by 2023, local EU production accounts for around 70% of the EU market and EU exports account for around 5% of the international market in terms of total chemicals sales**.

FIGURE 4.5

Chemical share of exports and imports overview

%, €bn, 2023, EU27 & World



Note: EU27 Market = EU27 nominal sales – EU27 exports + EU27 imports i.e. c.€622bn = €655bn - €222bn + €189bn
Sources: Cefic, Advancy analysis

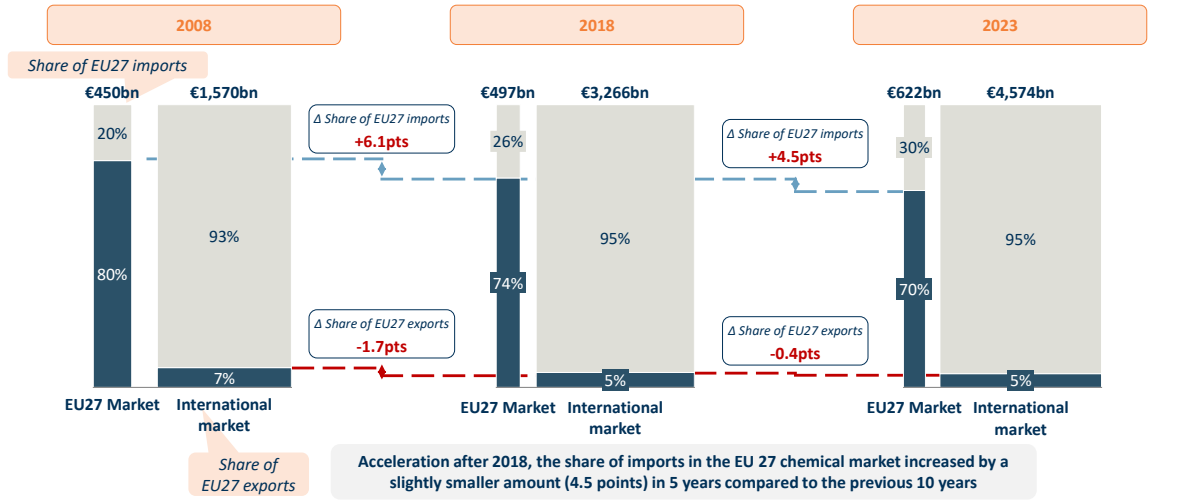
These export and import shares evolved between 2008 and 2023 as follows:

- Imports have increased over time: from 20% of local sales in Europe in 2008 to 30% in 2023. This evolution has accelerated in recent years with +4.5 points over the past five years versus +6 points between 2008 and 2018.
- Exports have decreased over time: from 7% to 5% of the international market: at a slower pace of -1.7pts between 2008 and 2018 and -0.4pts between 2018 and 2023.

FIGURE 4.6

Chemical share of exports and imports evolution

%, €bn, pts, 08-18-23, World

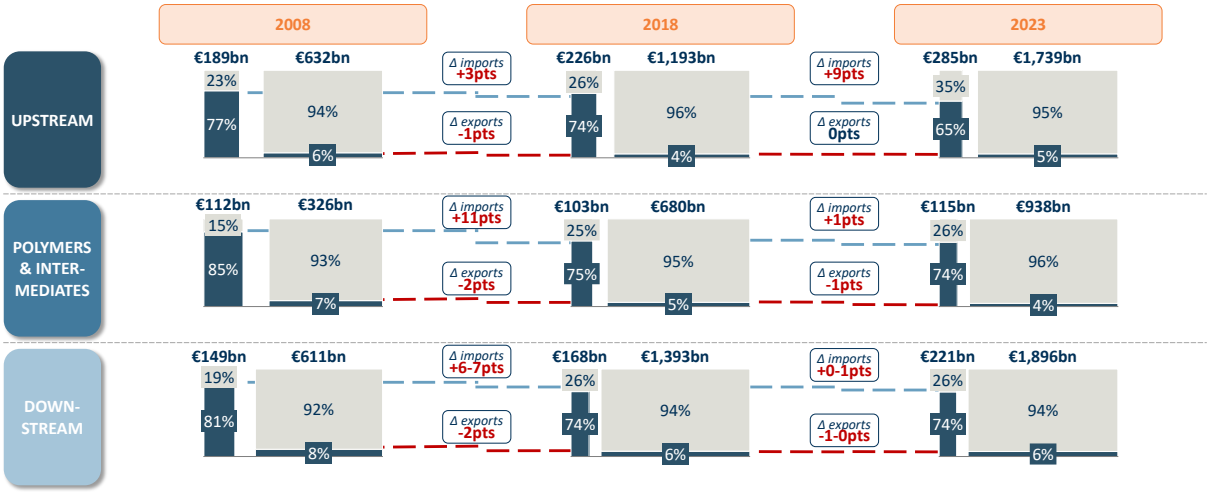


Sources: Cefic, Advancy analysis

This development was primarily driven by the upstream and polymers & intermediates sectors of the chemical industry, as shown in Figure 4.7.

FIGURE 4.7
Chemical share of exports and imports breakdown

%, €bn, pts, 08-18-23, World



Sources: Cefic, Advancy analysis

The upstream sector has experienced increased erosion in recent years, with the share of imports rising sharply in Europe between 2018 and 2023. Polymers & intermediates have seen a slower rate of erosion after 2018, following significant changes between 2008 and 2018. The downstream sector has shown more resilience but has experienced erosion over time in terms of exports and relative to imports between 2008 and 2018.

Since 2018, the global chemical industry has faced a series of unprecedented macroeconomic disruptions, including the US-China trade war, the COVID-19 pandemic, the post-COVID recovery, the European energy crisis, and elevated inflation, which all impacted volumes.

1. **Trade War (2018-2019)**: The United States imposed tariffs on more than $360 billion worth of chemicals imported from China, leading to an imbalance in global trade.
2. **COVID-19 Pandemic (2020)**: The pandemic has caused significant disruptions in the chemical and pharmaceutical supply chains. The sharp drop in volumes also led to the closure of industrial sites, prolonged shutdowns, or delays in investments, creating friction when the economy began to recover.
3. **Post-COVID Recovery (2021)**: The year 2021 saw a rapid economic recovery, but it also led to imbalances in value chains as companies tried to meet demand. Customers overstocked downstream in the chemicals value chain, both in anticipation of additional demand and/or to avoid supply disruptions.
4. **Energy Crisis in Europe (2021-2023)**: The Gazprom crisis, the outbreak of war in Ukraine and Western sanctions against Russia have led to a sharp rise in energy costs, which has had an impact on energy-intensive sectors such as chemicals. High energy costs have led to slowdowns and operational difficulties for players in Europe, while also causing high inflation.
5. **Inflation, Destocking, and High Costs (2022-2024)**: The period 2022-2024 was marked by high inflation, persistently elevated energy costs, and higher interest rates, aimed at curbing inflation, and rising capital costs. These deflationary pressures led to a slowdown in the market at global level and a sharp decline in Europe in terms of volumes produced.

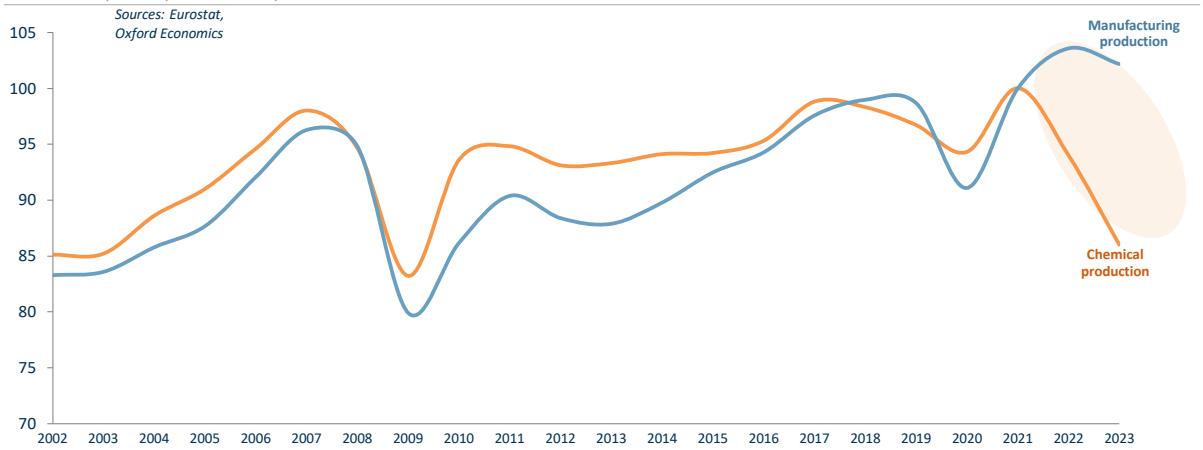
The volumes of the European chemical industry have decreased significantly since 2021, with a 14% drop compared to the volumes achieved in that year. This decline was much more pronounced than the impact on

the European manufacturing industry. Such a sharp decline and significant deviation from the overall manufacturing industry had not been seen in the last 20 years.

FIGURE 4.8

European chemical production versus manufacturing

2021 = 100, EU27, 2002-2023, Production



Sources: Eurostat, Advancy analysis

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In conclusion, the European chemical industry has lost approximately 11 percentage points of market share in the global chemical market between 2008 and 2023. This decline can be attributed to three main factors: 1) lower growth in domestic demand, 2) reduced growth in export markets and a lack of export competitiveness, and 3) a residual effect stemming from insufficient investment and domestic market competitiveness. This situation has worsened in recent years due to increasing market tensions and competition.

ENDNOTES

Figure 4.1: Evolution of regional shares of the chemicals market – *Cefic 2023, Gulf Petrochemicals & Chemicals Association, Advancy analysis*

Figure 4.2: Factors driving the evolution of market shares – *Cefic, Oxford Economics, Advancy analysis*

Figure 4.3: Industrial output evolution – *Cefic, Oxford Economics, Gulf Petrochemicals & Chemicals Association, Advancy analysis*

Figure 4.4: Constant market share analysis – *Cefic, Advancy analysis*

Figure 4.5: Chemical share of exports and imports overview – *Cefic, Advancy analysis*

Figure 4.6: Chemical share of exports and imports evolution – *Cefic, Advancy analysis*

Figure 4.7: Chemical share of exports and imports breakdown – *Cefic, Advancy analysis*

Figure 4.8: European chemical production versus manufacturing – *Cefic, Advancy analysis*

5 Section 5 – The Competitiveness Gap, In Depth

The European chemical industry generated around €165 billion of added value in 2023 from a complex and diversified chemical value chain. Examples of chemical products have been selected to illustrate the risks and opportunities the chemical industry faces.

At the upstream level of the value chain, which is the most energy and capital intensive, three segments have been studied: 1) ethylene/propylene, both organic chemicals, 2) ammonia, and 3) chlor-alkali chemicals, both inorganic chemicals. These are the main building blocks of many chemicals. These segments have suffered the most from rising energy costs, weak demand, and low utilisation rates. These industries are also at the heart of the European decarbonisation pathway. Tomorrow's ammonia can be produced partially by a green electrolytic process. Some ethylene and propylene crackers can be converted to bio-feedstocks. Crackers are essential for chemical recycling. The chlor-alkali process already relies on an electrolytic process. In these segments, plant closures have been announced to restore resource efficiency. But additional support is needed to help reach the level of investment needed to transition these assets and meet the new demand in Europe with the right quality, compliance, and pricing.

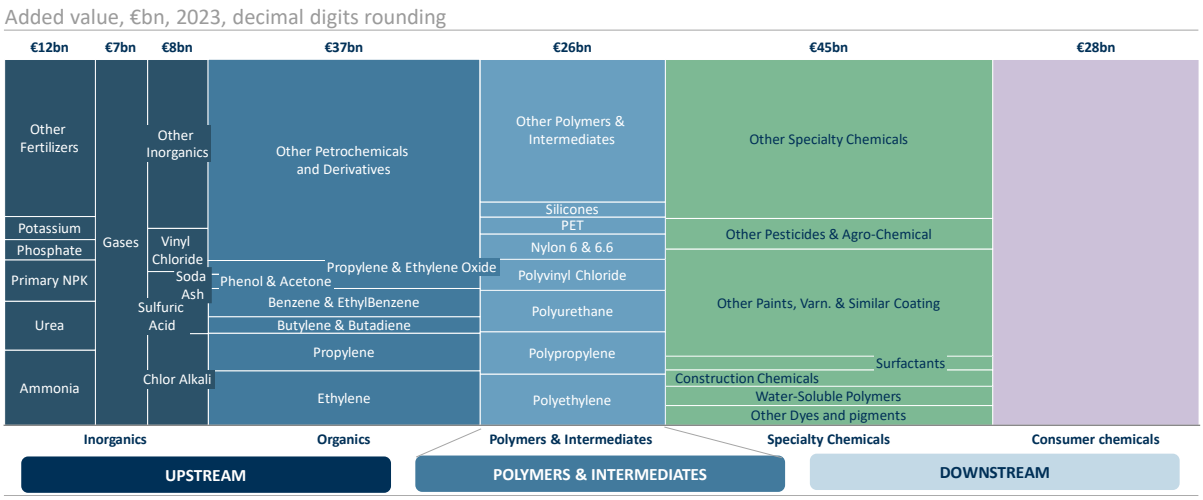
At the polymers and intermediates level of the value chain, three segments have been selected: 1) silicones, 2) PVC directly linked to the chlor-alkali value chain, and 3) biopolymers. Silicones are a clear example of a missed opportunity for Europe. Europe was a leading region in silicone production 15 years ago and has not invested in the last 15 years while China has heavily invested in this segment. Europe will not be competitive tomorrow in the silicone raw material market, but Europe can draw conclusions from this missed opportunity. In this case, China's integrated strategy from metallic silicon to photovoltaic panels has led to a dedicated support for chemical silicones and has made the European region less competitive and increasingly dependent on imports at all levels of the value chain. PVC plastics are an example of the changes underway due to increased scrutiny and the need to develop a circular economy. When considering sustainable plastic products, the main route for the industry is to develop mechanical or chemical recycling. PVC players are investing to develop these capacities, but they are facing increased pressure and competition from other regions, which limits their ability to make these investments. In the case of PVC, a specific anti-dumping measure has been put in place to limit imports from the USA and Egypt. Biopolymers are an area where Europe has a head start and a desire to develop. The chemical industry needs more support to ensure that biowaste can be obtained advantageously. In this segment, competition with China is intensifying due to very innovative developments by chemical companies, while the other regions are comparatively lagging (the USA, the Middle East, North Asia). Europe must support the development of the industry to make it a success and a growth platform for Europe.

At the downstream level of the value chain, three markets have been selected, in each of which several ingredients are manufactured and combined: 1) the personal care market, 2) the animal health and nutrition market and 3) the chemical pharmaceutical market. In the personal care market, Europe is at the forefront of the industry with a dense ecosystem of companies both at the chemical stage and downstream with large and small cosmetic companies. The personal care industry contributes to the positive trade balance of the European industry. This industry continues to innovate and develop more sustainable solutions. Chemical players are impacted by the increasingly costly and

more complex regulatory framework. This complexity is more manageable, though still very costly, for large companies. However, for SMEs, it can easily hinder their growth or force them to rely on expensive outsourced services. Europe needs to find a balance to maintain its advantage in the industry by giving more space to players and understanding the constraints they face. In the field of animal health and nutrition, the European chemical industry is at the forefront of innovative solutions to reduce livestock emissions and the use of antibiotic growth promoters. However, Europe has lost ground on more basic nutrition ingredients such as vitamins and amino acids, essential for animal growth. Europe is now critically dependent on imports for specific products. This can translate into higher prices in case of supply crises. In the pharmaceutical market, the chemical industry is a dense network of contract development and manufacturing companies. Each chemical product is manufactured in several steps and by many companies involved. In this segment, the least complex steps have been relocated to Asia, driven by lower costs, less stringent regulatory constraints and now by a large existing ecosystem of innovative companies. Europe still holds an advantage in the more complex and downstream steps closer to the production of finished drugs. Yet other regions such as India and China have put in place strong industrial policies to support the development of these downstream stages, which is not the case in Europe.

These different examples illustrate the strength of the European chemical industry, which benefits from a dense network of players, long-standing experience and a performance-driven approach. Rising energy and raw material costs are putting pressure on upstream sectors and polymers & intermediates and are pushing some players to reconsider their global footprint. These assets can be part of Europe's future green transition and must therefore be carefully supported. The increasingly complex administrative environment, with higher regulatory and environmental costs, also impacts investment decisions and can be improved to better support the transition and modernisation of the European chemical industry. Europe still has significant strengths, particularly in its non-price competitiveness factors (NPCF), illustrated by its leading position in the downstream segment. These segments must be supported so that they continue to innovate and differentiate themselves, through security of supply, simple and clear regulation, and a long-term industrial strategy.

