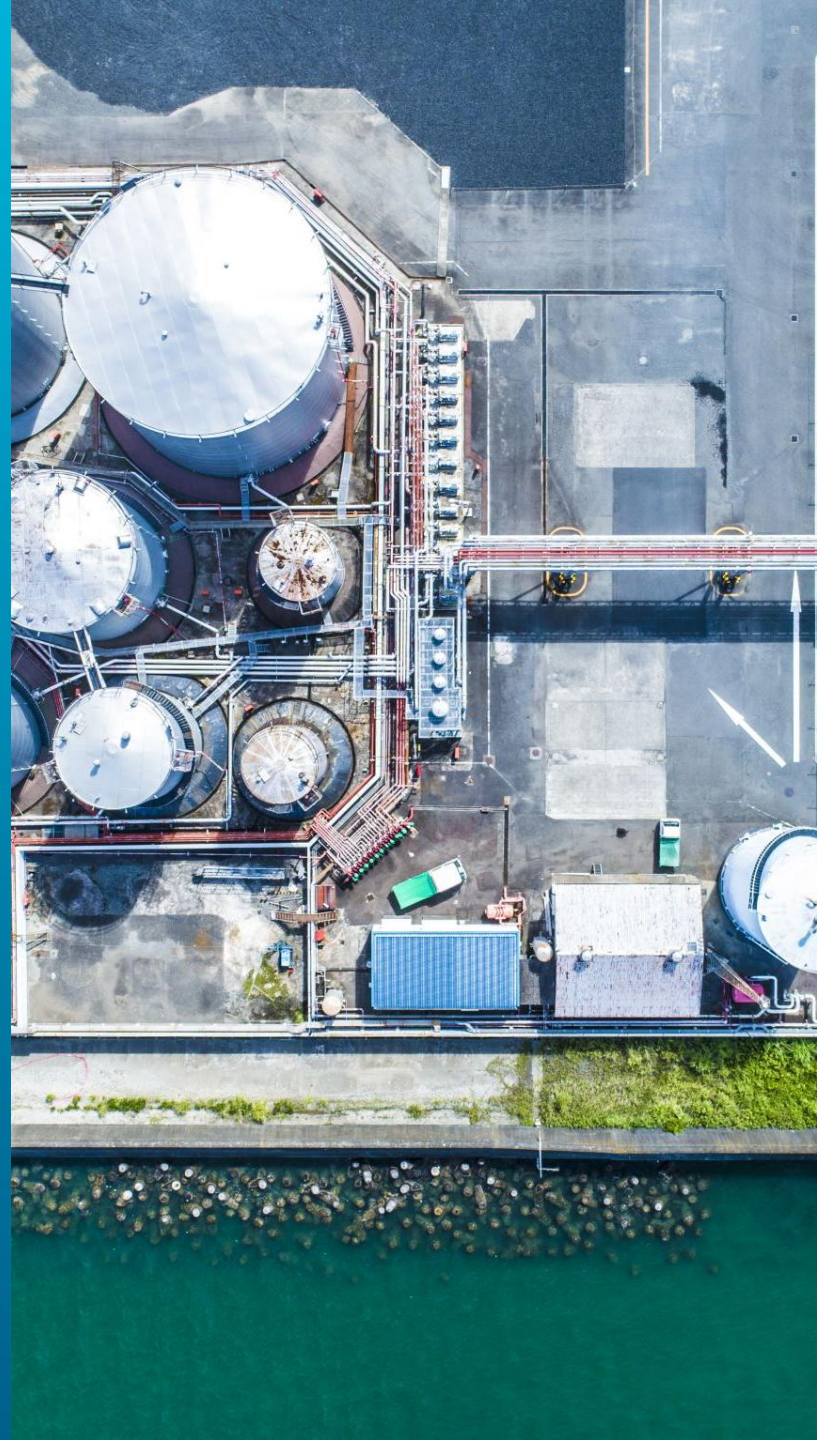
Emissions Reduction in the EU Chemical Industry: Efficiency or Activity Decline?

Prepared by:
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01

Purpose & framing



Objective of the study

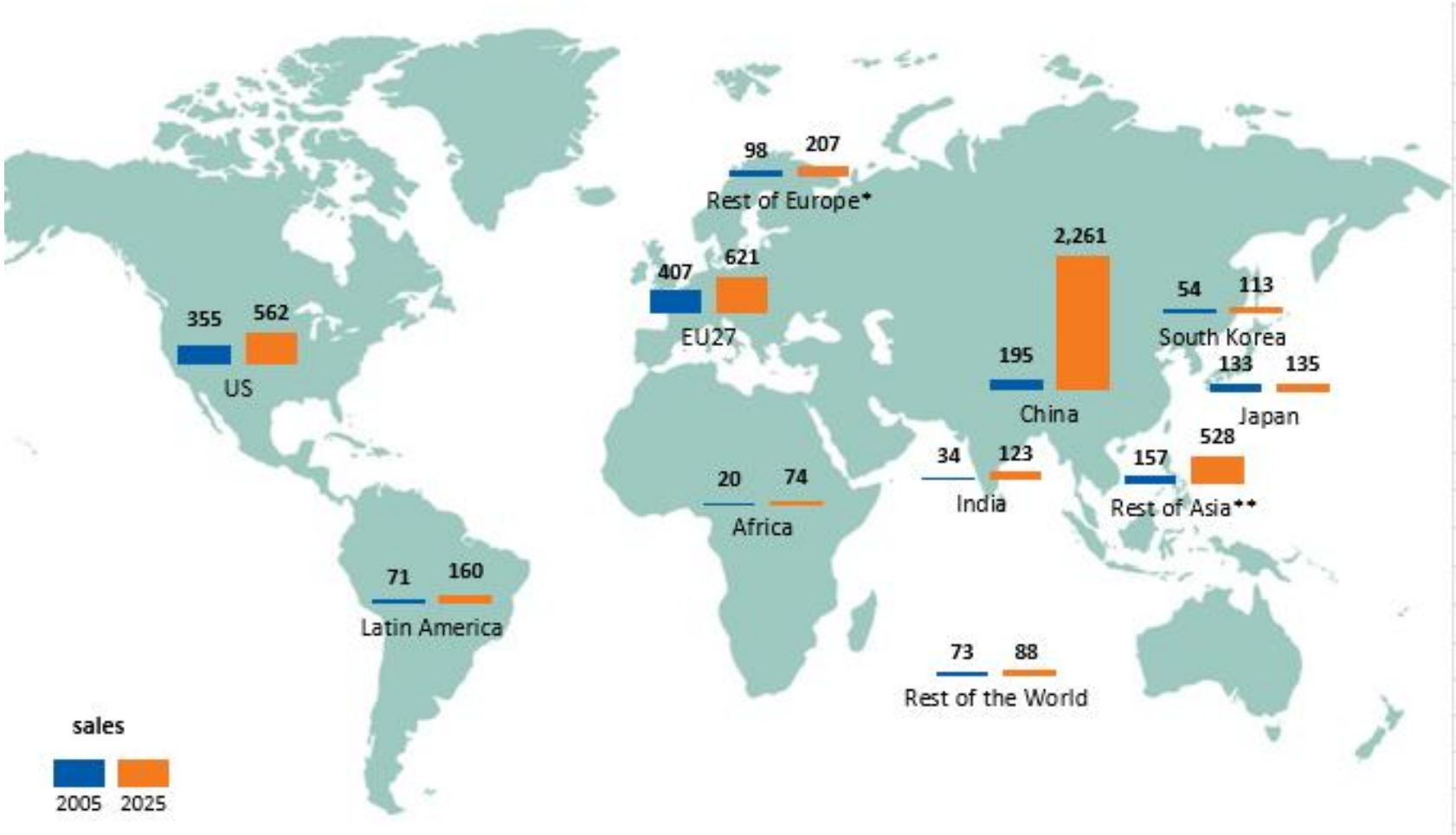
- The chemical industry is one of the key pillars of the EU27 economy, **directly employing more than 1.2 million people and accounting for around 7% of total manufacturing value added**. As a core supplier to a wide range of downstream sectors, it plays a strategic role in industrial value chains and European competitiveness.
- As part of the energy-intensive industries, the chemical sector is strongly exposed to energy prices. Since 2022, the sharp increase in energy costs, combined with intensifying global competition, has led to a significant adjustment in the sector. In particular, the period is characterised by a **simultaneous decline in both emissions and production levels across several EU countries, alongside increasing reports of capacity reductions and site closures.**
- A Cefic 2026 Report – commissioned to Roland Berger – shows that chemical plant closures in Europe, surged sixfold since 2022, reaching a cumulative 37 Mt of capacity – or around 9% of European production capacity
- This observed co-movement raises an important question: **to what extent are reductions in emissions driven by genuine improvements in emission intensity, and to what extent do they reflect lower industrial activity and structural contraction?**
- This study quantifies these effects by decomposing emissions into production and emissions intensity components

02

Economic importance of the EU chemical sector



Global chemical sales 2025 are 3.0 times higher than in 2005



Global chemical sales (2025, €4,873 bn)

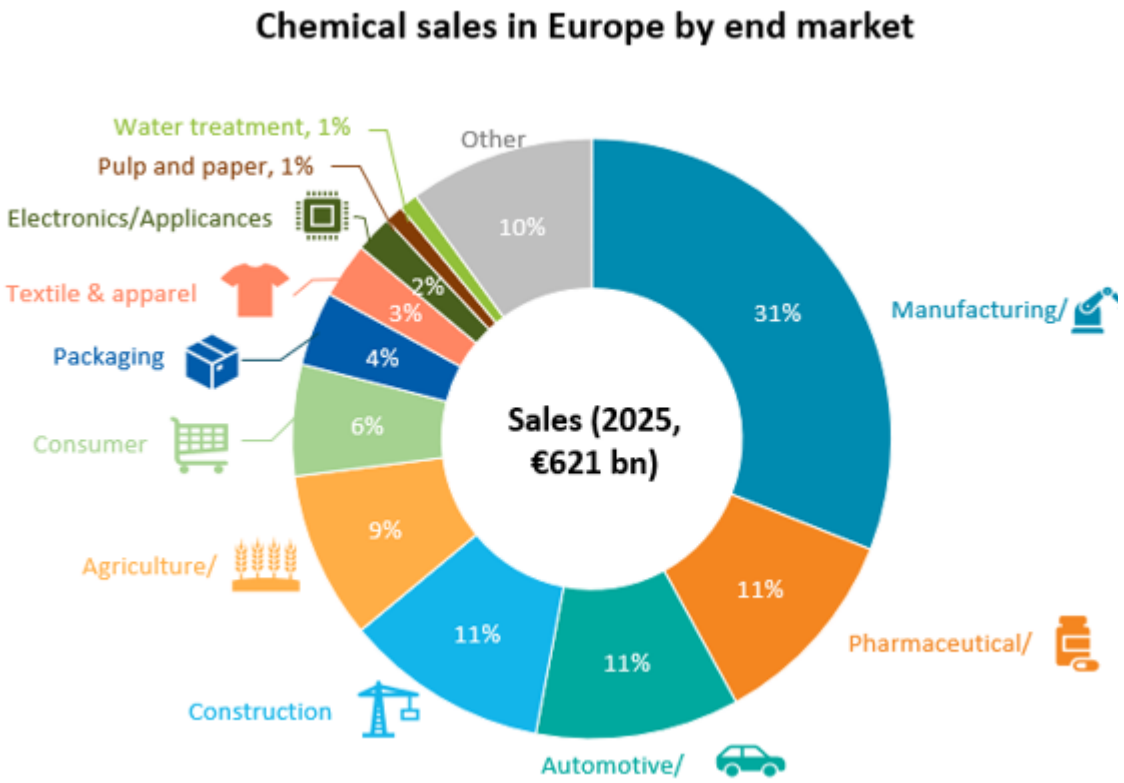
Europe is the second-largest chemicals producer in the world (13%)

Source: Cefic Chemdata International

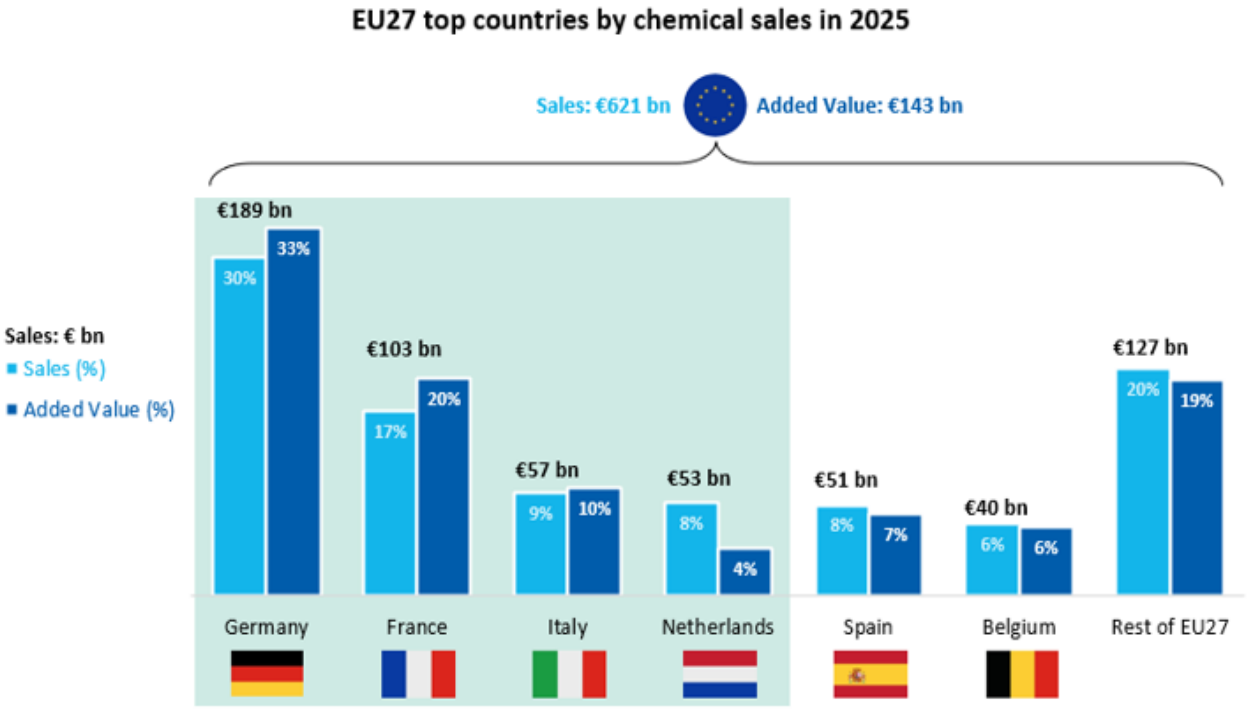
* Rest of Europe covers UK, Switzerland, Norway, Türkiye, Russia and Ukraine

** Asia excluding China, India, Japan and South Korea. Middle East is in Rest of Asia.

We are “the industry of industries”