FIGURE 5.1
European chemicals overview



Note: Consumer Chemicals: personal care, home care, fragrances
Sources: Cefic, Advancy analysis

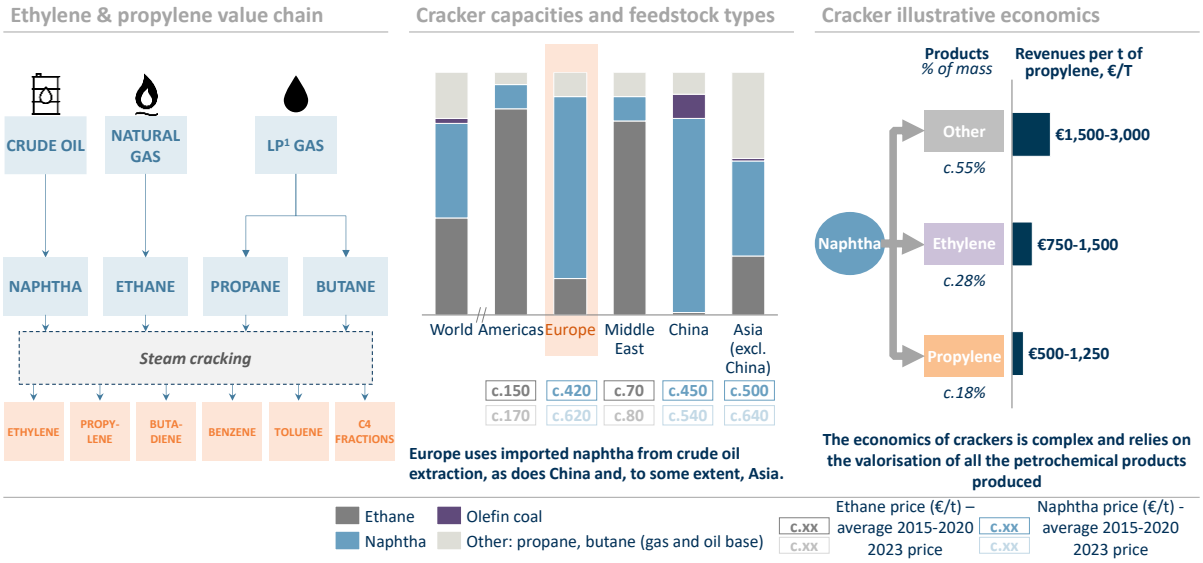
5.1 Upstream chemicals

Three key basic chemicals are presented in the section below: ethylene/propylene, ammonia, and chlor-alkali. These are upstream chemicals used in a wide variety of everyday products.

5.1.1 Organics: ethylene & propylene

Among the basic organic chemicals, ethylene and propylene are the largest in volumes of production. They form the backbone of many chemicals.

FIGURE 5.2 **Cracker economics overview**



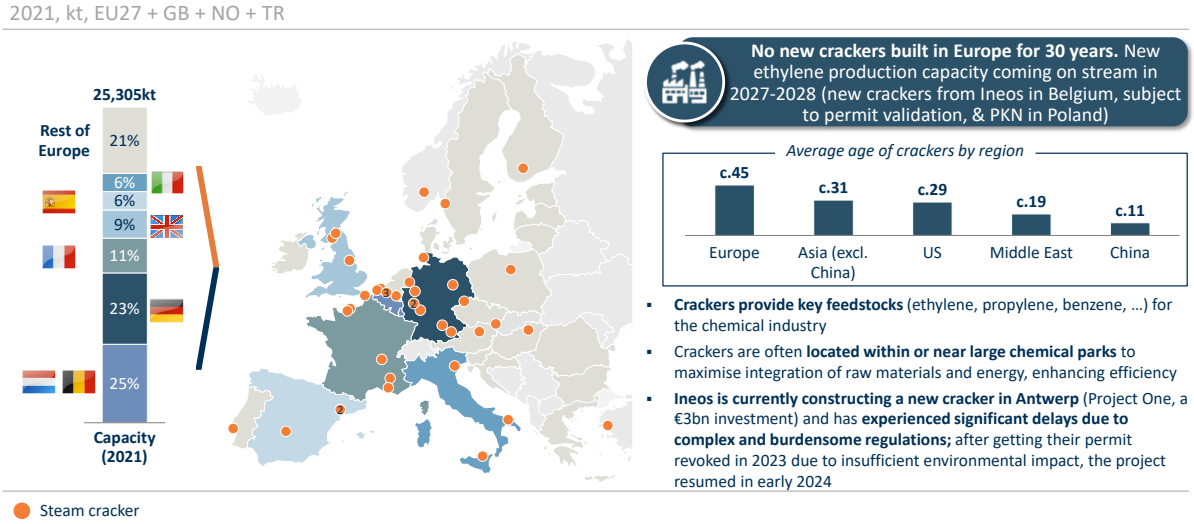
Note: (1) Liquified petroleum
Sources: Advancy analysis

Ethylene and propylene are based on two feedstocks: 1) naphtha and 2) ethane. Both feedstocks play a crucial role in competitiveness, depending on the price cycle of the specific feedstock used. European crackers, like those in China, primarily use naphtha as a feedstock, while productions in the United States and the Middle East use ethane. Ethane from shale gas has proven to be very cost-competitive in recent years, giving the United States an advantage, while the Middle East has benefited from competitive naphtha and ethane crackers due to its abundant local oil and gas supply.

Europe faces challenges due to higher-cost feedstocks and an aging cracker network, highlighting long-standing investment deficits. No new crackers have been constructed in Europe for 30 years, given high investment costs, stringent regulation, low additional demand, and competitive pressures. However, new ethylene capacity is expected to be commissioned between 2027 and 2028, with a large new cracker planned by INEOS in Belgium (pending permit approvals) and one by PKN in Poland. Crackers are essential to the chemical industry, providing critical feedstocks such as ethylene, propylene, and benzene. They play a significant role in chemical park ecosystems, optimizing the integration of raw materials and energy to improve efficiency.

FIGURE 5.3

Capacity and map of European steam crackers



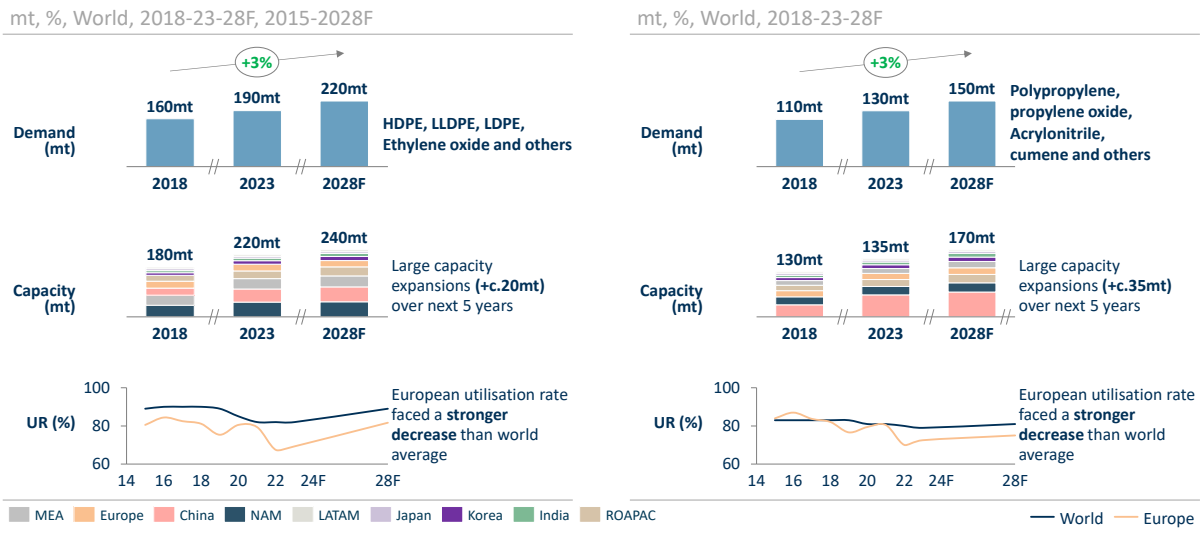
Sources: Cefic, ECSPP, Petrochemicals Europe, Advancy analysis

Europe is falling behind other regions in overall capacity growth, as other areas are set to add significant new capacity (especially China, ROAPAC and the Middle East) while Europe remains stable/declining for both ethylene and propylene.

In addition to limited capacity rejuvenation, the European ethylene and propylene sectors have faced a significant decline in utilisation rates since 2022. This drop has been driven by weakened domestic demand and a worsening trade balance in 2022-23 for ethylene.

FIGURE 5.4

European ethylene and propylene overview



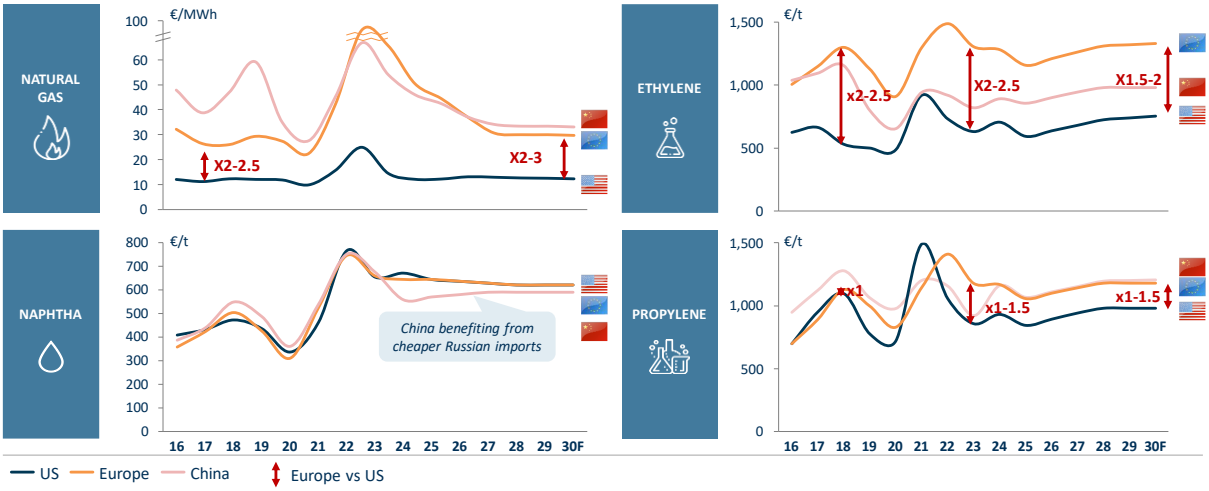
Note: (1) Including Ukraine, Russia
Sources: Cefic, Trade data, Advancy analysis

Europe's reduced utilisation rate was caused by: 1) growing global supply, 2) weak demand in Europe, and 3) reduced competitiveness relative to other regions: Europe was already at a disadvantage relative to the USA and the Middle East, but recently China and to a lesser extent other Asian countries like India began to benefit from discounted Russian naphtha after the beginning of the war in Ukraine.

FIGURE 5.5

Natural gas, Naphtha, Ethylene, and Propylene price evolution

€/MWh, €/t, 2016-2030F



Sources: Cefic, Advancy analysis

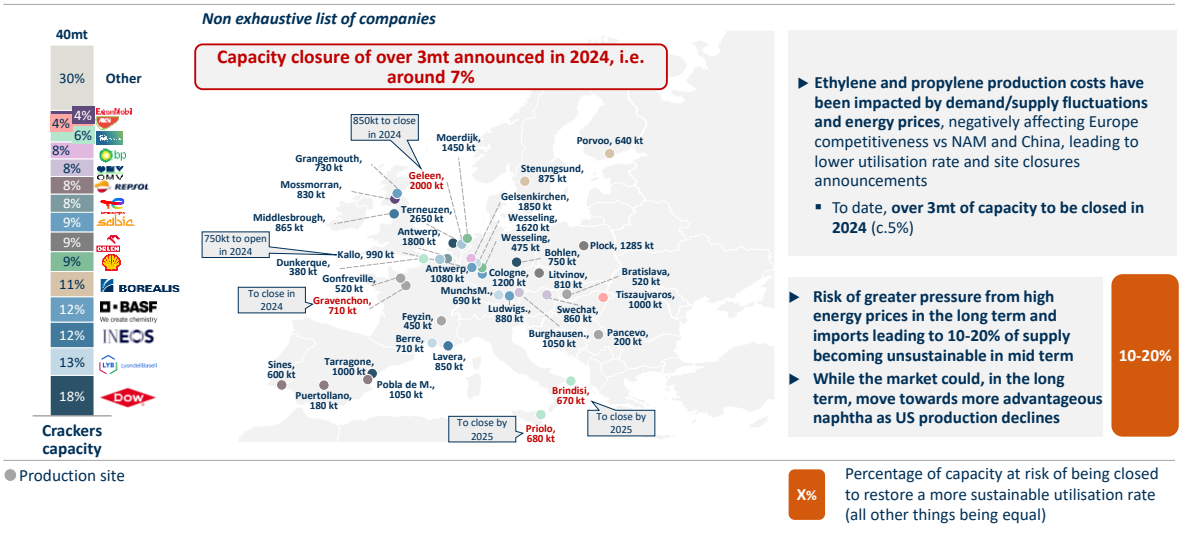
European crackers are being hit by weaker demand in Europe, declining competitiveness against China in naphtha, which benefit from a discount on Russian oil, (avoiding trade sanctions), and increased capacity in other regions, notably the United States, which benefits from competitive ethane (see section 3.3 energy) and the Middle East. This results in capacity closures: to date, over 3mt of capacity is expected to close in 2024 (c.5%).

It must be stressed that the closure of a naphtha cracker is a difficult industrial decision to take, as the cracker is the link between refining and petrochemicals, with possible synergies upstream and downstream. The closure of almost 3 million tons of crackers in the EU and the closures of major players, such as Exxon, Versalis and Sabic, are a sign of urgency.

FIGURE 5.6

Cracker capacity and production sites

mt, 2024, EU15, HU, CZ, NO, PL



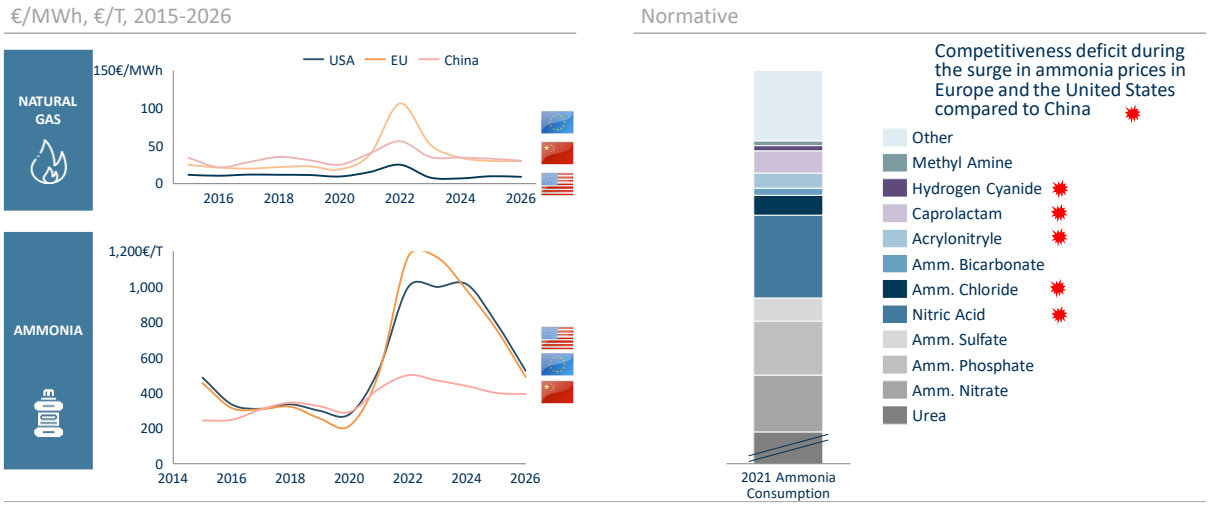
Sources: Advancy analysis

5.1.2 Inorganics: Ammonia

Among the basic inorganic chemicals, ammonia is the most important. Ammonia is essential to produce nitrogen fertilisers, which are necessary for plant growth and the high productivity of European agriculture. Ammonia is used in many other chemicals. Ammonia is also a key component of the European decarbonisation pathway, as it shows high potential in new low-carbon fuels and as a transport medium for low-carbon hydrogen.

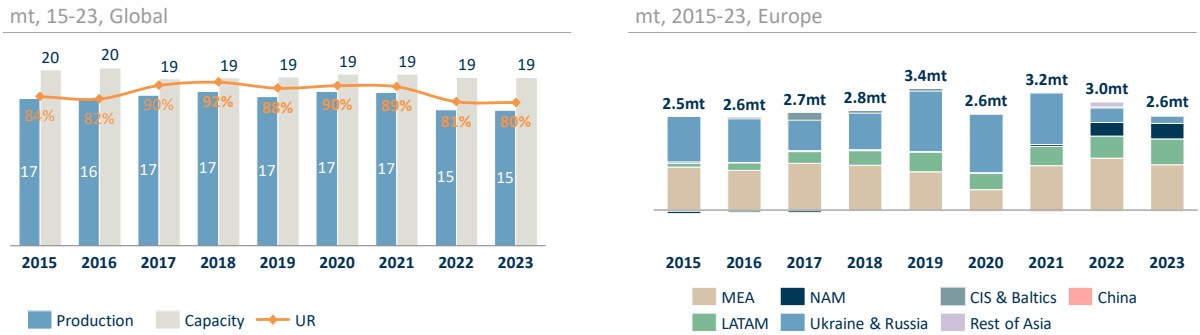
Ammonia producers in Europe faced significant challenges in 2022-23, primarily driven by soaring natural gas prices. The global ammonia market was strongly disrupted, which led to plants shutting down due to the surge in energy costs. Rising energy costs have not been reflected in the price of ammonia in China due to import and export restrictions and the commitment of local authorities to keep the price of this essential agricultural commodity affordable. This has created a significant gap compared to other regions and provided a temporary competitive advantage in many chemical products.

FIGURE 5.7
Ammonia cost increase: energy cost and impacts



Sources: Advancy analysis

FIGURE 5.8
Grey ammonia EU market evolution



- The global grey ammonia market has been impacted by the war in Ukraine: several plants have been stopped due to the surge in gas prices
- In Europe, specific capacity closures have already been announced, partially restoring the sector's utilisation rate
- Additional capacities reduction to come by 2030 due to the transition to green ammonia (1-2mt) and permanent plant closures (1mt)

- Europe is a net importer of ammonia (+2.6 Mt in 2023)
- A shift in importing regions has been observed since 2021, with imports from Russia being replaced by imports from MEA, LATAM and NAM

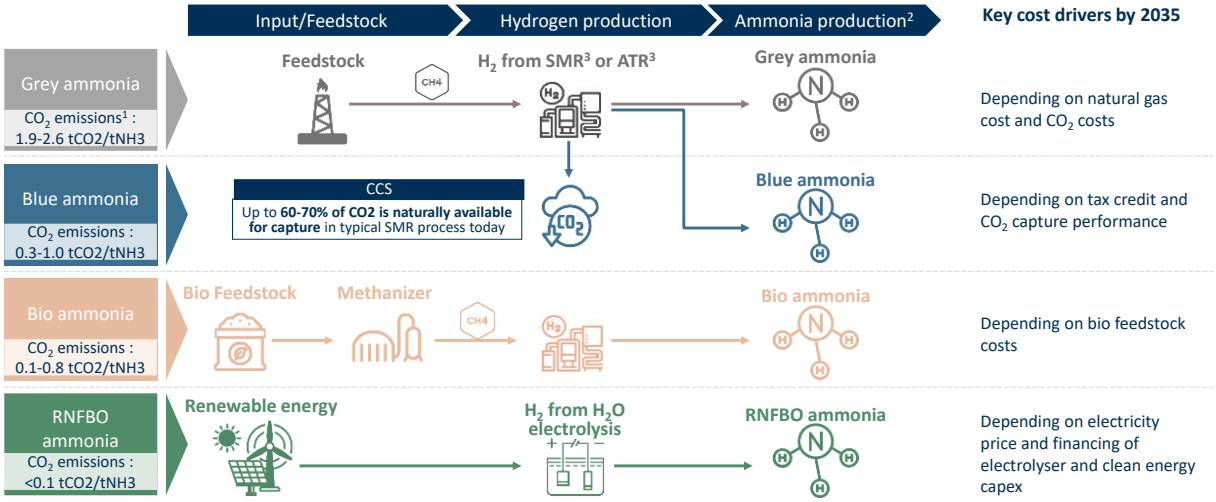
Sources: Advancy analysis

Ammonia is a critical sector for Europe's future with promising technologies under development, such as renewable ammonia (RNFBO), bio ammonia (using bio-waste feedstocks such as biogas), and blue ammonia (using carbon capture). Ammonia plays a key role in Europe's path to climate neutrality. These innovations could

be vital for the continent's low-carbon transition. **In the years ahead, clean ammonia will not only meet part of Europe's demand for nitrogen-based fertilisers and chemical feedstocks but also support emerging markets, such as bunkering, power generation, and hydrogen storage**.

FIGURE 5.9

Overview of ammonia production processes



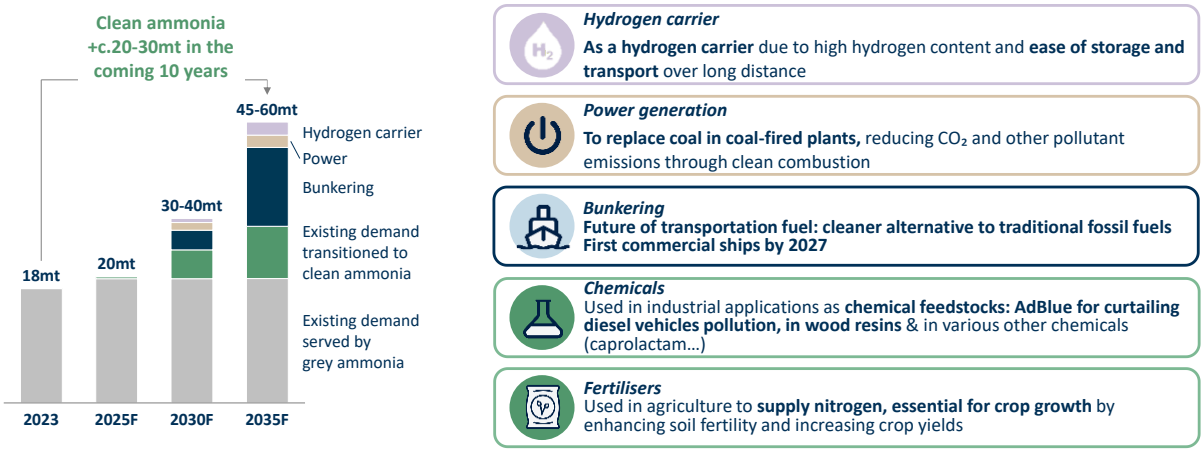
Note: (1) Scope 3 emissions from natural gas and embedded assets are not included – (2) Combining H2 with nitrogen from the air – (3) SMR = Steam Methane reforming, ATR = Autothermal Reforming

Sources: Advancy analysis

FIGURE 5.10

Ammonia demand evolution in Europe

mt of product, 2023-35F, Europe

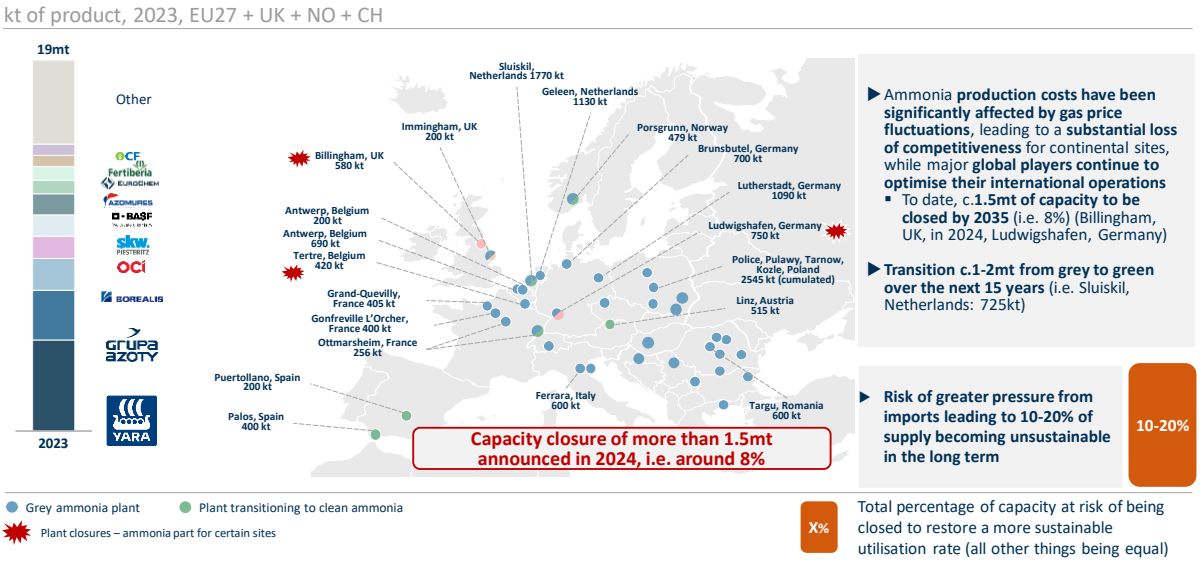


Sources: Advancy analysis, Yara, OCI, Argus, MAN

Europe's current grey ammonia production (from natural gas) has been under pressure. In Europe, specific capacity closures have already been announced, that will restore the sector's utilisation rate. Further capacity evolutions are expected by 2030, driven by the transition to green ammonia (estimated at 1-2 million tons) and the permanent closure of certain plants (around 0.5-1 million tons).

FIGURE 5.11

Ammonia supply landscape in Europe



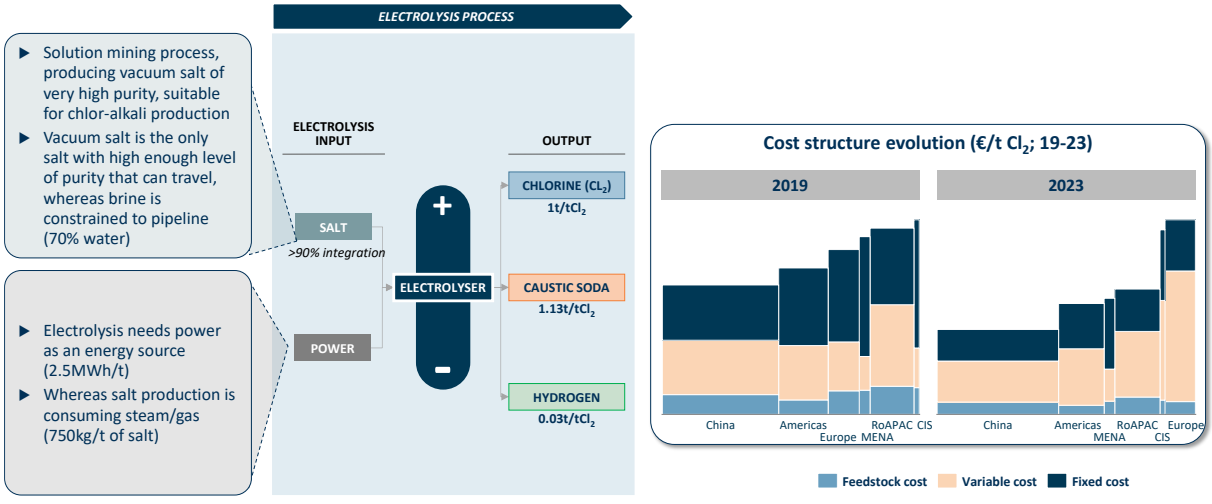
Sources: Advancy analysis

5.1.3 Inorganics: Chlor-Alkali

Another key segment of the inorganic chemicals sector is chlor-alkali, a process that uses salt and electricity to produce three primary products: chlorine, caustic soda, and hydrogen. The production of caustic soda, which represents the largest portion of the value, is intrinsically linked to chlorine output. This creates an important level of dependency between local supply and demand, as chlorine's transport is costly (transported in diluted form) and dangerous (explosive and toxic). The profitability for chlor-alkali producers depends on the fully integrated ECU (European Electrochemical Unit) margin, which accounts for the combined production of chlorine, caustic soda, and hydrogen.

FIGURE 5.12

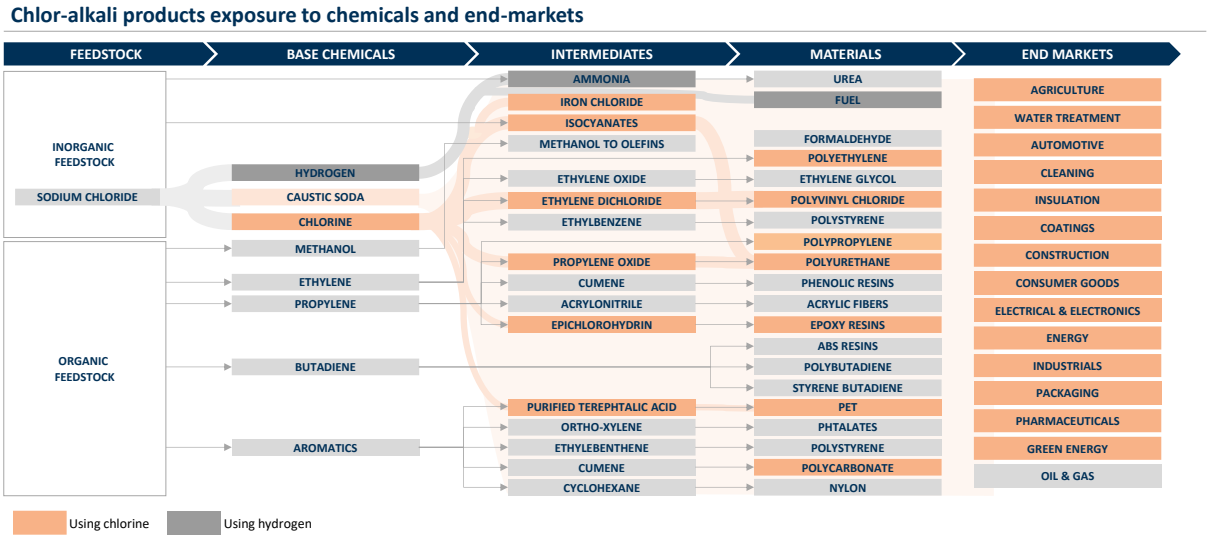
Chlor-alkali electrolysis process and cost structure



Source: Advancy analysis

Chlorine is used in about 40% of organic chemicals, while caustic soda is used in a wide range of chemical synthesis applications and is used in over 60% of chemical production.

FIGURE 5.13
Chlor-alkali exposure

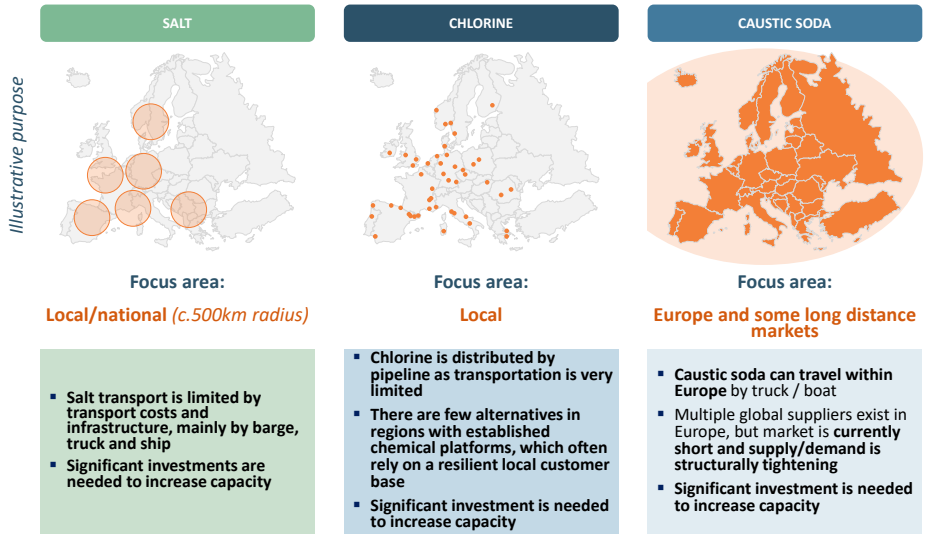


Source: Advancy analysis

Chlor-alkali products serve different markets: salt and chlorine are confined to local markets due to limited transportation options, while caustic soda has a broader reach, with distribution extending across Europe.