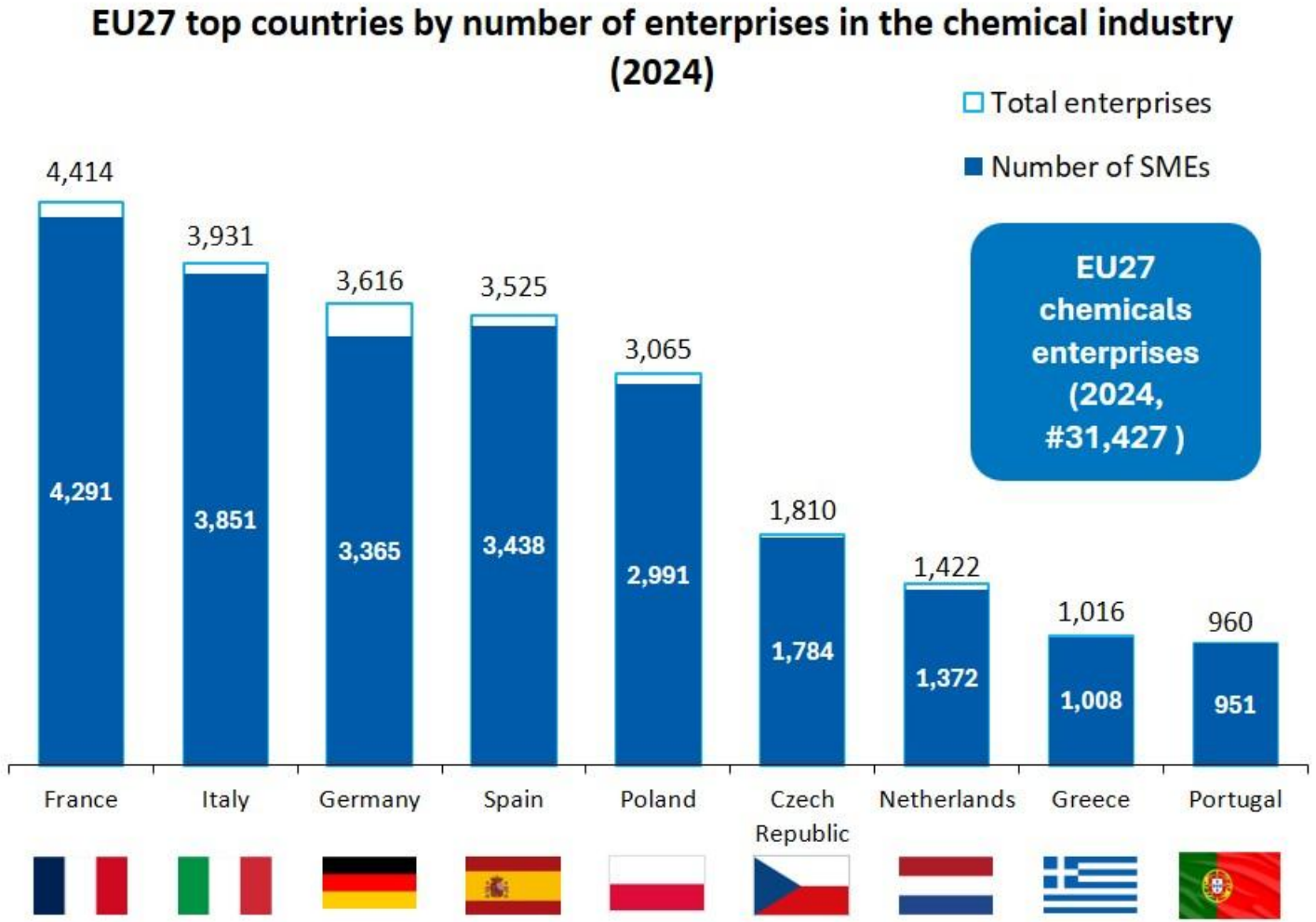
There is no resilient, nor safe, nor strong Europe, without a strong European industry



Four Member States drive two-thirds of EU27 chemical sales

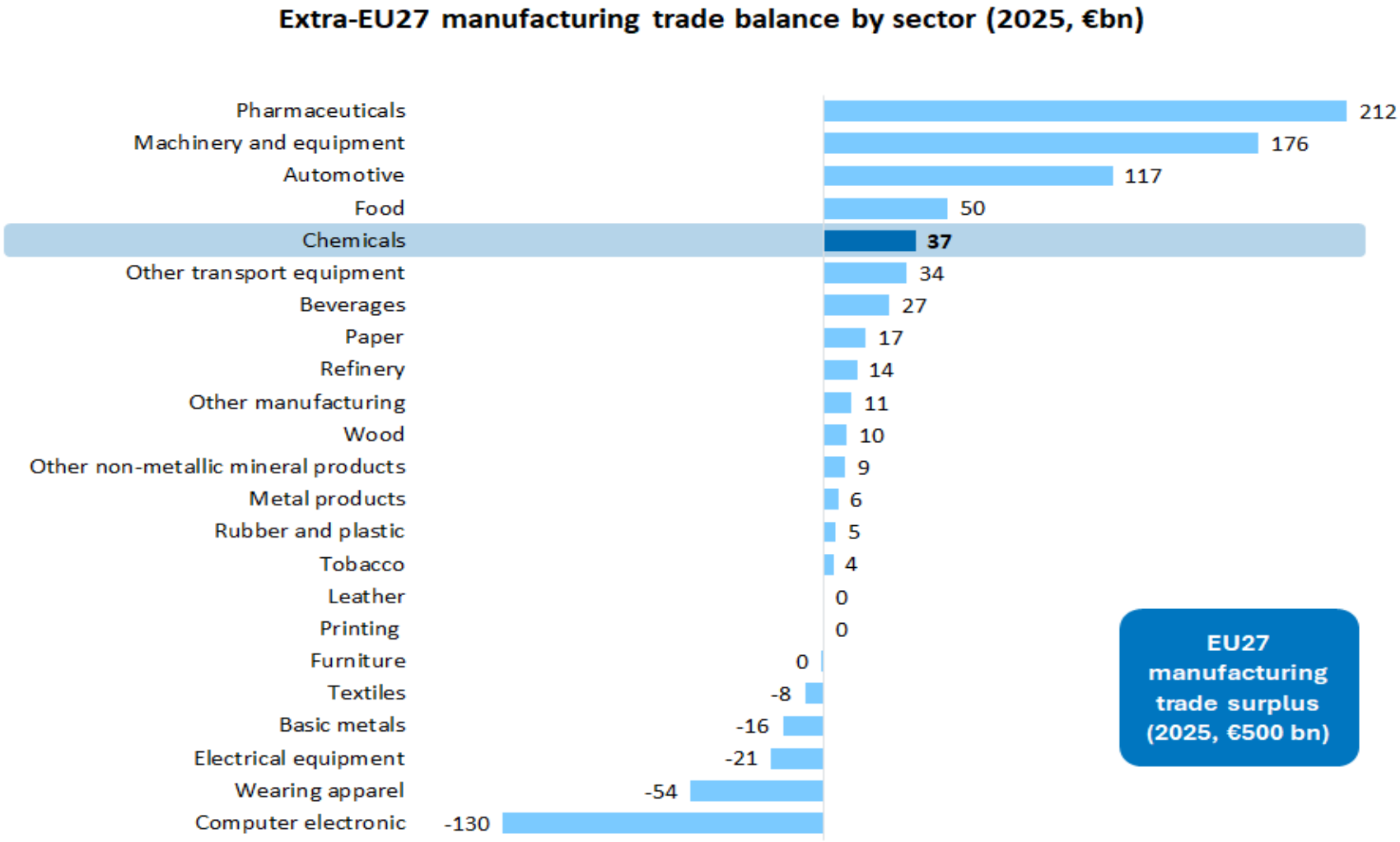
Source: Cefic-Advancy Joint Study: The Competitiveness of the European Chemical Industry (2025)

30,548 SMEs operate in the EU27 chemical industry



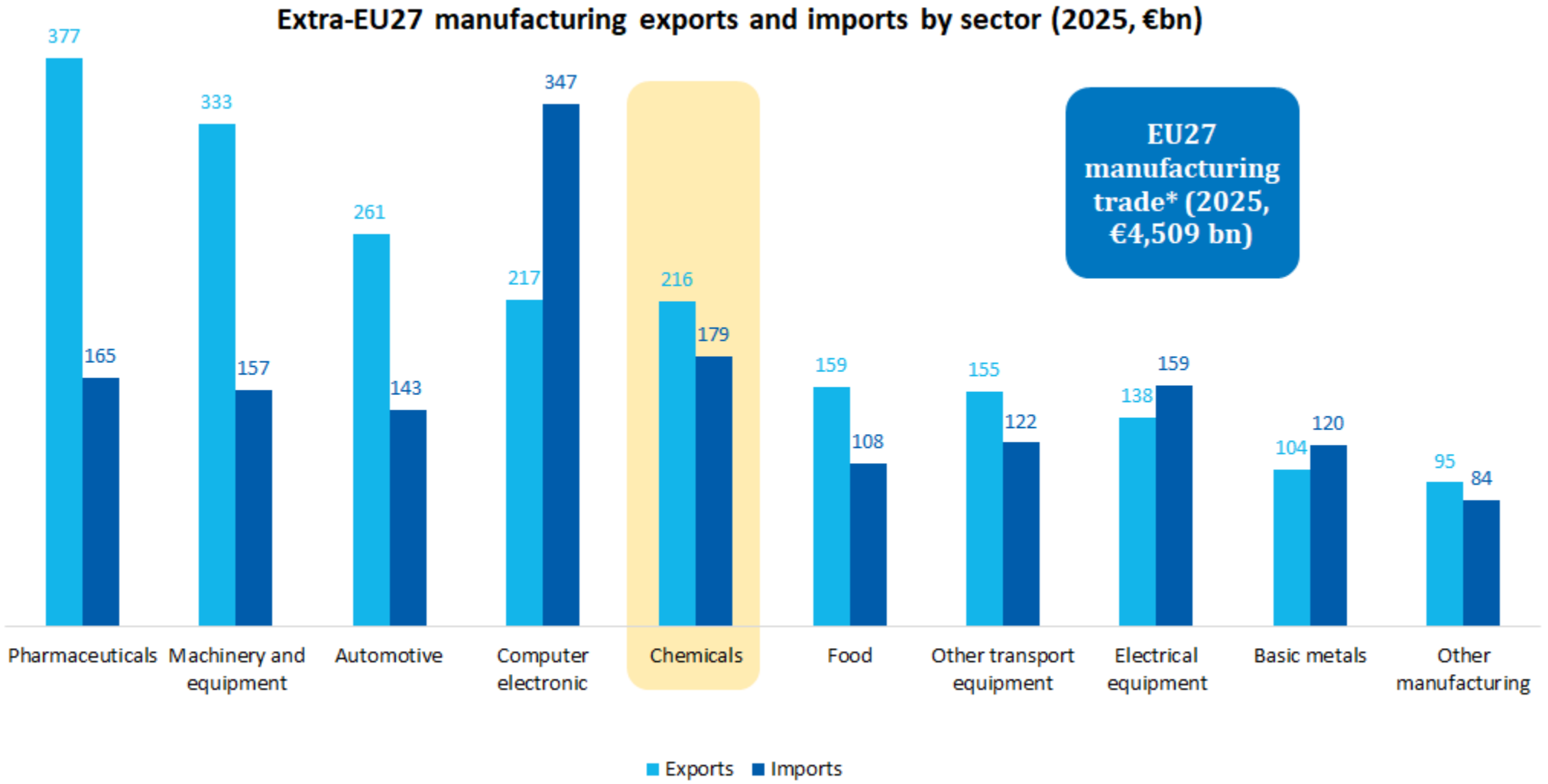
Source: Cefic analysis based on Eurostat data

Chemicals are a key contributor to EU27's trade balance (€37 bn)



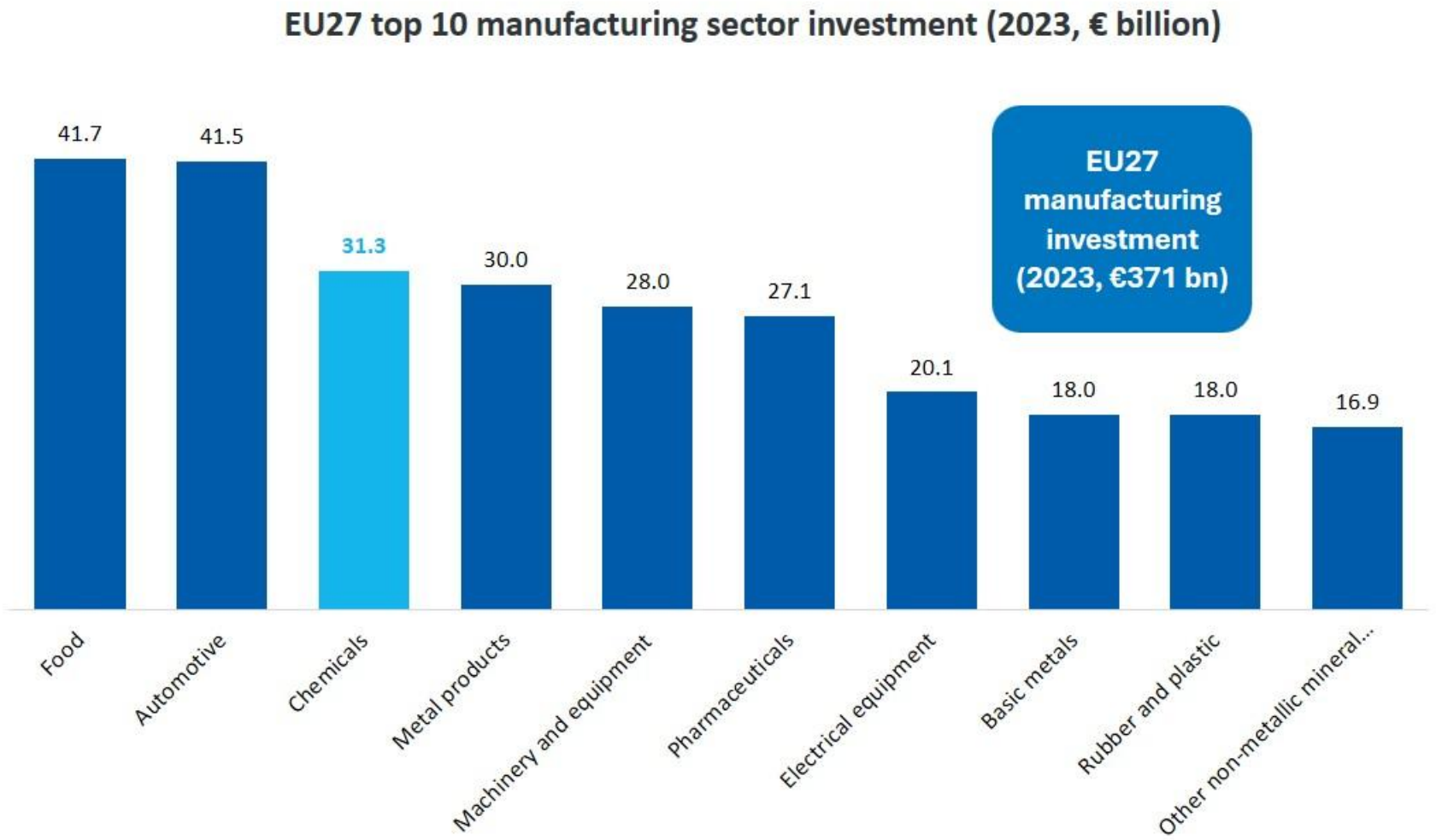
Source: Cefic analysis based on Eurostat data

Chemicals are a key contributor to EU27's trade (€394 bn)



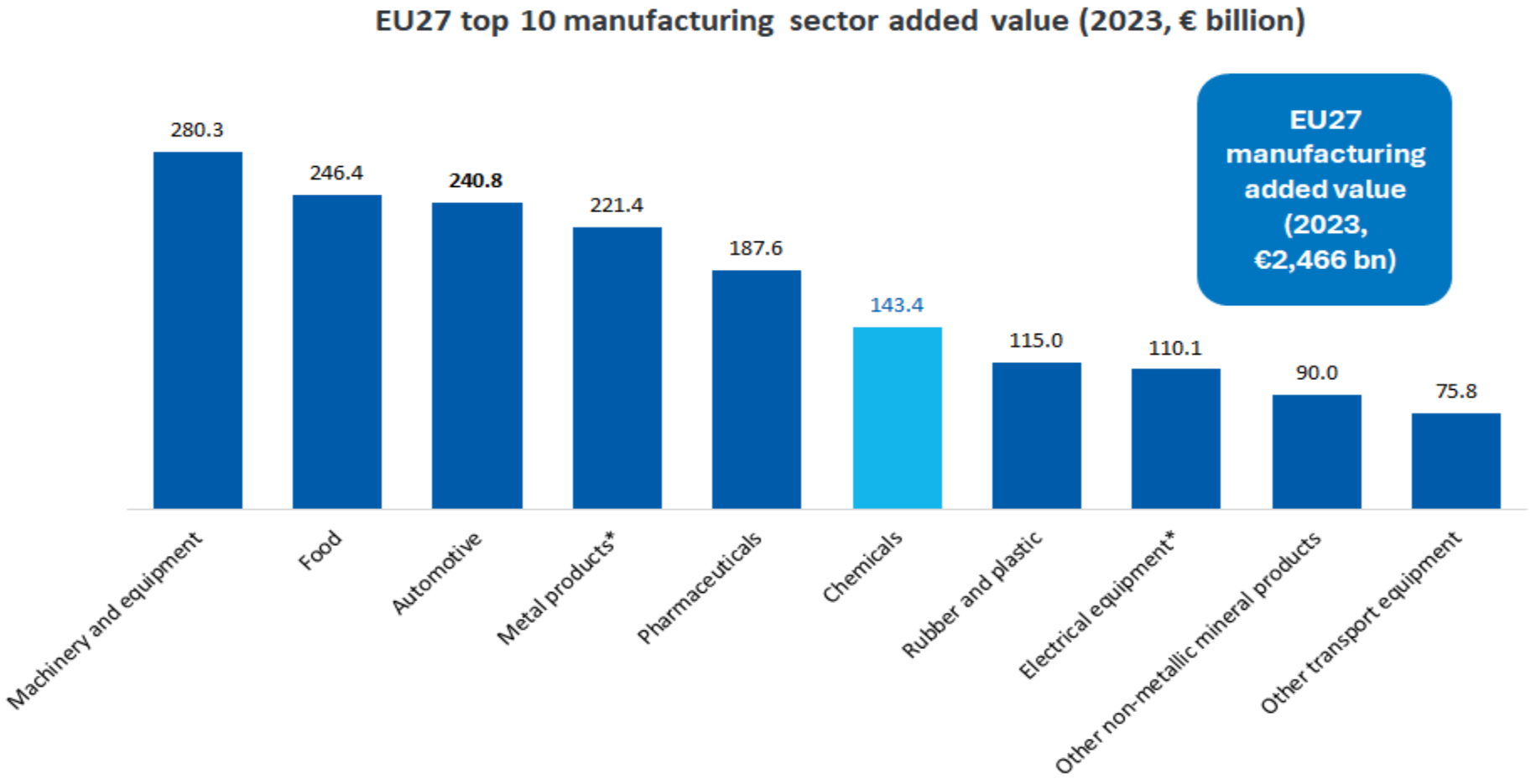
Source: Cefic analysis based on Eurostat data, *trade = exports + imports

Chemical sector is the third manufacturing sector by investment



Source: Cefic analysis based on Eurostat SBS database

The chemical industry is a major sector in Europe, representing 6% of manufacturing added value



Source: Cefic analysis based on Eurostat SBS database

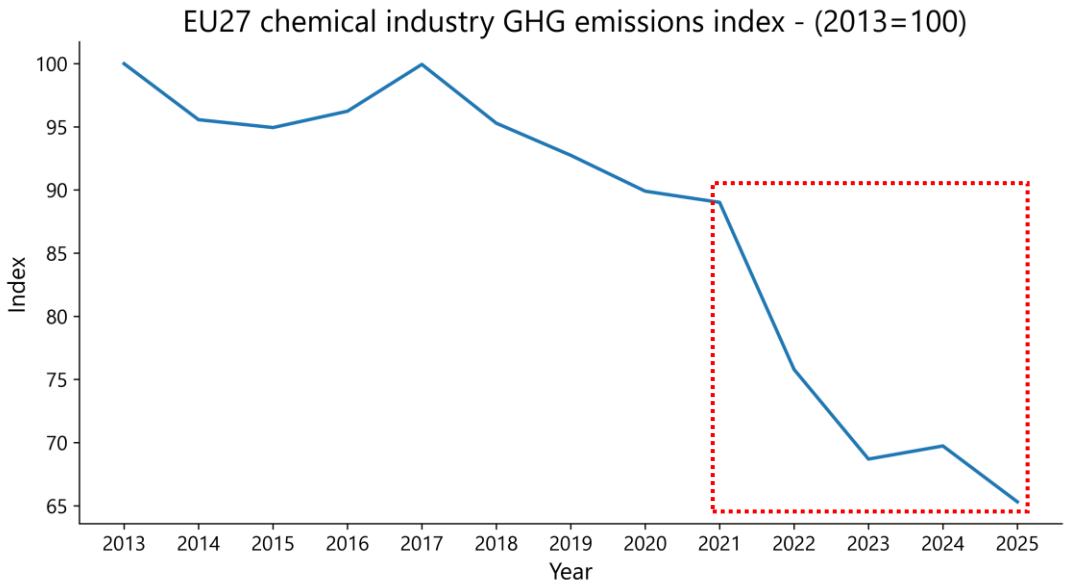
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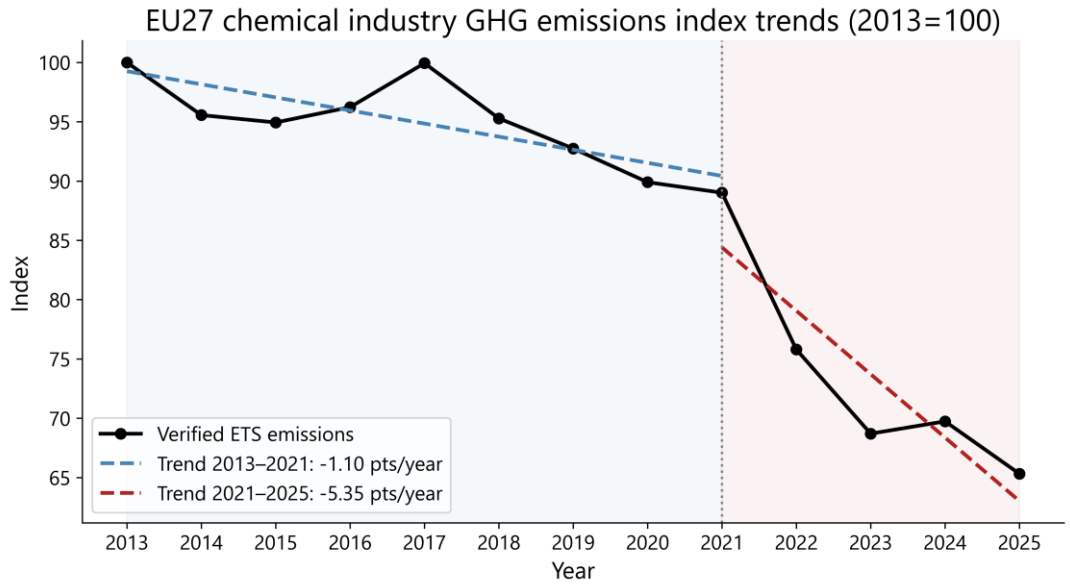
Drivers of recent emission trends in the chemical sector



EU27 chemical emissions: structural break after 2022

Modest decline pre-2022, followed by an abrupt drop coinciding with the energy crisis



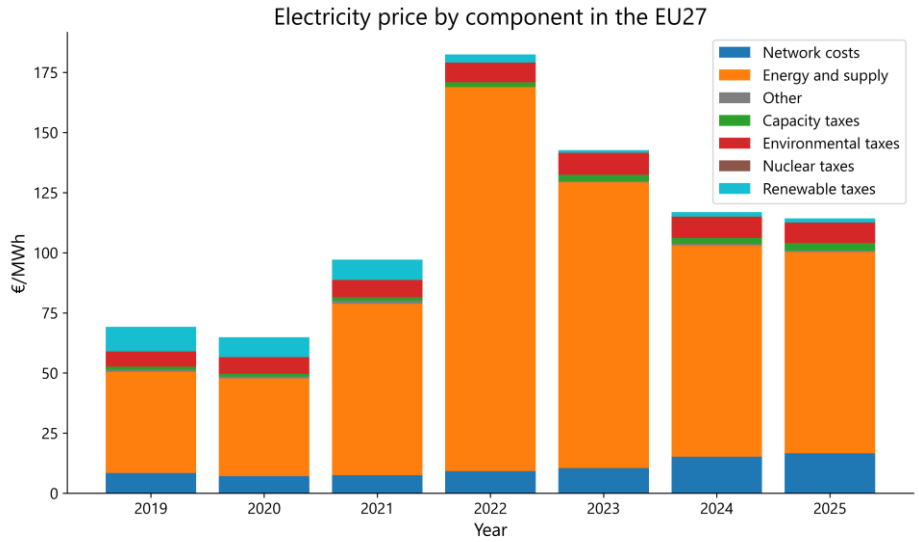


- Emissions declined gradually pre-2022 (−11% over 2013–2021)
- Since 2022, emissions fell sharply (−26.6% by 2025)
- The rate of decline accelerated ~5× after the energy crisis
- This suggests a structural change, not a continuation of prior trends

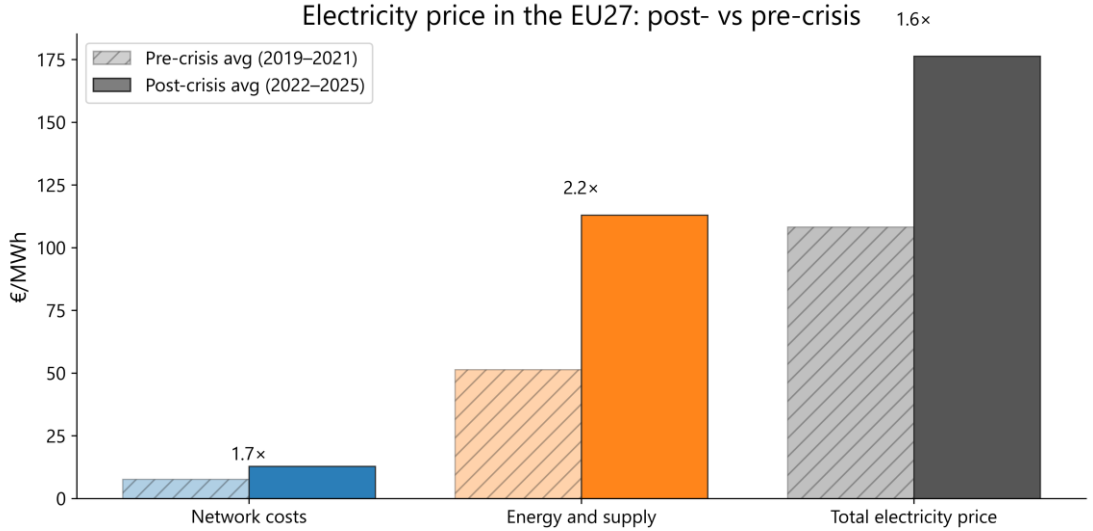
- Emissions data are retrieved on 23-06-2026 from the Union Registry Public Website, “Operators yearly activity daily” file.
- The chemical industry is filtered based on a Cefic internal list of installations based on activity codes, four-digit NACE Rev. 2 codes matched to ETS installations based on the Commission’s carbon-leakage lists, and a manual inspection of combustion installations serving chemicals production.