The chlor-alkali process also produces hydrogen as a by-product, which is then valorised by many chemical companies in their processes. **In fact, hydrogen is produced in many chemical processes as a by-product, accounting for about 1/3 of hydrogen capacity in Europe.** These processes include: chlor-alkali and sodium chlorate production, ethylene and propylene from propane dehydrogenation, and the styrene process and refineries.

FIGURE 5.14
Market reaches of different chlor-alkali products

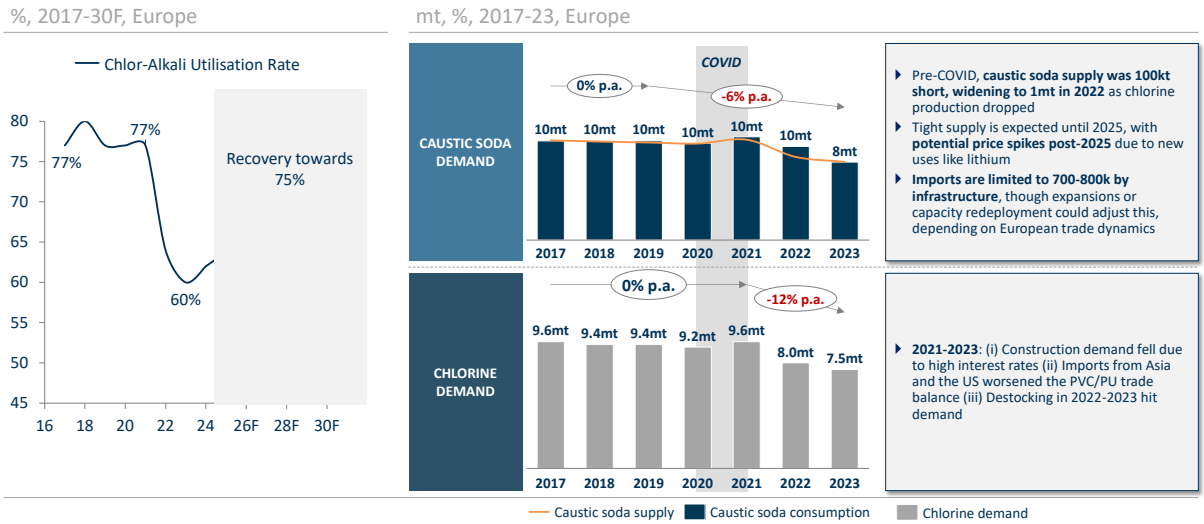


Source: Advancy analysis

Utilisation rates of chlor-alkali plants saw a sharp decline in 2022-23 for both caustic soda and chlorine, driven by soaring energy costs. However, a recovery is anticipated in the coming years, with the market for caustic soda expected to tighten due to increasing demand in electrical batteries applications.

FIGURE 5.15

Chlor-alkali utilisation rate and demand evolutions

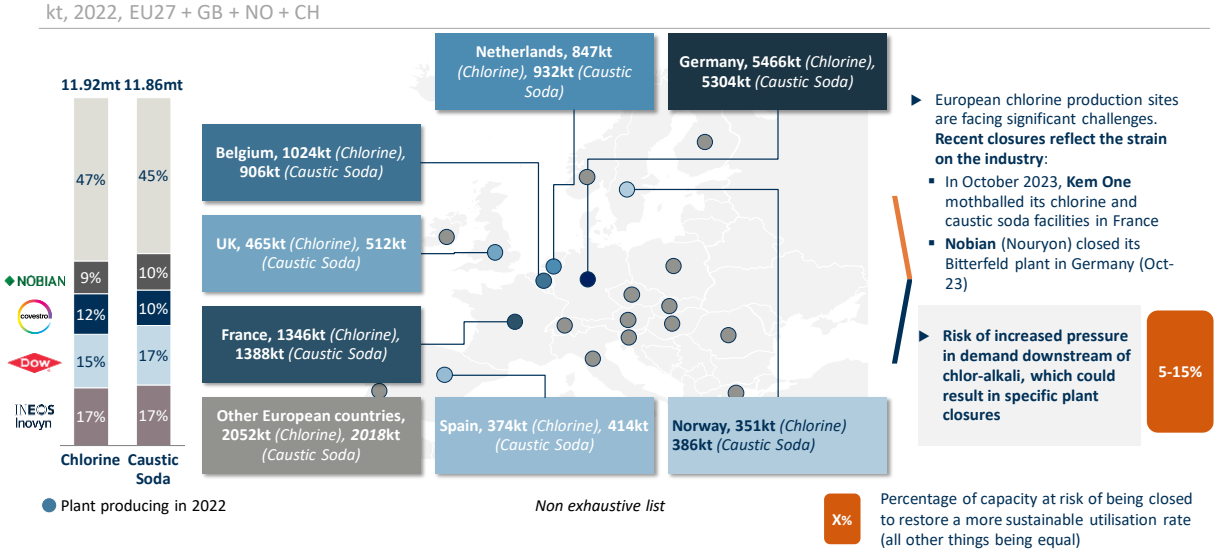


Source: Advancy analysis

Chlor-alkali production capacities play a critical role in supplying large downstream markets, such as PVC, which are under intense competitive pressure. This dynamic could result in specific plant closures.

FIGURE 5.16

Chlorine and caustic soda supply landscape in Europe



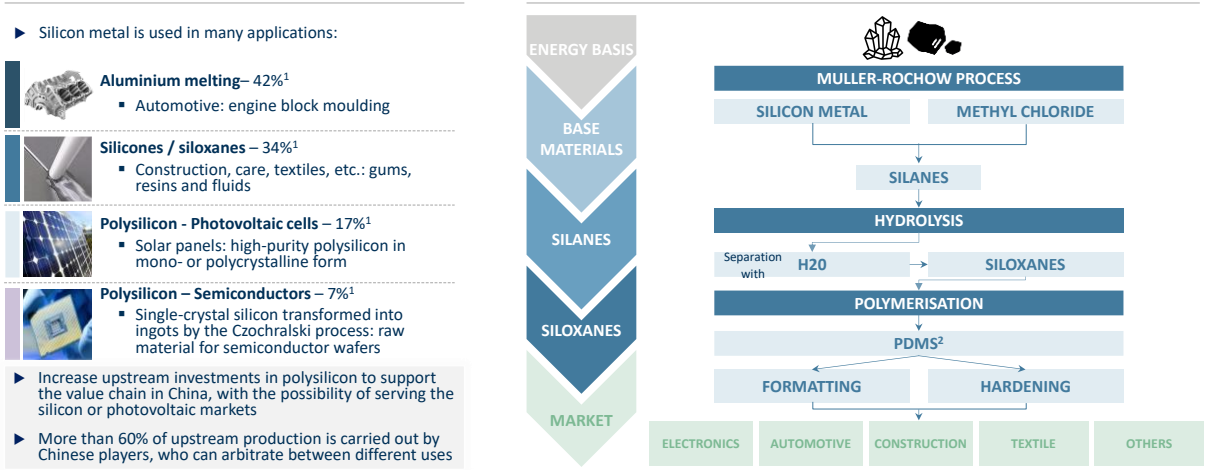
Sources: Advancy analysis

5.2 Polymers & Intermediates chemicals

One step further downstream in the value chain, chemical companies produce polymers and intermediates from basic chemicals that in turn form the backbone of plastics and more complex materials.

5.2.1 Silicones

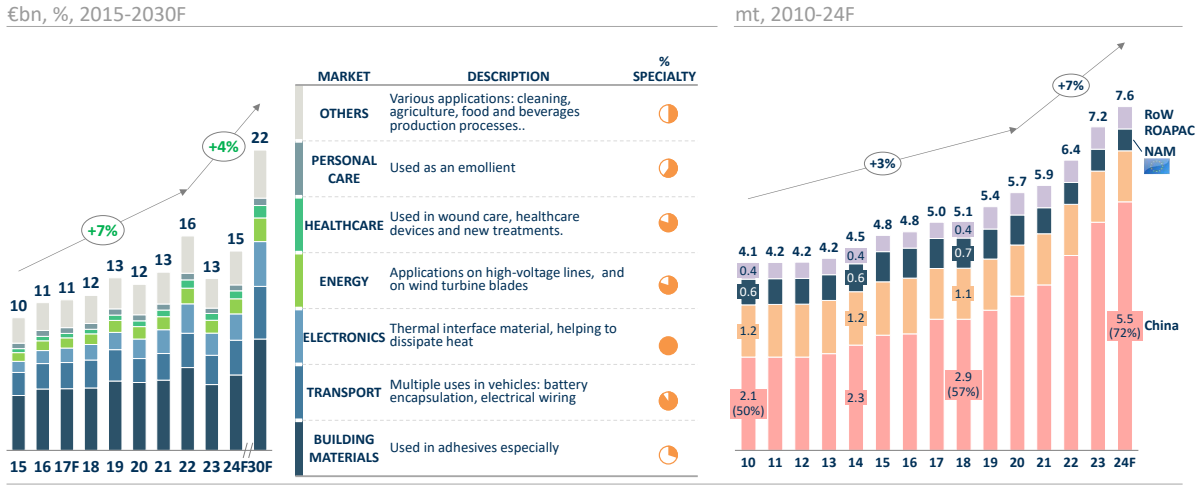
FIGURE 5.17
Silicon role and value chain



Notes: (1) Share of application markets in global demand 2020 (2) PDMS: Polydimethylsiloxane
Sources: Advancy analysis

Silicones are a particularly good example of a missed opportunity. Silicon metal serves as the foundation for silicones—essential in the automotive, construction, and textile industries—and is a critical component of polysilicon used in the photovoltaic and semiconductor end-markets. Silicones are then used in different applications, from building materials to personal care products. Some applications are specialty chemicals, involved in high performing applications and in innovative technologies (defence, energy, health care applications).

FIGURE 5.18
Silicone demand and capacity evolution



Sources: Advancy analysis

China plays a dominant role in this market, with over 60% of upstream production controlled by Chinese players. These producers possess the strategic advantage of arbitrating between different end-uses, enabling them to

pivot production to meet demand in either the silicone or photovoltaic markets. Recent increases in upstream investments in polysilicon have further strengthened China's position in the value chain, ensuring a robust supply to support both domestic and foreign industries.

The silicone market is experiencing robust growth, exceeding 5% annually, driven by China's expanding production capacity and increasing global demand, which now accounts for over 60% of global supply *(figure 18)*.

Europe has historically been an important production region, accounting for around 25% of supply in 2010. However, it has not kept up with market growth or been able to compete with China, which made the development of silicon metal (particularly for photovoltaics) a strategic target.

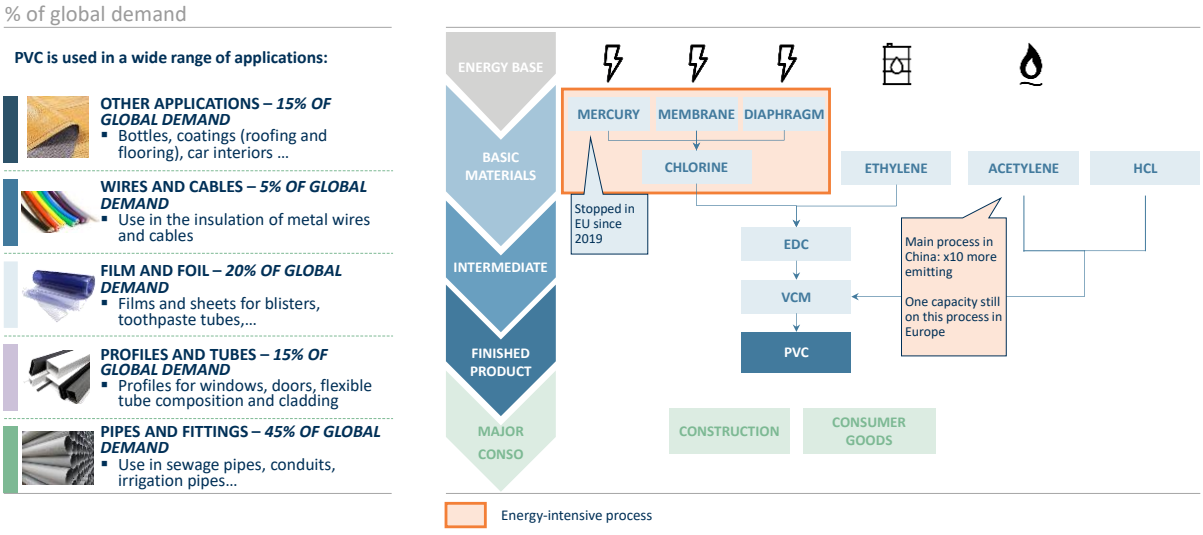
Historically, Europe has faced higher fixed operating and SG&A (Selling, General & Administrative) costs. Since 2022, rising energy prices have further exacerbated variable costs, significantly impacting European utilisation rates. This deterioration in cost competitiveness could result in the closure of 5 to 10% of capacity, to restore a more sustainable utilisation rate for the European industrial landscape.

If Europe had invested strategically in this area over the last 15 years with an integrated value chain strategy, it could have maintained a significantly higher market share, thanks to its existing knowledge, both in the more standardised segments and in the specialised segments.

5.2.2 Polyvinyl Chloride

Polyvinyl Chloride (PVC) is a thermoplastic polymer widely used in construction, with its production process highly reliant on energy-intensive inputs such as electricity and oil. PVC is produced from chlorine and ethylene.

FIGURE 5.19
PVC role and value chain



Sources: Advancy analysis

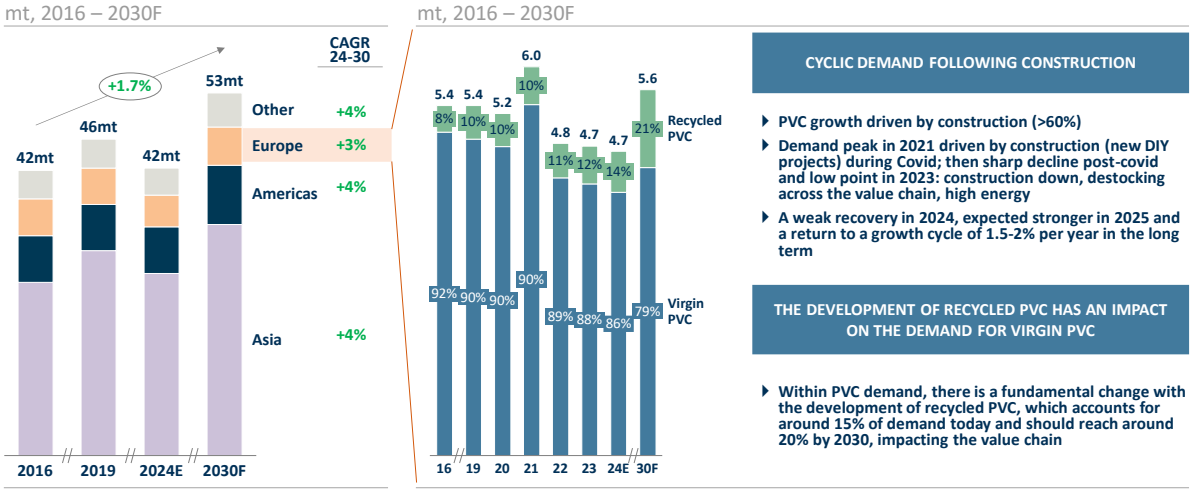
Europe's 5-million-ton PVC market is closely tied to the construction industry, which accounts for over 60% of PVC demand. This dependence creates cyclicality *(figure 5.20)*, with demand fluctuating in response to construction trends and broader economic conditions:

- PVC demand peaked in 2021, driven by a surge in DIY projects and heightened construction activity during COVID.

- Post-pandemic, the market experienced a sharp decline as construction slowed, energy costs surged, and destocking affected the value chain.
- Demand hit a critical low in 2023, marking a particularly challenging year for the sector.
- A gradual recovery is expected, with a weak rebound in 2024 and stronger growth anticipated in 2025.
- Long-term growth is projected at 1.5–2% annually, reflecting the sector's underlying resilience.

In parallel, the growing adoption of recycled PVC is reshaping the market. Recycled PVC currently accounts for approximately 15% of demand, and this share is expected to rise to 20% by 2030 *(figure 5.20)*. This shift will significantly affect the value chain, reducing demand for virgin PVC while aligning the industry with sustainability goals.