Severe electricity price shock post-2022

Driven by energy supply costs, electricity prices increased significantly vs pre-crisis levels



Note: Consumption band = Consumption 150 000 MWh or over - band IG (MWH_GE150000)

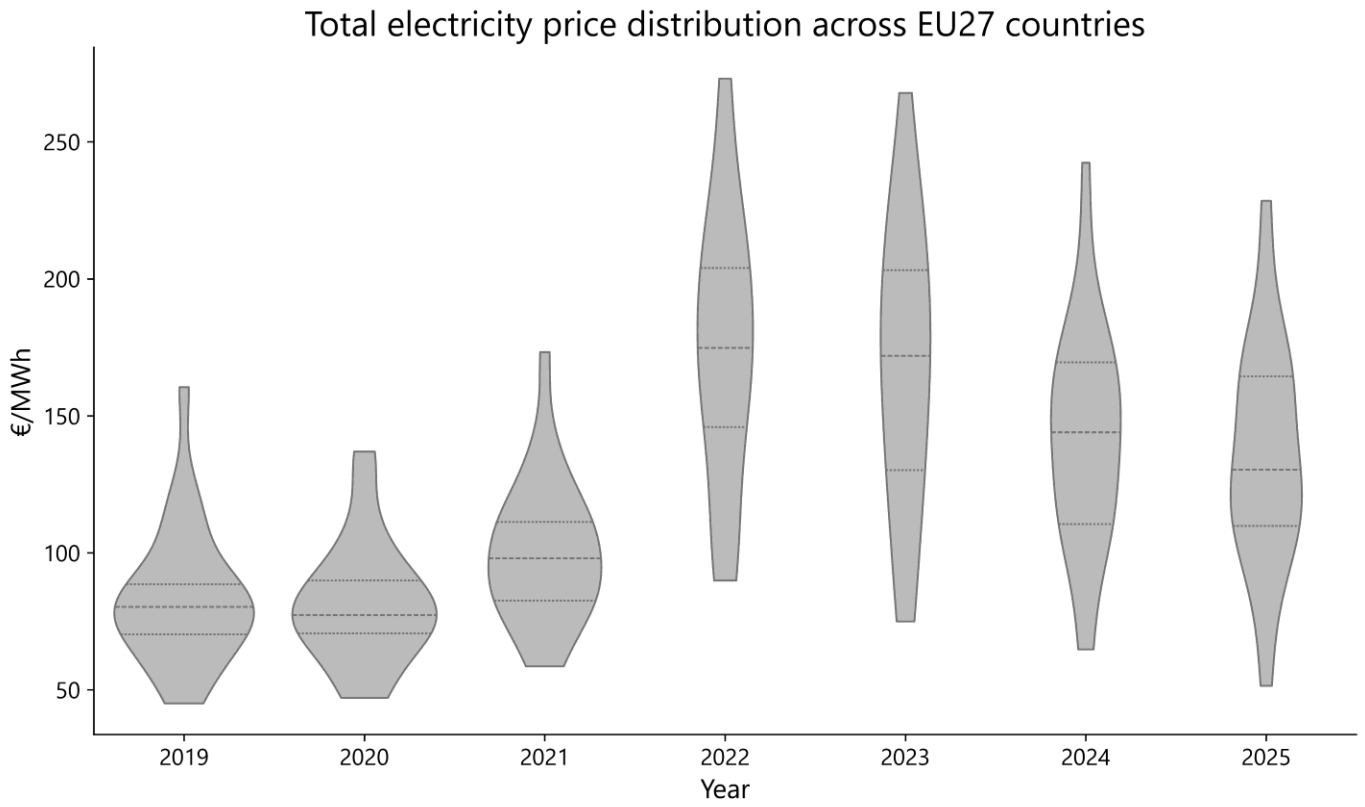


Note: Consumption band = Consumption 150 000 MWh or over - band IG (MWH_GE150000)

- Electricity prices for large industrial users increased by ~60% post-2022, primarily driven by energy supply costs.
- The increase is most driven by energy supply costs (+2.2×)
- On top of the surge in energy supply costs, network costs also increased (~+70%), contributing marginally to the overall price rise

- Sources: electricity price by component based on [nrg_pc_205_c] Electricity prices components for non-household consumers - annual data (from 2007 onwards)

Electricity prices rose after 2022, with wider gaps across EU27 countries



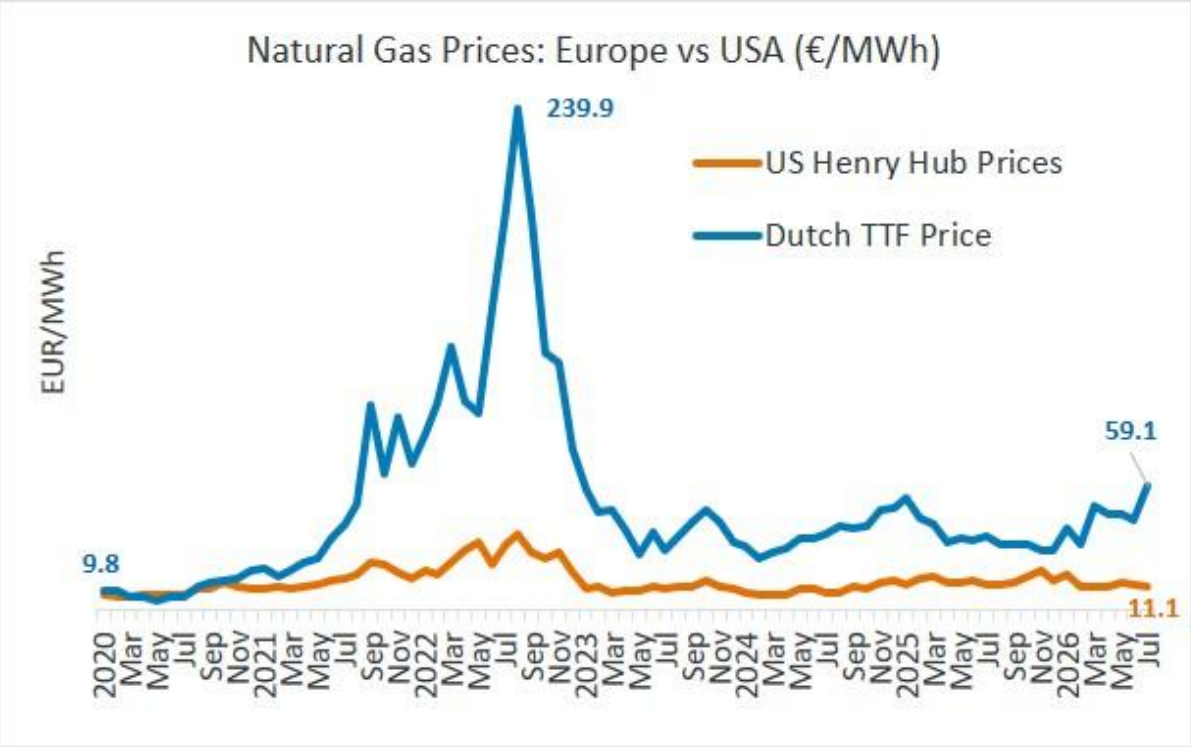
Note: Shows the highest industrial consumption band with complete EU27 country coverage across all years (Consumption from 20 000 MWh to 69 999 MWh - band IE).

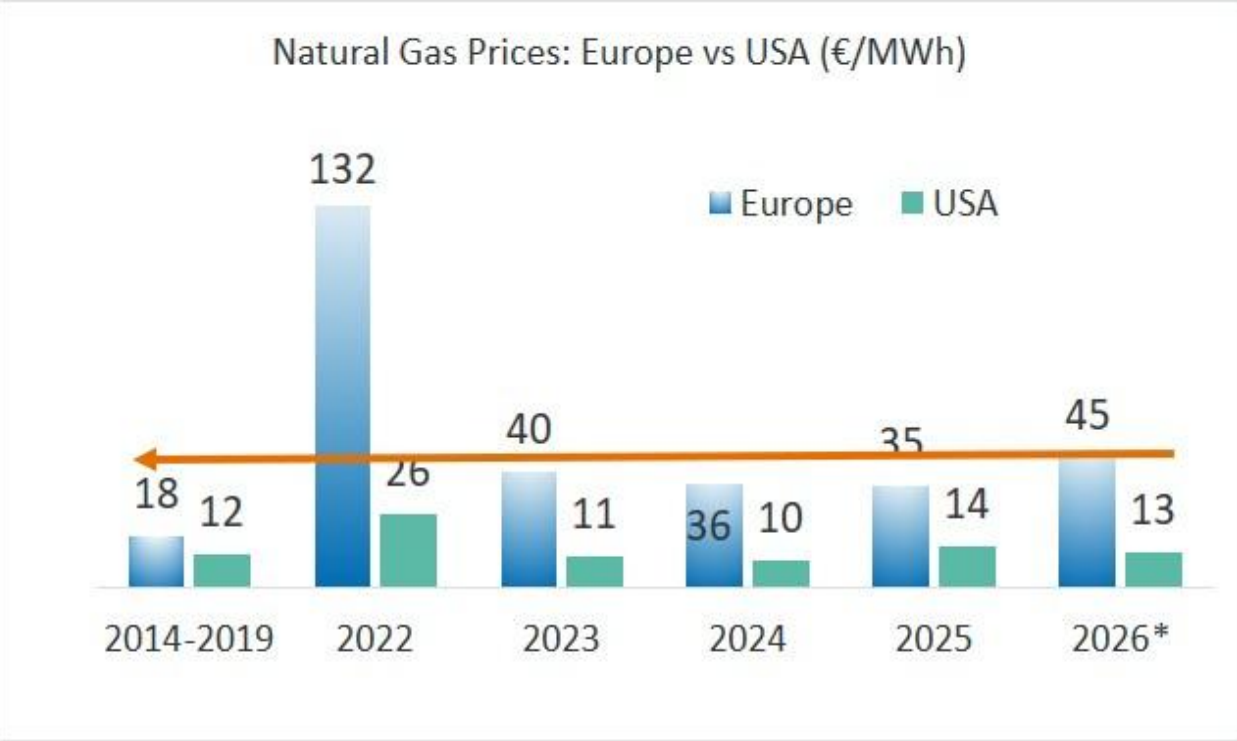
- Median electricity prices increased sharply from 2022 onwards, indicating a broad-based cost shock across EU27 countries
- The distribution widened after 2022, suggesting greater divergence in electricity prices between Member States
- This weakens the interpretation of a single “EU27 electricity price” and points to increasingly country-specific competitiveness pressures

Note:
Each distribution is summarised by three horizontal markers: the central line shows the median, while the upper and lower lines indicate the interquartile range (25th and 75th percentiles).
The price includes Energy and supply, network costs, taxes (excluding VAT).
Data source: [nrg_pc_205_c] Electricity prices components for non-household consumers - annual data (from 2007 onwards) (accessed on: 31/08/2026)

Energy: Structural cost disadvantage for European chemicals

Gas prices in Europe in 2026: 2.5 times higher than pre-crisis levels (2014-2019)



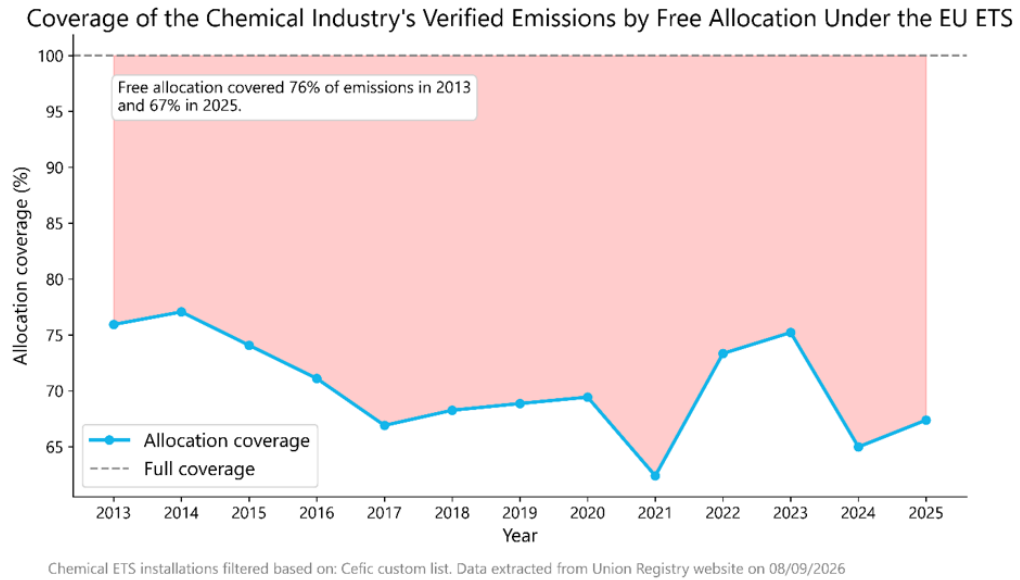


- European gas prices spiked sharply in 2022, far exceeding US levels
- Despite declines, Europe maintains a significant price premium vs the USA
- In 2022, European prices were ~5× higher than in the US (132 vs 24 €/MWh)
- The gap remains structurally elevated in 2023–2025
- This creates a sustained cost disadvantage for energy-intensive sectors such as the chemical industry

Source ICE Dutch TTF Natural Gas Futures Historical Prices - Investing.com and INSEE Oil Prices data and ICIS, 2026 (Jan-July)

EU carbon prices have risen sharply, increasing cost pressure on ETS-covered industries

Free allocation is carbon leakage protection



- Free allocation partially compensates EU producers for the carbon-cost asymmetry with competitors that do not face an equivalent carbon price*.
- Free allocation covered 67% of verified emissions in 2025, compared with 76% in 2013. The remaining emissions create a net allowance requirement.

EUA price increased over the years



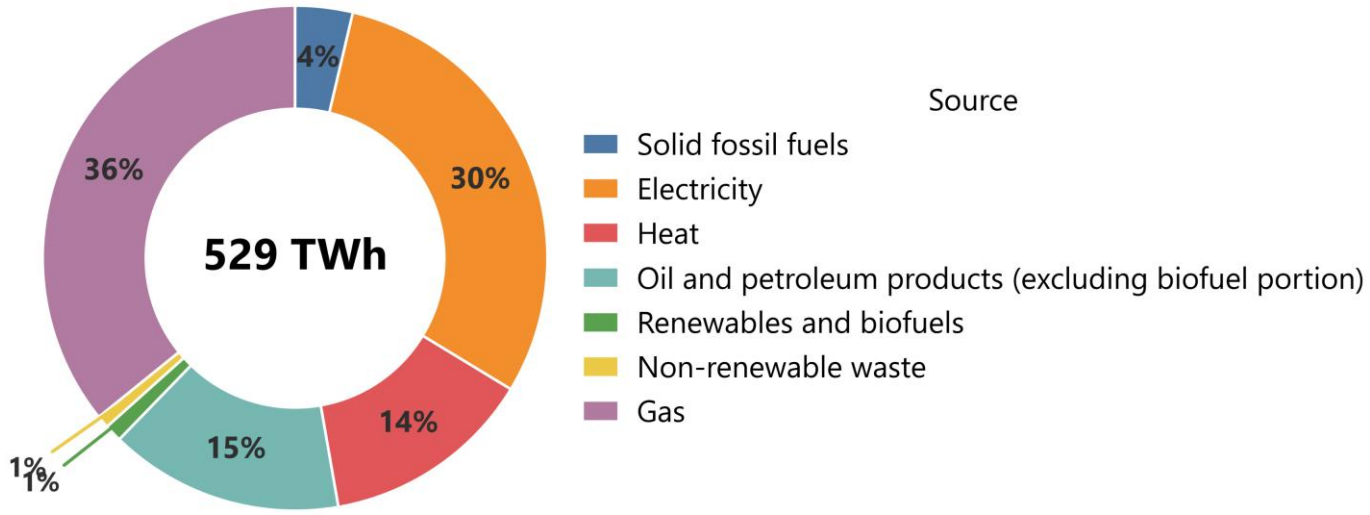
- EU ETS carbon prices increased from below €5/tCO_2 in the mid-2010s to around €80/tCO_2 today.
- For energy-intensive sectors, increasing carbon costs add to broader competitiveness pressures.

* The competitiveness of the European Chemical Industry - a Cefic & Advancy report - cefic

Chemical industry highly exposed to gas and electricity

Gas and electricity together account for 66% of total energy consumption in the EU27 chemical sector (2024)

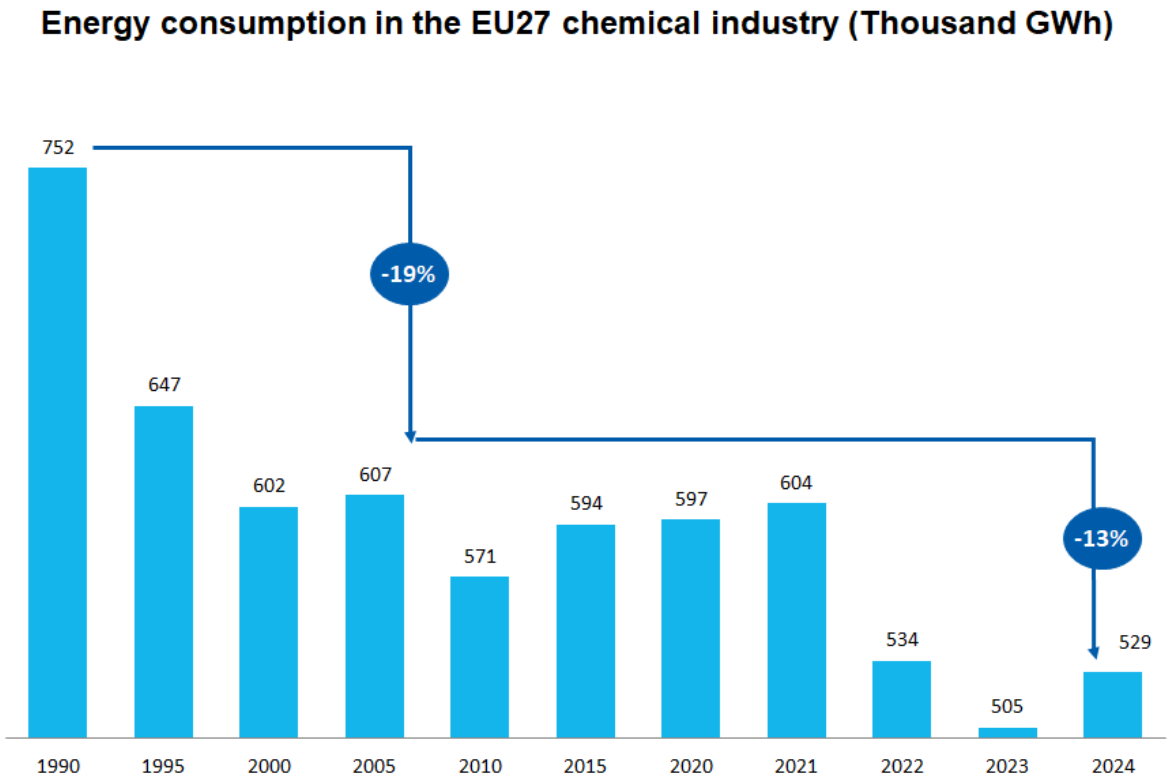
Total energy consumption in the EU27 chemical industry by source (2024)



- Gas (36%) and electricity (30%) account for ~66% of total energy use, which are the energy carriers most affected by the post-2022 price shock.
- The sector is therefore highly exposed to changes in energy prices, increasing the likelihood of production cuts and capacity closures
- Chemical sites often integrate process heat, steam networks, cogeneration and heat recovery across multiple production units.
- Chemical production processes and heat management are highly integrated, meaning that the energy transition is more complex than simply switching to lower-carbon energy sources.

Source: [nrg_bal_c] Complete energy balances

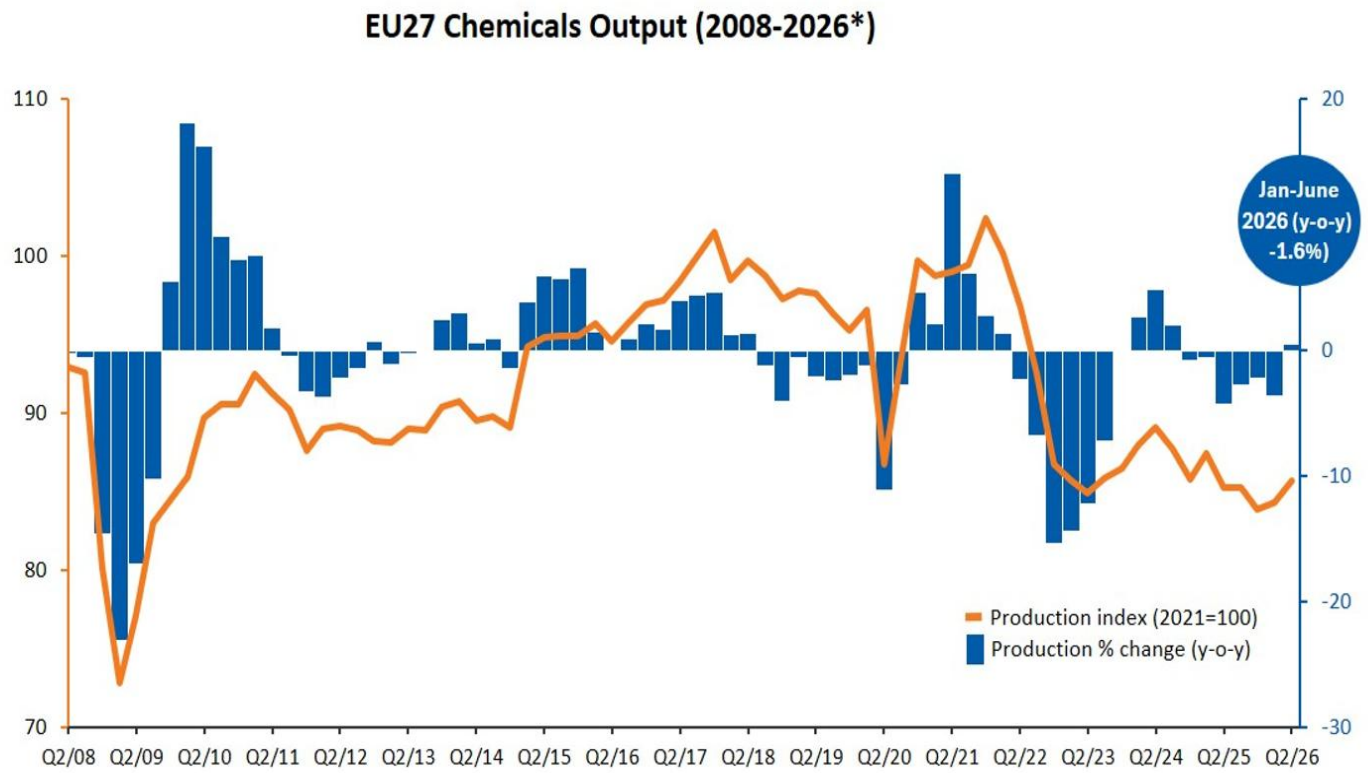
EU27 energy consumption: Long-term decline, but sharp drop after 2022



- Energy consumption declined gradually between 1990 and 2021 (–~20%)
- This reflects structural changes, efficiency gains, and sector evolution
- After 2021, energy consumption fell sharply (–13% in 3 years)
- The pace of decline is significantly faster than historical trends
- This suggests a short-term contraction in activity, rather than gradual structural change

Source: Cefic analysis based on Eurostat data

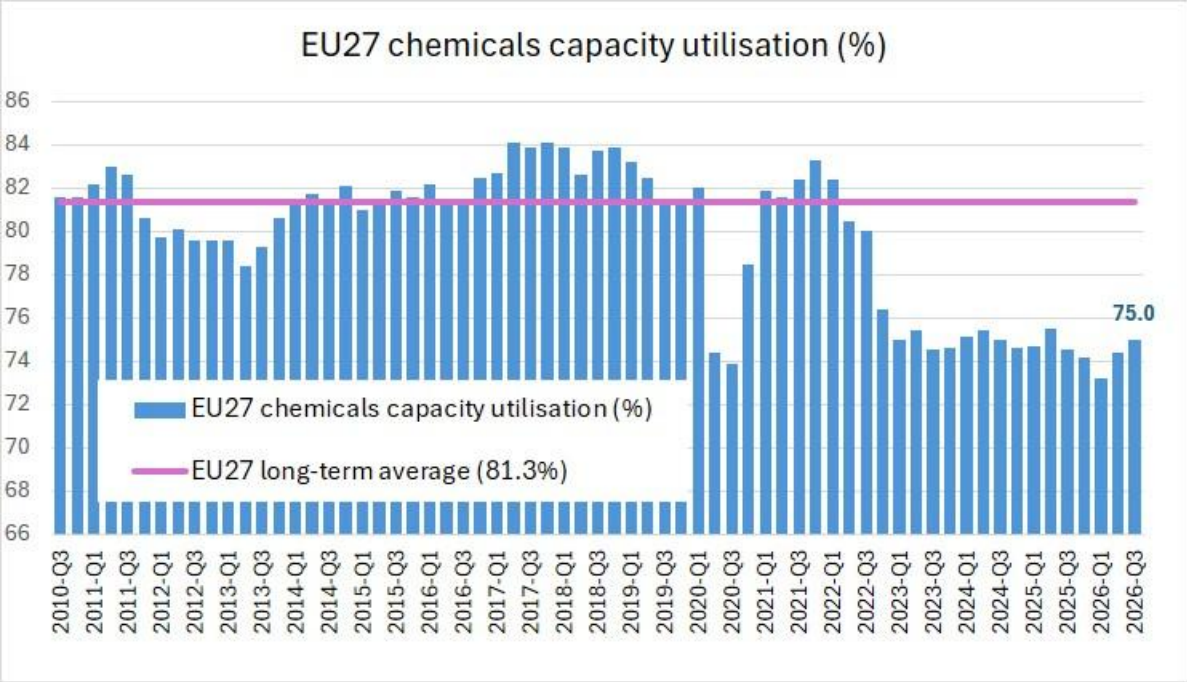
Sustained decline in EU27 chemical production after 2022

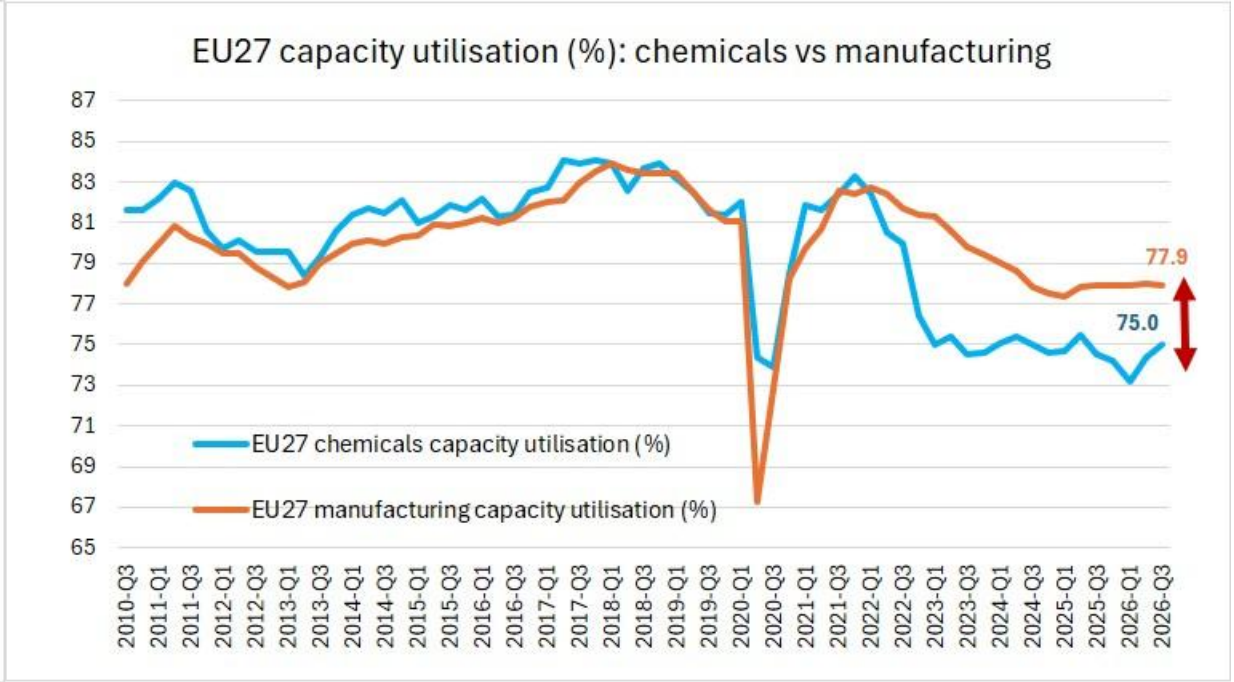


- Chemical production declined sharply in 2022–2023 following the energy crisis
- Output remains below pre-crisis (2021) levels
- The recovery is partial and unstable, with continued negative YoY in 2024–2026
- This indicates a sustained loss of industrial activity, not just short-term volatility
- Consistent with energy cost pressures and competitiveness challenges

Source: Cefic Analysis based on Eurostat Data

EU27 chemicals capacity utilisation: Structural weakness persists



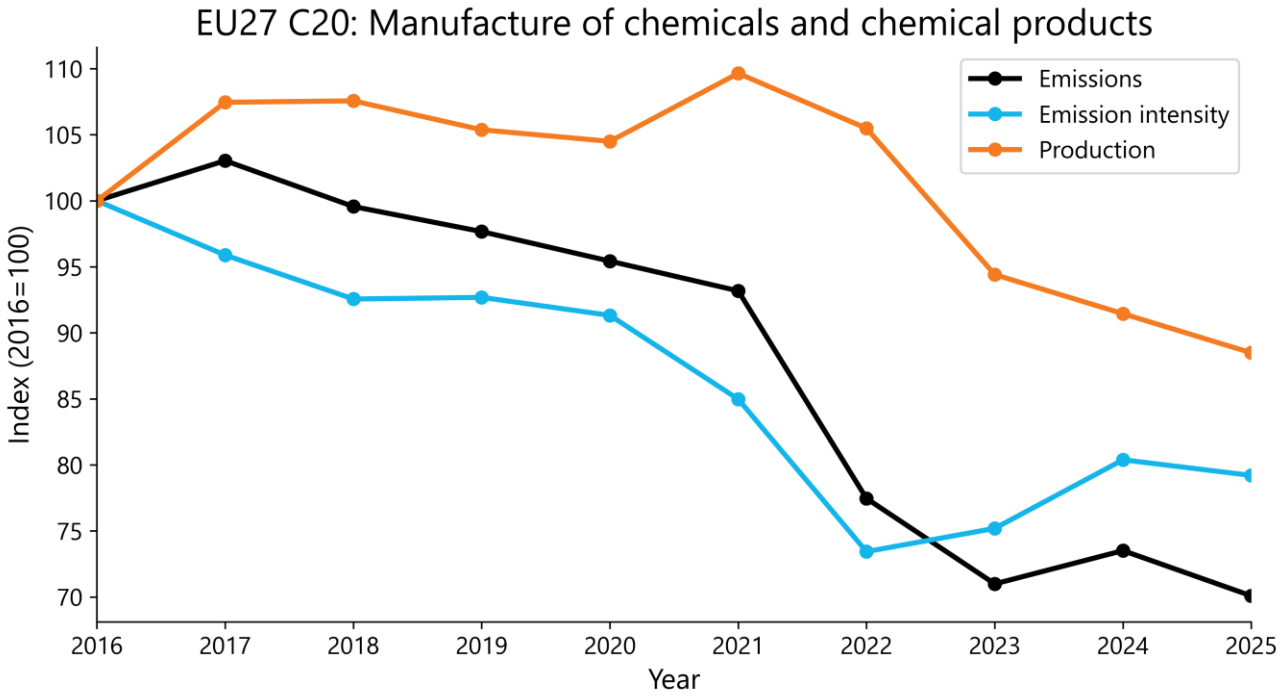


Persistently low-capacity utilisation suggests that the recent decline is not purely cyclical and may lead to permanent capacity reductions.