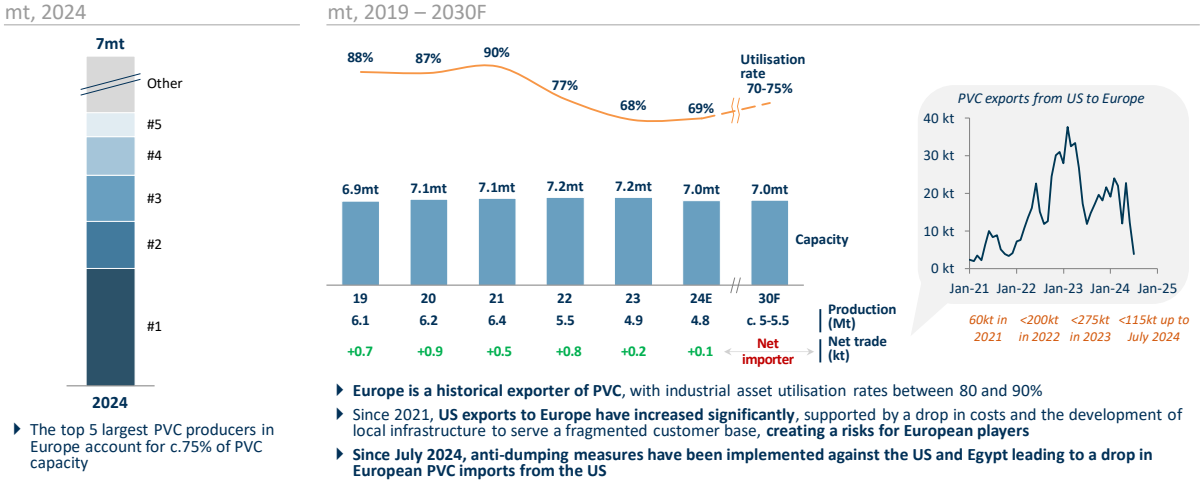
FIGURE 5.20
PVC demand evolution



Sources: Oxford Economics, Advancy analysis

Since mid-2022, Europe's PVC industry has faced significant challenges due to weakened demand, increased US imports, and persistently high energy costs, all of which have raised concerns about the viability of industrial sites. Traditionally an exporter of PVC, Europe has historically maintained industrial asset utilisation rates between 80% and 90%. The rise in US imports began in 2021, driven by lower production costs and the expansion of local infrastructure to serve Europe's fragmented customer base creating a risk for European players.

FIGURE 5.21
European PVC supply overview



Sources: Oxford Economics, Trade data, Advancy analysis

In response, anti-dumping measures were introduced in July 2024 targeting PVC imports from the USA and Egypt. These measures have led to a decline in US-origin imports with an average of 18kt per month over the first 6 months of the year, down to 3kt per month from July to September.

US producers benefit from significantly lower production costs, driven by the abundance of shale gas and its by-product, ethane.

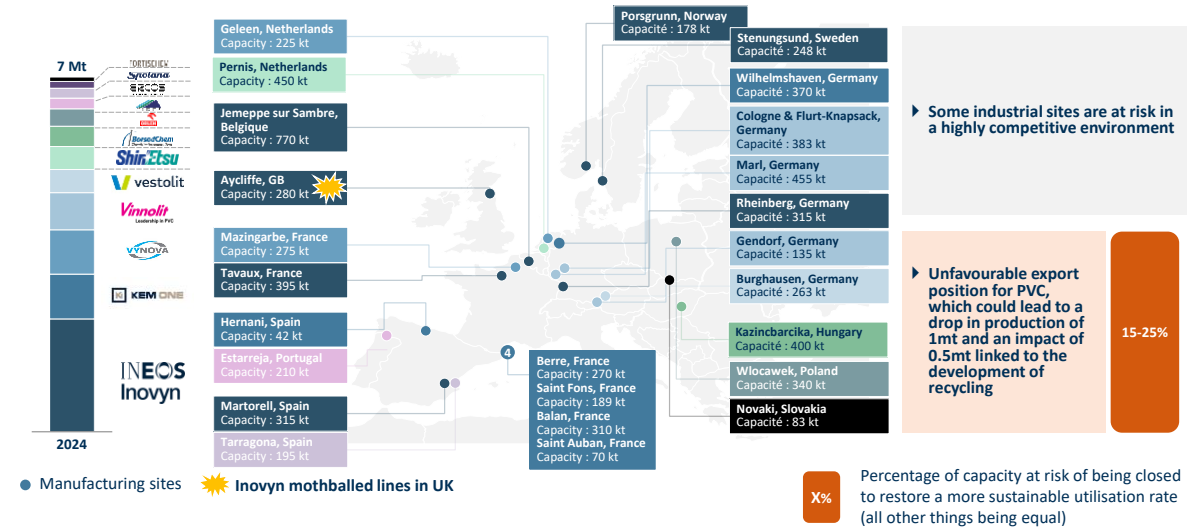
- The ethylene price in the USA is lower than Europe due to ethane crackers.
- Gas and electricity prices in the USA are much lower than in Europe.
- The sharp rise in natural gas prices in Europe, exacerbated by the war in Ukraine, has further compounded this disadvantage.
- Additionally, the increasing cost of CO_2 emissions in Europe, coupled with the absence of a comprehensive emissions trading scheme in the USA, means European producers are at a further disadvantage, particularly in the global export market, where their competitiveness continues to erode.

European PVC plants face a risk of closure, driven by competitiveness and low utilisation rates.

FIGURE 5.22

PVC supply landscape in Europe

Mt, 2024, EU27, GB & NO



Sources: Advancy analysis

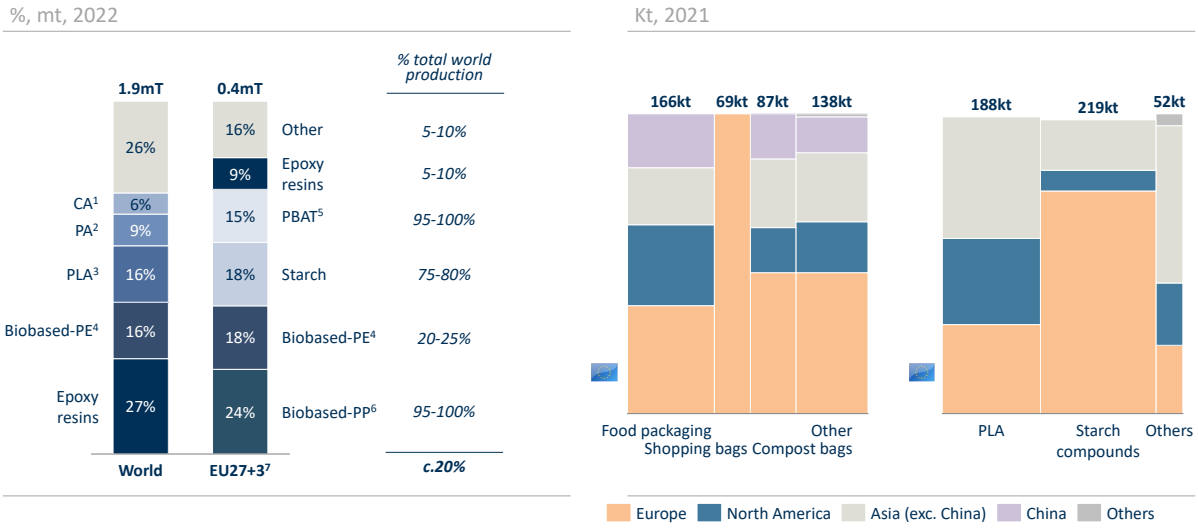
5.2.3 Bio polymers

Europe has been leading the way in bioplastics, producing 20% of the world's bio-based plastics and consuming 50% of biodegradable plastics *(figure 5.23)*.

This leadership reflects the European Union's increasing efforts to introduce and adapt policies supporting the bio-economy and circular economy *(figure 5.24)*. While the lack of a fully clear and comprehensive policy framework still limits the market expansion, ongoing advancements and commitment from policymakers provide a promising foundation for accelerated growth and long-term innovation.

FIGURE 5.23

Bio-based plastics production and consumption



Notes: (1) Cellulose Acetate, (2) Polyamides, (3) Polylactic acid, (4) Polyethylene, (5) Poly(butylene adipate-co-terephthalate), (6) Polypropylene, (7) Norway, Switzerland, UK, (8) Included in food packaging for North America and China
Sources: Plastics Europe, Advancy analysis

To support European positioning in the biopolymer sector, the chemical industry needs access to raw materials that are competitive at world market prices. Biopolymers are based on bioethanol, sugar and glucose. In recent years, prices have increasingly diverged across regions, partly due to differences in raw material support policies. Prices are lower in the US, Canada and Brazil, due to access to raw materials and specific subsidies. In recent years, the Chinese chemical industry has also benefited from low sugar prices, based on duty free imports from the USA, Canada and Brazil and additional local support to develop the industry. These increasingly uneven conditions of competition have repercussions on Europe's competitiveness. This is also impacting the feed additive segment described below.

FIGURE 5.24

EU efforts in favour of bioplastics

Sources: European bioplastics, Cefic, Plastics Europe, Advancy analysis

5.3 Downstream chemicals

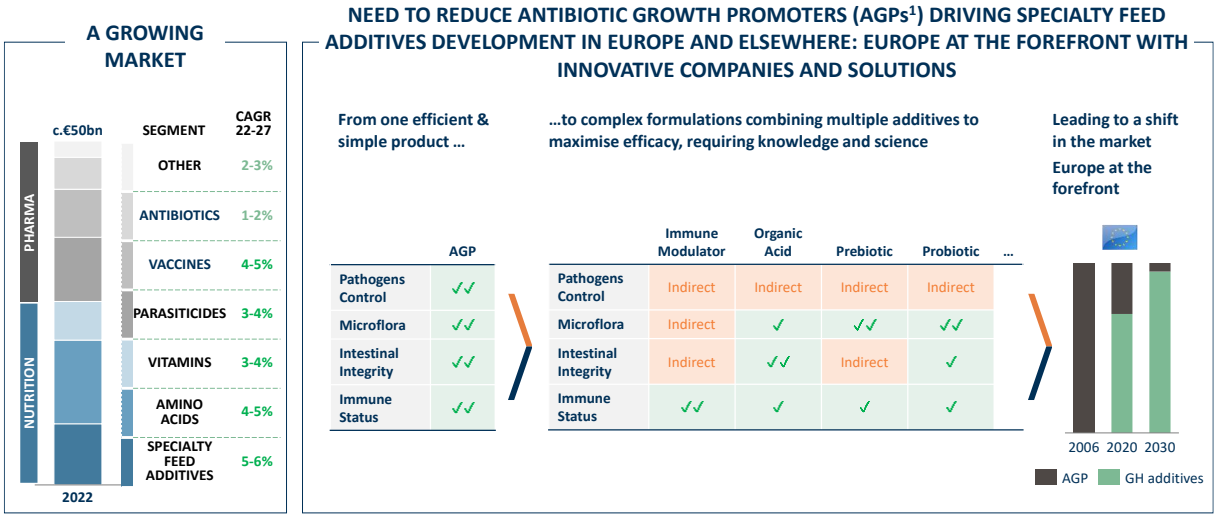
The downstream segment includes a very dense network of small and large chemical companies in Europe. In general, downstream products are of higher value. They can be complex molecules produced through reaction steps in small batch reactors (e.g. specialty pharmaceuticals) and/or complex formulations, multiple blended ingredients (e.g. formulated personal care products or paints and coatings). In general, they are more labour-intensive and less energy or capital-intensive comparatively.

The European chemical industry has an advantageous positioning in most of the verticals within the downstream chemicals. Three specific markets selected show Europe's strength as well as the challenges it will face in the future: **(1) feed additives, (2) personal care and (3) pharmaceuticals**. These markets are growing, driven by favourable megatrends. In feed additives, Europe has lost ground in the production of basic ingredients (vitamins and amino acids), where it is increasingly dependent on imports; however, it remains strong in specialty feed additives that strengthen animal health and nutrition with targeted actions. The European chemical industry is well positioned in the personal care market with a dense ecosystem of innovative companies. In pharmaceuticals, Europe maintains a strong positioning in specialised areas of the pharmaceutical value chain but is dependent on imports for simpler steps of pharmaceutical production and increasingly for the most complex ones.

5.3.1 Feed additives

The feed additives market is growing at 3-4% with specialty feed additives being the main growing segment (+5-6% CAGR 22-27) followed by amino acids and vaccines (+4-5% CAGR 22-27).

Figure 5.25
Animal health & nutrition market 2022



Note: (1) Antibiotic Growth Promoters: used to describe any medicine that destroys or inhibits bacteria, GH additives: Gut health additives
Sources: Advancy analysis

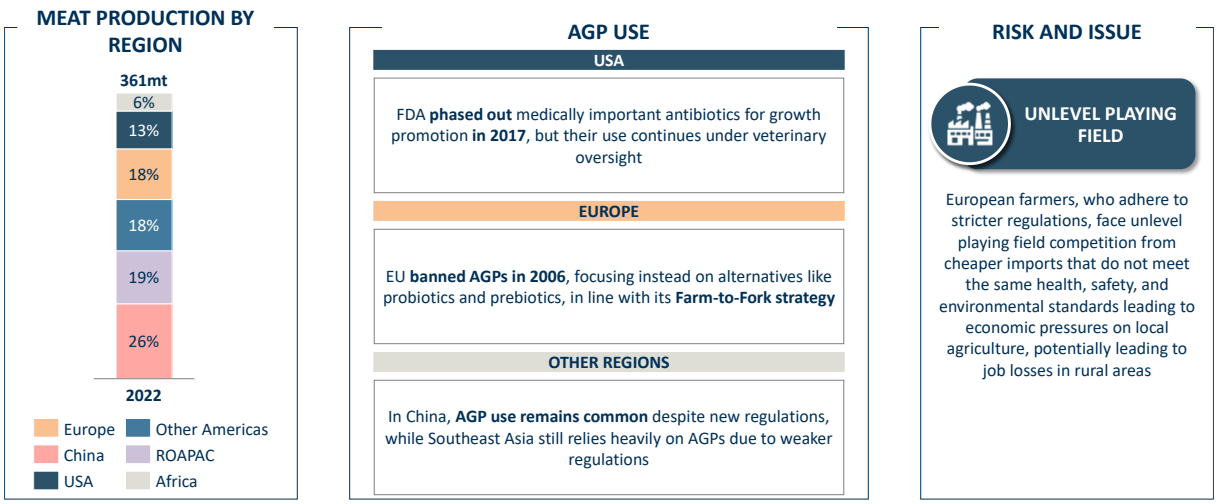
Over recent years, antibiotic growth promoters (AGPs) have been phased out, particularly in the European Union. This is due to rising concerns about antibiotic resistance and the objective to mitigate the risks of resistance transfer from animals to humans, which can reduce the effectiveness of antibiotics in human medicine. The industry is shifting from simple product (AGP) to a combination of several specialty feed additives that reinforce animal health and nutrition so that the animal can cope with bacteria without AGP. This involves innovative

companies in Europe that have developed new products and complex formulation to reach similar performance as AGP (formulations combining several ingredients such as organic acids, prebiotics, probiotics).

These highly relevant innovations also lead to additional costs in animal feed, which may put European farmers at a disadvantage compared to imported products that do not comply with the AGP ban. Each region handles AGP differently:

- **United States**: FDA phased out medically important antibiotics for growth promotion in 2017, but their use continues under veterinary oversight.
- **Europe**: EU banned AGPs in 2006, focusing instead on alternatives like probiotics and prebiotics, in line with its Farm-to-Fork strategy 2030 objectives.
- **Other Regions**: In China, AGP use remains common despite new regulations, while Southeast Asia still relies heavily on AGPs due to weaker regulations.

Figure 5.26
Meat production by region in 2022

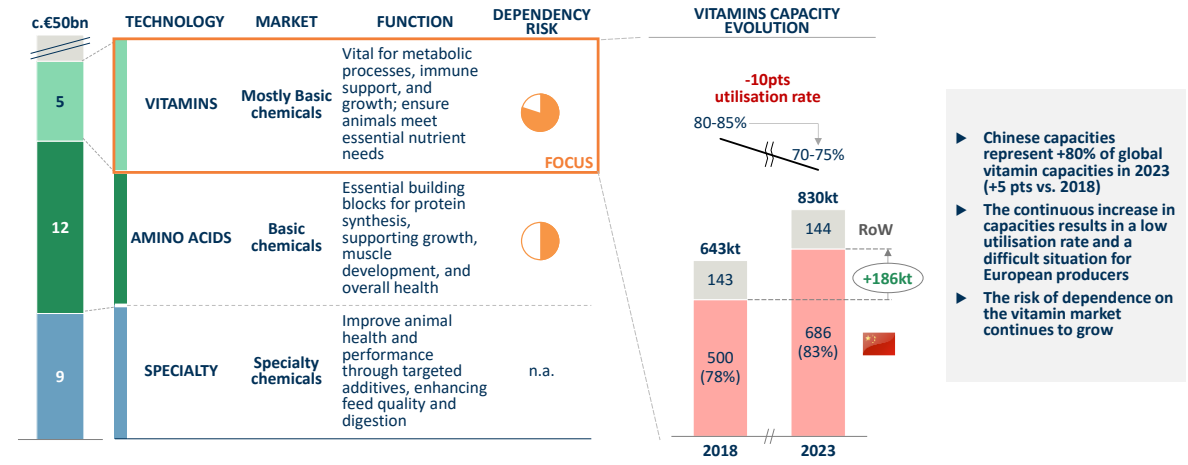


Note: (1) Antibiotic Growth Promoters / Sources: FAO, Advancy analysis

This pressure has an ambivalent effect, it pushes for the development of higher premium products in Europe which can be beneficial for the demand for specialty additives, but it also pushes the total volumes demand down impacting the more basic feed additives.

Figure 5.27
Dependency risk in the feed additives market

kt, %, 2018-2023, Global



Source: Advancy analysis

In the past 10-20 years basic feed additives have shifted to Asia, raising supply security concerns in some cases. For example, the capacity of vitamins is mainly located in China, which accounts for 83% of the global vitamin capacity in 2023.

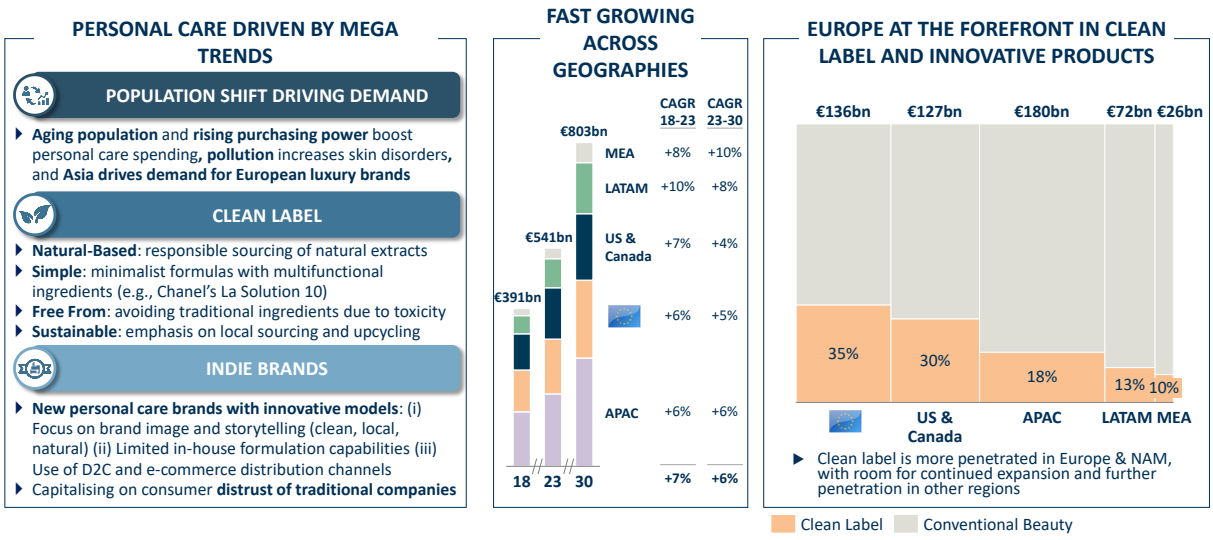
Feed additives highlight the strength of the European chemical industry in innovative solutions development but also underscores the risks of losing out on the production of more commoditized products.

The raw materials for vitamins and amino acids are mainly sugar and glucose (starch). The prices of those raw materials are much higher (almost twice as high) in Europe than in Brazil, the USA and Canada. China can import these raw materials duty-free. Therefore, China continues to supply the European market with vitamins and amino acids (up to 80%) at very competitive prices. This competition has worsened in recent years. This must be put in the context of amino acids becoming even more "essential" in the EU's strategic autonomy in protein.

5.3.2 Personal care

The personal care market is experiencing strong nominal growth driven by three mega trends: (i) population shift i.e. aging population and rising purchasing power, (ii) clean label penetration and (iii) indie brands development.

Figure 5.28
Personal care end-market overview

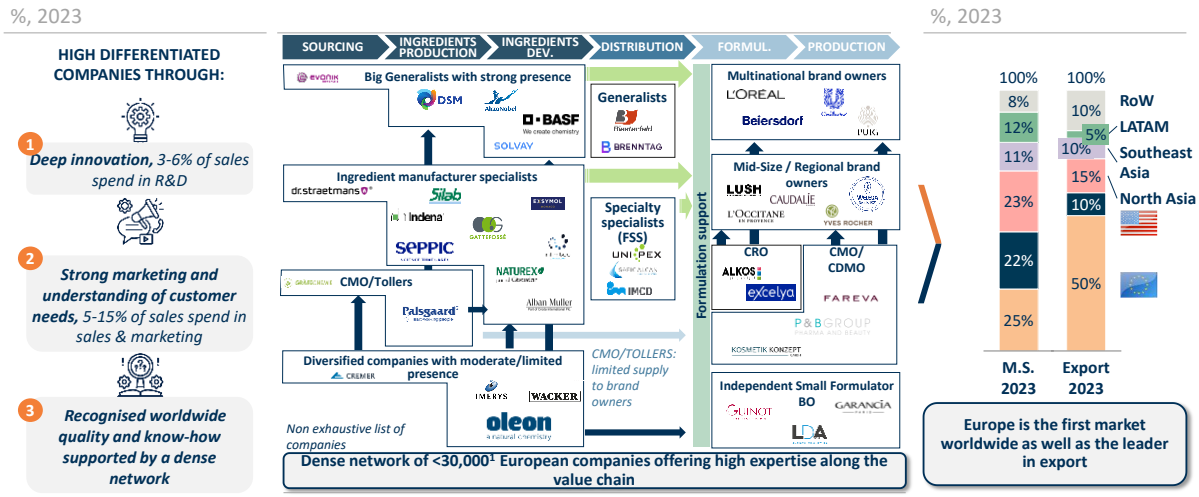


Sources: Euromonitor, Advancy analysis

Through a dense network of ingredient producers and renowned brand customers, Europe is positioned as a leading region in the personal care sector as well as one of the leading regions in terms of global exports.

This is an inspiring segment of the chemical industry that shows the strength of Europe: strong innovation, deep ecosystem, long term investment, strong marketing, and science. These areas of knowledge are hard to copy, yet production is becoming increasingly outsourced to lower cost regions creating emerging competitors (for example India leading fine chemicals companies that are becoming increasingly strong in flavour and fragrance).

Figure 5.29
European positioning in the personal care sector



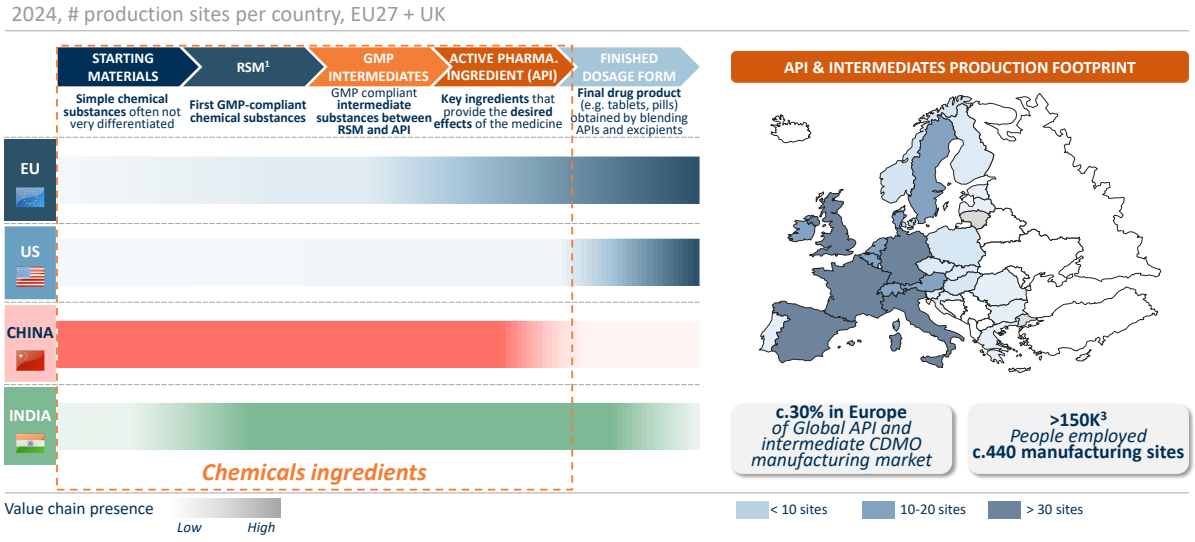
Note: (1) From production to wholesale of cosmetics / Sources: Cosmetics Europe Association, Advancy analysis

5.3.3 Pharmaceuticals

The upstream pharmaceutical sector, i.e. intermediates/precursors to pharmaceuticals products is a typical example of where Europe still has strong knowledge and positioning. However, by outsourcing the least complex steps, Europe has lost ground and knowledge over time and now faces increasing competition on complex steps and critical supply issues.

Europe remains present in the manufacturing of Active Pharmaceutical Ingredients (APIs) and Finished Dosage Forms (FDFs), which are less sensitive to price competition and increasingly driven by innovation. While these segments of the pharmaceutical value chain remain strong in Europe, a significant part of the earlier stages of the value chain has moved to Asia.

Figure 5.30
Pharmaceuticals end-market overview



Notes: (1) Regulatory Starting Material, GMP: Good Manufacturing Practices, (2) c.3% of European industrial production, (3) for the merchant market (c.€70bn)
Sources: EFPIA, IQVIA, APIC, Company information, Advancy analysis

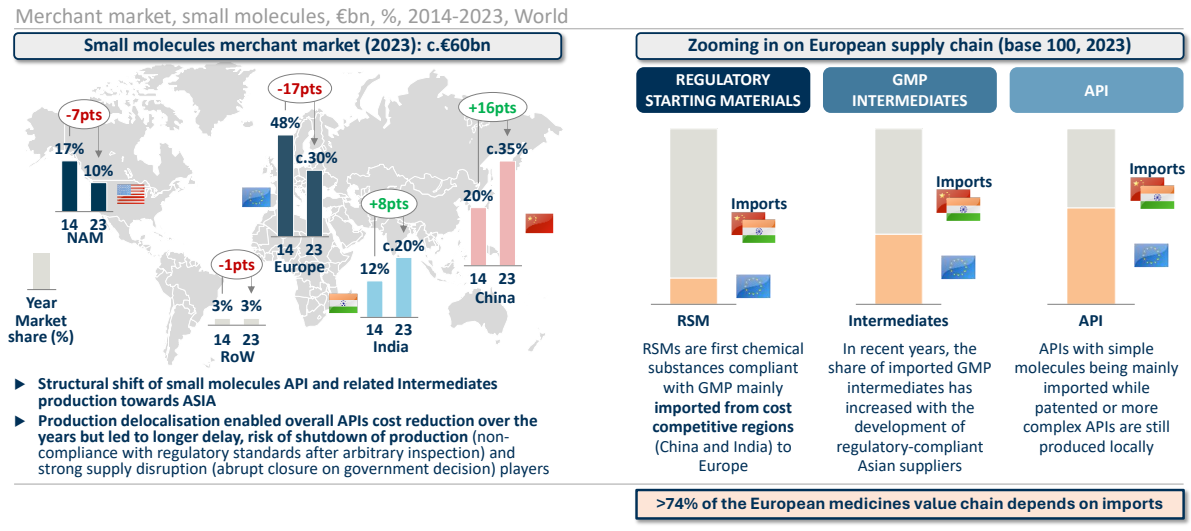
The global small molecules, APIs, and intermediates market was valued at approximately €60 billion in 2023. Over the past decade, a structural shift in production has moved a sizeable portion of small molecules APIs and intermediates manufacturing to Asia, primarily China and India, in pursuit of optimized manufacturing costs. As a result, Europe now ranks as the second-largest global region in this market, just behind its Asian counterparts. This shift has made Europe heavily reliant on imports, with over 74% of its pharmaceutical value chain depending on non-European suppliers. The relocation of production to cost-competitive regions has reduced the overall cost of APIs but has also introduced significant challenges:

- **Extended supply delays:** Longer lead times due to geographical distance and complex supply chains.
- **Regulatory risks:** Abrupt shutdowns from non-compliance with Good Manufacturing Practices (GMP) after inspections.
- **Supply chain disruptions:** Vulnerability to government-imposed closures, particularly in response to policy changes or environmental regulations in producer countries.

These risks highlight the fragility of Europe's supply chain for APIs and intermediates, which is critical for ensuring the continued production of medicines and the strategic independence of Europe. Europe's reliance on imports is particularly clear in the upstream, more commoditised steps of the pharmaceutical value chain:

- **Regulatory Starting Materials (RSMs):** These are the initial chemical substances used in API production and must meet GMP standards. The vast majority of RSMs are imported from cost-competitive regions, primarily China and India.
- **GMP-Compliant Intermediates:** In recent years, Europe has increasingly imported intermediates from regulatory-compliant Asian suppliers, as these regions have rapidly developed the expertise.
- **Simple APIs:** Simple molecules are predominantly sourced from Asia due to lower production costs; Europe retains local manufacturing capacity for patented and more complex APIs, where innovation, regulatory expertise, and proximity to market remain competitive advantages.

Figure 5.31
European market-share in the basic pharmaceutical market

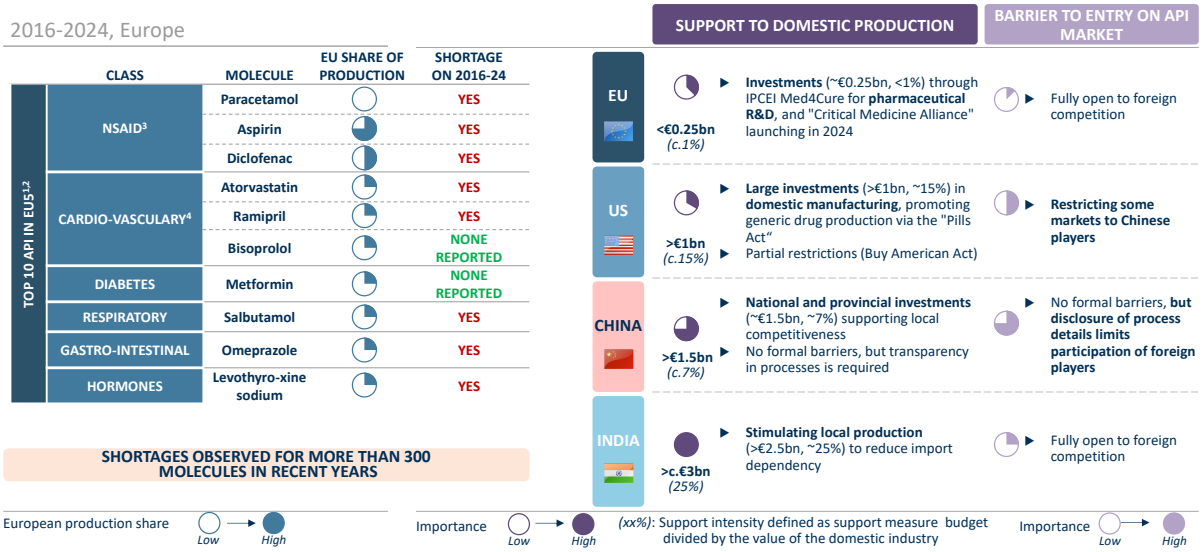


Sources: Company data, IQVIA, Advancy

In Europe, more than 800 molecules have faced shortages in recent years, primarily due to supply chain issues caused by the region's lack of a comprehensive strategy compared to other global regions. This has left Europe heavily reliant on outside-Europe production and external policy frameworks.