Source: Cefic Analysis based on Eurostat Data, Nace 20 only

NACE 20: GHG emissions decline closely tracks production in the chemical sector after 2022

The sharp decline in emissions post-2022 is primarily driven by reduced production rather than improvements in emissions intensity

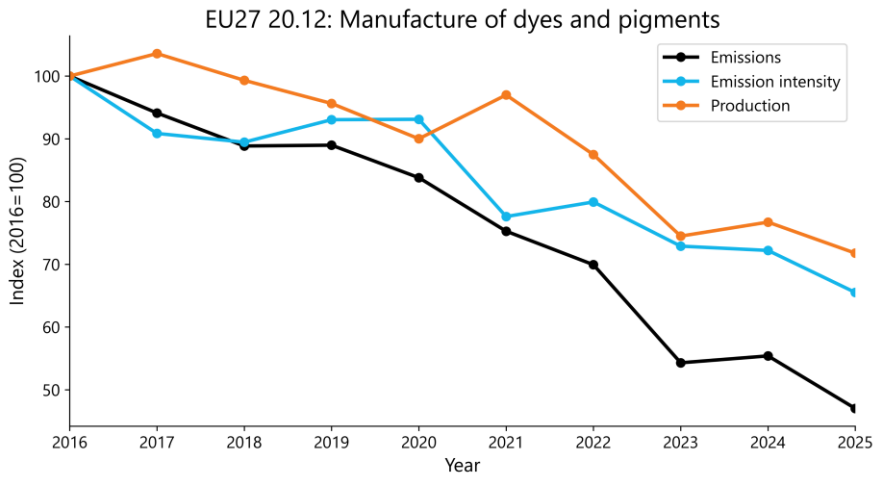


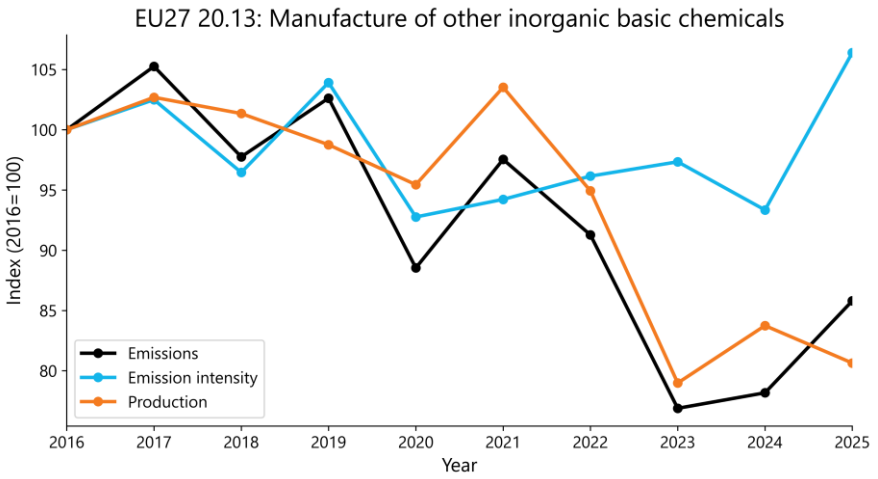
- Production and total emissions declined sharply after 2022.
- However, emissions intensity deteriorated between 2022 and 2024, partially reversing earlier improvements.
- Operating plants below optimal utilization can increase energy and emissions requirements per unit of output because some process and utility loads do not decline proportionally with production.

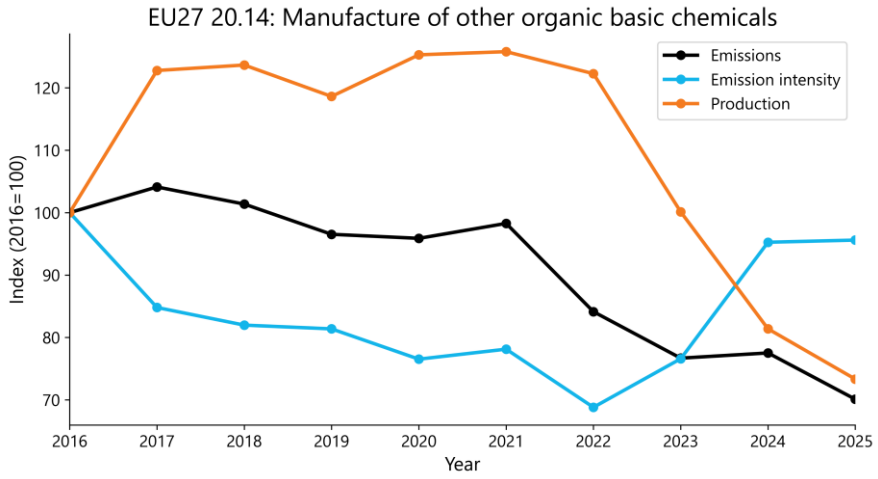
Cefic analysis based on:

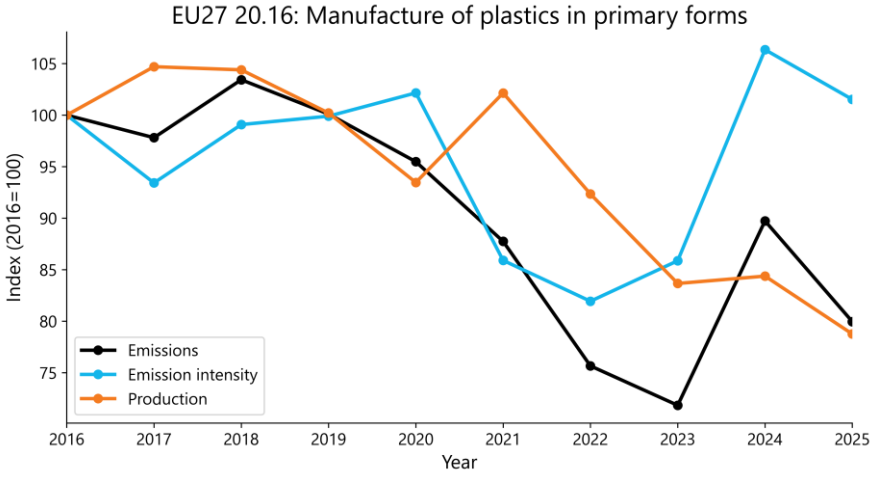
- Emissions data retrieved on 23-06-2026 from the Union Registry Public Website, “Operators yearly activity daily” file.
- The chemical industry is filtered based on a Cefic internal list of installations based on activity codes, four-digit NACE Rev. 2 codes matched to ETS installations based on the Commission’s carbon-leakage lists, and a manual inspection of combustion installations serving chemicals production.
- Production index data from Eurostat (sts_inpr_a), accessed 25 June 2026. https://doi.org/10.2908/STS_INPR_A

Activity-driven GHG emissions decline observed across chemical subsectors









- Cefic analysis based on:
  - Emissions data retrieved on 23-06-2026 from the Union Registry Public Website, “Operators yearly activity daily” file.
  - The four-digit NACE Rev. 2 codes matched to ETS installations based on the Commission’s carbon-leakage lists, as described by EUETS.INFO
  - Production index data from Eurostat (sts_inpr_a), accessed 25 June 2026. https://doi.org/10.2908/STS_INPR_A
- NACE codes were selected based on (i) their share of emissions within NACE 20 and (ii) data completeness.

Recent emissions reductions appear largely activity-driven

The observed decline in emissions coincides with a period of significantly higher energy and carbon costs, lower production levels and reduced capacity utilisation.

- Energy prices surged sharply post-2022, creating a major cost shock
- The chemicals sector is highly exposed (≈66% gas + electricity)
- Energy consumption fell rapidly, exceeding historical trends
- Production declined and remains below pre-crisis levels
- Capacity utilisation is persistently low (~74% vs ~81% average)

04

What explains the decline in emissions?



Objective and approach

- The objective of this analysis is to explain observed changes in emissions at country level by separating two key drivers: changes in economic activity (production) and changes in emissions intensity (efficiency).

- Rather than looking at emissions alone, we rely on a structural identity where emissions are the product of production and emissions intensity. This allows us to distinguish whether changes are driven by demand shocks (e.g. crisis-induced production changes) or by structural efficiency improvements.

- The analysis is performed for two distinct periods: 2016–2019 (pre-crisis adjustment) and 2022–2025 (energy crisis and aftermath), enabling a direct comparison of underlying drivers.

- The analysis compares the average of 2016-2019 with the average of 2022-2025. This period design is intentional. It avoids relying on a single pre-crisis or post-crisis year and therefore reduces noise from annual shocks, outages, rebound effects and reporting irregularities.

Geographical Scope

- The analysis includes the countries covered under EU ETS, mainly the EU27 and Norway.
- Due to data availability and completeness, some EU27 countries were excluded from the analysis.
- The table below presented the countries that are included in the analysis, which represent 92% of the total EU ETS chemical average emissions between 2019 and 2025.
- The countries below also present 86% of chemicals production in countries within the EU ETS (average between 2019 and 2024)*.

Country Code	Country
AT	Austria
BE	Belgium
BG	Bulgaria
CZ	Czech Republic
DE	Germany
DK	Denmark
ES	Spain
FR	France
HU	Hungary
IT	Italy
NL	Netherlands
NO	Norway
PL	Poland

* source: PRODCOM (NACE 20) Statistics | Eurostat

Analytical Framework

- The decomposition is based on the identity:
  - $E = P \times I$, where E denotes emissions, P production, and I emissions intensity.
- We express changes between a base year (b) and a target year (t) using indices:
  - $E_{index} = \frac{E_t}{E_b}$
  - $P_{index} = \frac{P_t}{P_b}$
  - $I_{index} = \frac{E_{index}}{P_{index}}$.
- Taking logarithms allows a clean additive decomposition:
  - $\ln(E_{index}) = \ln(P_{index}) + \ln(I_{index})$
- This transformation is key: it converts multiplicative changes into additive components that can be interpreted as contributions of activity and efficiency to emissions changes.



Notes and references

Interpretations of activity and intensity contributions

- We define the contribution of each driver as a share of the total log-change in emissions:
  - $Activity\ share\ = \frac{\ln(P_{index})}{\ln(E_{index})}$
  - $Intensity\ share\ = \frac{\ln(I_{index})}{\ln(E_{index})}$

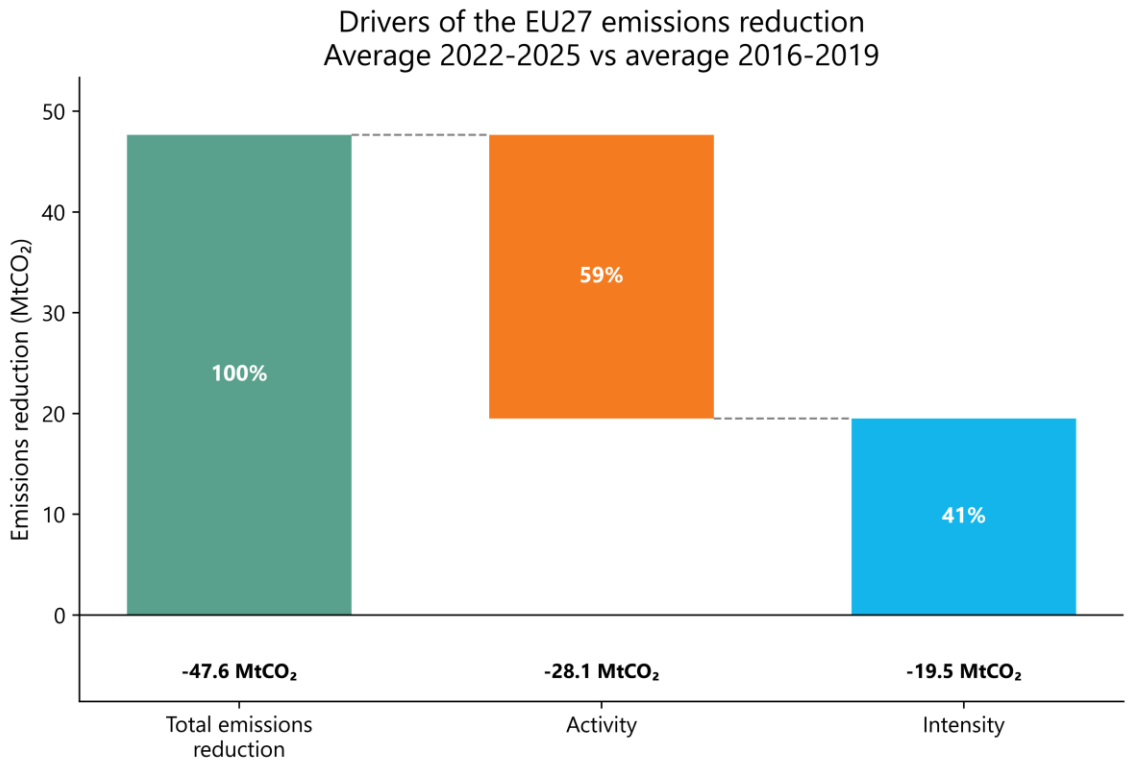
- These shares sum to one and indicate the relative importance of each mechanism. A higher activity share means emissions changes are primarily driven by production changes, while a higher intensity share indicates improvements (or deteriorations) in emissions intensity.
- When emissions decline, $\ln(E_{index})$ becomes negative. In this case, shares can exceed one or become negative, which is not an issue but reflects opposing forces (e.g. production growth combined with strong efficiency gains).