Figure 5.32

Shortages dynamics in Europe between 2016 and 2024 & Domestic support policies



Notes: (1) In standard units, (2) EU5: France, Germany, Italy, Spain, UK, (3) Nonsteroidal anti-inflammatory drugs (4) Include antithrombotic, (5) Customs Processing Fees, (6) Special Economic Zones, (7) Production Linked Incentive, (8) Strengthening of Pharmaceutical Industry

Sources: IQVIA, EFCG, European Commission, Advancy analysis

European companies need support to invest in automation and advanced chemical processes to enhance their competitiveness against non-European rivals; Europe currently faces an unlevelled playing field where their competitors are strongly supported by local industrial policies.

***

In conclusion, the different examples presented in this section show the strengths and weaknesses of the chemical sector in Europe. They highlight the dense network of companies producing essential products for Europe, innovating to stay ahead, and transitioning to reduce their emissions. They show, especially for the upstream sector, the impact of energy competitiveness or new regulation. For the downstream sector on the other hand, they indicate the risks of outsourcing too much production and lacking integrated value chains and industrial policies. European chemical companies face an uneven playing field with other regions who receive more support and face less administrative burden. For example, the IRA helps to develop low-carbon hydrogen in the US, China's Target 2025 drives strategy supporting heavy investments in silicones up to photovoltaic panels and the Indian government strongly supports the development of its fine chemical industries (pharmaceuticals, agrochemicals).

ENDNOTES

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Figure 5.3: Capacity and map of European steam cracker – *Cefic, ECSPP, Petrochemicals Europe, Advancy analysis*

Figure 5.4: European Ethylene and propylene overview – *Cefic, Trade data, Advancy analysis*

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Figure 5.23: Bio-based plastics production and consumption – *Plastics Europe, Advancy analysis*

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Figure 5.28: Personal care end-market overview – *Euromonitor, Advancy analysis*

Figure 5.29: European positioning in the personal care sector – *Cosmetics Europe Association, Advancy analysis*

6 Section 6 – Next Steps: A Call for Action

As shown throughout this report, the European chemical industry is at a crossroads. The European chemical industry has faced a sharp slowdown, stronger than the general economy, driven by reduced demand and challenged competitiveness. The trend of structural oversupply caused by overinvestments is reflected in the low utilisation rate of the industry, at only 75% for the past nine quarters. The depth and duration of the slowdown is unprecedented. Europe's competitiveness is impacted by comparatively high energy and raw material costs, and has weakened relative to its peers, in terms of rising regulatory and environmental costs, as well as an increasingly complex investment environment and more uncertain demand expectations.

Without proactive measures to create a business environment that allows businesses to leverage their strengths and enables Europe to achieve its objectives, the European chemical industry risks losing its competitive edge compared to the USA, China, and other regions, particularly in the upstream and polymers & intermediates sectors. Disruptions in the upstream and polymer parts of the value chain can have a domino effect on the downstream part of the value chain: less investments, less reliability of supply due to fewer suppliers and increased dependence on imports, and fewer trained workers.

The current uncertain situation has led chemical players to review their footprint. There are already around 11 million tons of announced capacities to be closed in Europe in 2023 - 2024, impacting 21 major sites. This corresponds to a loss of 2-4% of the European upstream chemical and polymer industry.

The European chemical industry faces further risks, but also opportunities. Restoring its competitiveness in the short term and supporting the recovery of demand are essential to maintain its positioning and support the next growth opportunity it can seize in the medium-term. **Without urgent active policy measures and market recovery, around 8% of value added in the chemicals sector could be further impacted.** At the same time, the European chemical industry plays a key role in innovation and sustainability development supporting decarbonisation and the transition to a circular economy in Europe. Provided it regains competitiveness, the European chemical industry will continue to seize those medium-term opportunities**.**

The European chemical industry needs an "Industrial Deal" to restore its competitiveness and be best positioned to address future growth. Chemical companies are actively investing and monitoring their footprint to address future needs. Yet, more urgent, and concrete actions are needed to alleviate some of their burdens and achieve a promising scenario of a new industrial deal. Such actions must include sufficiently competitive energy for energy-intensive producers such as the chemical industry, a lighter environmental and regulatory burden, and a more incentive-based industrial policy to foster investment and innovation.

Increasingly, actions are being taken to support European competitiveness, but they do not match the urgency of the chemical sector. In February 2024, the European industry proposed 10 critical points to support the business case to invest in Europe. Those points have also been covered in the Letta report and the Draghi report. From these initiatives, seven crucial action levers have been identified, providing a framework for revitalising the region's industrial competitiveness. They call for action in the coming months: 1) to develop a clear industrial policy supporting business and

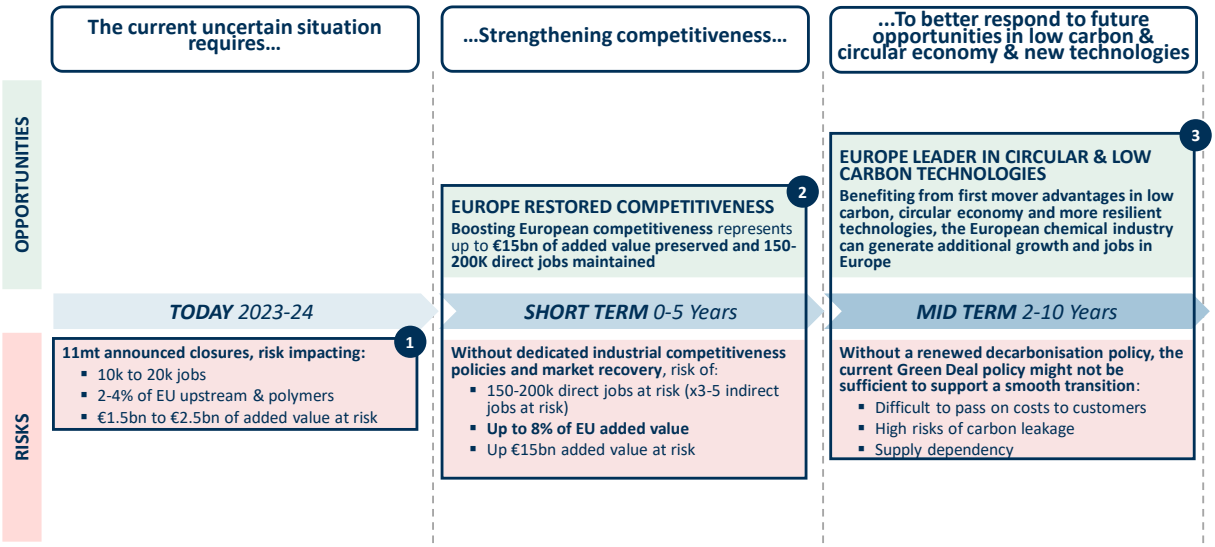
manufacturing in Europe, 2) to reduce administrative burden and current uncertainties around policy costs to incentivise future investment, 3) to restore the energy competitiveness and have competitive feedstocks, 4) to finance the transition, innovation, and support modernisation of existing assets, 5) to foster a level playing field versus other regions, 6) to support strategic autonomy, 7) to boost customer industries and end consumer demand, particularly for high end-, added value-, net-zero, low-carbon and circular products.

A game changing policy could trigger investment by alleviating unilateral burdens and isolated EU policy moves. The next sections explore opportunities, risks, and policy options in further detail.

6.1 Risks & Opportunities ahead

Figure 6.1

European risks and opportunities



Sources: Advancy analysis

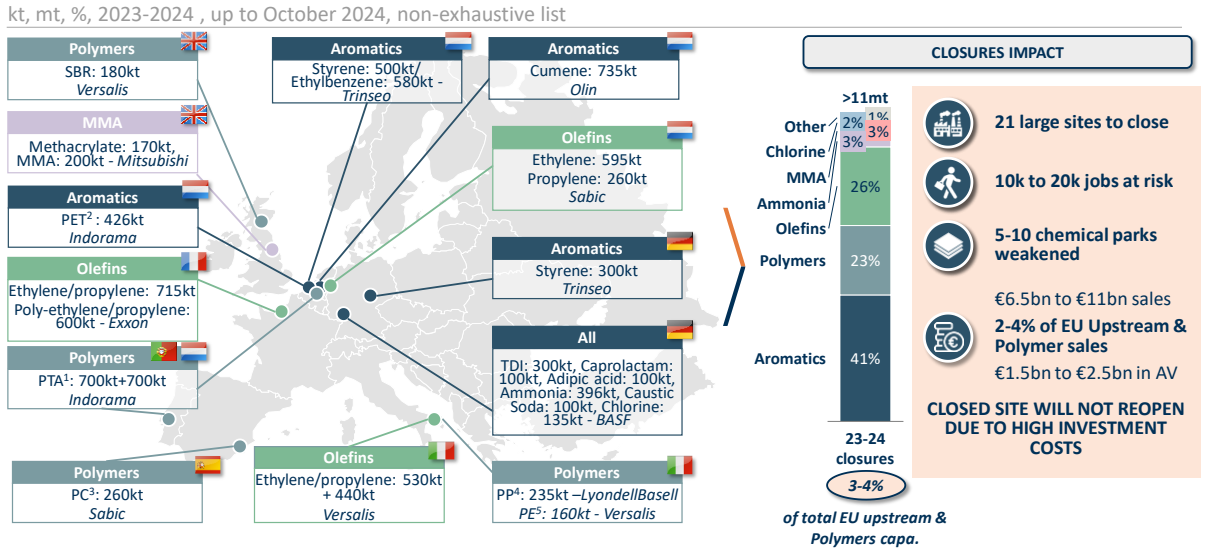
The European chemical industry is at a crossroads impacted by demand, supply, and competitiveness impacts and faces strong regional competition. In this current uncertain situation, the European chemical industry must restore its competitiveness to better respond to future opportunities in low carbon, circular economy, and innovative technologies.

The current uncertain situation has led chemical players to review their footprint. There are already around 11 million tons of announced capacities to be closed in Europe in 2023 - 2024, impacting 21 major sites. This represents:

- 10,000 to 20,000 jobs
- 3 to 4% of the EU's total upstream and polymer capacity closing, weakening 5 to 10 chemical parks.
- €6.5 billion and €11 billion sales at risk, or about 2 to 4% of total EU upstream and polymer sales; the impact on added value (AV) is estimated to range between €1.5 billion and €2.5 billion.

Figure 6.2

European capacity closure announcements

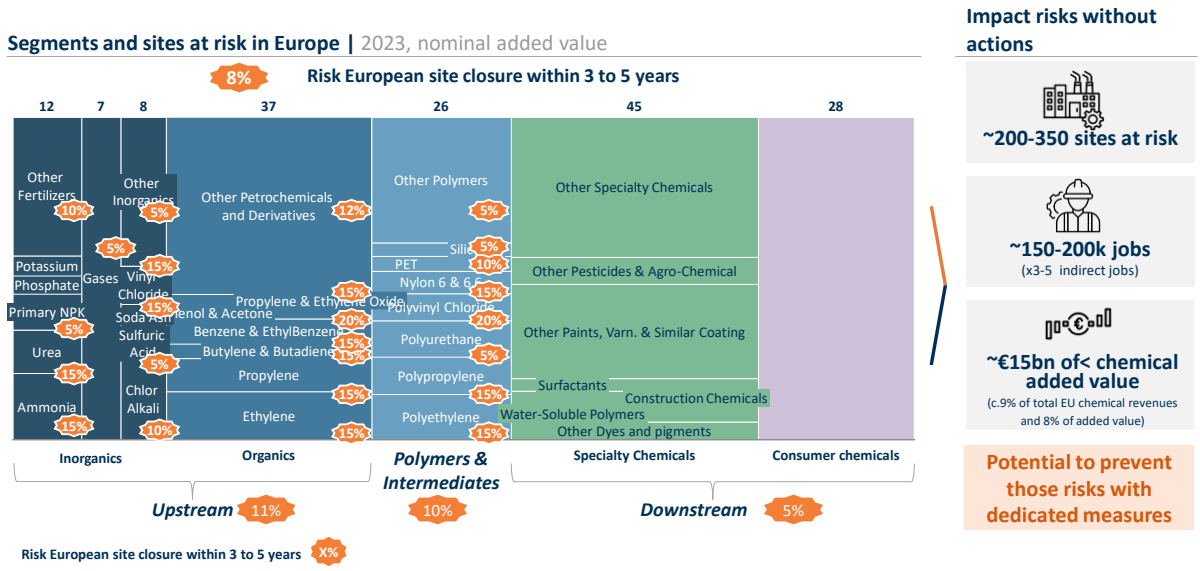


Notes: (1) Purified terephthalic acid, (2) Polyethylene terephthalate, (3) Polycarbonate (4) Polypropylene (5) Polyethylene
Sources: Company websites, S&P, Chemical week, Advancy analysis

The European chemical industry faces risks, but also opportunities. Restoring its competitiveness in the short term and supporting the recovery of demand are essential to maintain its positioning and support the next growth opportunity it can seize in the medium-term.

With a dedicated industrial policy and market recovery, the chemical industry can avoid the risks of additional closures. 300 to 350 sites could be at risk, meaning 150,000 to 200,000 direct jobs and up to 8% of EU chemical sales, with up to €15 billion impacted in added value, especially in the upstream market (11% of added value) with the organic chemicals, and in the polymer market (10% of added value). There could be a knock-on effect on the downstream market, facing a smaller risk of approximately 5% of its value.

Figure 6.3
Short term risks



Methodology: The risk impact is assessed at the level of each key chemical, considering the supply/demand balance in Europe in the coming years, based on the current recovery in market demand, existing supply, and import/export levels. Examples of value chains are in Section 5 and additional value chain assessment was based on Advancy's knowledge and discussions with market experts. Taking a step back, the resulting overall level of 8% corresponds to a normative range that should improve the European usage rate to the 80-85% range, necessary to operate a healthy business.
Sources: Cefic, Advancy analysis

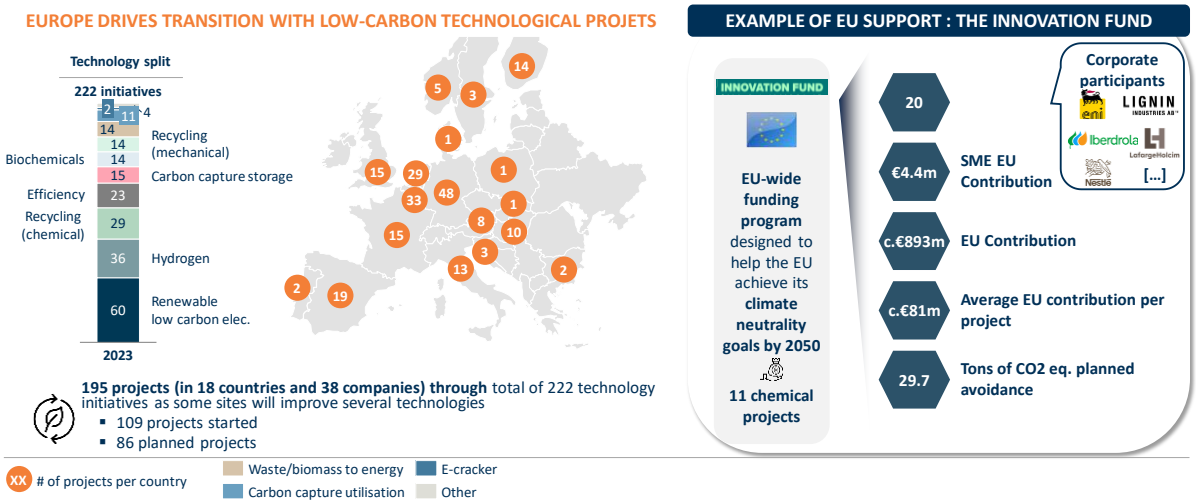
As Draghi's report highlights, it is important to support the growth of manufacturing demand in Europe. Specific value chains and downstream demand for chemicals are facing increased pressure in recent times, including automotive, pharmaceuticals, agriculture and general manufacturing, which account for around 60% of chemicals end markets.

At the same time, the European chemical industry is already investing in areas of growth, especially in low carbon and circular technologies. There are indeed emerging sectors and potential rewards ahead. Europe is already leading a low-carbon technological transition with 222 initiatives already in the pipeline and the potential support of the EU's innovation fund for example based on Cefic assessment. This must be accelerated, extended, and better supported.