Notes and references

Emissions reduction is primarily driven by lower production (at least 60%)

EU27 average, comparing 2016–2019 vs 2022–2025

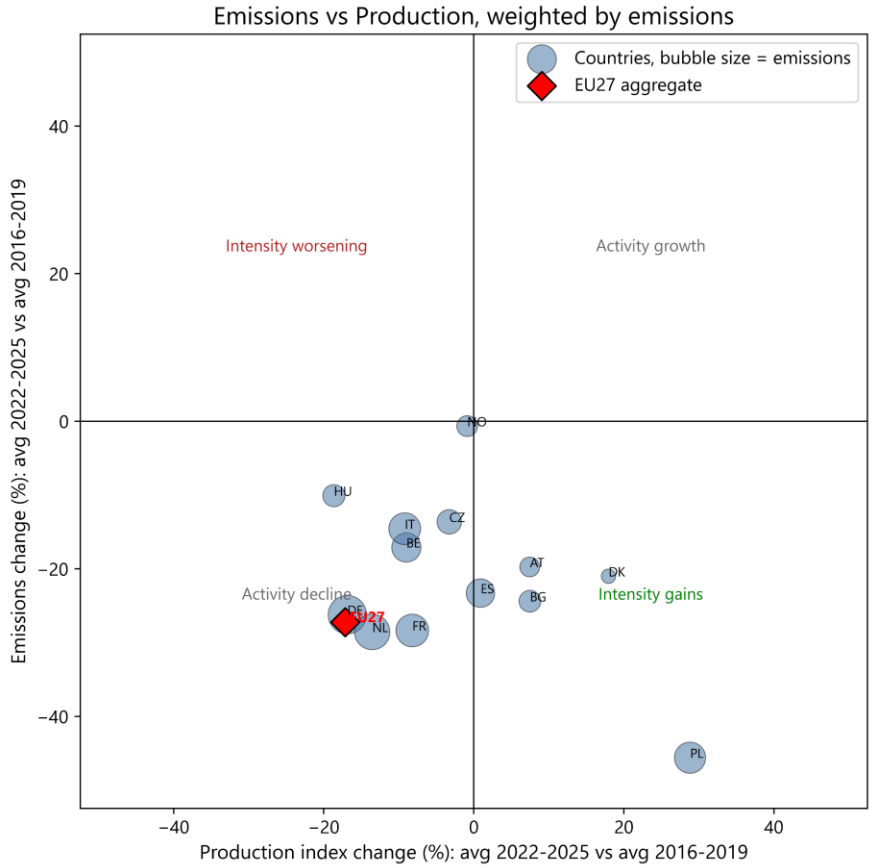


- The majority of emissions reduction is driven by lower production levels.
- Intensity improvements contribute significantly but are secondary.
- This confirms that the post-2022 decline is not purely driven by decarbonization, as most of the observed emissions reduction reflects a contraction in industrial activity rather than technological progress.

Note: *Intensity refers to emissions intensity (emissions per unit of production index). Changes in intensity may reflect technological improvements, fuel switching, changes in product mix, capacity utilisation, or other structural factors. A reduction in emissions intensity should therefore not be interpreted solely as decarbonisation or efficiency gains.*

Country-level results point to activity-driven emissions reductions

Comparing pre-crisis (2016–2019) and post-crisis (2022–2025) averages

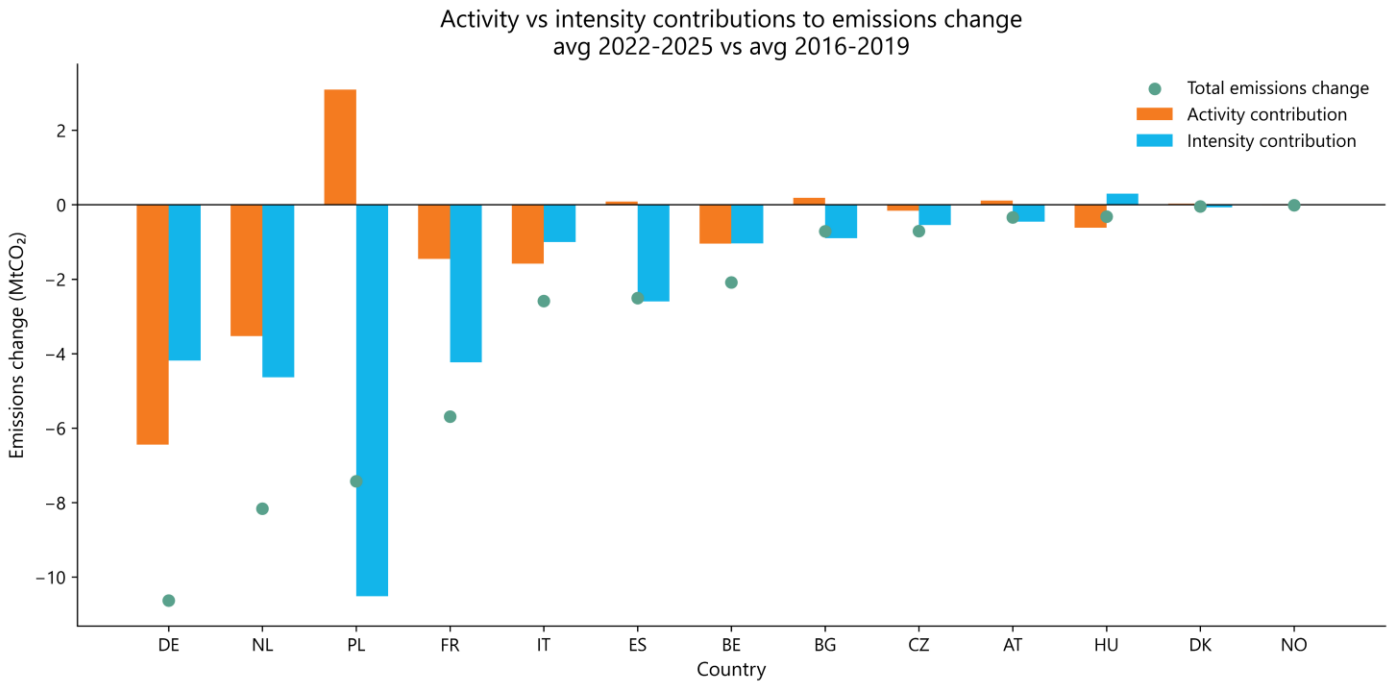


- Countries in the activity decline quadrant account for ~80% of baseline chemical ETS emissions and 66% of production volumes.
- At EU aggregate level, emissions fell by 31.8%, while production declined by 18.8%
- This indicates that the emissions reduction is strongly associated with lower production activity
- Emissions fell faster than production, suggesting that emissions intensity also contributed to the decrease

Cefic analysis based on:

- Emissions data retrieved on 23-06-2026 from the Union Registry Public Website, “Operators yearly activity daily” file.
- The chemical industry is filtered based on a Cefic internal list of installations based on activity codes, four-digit NACE Rev. 2 codes matched to ETS installations based on the Commission’s carbon-leakage lists, and a manual inspection of combustion installations serving chemicals production.
- Production index data from Eurostat (sts_inpr_a), accessed 25 June 2026. https://doi.org/10.2908/STS_INPR_A

Country results show different drivers behind emissions reductions



1. **Activity-driven reductions**
   - Germany, Italy, Netherlands
   - Emissions decline mainly reflects lower production/activity.
2. **Intensity-driven reductions**
   - Poland, Austria, Spain
   - Emissions fall despite stable or rising activity, pointing to improved emissions intensity.
3. **Mixed cases**
   - France, Czech Republic, Hungary
   - Both activity and intensity effects matter; in some cases, intensity worsens despite falling activity.

The EU27 result masks strong country differences: in several major emitters and chemical producers, emissions reductions are closely linked to lower activity rather than cleaner production.

Cefic analysis based on:

- Emissions data retrieved on 23-06-2026 from the Union Registry Public Website, “Operators yearly activity daily” file.
- The chemical industry is filtered based on a Cefic internal list of installations based on activity codes, four-digit NACE Rev. 2 codes matched to ETS installations based on the Commission’s carbon-leakage lists, and a manual inspection of combustion installations serving chemicals production.
- Production index data from Eurostat (sts_inpr_a), accessed 25 June 2026. https://doi.org/10.2908/STS_INPR_A

Most large emitting countries experienced lower emissions alongside declining production

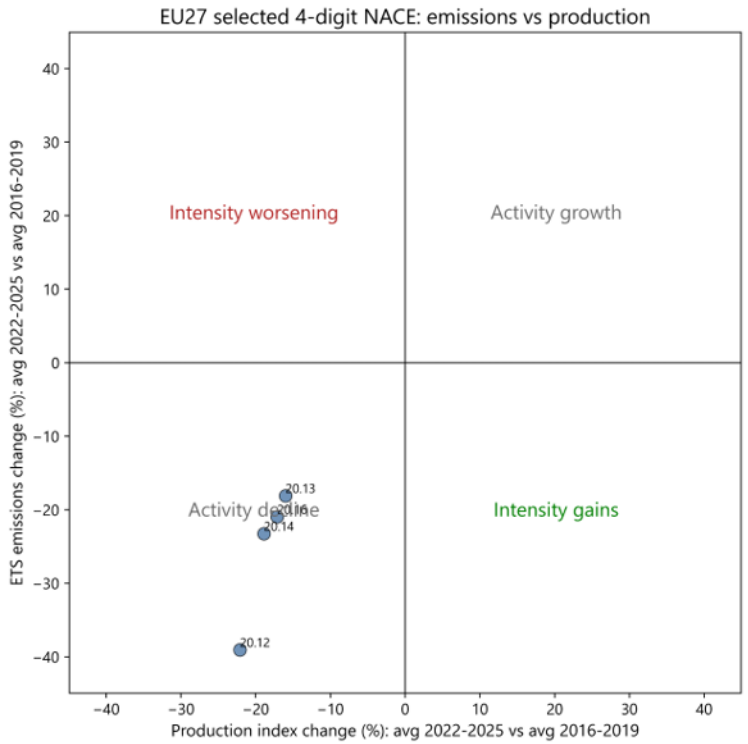
Country	Emissions change (%)	Production change (%)	Intensity change (%)	Activity (%)	Intensity (%)
HU	-10,1	-18,6	10,5	194	-94
NO	-0,7	-0,9	0,2	129	-29
IT	-14,6	-9,2	-5,9	61	39
DE	-26,2	-16,8	-11,3	61	39
BE	-17,1	-9	-8,9	50	50
NL	-28,6	-13,5	-17,4	43	57
FR	-28,4	-8,2	-22	26	74
CZ	-13,6	-3,3	-10,7	23	77
ES	-23,3	0,9	-24	-3	103
BG	-24,4	7,5	-29,7	-26	126
AT	-19,8	7,5	-25,3	-33	133
PL	-45,6	28,8	-57,8	-42	142
DK	-21	18	-33	-70	170

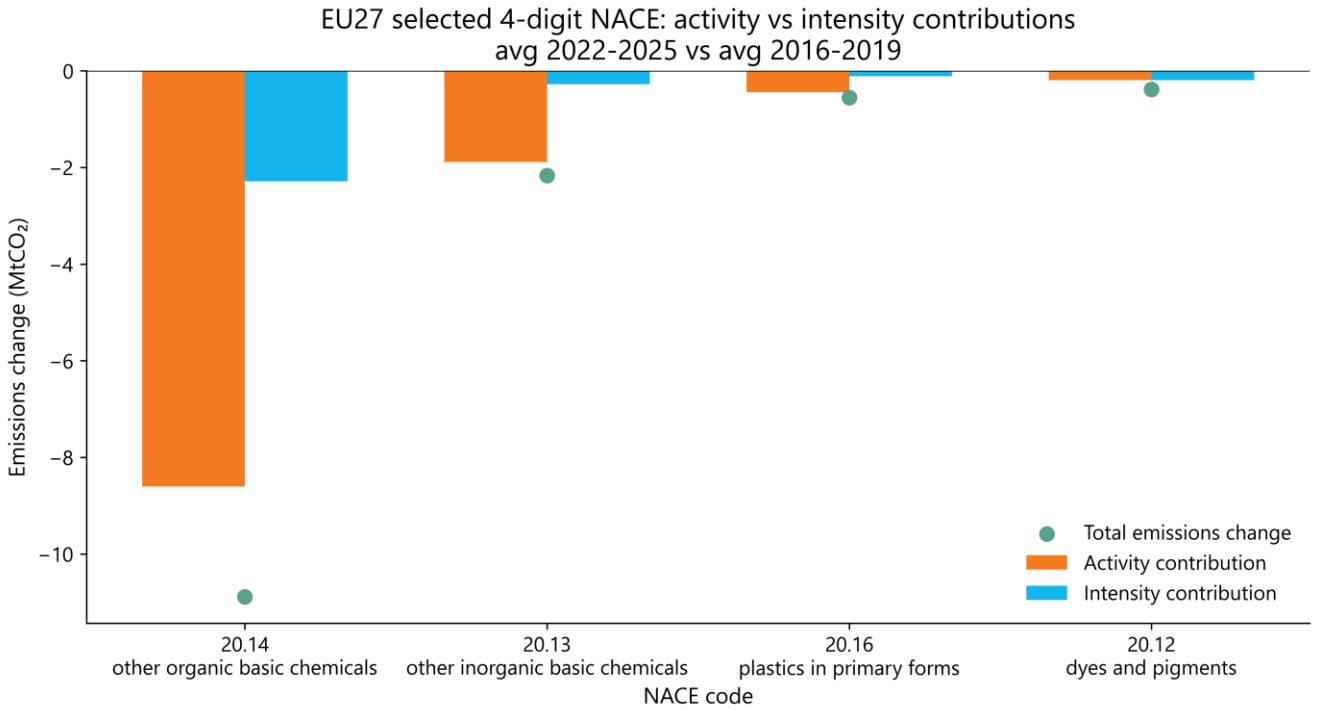
- Activity declines contributed to emission reductions in many of the largest emitting countries.
- Other countries exhibit different combinations of activity and efficiency effects.
- Intensity improvements contributed in several countries, but do not outweigh the overall impact of lower production/activity levels.

Cefic analysis based on:

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- The chemical industry is filtered based on a Cefic internal list of installations based on activity codes, four-digit NACE Rev. 2 codes matched to ETS installations based on the Commission’s carbon-leakage lists, and a manual inspection of combustion installations serving chemicals production.
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Activity-driven emissions decline is consistent across chemical subsectors





- In all major subsectors, emissions reductions are closely aligned with declines in production
- Activity effects dominate in basic chemicals, which account for a large share of emissions
- Intensity improvements are present, but heterogeneous across subsectors
- Results confirm that the activity-driven pattern holds beyond the aggregate level

- Cefic analysis based on:
  - Emissions data retrieved on 23-06-2026 from the Union Registry Public Website, “Operators yearly activity daily” file.
  - The four-digit NACE Rev. 2 codes matched to ETS installations based on the Commission’s carbon-leakage lists, as described by EUETS.INFO
  - Production index data from Eurostat (sts_inpr_a), accessed 25 June 2026. https://doi.org/10.2908/STS_INPR_A
- NACE codes were selected based on (i) their share of emissions within NACE 20 and (ii) data completeness.

05

Industrial activity and capacity loss



Estimating changes in industrial capacity

In the following analysis, capacity is not directly observed, but can be inferred from:

→ Production

→ Capacity utilisation rates

We construct a proxy for capacity using:

→ Capacity $\propto$ Production $\div$ Utilisation

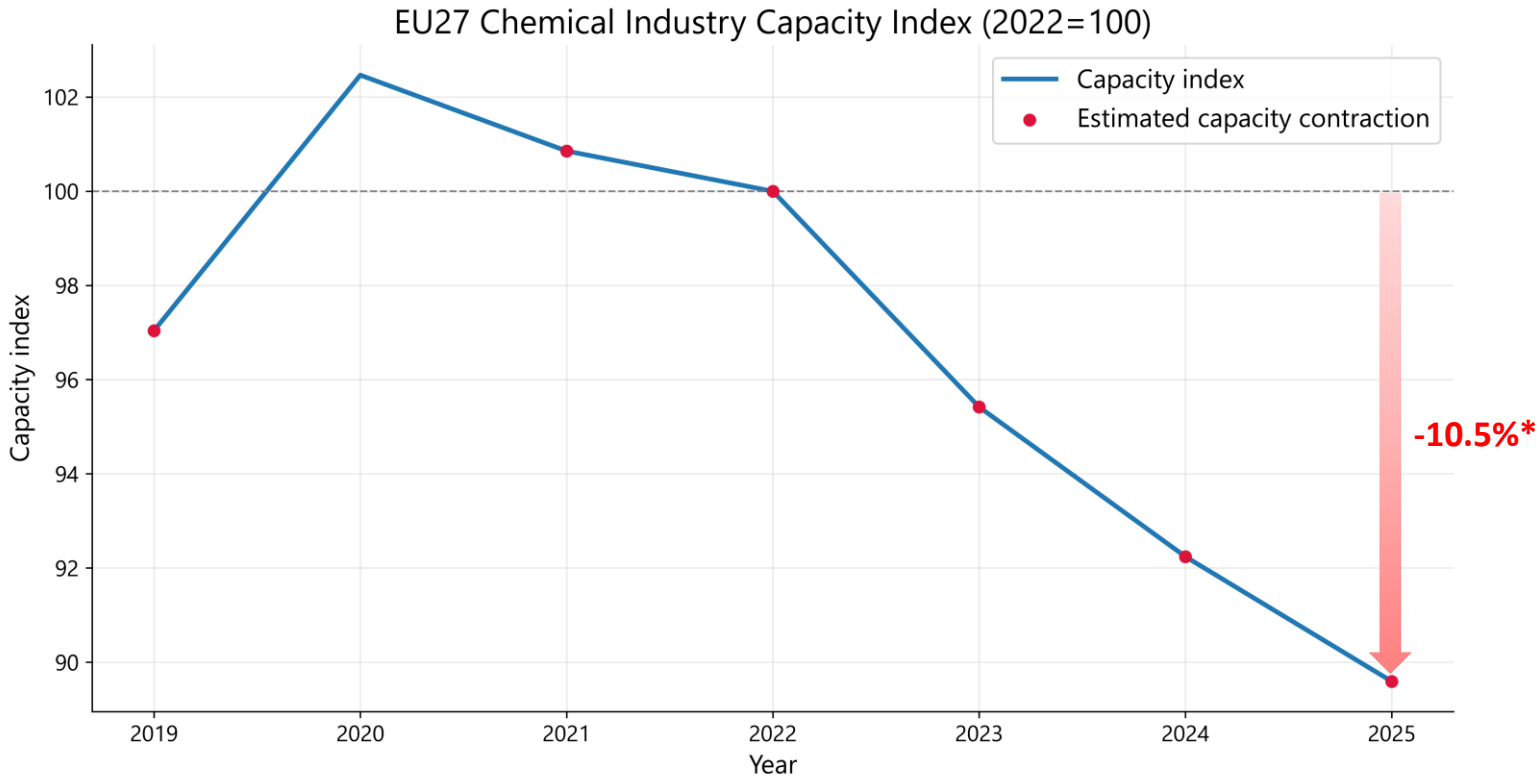
A decline in this proxy suggests:

→ Structural reduction in capacity (e.g. plant closures or downsizing)



Structural decline in capacity post-2022

EU27 average, comparing 2016–2019 vs 2022–2025

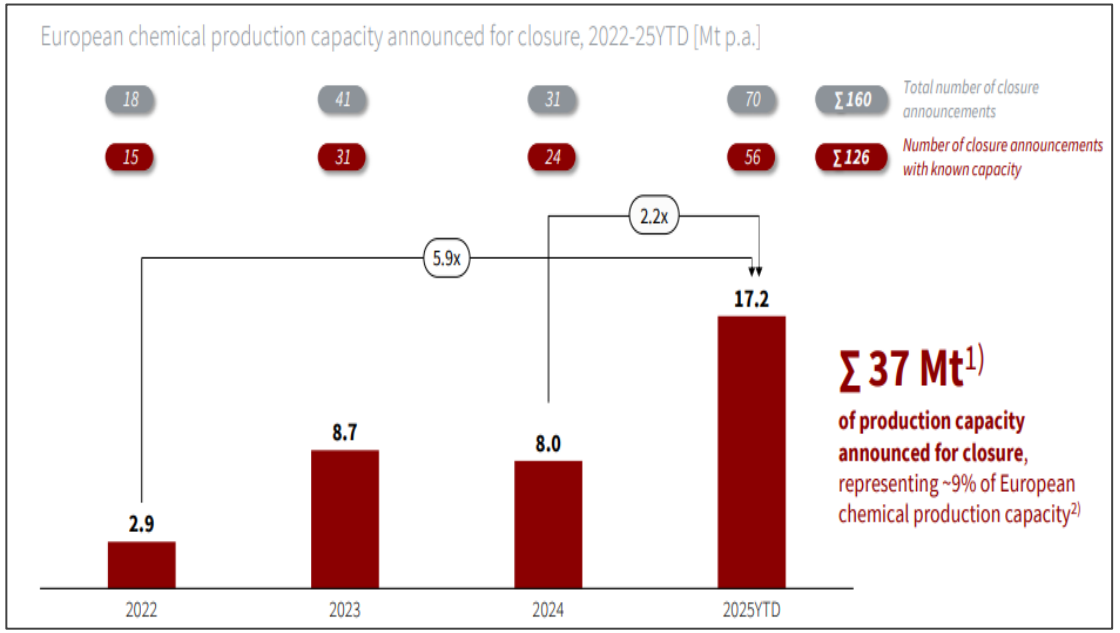


- Capacity peaked before the crisis and has declined steadily since 2022
- By 2025, estimated capacity is ~10% below pre-crisis levels
- This suggests a structural reduction in industrial capacity, not just lower utilization
- Part of the emissions reduction reflects **structural capacity loss**, not just temporary reductions in activity

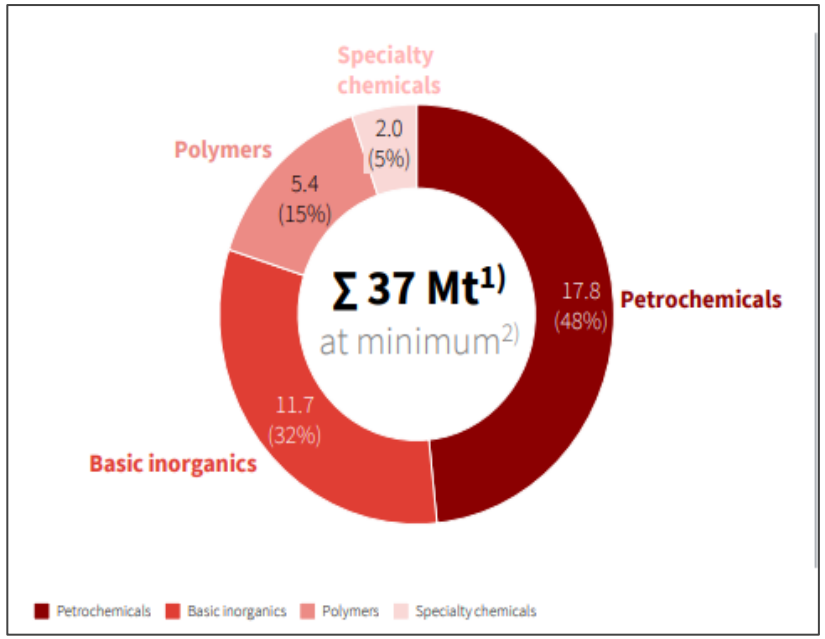
* consistent with Roland Berger's independent estimate of ~9% capacity reduction during the same period: European Chemical Closures & Investments Radar 2022-2025 - cefic

Europe is losing industrial capacity at a speed we have never seen before

Chemical plant closures in Europe (since 2022), resulting in the loss of 20,000 direct jobs, and 89,000 indirect jobs



Upstream chemicals account for 80% of production capacity announced for closure

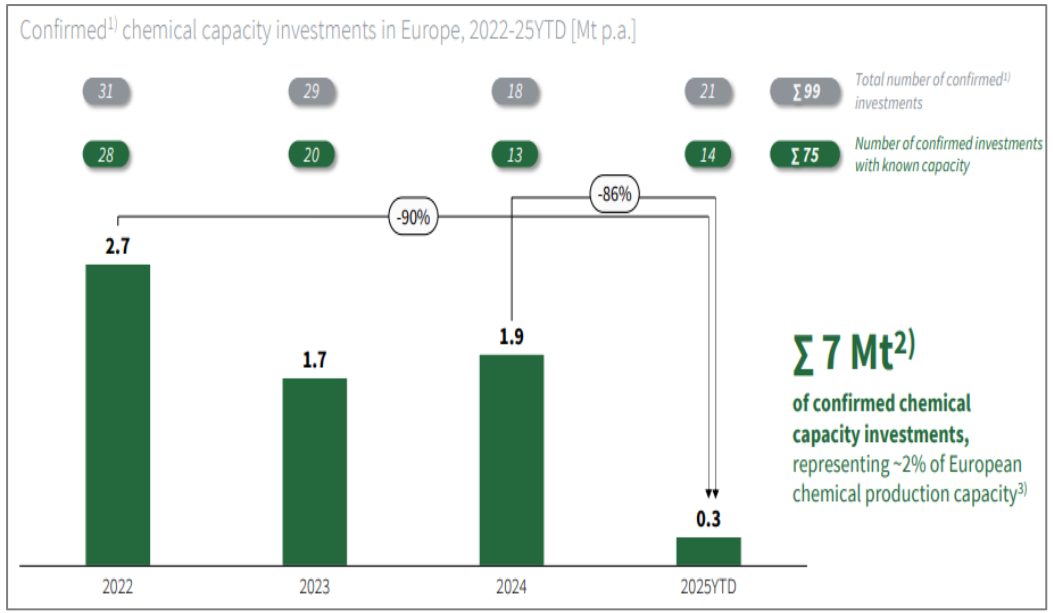


- A Cefic Report (2026) – commissioned to Roland Berger – shows that chemical plant closures in Europe, surged sixfold since 2022, reaching a cumulative 37 Mt of capacity – or around 9% of European production capacity
- This is consistent with our estimate of ~10% capacity decline based on production and utilization.
- Chemical plan closures rate surges six-fold in Europe since 2022. The cost of energy is the main driver behind so dramatic plan closures (49% of feedback), followed by low demand (19%). Regulations and overcapacity account for less than 10% each.

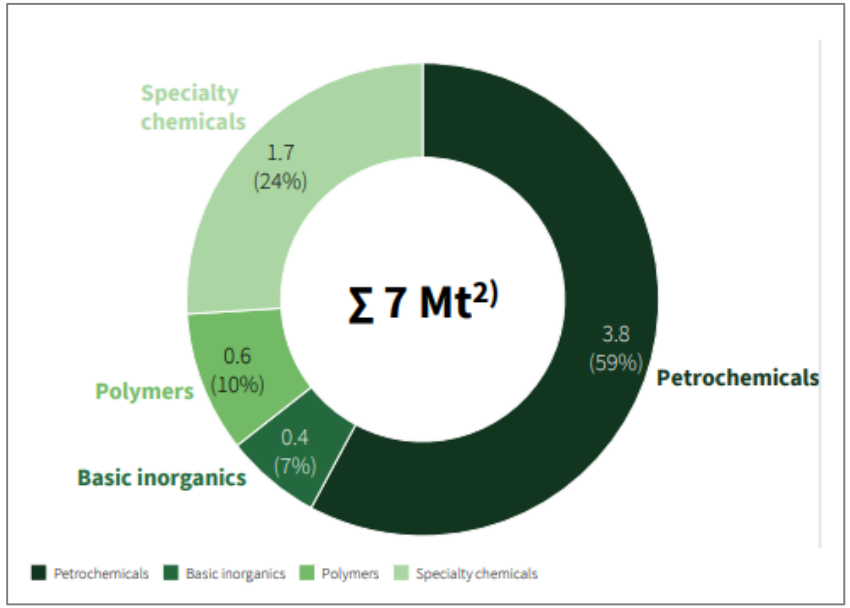
Source: Roland Berger Report (Commissioned by Cefic) on “European chemical closures and investments radar 2022-2025”, Dec 2025

New investments have collapsed since 2022 (~–90%)

7 Mt of confirmed chemical capacity investments, representing ~2% of European chemical production capacity



Petrochemicals is the main segment (59%) of confirmed investments since 2022



- Low investment means lost capacity is not being replaced
- This reinforces the evidence of structural contraction in the sector
- The collapse in new investments suggests that current capacity losses are likely to be long-lasting, not temporary.

Source: Roland Berger Report (Commissioned by Cefic) on “European chemical closures and investments radar 2022-2025”, Dec 2025

06

Conclusion



At least 60% of the post 2022 reduction of emissions in our sector is a result of lower production

Emissions reductions driven by lower output risk weakening European value chains rather than decarbonising production.

1. Production contraction explains most of the decline

At least 60% activity-driven

EU27 emissions fell by 27%, with nearly two-thirds of the reduction linked to lower production activity. The remaining one-third is attributable to a combination of structural changes, production reallocation, and investments that improved efficiency.

2. Structural capacity loss is visible

Capacity contracted by ~10% since 2022

Closures have surged **six-fold** since 2022, confirmed investments are nearly **90% lower** in the same period, and upstream assets account for most announced capacity losses.

3. Policy response must be integrated

Clean production

The policy test is to keep production in Europe while lowering intensity: **competitive energy, access to infrastructures, strong market demand for low-carbon products, and investment certainty.**

A business case for low carbon investments is urgently needed

Europe needs to achieve emissions reductions while reversing industrial activity decline, reducing import dependencies, and strengthening European value chains.

07

References



Data Sources

- **Production index :** Eurostat, Production in industry – annual data (sts_inpr_a), accessed 25 June 2026. https://doi.org/10.2908/STS_INPR_A

- **Chemical industry emissions based on:**
  - European Commission (Union Registry), Operators yearly activity daily, accessed 23 June 2026. https://union-registry-data.ec.europa.eu/report/welcome

  - Filtering the installations belonging to the chemical industry is based on an internal list developed based on:
    - The activity codes provided by the Union Registry for each installation
    - Matching 4-digit NACE codes with installations Commission's carbon leakage list (2021).
    - A final manual inspection of combustion installations belonging to the chemical industry

- **Capacity utilization:** Eurostat, Business and Consumer Surveys (BCS), Euro indicators.