Figure 6.4

Low carbon transition development

EU, UK and Norway, 2024

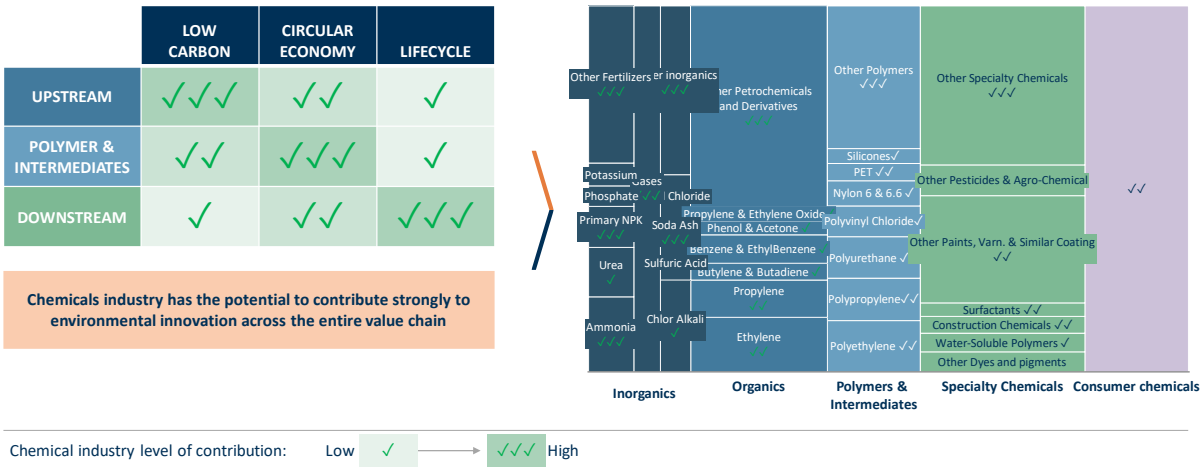


Note: (1) Electricity / Source: Cefic

With its regained competitiveness and the recovery in demand, the European chemical industry will continue to seize medium-term opportunities in more sustainable and transversal chemical growth areas. The development of low-carbon technologies, circular economy and improved life cycles can generate additional opportunities in the next 10 years: for example, clean ammonia in fuel, bio-naphtha, HVO and SAF biofuel, recycled plastics, and performance additives improving product lifecycle.

Figure 6.5

Sustainability opportunities



Methodology: The opportunity impact assessed at the level of each key chemical, considering the new demand in the coming years, the potential conservative premium expected on this new demand (5-10%) and the resulting impact at the aggregated level from low to high. Some examples of new value chains have been detailed in Section 5: green ammonia in maritime fuel, biopolymers, bio-naphtha in propylene-ethylene and in Sustainable aviation fuel for example.
Source: Advancy analysis

The European chemical industry is also involved in innovative cross-cutting technologies by developing high-performance materials and ingredients used in these applications. Figure 6.6 lists 8 important innovation areas

for Europe, in most of which chemicals have a role to play and innovative chemical companies support the development of these new products.

Figure 6.6
Next transversal technologies and role of chemicals

SIGNIFICANT AREAS OF INNOVATION	ROLE OF CHEMICALS	OPPORTUNITY IMPACT		
		UP-STREAM	POLYMERS	DOWN-STREAM
AUTOMATION	▶ High performance & engineering polymers ▶ Specialised chemicals additives	Low	High	High
CONNECTIVITY	▶ High performance & engineering polymers	Limited	Low	Low
CLOUD	▶ Performance polymers & thermal management materials	Limited	Low	Low
NEXT-GENERATION COMPUTING	▶ Performance polymers & thermal management materials	Limited	Low	Low
AI-TECHNOLOGY	▶ Performance polymers & thermal management materials	Limited	Low	Low
BIOECONOMY	▶ Upstream chemicals, fermentation ▶ Biopolymers ▶ Downstream formulation	High	High	Mid
NEXT-GEN MATERIALS	▶ High performance & engineering polymers ▶ Specialised chemicals additives	Low	High	High
CLEANTECH	▶ High performance & engineering polymers ▶ Specialised chemicals additives ▶ Chemical recycling	Mid	Mid	Mid

Methodology: The opportunity impact assessed at the level of each key chemical, considering the new demand in the coming years and the resulting impact at the aggregated level.
Source: Advancy analysis

6.2 Growing awareness, but more actions needed

The year 2024 marked a turning point in raising awareness of Europe's widening competitiveness gap, particularly in the industrial sector. Key milestones, such as the Antwerp Declaration and the Draghi Report, have underscored the urgent need for action while driving a deeper political focus on the issue. However, while progress is being made, the measures taken so far fall short of bridging this gap. With bold and decisive action, Europe has a unique opportunity to strengthen its industrial base and ensure the resilience of its chemical sector.

Figure 6.7
Milestones in addressing Europe's Competitiveness Gap

Overall, there is a growing awareness of the competitiveness gap in Europe, but the measures taken so far are insufficient to close this gap and strengthen industrial competitiveness

Source: Advancy analysis

Leading companies have come together to support ten critical points outlined in the Antwerp Declaration, highlighting urgent actions needed to safeguard the industry's future and competitiveness.

Figure 6.8

The 10 points of the Antwerp Declaration

Antwerp Declaration 10 points must be urgently implemented

1	**PUT THE INDUSTRIAL DEAL AT THE CORE OF THE NEW EUROPEAN STRATEGIC AGENDA FOR 2024-2029** Advocate for a comprehensive plan to prioritize competitiveness, simplify regulations, and introduce an Omnibus proposal for corrective measures
2	**INCLUDE A STRONG PUBLIC FUNDING CHAPTER WITH A CLEAN TECH DEPLOYMENT FUND** Support energy-intensive industries with public funding aligned with a streamlined State Aid framework, promoting private investment in clean technologies
3	**MAKE EUROPE A GLOBALLY COMPETITIVE PROVIDER OF ENERGY** Reduce energy costs through new projects for affordable, low-carbon energy and a cohesive EU Energy Strategy
4	**FOCUS ON THE INFRASTRUCTURE EUROPE NEEDS** Use EU funds to build top-tier energy, digital, CCUS, and recycling infrastructure, address cross-border transport bottlenecks, and ensure skilled labour availability
5	**INCREASE THE EU'S RAW MATERIALS SECURITY** Increase domestic mining and recycling, create a Circular Carbon Strategy, and secure critical materials through global partnerships
6	**BOOST DEMAND FOR NET ZERO, LOW CARBON AND CIRCULAR PRODUCTS** Promote net-zero and circular products via transparent labelling, public procurement, and expanded EU acts for low-carbon products
7	**LEVERAGE, ENFORCE, REVIVE AND IMPROVE THE SINGLE MARKET** Reduce fragmentation, create a single market for waste and recycled materials, and improve import measures enforcement
8	**MAKE THE INNOVATION FRAMEWORK SMARTER** Support high-quality science, protect IP, encourage digitalization, and facilitate the transition from demonstration to commercial tech
9	**A NEW SPIRIT OF LAW-MAKING** Enable business innovation with flexible legislation, reduce reporting, ensure coherence, and evaluate new policies through competitiveness and innovation checks
10	**ENSURE THE STRUCTURE ALLOWS TO ACHIEVE RESULTS** Appoint a First Vice-President to oversee the European Industrial Deal's integration and alignment across key departments

Source: Antwerp declaration

The Antwerp Declaration was further reinforced by the Draghi Report. It underlines the urgency of addressing Europe's industrial challenges, especially of EU's energy-intensive sectors.

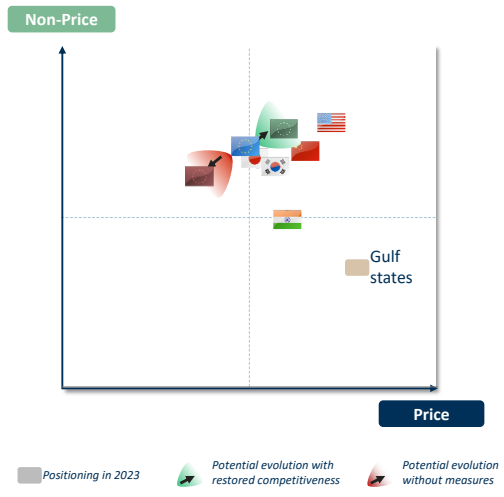
From these initiatives, seven crucial action levers have been identified, providing a framework for revitalizing the region's industrial competitiveness and ensuring long-term sustainability.

Figure 6.9

7 action levers to address Europe's chemical industry challenges

	ADVANCY IDENTIFED STRATEGIC POINTS	ANTWERP POINTS	ADDRESSED COMPETITIVENESS FACTORS
1	Develop a clear industrial policy supporting business and manufacturing in Europe	1, 2, 8, 9, 10	Investment, Subsidies & tax policies, innovation, human capital, industrial & trade policies
2	Reduce the administrative burden and current uncertainties around policy costs to incentivize future investments	2, 9	Environmental, regulatory cost, industrial & trade policies
3	Restore the energy competitiveness and have competitive feedstocks	3, 4	Energy & feedstocks
4	Finance the transition, innovation, and support modernisation	2, 8	Energy, environmental, regulatory, investment, innovation, human capital
5	Foster a level playing field	5, 7, 9	Subsidies & tax, Supply/demand ecosystem
6	Support strategic autonomy & security of supply	2, 4, 5	Investment, Subsidies & tax, Innovation, supply/demand ecosystem, industrial & trade policies
7	Boost customer industries and end consumer demand, particularly for high end-, added value-, net-zero, low-carbon and circular products	6	Supply/demand ecosystem

COMPETITIVENESS EVOLUTION



Sources: Advancy analysis

1. **Develop a clear industrial policy supporting business and manufacturing in Europe**: advocate for a comprehensive plan to balance competitiveness, innovation, and resilience. Industrial policy should assist companies to position themselves successfully in global competition by adapting the regulatory framework to create maximum impact across the board. It must have a more incentive-driven policy that better reflects industry constraints (time, capital, people) and with reliable support for key technologies for the chemical industry and rapid regulatory recognition (chemical recycling, CCU/S etc.).
2. **Reduce the administrative burden and current uncertainties around policy costs to incentivize future investments:** simplify and accelerate permitting, and reduce unnecessary compliance costs, red tape, and regulatory burden. Introduce an Omnibus proposal for corrective measures based on clear industrial policy goals. Prioritise, and accompany new legislation with a comprehensive impact assessment including a competitiveness check. Avoid and remove emerging systematic EU policy costs that cause inflation and weaken competitiveness.
3. **Restore the energy competitiveness and have competitive feedstocks**: invest significantly in all renewable and renewable carbon energy and infrastructures (double down on the current efforts). Revise EU legal requirements that lead to an increase of energy costs and improve today's electricity market mechanism to support energy-intensive 24/7 baseload demand and competitive prices. Promote short term/medium term competitiveness of natural gas and crude oil. Revise EU's instruments to effectively protect against carbon leakage.
   The chemical industry needs access to affordable and stable baseload power. The rapid development of intermittent renewables is essential, but it should be accompanied by measures or complementing technologies that ensure baseload power.
4. **Finance the transition, innovation, and support modernisation**: support the transition to low carbon technologies with public funding (e.g. double Horizon Europe to 220 Bn €) aligned with a streamlined State Aid framework aimed at sectors and value chains at risk of relocation, promoting private investment in clean technologies, protect IP and promote innovation, support asset revamping and competitiveness improvement.
   Overall, the triple transition: energy / digitalisation / circular economy, needs more time and resources.
5. **Foster a level playing field** via effective global trade agreements, trade defence reinforced support, ensuring that Green Deal regulations do not induce carbon leakage, are applied uniformly in a harmonised manner (including imports and exports), cannot be circumvented, and do not hamper exports.
6. **Support strategic autonomy and security of supply:** secure critical raw materials, ensure value chain integrity, support domestic recycling and circularity.
7. **Boost customer industries and end consumer demand, particularly for high end-, added value-, net-zero, low-carbon and circular products:** support strategic demand in unfavourable economic cycle, promote net-zero and circular products via transparent labelling, standards, public procurement, lower VAT, and expanded EU acts.

The EU should take stock of the calls of Antwerp to help restore the business case for investments in Europe, carefully assess the regulatory situation as well as the added value of all enacted policies before launching major new proposals. European chemical industry players will have to adapt their individual strategies and investment decisions to the global economic environment as well as to the policy frameworks and perspectives provided by the EU and the national governments. *[More detailed recommendations are beyond the scope of this report*].

ENDNOTES

Figure 6.1: European risks and opportunities – *Advancy analysis*

Figure 6.2: European capacity closure announcements – *Company websites, S&P, Chemical week, Advancy analysis*

Figure 6.3: Short term risks – *Advancy analysis*

Figure 6.4: Low carbon transition development – *Cefic*

Figure 6.5: Sustainability opportunities – *Cefic, Advancy analysis*

Figure 6.6: Next transversal technologies and role of chemicals – *Cefic Advancy analysis*

Figure 6.7: Milestones in addressing Europe's Competitiveness Gap – *Advancy analysis*

Figure 6.8: The 10 points of the Antwerp Declaration – *Antwerp declaration*

Figure 6.9: 7 action levers to address Europe's industrial challenges – *Advancy analysis*

7 Abbreviations

Abbreviation	Definition
ABS	Acrylonitrile Butadiene Styrene
ADR	European Agreement concerning the International Carriage of Dangerous Goods by Road
Agro	Agricultural
APAC	Asia Pacific
API	Active Pharmaceutical Ingredient
Bbl	Barrel
Bn	Billion
BPR	Biocidal Products Regulation
C4	Butadiene
CAGR	Compound Annual Growth Rate
Capex	Capital Expenditure
CAD	Chemical Agents Directive
CCA	Cumulative Cost Assessment
CDI	Core Dependency indicator
CDMO	Contract Development and Manufacturing Organization
CIS	Commonwealth of Independent States
CMR	Carcinogenic, mutagenic, or toxic for reproduction
CMS	Constant Market Share
CH3OH	Methanol
CLP	Classification, Labelling and Packaging
CO	Carbon Monoxide
CO_2	Carbon dioxide
CPR	Construction Products Regulation
CSRD	Corporate Sustainability Reporting Directive
CZ	Czechia
DEA	Drug Enforcement Administration
DCE	Diethanolamine
Deriv.	Derivative
DSI	Drug Safety Institute
ECU	European Electrochemical Unit
EEA	European Environment Agency
e.g.	For example
Equip.	Equipment
ETS	Emissions Trading System
EU	European Union
EV	Electric vehicle

EVA	Ethylene-vinyl acetate
Excl.	Excluding
F	Forecasted
FDF	Finished Dosage Forms
Feedstock & SC	Feedstock & supply chain
FMCG	Fast moving consumer goods
FTE	Full-time employee
GDP	Gross Domestic Product
GHG	Greenhouse Gases
GMM	Genetically modified micro-organism
GMP	Good Manufacturing Practice
GWh	Gigawatt hour
HDPE	High-density polyethylene
HU	Hungary
IED	Industrial Emissions Directive
Incl.	Including
Indus.	Industrial
kt	Kiloton
LATAM	Latin America
LCE	Lithium carbonate equivalent
LDPE	Low-density polyethylene
LLDPE	Linear low-density polyethylene
LNG	Liquid Natural Gas
LPG	Liquid Petroleum Gas
Raw mat.	Raw material
MDI	Methylene diphenyl diisocyanate
MEA	Middle East & Africa
MMA	Methyl Methacrylate
M.S.	Market Share
MT	Megaton
MWH	Megawatt hour
n.a.	Not applicable
NAM	North American Market
NGL	Natural Gas Liquids
NH3	Ammonia
NIS2	Network and Information Security Directive
NO	Norway
NPCF	Non-Price Competitiveness Factors
O&G	Oil & Gas
Opex	Operating expenses

p.a.	Per annum
PAP	Para-aminophenol
PCF	Price/Cost Competitiveness Factors
PCT	Polycyclohexylenedimethylene terephthalate
PET	Polyester
Pharma	Pharmaceuticals
PMI	Purchasing Managers' Index
PMMA	Poly methyl methacrylate
PO	Poland
POP/PIC	Prior Informed Consent Regulation
pts	Points
PVC	Polyvinyl chloride
R&D	Research & Development
REACH	Registration, Evaluation, Authorisation and restriction of chemicals
RED	Radio Equipment Directive
RID	Regulation concerning the International Carriage of Dangerous Goods by Rail
RoW	Rest of World
RSM	Regulatory Starting Materials
SAF	Sustainable Aviation Fuel
SAN	Styrene-acrylonitrile copolymer
SBR	Styrene-butadiene
TEA	Triethylamine
T / Tn	Trillion
TDI	Toluene diisocyanate
UPR	Unsaturated polyester resins
US	United States
UR	Utilisation Rate
Vs.	Versus
WFD	Water Framework Directive
Y-o-y	Year-on-year

THE COMPETITIVENESS OF THE EUROPEAN CHEMICAL INDUSTRY

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